

BMJ Open Anxiety and stress among healthcare professionals during COVID-19 in Ethiopia: systematic review and meta-analysis

Aragaw Asfaw Hasen ¹, Abubeker Alebachew Seid ²,
Ahmed Adem Mohammed ²

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¹Department of Statistics, College of Natural and Computational Sciences, Samara University, Semera, Afar, Ethiopia

²Department of Nursing, College of Medicine and Health Sciences, Samara University, Semera, Afar, Ethiopia

Correspondence to

Aragaw Asfaw Hasen;
aragawasafaw5@gmail.com

ABSTRACT

Objective This study intended to assess the impact of COVID-19 pandemic on anxiety and stress among healthcare professionals in Ethiopia.

Design This study applied a design of systematic review and meta-analysis of observational studies.

Data sources

Eligibility criteria and outcomes Observational studies examining anxiety and stress among healthcare professionals in Ethiopia following COVID-19 pandemic were considered. The primary outcomes were the prevalence of anxiety and stress and the secondary outcomes were factors associated to the prevalence of anxiety and stress.

Data extraction and synthesis Two authors extracted the data and performed quality assessment independently. The Newcastle-Ottawa Scale was used to evaluate the quality of eligible studies. Random-effect model with the inverse variance method was used to estimate the pooled effect size of the outcome variables with its 95% CI. Publication bias was checked by DOI plot and Luis Furuya Kanamori index. Stata V.14.0 (StataCorp) software was used for statistical analysis.

Results Thirteen studies were included. From eight studies the pooled prevalence of anxiety was 46% (95% CI 0.30% to 0.61%, $\tau^2=0.0497$, $I^2=99.07%$, $p<0.001$). Nine studies reported about stress and the pooled prevalence was 51% (95% CI 0.41% to 0.62%, $\tau^2=0.0253$, $I^2=97.85%$, $p<0.001$). Age, sex, marital status, working department, history of contact with confirmed COVID-19 cases and profession were associated factors for high level of anxiety and stress.

Conclusions COVID-19 pandemic highly affects mental health of healthcare professionals in Ethiopia. Anxiety and stress were among reported mental health problems among healthcare professionals during the pandemic. Timely psychological counselling programmes should be applied for healthcare professionals to improve the general mental health problems.

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INTRODUCTION

The COVID-19 pandemic, caused by SARS CoV-2, was first noted by authorities in Wuhan City, China, in December 2019.¹ The

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Screening, data extraction and quality assessment were done by two authors independently.
- ⇒ Newcastle-Ottawa Scale used to assess the risk of bias of the included studies.
- ⇒ Lack of sufficient studies on the impact of COVID-19 on anxiety and stress of healthcare professionals in Ethiopia.
- ⇒ Sensitivity analysis was not assessed due to no influential study was observed in the DOI plot.

fight against COVID-19 primarily being led by health professionals. They have a lot of clinical responsibility in the healthcare settings, which makes them extremely susceptible to this disease. Studies have begun examining the mental health problems related to the COVID-19 epidemic. For instance, a research on the COVID-19 pandemic's effects on the mental health of Spanish healthcare workers (HCWs) revealed that the effects are more severe for HCWs than for non HCWs.² As a result of the COVID-19 outbreak, more than two-thirds, more than half and almost one-fifth of the nurses in Iran reported anxiety, depression and stress, respectively.^{2,3}

According to a Chinese study, COVID-19 affected HCWs more psychologically than the overall population.⁴ Compared with the general population, HCWs were in higher risk perception, level of worry and knowledge related to COVID-19 infection.⁵ Compared with those documented elsewhere, the prevalence of anxiety is significantly higher among HCWs working in Africa.⁶ According to the UNICEF situation report, Ethiopia has 96169 confirmed cases of COVID-19 as of 31 October 2020, and as of that date, 1876 healthcare professionals had tested positive and 77 had passed away.⁷

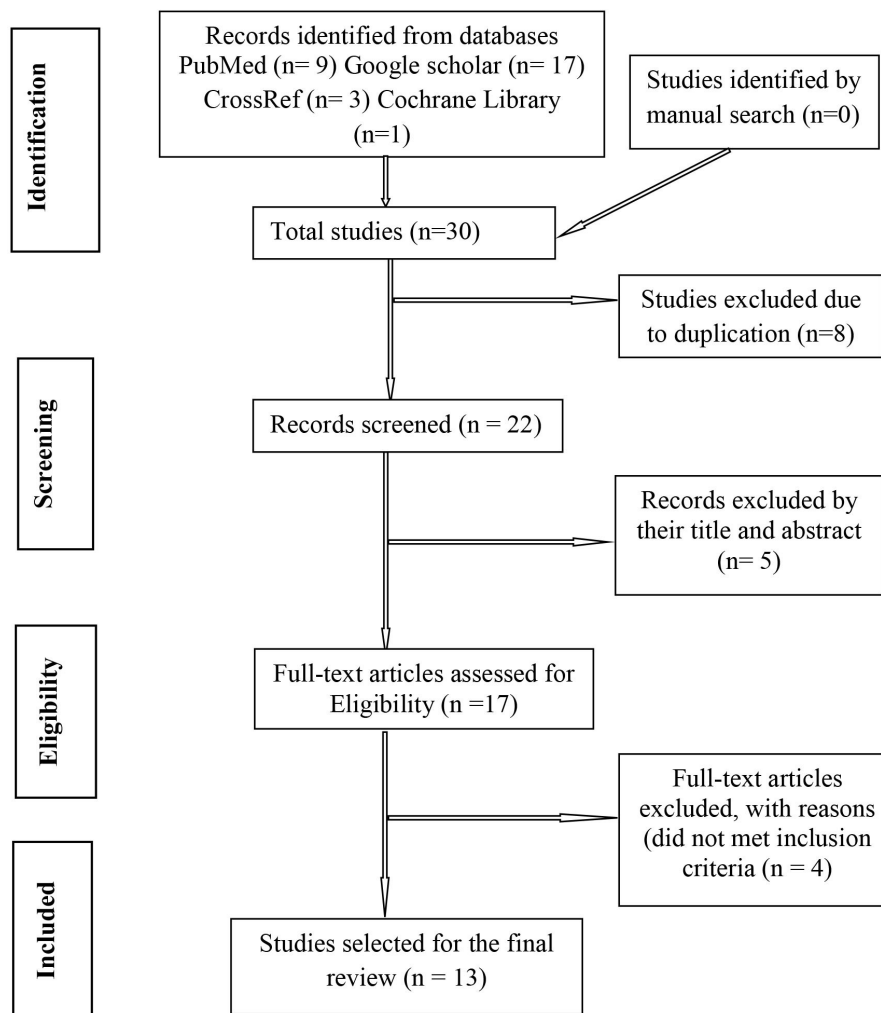


Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart.

According to research conducted in Ethiopia, the prevalence of anxiety ranges from 26.8% to 64.7%.⁸⁻¹⁰ High levels of anxiety are correlated with being a female health worker,⁹ being married,⁸ lack of personnel protective equipments and age,^{8,9} having chronic illness^{8,10} and contact with COVID-19 patient.¹⁰

Studies conducted during the pandemic revealed that the prevalence of stress among medical staff in Ethiopia varied from 31.4% to 78.3%.⁹⁻¹⁵ The following factors are linked to HCWs' stress: age^{10,11} being employed by a hospital^{9,11} being female, being married, being nurse¹⁴ and history of chronic illness^{10,14} are factors associated with stress of HCWs. Moreover, the results of a global meta-analysis conducted during the pandemic revealed that anxiety and psychological distress were both prevalent 38.12% and 37.54%, respectively. These mental health problems during COVID-19 pandemic need timely credit and initiation of interventions.¹⁶ In low-income and middle-income countries such as Ethiopia, little or no attention is given to psychological well-being of healthcare profession during the COVID-19 pandemic.⁸⁻¹⁰ All the effort is to control the spread of the pandemic and reduce its economic, social and political impacts.

COVID-19 aggravates the mental health problems of healthcare professionals in Ethiopia. In addition, study results in Ethiopia showed that the evidence on mental health problems during the COVID-19 pandemic has reported high prevalence with heterogeneous findings.⁸⁻¹⁵ Therefore, comprehensive understanding and a summary on the impact of COVID-19 on the mental health status of healthcare professionals in Ethiopia is a timely study. This study aims to address this gap by providing a systematic review and meta-analysis to estimate the pooled prevalence of anxiety and stress and their associated factors during the COVID-19 pandemic. The study also provides comprehensive evidence for researchers, practitioners and mental health intervention policy makers to focus on healthcare professional's mental well-being during COVID-19 pandemic and future emergency situations.

Objectives

General objective

- ▶ This study intended to assess the impact of COVID-19 on anxiety and stress among healthcare professionals in Ethiopia.

Table 1 Key characteristics and quality of the included studies for anxiety and stress on HCWs during the COVID-19 pandemic in Ethiopia

No	Authors/year	Region	Study design	Study population	Sampling design	Gender (male %)	Cases	Sample size (n)	Mental disorders	Instrument	Prevalence (%)	Quality
1	Teshome <i>et al</i> (2020) ¹²	SNNP	CS	All HCWs	Multistage	482 (60.40)	284	798	Anxiety	GAD-7	35.6	8
2	Teshome <i>et al</i> (2021) ²⁷	SNNP	CS	All HCWs	SRS	482 (60.40)	493	798	Stress	PSS-10	61.8	8
3	Jemal <i>et al</i> (2021) A ²⁸	AA and Oromiya	CS	All HCWs	Stratified	540 (66.17)	276	816	Stress	DASS-21	33.8	8
							636	816	Anxiety	DASS-21	78	
4	Jemal <i>et al</i> (2021) B ²⁶	Oromiya	CS	All HCWs	SRS	279 (66.90)	242	417	Stress	IES-R	58	8
							128	417	Anxiety	GAD-7	30.7	
5	Yitayih <i>et al</i> (2021) ¹¹	Oromiya	CS	All HCWs	Systematic	118 (47.38)	195	249	Stress	IES-R	78.3	7
6	Tsehay <i>et al</i> (2020) ¹⁴	Amhara	CS	All HCWs	N/A	181 (42.78)	178	423	Stress	Kasseler-10	42	8
7	GebreEyesus <i>et al</i> (2021) ⁹	SNNP	CS	All HCWs	SRS	167 (51.86)	101	322	Stress	PSS-10	31.4	9
							116	322	Anxiety	GAD-7	36	
8	Dagne <i>et al</i> (2021) ²⁵	All region	CS	All HCWs	Snowball	276 (71.13)	101	388	Anxiety	GAD-7	26.8	7
9	Kibret <i>et al</i> (2020) ⁸	Amhara	CS	All HCWs	N/A	62 (20.32)	192	305	Anxiety	GAD-7	63	9
10	Habtamu <i>et al</i> (2021) ²⁹	AA	CS	Frontline HCWs	N/A	101 (42.43)	74	238	Anxiety	GAD-7	31.1	9
11	Asnakew <i>et al</i> (2021) ¹⁰	Amhara	CS	All HCWs	SRS	292 (69.7)	271	419	Anxiety	DASS-21	64.7	7
							267	419	Stress	DASS-21	63.7	
12	Hajure <i>et al</i> (2021) ¹³	Oromiya	CS	All HCWs	Convenience	86 (67.71)	51	127	Stress	IES-R	40.2	7
13	Chekole <i>et al</i> (2020) ¹⁵	SNNP	CS	All HCWs	Systematic	161 (65.98)	126	244	Stress	PSS-10	51.6	9

AA, Addis Ababa; CS, cross-sectional; DASS-21, 21-item Depression Anxiety Stress Scale; GAD-7, 7-item Generalised Anxiety Disorder scale; HCWs, healthcare workers; IES-R, Impact of Event Scale (Revised); Kasseler-10, Kessler Psychological Distress Scale; N/A, sampling not applied; PHQ-9, 9 item Patient Health Questionnaire; PSS-10, 10 item Perceived Stress Scale; SNNP, Southern Nations Nationalities and People; SRS, simple random sampling.

Specific objectives

- ▶ To calculate the pooled prevalence of anxiety and stress during COVID-19 pandemic among healthcare professionals in Ethiopia.
- ▶ To provide the pooled effect size and summary for associated factors of anxiety and stress during COVID-19 pandemic among healthcare professionals in Ethiopia.

To provide far-reaching evidence to focus on the mental well-being of healthcare professionals during COVID-19 pandemic and future emergency situations.

METHODS AND ANALYSIS

Protocol registration

This study is conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement.¹⁷ The protocol was registered in the International Prospective Register of Systematic Reviews PROSPERO registration number: CRD42022314865. The PRISMA flow chart for reporting systematic review and meta-analysis is presented in figure 1.

Search strategy

Searching literature was conducted in PubMed, Cochrane Library, CrossRef and Google Scholar databases and articles published from the occurrence of the pandemic to June 2022 were included. Observational studies that assess the mental health (anxiety and stress) impact of COVID-19 among healthcare professionals in Ethiopia were considered. Systematic searches were conducted by combining every possible combination of predefined search terms determined by Medical Subject Headings (MeSH) and keywords (online supplemental file 1). Reference lists of key full text articles included in the review were checked to recognise any potentially eligible studies. The systematic procedure substantiates that the literature search comprises all published studies on the impact of COVID-19 among healthcare professionals in Ethiopia. The search results were exported to Mendeley where duplicates were removed.

Two authors (AAH and AAS) independently screened titles and abstracts of the studies, and any disagreement between the authors was resolved by consensus or by another third author (AAM). The search strategy of

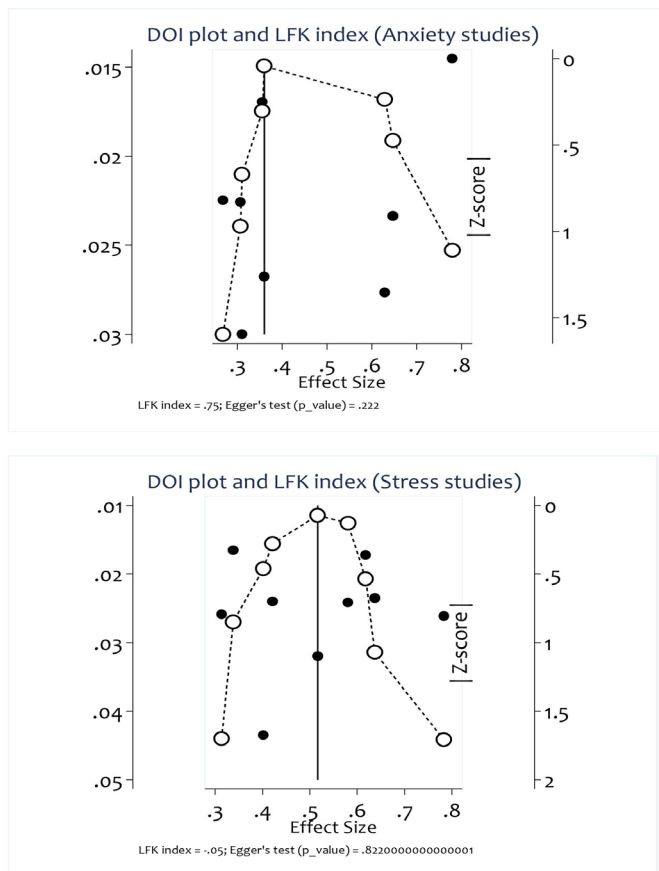


Figure 2 DOI plot for assessment of publication bias.²³ LFK, Luis Furuya Kanamori.

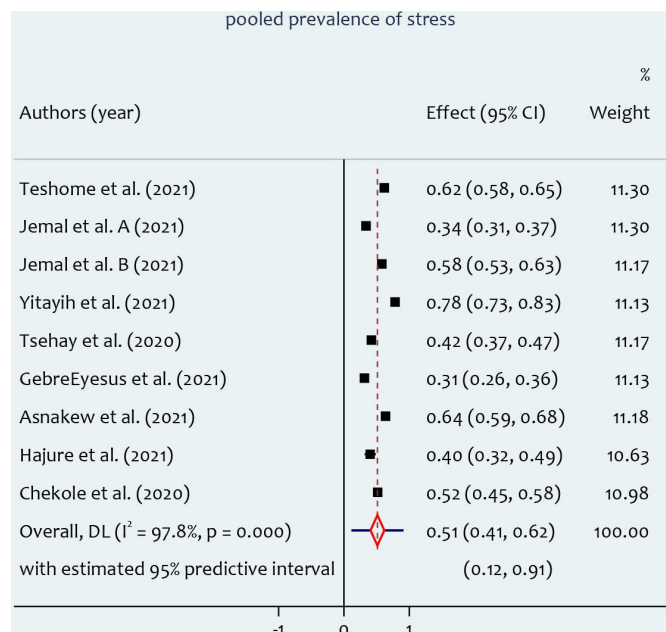


Figure 3 A forest plot for the prevalence of stress among the healthcare professionals during the COVID-19 pandemic. The pooled prevalence of stress. Note: Weights are from random-effects model. ES, effect size; Weight, weight of each included study.

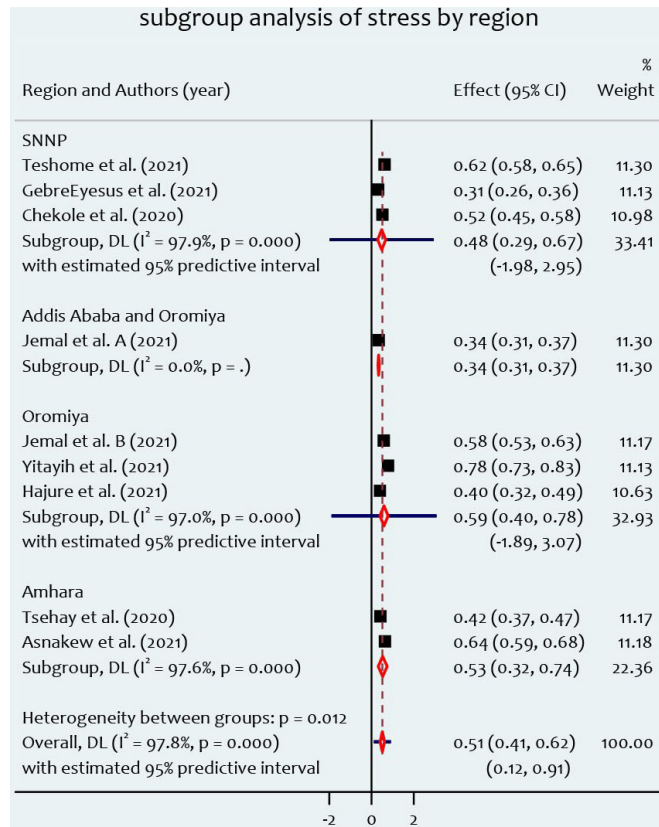


Figure 4 A subgroup analysis of prevalence of stress among healthcare workers during the COVID-19 pandemic by region. Note: Weights and between-subgroup heterogeneity test are from random-effects model. SNNP, Southern Nation Nationalities and People.

databases is presented in online supplemental file 1. The search strategy is considered as suitable to reduce the risk of selection and detection bias.

Eligibility criteria

Inclusion criteria

For this study, only observational studies (cross-sectional studies) that investigated the influences of COVID-19 on the mental health (anxiety and stress) of healthcare professionals during the pandemic in Ethiopia were included.

Setting/context

Studies conducted in Ethiopia were the concern of this systematic review.

Population

This review included studies involving all groups of healthcare professionals.

Study design

Observational studies (cross-sectional studies) that reported the prevalence of anxiety and stress and their associated factors.

Language

Studies reported in English language were considered.

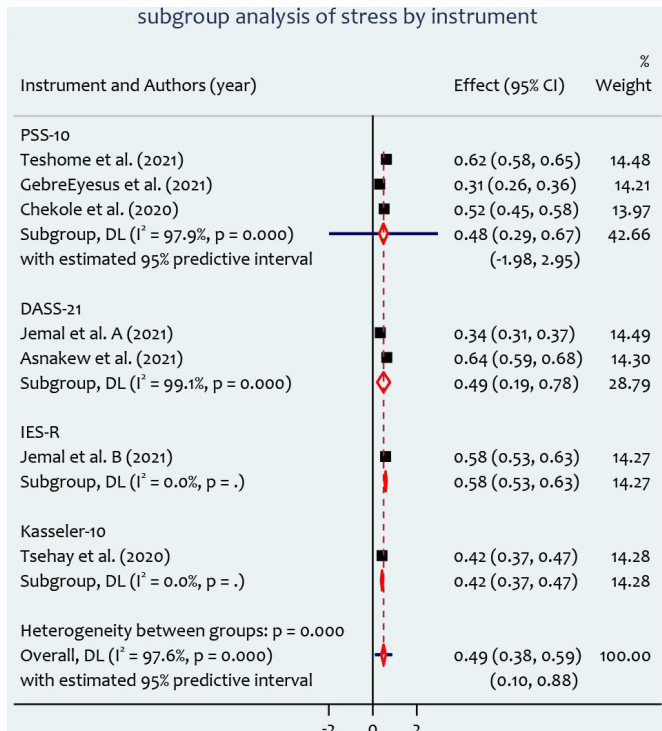


Figure 5 A subgroup analysis of prevalence of stress among healthcare workers during the COVID-19 pandemic by the instrument used. Note: Weights and between-subgroup heterogeneity test are from random-effects model. DASS-21, 21-item Depression Anxiety Stress Scale; IES-R, Impact of Event Scale-Revised; Kessler-10, 10-item Kessler Psychological Distress Scale; PSS-10=10item Perceived Stress Scale.

Table 2 Mental disorders and heterogeneity assessment among subgroups

Mental disorders	Subgroup	Cochran's Q-statistics	df	P value
Stress	Region	10.99	3	$p < 0.001$
	Instrument	21.97	3	$p < 0.001$
Anxiety	Region	750.46	5	$p < 0.001$
	Instrument	17.77	1	$p < 0.001$

Exclusion criteria

The following types of studies were excluded:

1. Studies that involved whole population.
2. Studies that did not have enough statistical data to be extracted.
3. Descriptive reviews, randomised controlled trials, systematic review, meta-analysis, editorials, comments, conference abstracts, opinions and studies not exactly reported the prevalence and associated factors of anxiety and stress of healthcare professionals were excluded.

Outcome measures

There were two main outcomes in this systematic review and meta-analysis. The primary outcomes were the pooled prevalence of anxiety and stress among healthcare

professionals during the COVID-19 pandemic. The secondary outcomes of the study were the pooled effect size of associated factors related to the prevalence of anxiety and stress among healthcare professionals during the COVID-19 pandemic in Ethiopia.

Selection of studies

Two authors (AAH and AAS) assessed the studies based on inclusion and exclusion criteria. First, the authors assessed both the titles and abstracts of the studies identified from the searched databases. Then, full-text screening was done to screen the full texts selected in the previous stage. Moreover, we have a rationale for inclusion and exclusion of studies in the PRISMA flow diagram. Finally, the final list of articles for data extraction for systematic review and meta-analysis was prepared for the analysis.

Data extraction

The data extraction was done by two reviewers independently. There was pretest the data extraction form on three pilot surveyed studies, to ensure effective, facilitates the collection of all necessary data required for the valuable systematic review and meta-analysis. Disagreements were resolved by deep discussion. For the incorporated studies, we extracted the author's last name, year of publication, where the study was conducted (region), study design, cases, sample size, sampling design, study population, outcome measures and main findings.

Methodological quality assessment

Two authors (AAH and AAS) autonomously assessed the quality of the included studies by the Newcastle-Ottawa Scale (NOS).¹⁸ The scale rates observational studies based on three parameters named selection, comparability and

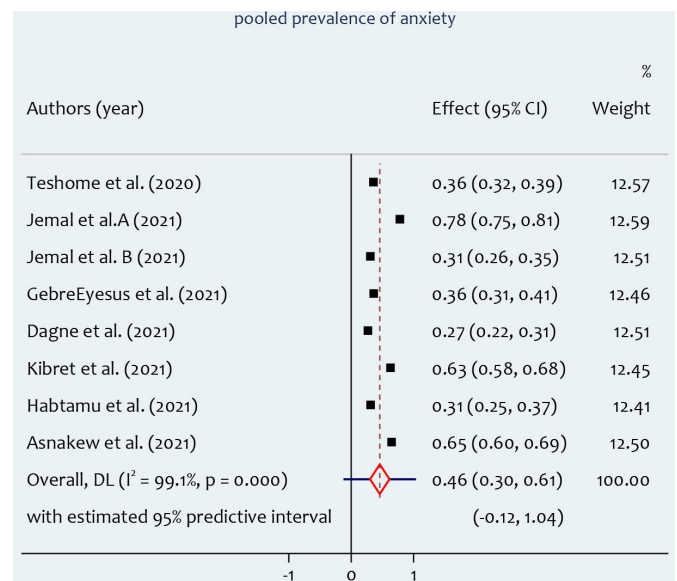


Figure 6 A forest plot for the prevalence of anxiety among the healthcare professionals during the COVID-19 pandemic. The pooled prevalence of anxiety. Note: Weights are from random-effects model. ES, effect size; Weight, weight of each included study

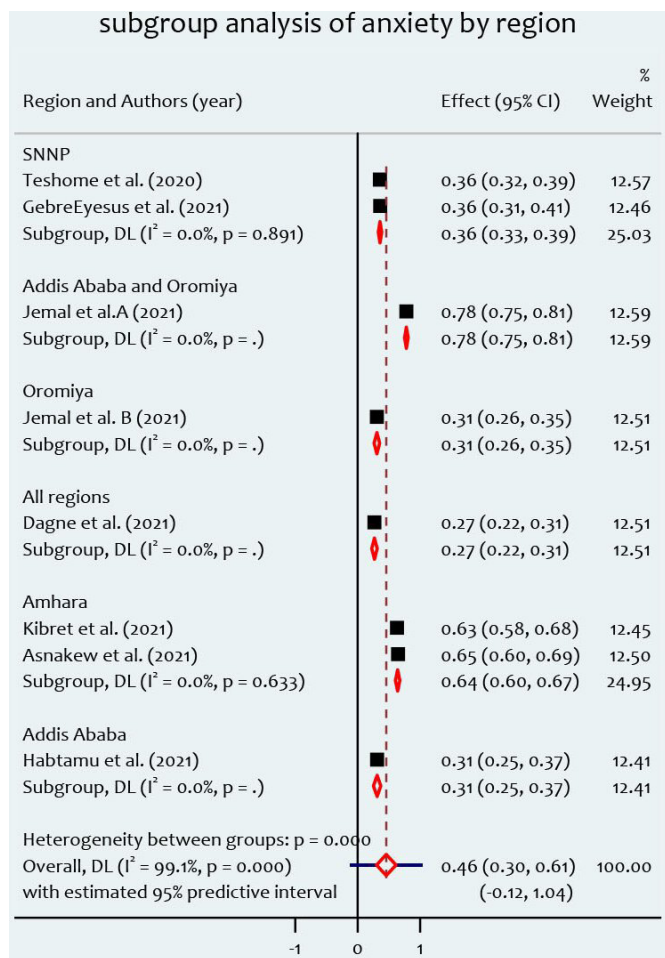


Figure 7 A subgroup analysis of prevalence of anxiety among healthcare workers during the COVID-19 pandemic by region. Note: Weights and between-subgroup heterogeneity test are from random-effects model. SNNP, Southern Nation Nationalities and People.

assessment of exposure/outcome. Studies with less than 5 scores were considered low quality, 5–7 scores of moderate quality and more than 7 scores of high quality.¹⁹ Studies with moderate and above quality score were considered for this systematic review and meta-analysis.

Data synthesis

The extracted data were entered in to Microsoft Excel and then imported to Stata V.14.0 (StataCorp) software to conduct the meta-analysis. We calculated pooled prevalence and pooled adjusted OR with 95% CI and predictive interval (PI) by using random-effect model with the generic inverse variance method. Assessment of heterogeneity was checked by τ^2 ,²⁰ I^2 and Cochran's Q -statistics.^{21 22} To decide the source of heterogeneity subgroup analyses was performed by regions and instruments used in individual studies. Publication bias was checked by DOI plot and Luis Furuya Kanamori (LFK) index as the number of studies used was small. The DOI plot and the LFK index tools were used to determine the effect (ie, publication bias) and asymmetry of studies with small sample size.^{23 24} A value outside the interval -1 and 1 were

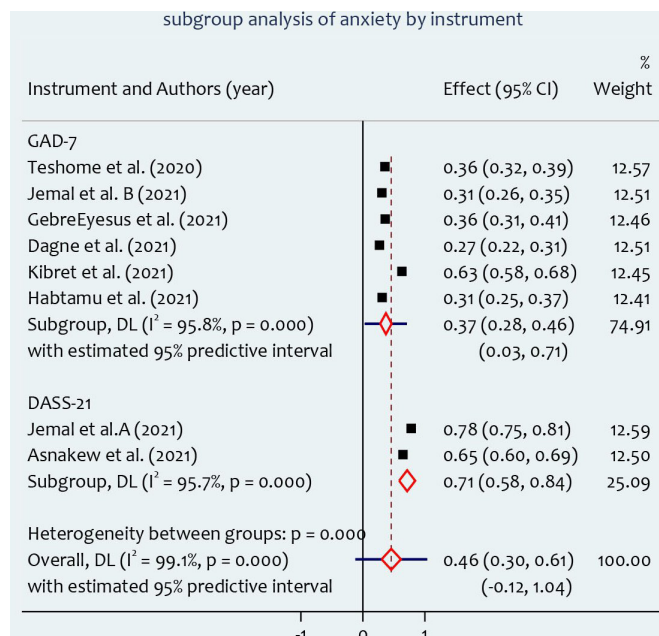


Figure 8 A subgroup analysis of prevalence of anxiety among healthcare professionals during the COVID-19 pandemic by instrument. Note: Weights and between-subgroup heterogeneity test are from random-effects model. DASS, 21-item Depression Anxiety Stress Scale; GAD-7, 7-item Generalised Anxiety Disorder scale.

considered consistent with asymmetry (ie, publication bias) according to the LFK index.²⁴

Patient and public involvement

No patient and public involvement.

RESULTS

A PRISMA diagram illustrating the steps of database search and refining process for the study on mental health problems of healthcare professionals during the COVID-19 pandemic period was depicted in figure 1. From our databases search, initially 30 studies were identified. Eight duplicates were removed and we inspected the titles and abstracts then five studies were removed. Seventeen full text studies were examined and four studies were removed by reasons that did not met inclusion criteria. Finally, we recognised 13 studies appropriate to this systematic review and meta-analysis.

Study characteristics

In this systematic review and meta-analysis, we included 13 cross sectional studies^{8–15 25–29} focused on the impact of COVID-19 on anxiety and stress status among healthcare professionals during COVID-19 in Ethiopia. When we observe the regional distribution, four studies^{9 12 15 27} were from SNNP, three studies^{11 13 26} were from Oromiya, three studies^{8 10 14} were from Amhara, one study²⁸ was from Addis Ababa and Oromiya, one study²⁹ was from Addis Ababa and one study²⁵ was in all regions (national level). Depending on the types of mental disorders,

eight studies^{8–10 12 25 26 28 29} were reported about anxiety and nine studies^{9–11 13–15 26–28} were reported about stress. Moreover, the summarised data of the key characteristics of the included studies are showed in [table 1](#).

Quality of included studies

A quality score of the 13 included studies using the modified NOS for cross-sectional studies quality assessment was presented in [table 1](#). Thus, four studies were regarded as moderate quality^{10 11 13 25} and nine studies were high quality^{8 9 12 14 15 26–29} were considered for final systematic review and meta analysis.

Publication bias

Publication bias was assessed by the DOI plot,²³ a tool used to visualise asymmetry and by the LFK index,²⁴ a tool used to detect and quantify asymmetry of study effects. As shown in [figure 2](#), no publication bias was observed. There is no asymmetry for anxiety studies (LFK index=0.75) and for stress studies (LFK index=-0.05). In both cases the, LFK index was between the interval (-1, 1), this supports there is no publication bias.²⁴

Meta analysis on prevalence of mental disorders

Pooled prevalence of stress

From a total of 9 studies, the pooled prevalence of stress was 51% (95% CI 0.41% to 0.62%, $\tau^2=0.0253$, $I^2=97.85\%$, $p<0.001$) as shown in the forest plot [figure 3](#). The significant variability of study results has been observed since $I^2=97.85\%$ and $\tau^2=0.0253$.

Subgroup analysis of stress by region

To explore the source of variability in studies subgroup analysis was done by region. From the forest plot in [figure 4](#), the pooled prevalence of stress in SNNP, Addis Ababa and Oromiya, Oromiya and Amhara was 48%, 34%, 59% and 53%, respectively. The prevalence was higher in Oromiya region compared with the others. The heterogeneity test result ([table 2](#)) ($Q=10.99$, $p<0.001$) indicates that there was significant variability among regions.

Subgroup analysis of stress by instrument

From the subgroup analysis by instrument used forest plot in [figure 5](#), the pooled prevalence of stress in 10-item Perceived Stress Scale, 21-item Depression Anxiety Stress Scale (DASS-21), Impact of Event Scale (Revised) and Kessler-10 was 48%, 44%, 59% and 42%, respectively. From heterogeneity test among instruments results ([table 2](#)) ($Q=21.97$, $p<0.001$) implies that there was significant heterogeneity among measurements used in the studies. This might be due to the existence of differences in sensitivity and specificity of the assessment instruments used to screen out mental disorders among healthcare professionals during the pandemic.

Pooled prevalence of anxiety

A total of 8 studies reported the prevalence of anxiety, and the pooled prevalence of the anxiety was found 46% (95% CI 0.30% to 0.61%, $\tau^2=0.0497$, $I^2=99.07\%$, $p<0.001$).

As shown in [figure 6](#), there exists significant heterogeneity among study findings on prevalence anxiety among healthcare professionals through the pandemic.

Subgroup analysis of pooled prevalence of anxiety by region

From the subgroup analysis of prevalence of anxiety by region the pooled prevalence of anxiety in SNNP, Addis Ababa and Oromiya, Oromiya, all regions, Amhara and Addis Ababa was 36%, 78%, 31%, 27%, 64% and 31%, respectively ([figure 7](#)). The prevalence was higher in the Addis Ababa and Oromiya region compared with the others. There was significant heterogeneity among regions ($Q=750.46$, $p<0.001$) ([table 2](#)).

Subgroup analysis of anxiety by the instrument

From the subgroup analysis by instrument used ([figure 8](#)) the pooled prevalence of anxiety in 7-item Generalised Anxiety Disorder scale (GAD-7) and DASS-21 was 37% and 74%, respectively. The heterogeneity test between group result ([table 2](#)) ($Q=17.77$, $p<0.001$) implies that the existence of significant heterogeneity between measurements (GAD-7 and DASS-21) used in the studies. This might be due to difference in sensitivity and specificity on the assessment instruments used.

Pooled adjusted OR of associated factors of mental disorders

As shown in [table 3](#), we found sex is associated factor of anxiety of healthcare professionals during the COVID-19 pandemic. Accordingly, the odds of female HCWs were nearly 1.89 times more likely to develop anxiety than male HCWs (pooled AOR 1.89, 95% CI 1.41 to 2.37). The test statistics revealed that no heterogeneity among the included studies ($\tau^2=0.00$, $I^2=0.00\%$ and $p=1.000$). The odds of HCWs working at COVID-19 isolation centre were three times more likely to develop anxiety than their counterparts (pooled AOR 3.02, 95% CI 1.67 to 4.37) and ($\tau^2=0.00$, $I^2=0.00\%$ and $p=0.634$). The odds of HCWs contact with confirmed cases are two times more than who do not have contact (pooled AOR 1.98, 95% CI 1.04 to 2.92) and ($\tau^2=0.00$, $I^2=0.00\%$ and $p=0.857$).

When we see sex as a factor of stress, the odds of female HCWs were two times more likely to develop stress than male (pooled AOR 2.02, 95% CI 1.23 to 2.80). The test statistics revealed no heterogeneity among the included studies ($\tau^2=0.00$, $I^2=0.00\%$ and $p=0.825$). Similarly, the odds of HCWs working at COVID-19 isolation centre were 2.38 times more to develop stress than pharmacy (pooled AOR 2.38, 95% CI 0.79 to 3.96) ($\tau^2=0.00$, $I^2=0.00\%$ and $p=0.634$). The odds of HCWs younger in age are 2.5 times more to develop stress than their counterparts (pooled AOR 2.50, 95% CI 0.16 to 4.85). The test statistics revealed that no heterogeneity among the included studies ($\tau^2=0.00$, $I^2=0.00\%$ and $p=0.861$). The odds of married HCWs were 2.8 times more to develop stress than single HCWs (pooled AOR 2.8, 95% CI 1.99 to 3.61) and ($\tau^2=0.00$, $I^2=0.00\%$ and $p=0.500$). Profession has its own influence to develop stress. The odds of medical laboratory professional HCWs were 2.69 times more to develop

Table 3 Pooled adjusted OR (AOR) of associated factors of anxiety and stress among HCWs during the pandemic in Ethiopia

Studies (ref. No)	Mental disorders	No of studies	Variables	Reference category	Pooled AOR (95% CI)	Heterogeneity	
						I ² (%)	P value
10 25 26 28	Anxiety	4	Sex (female)	Male	1.89 (1.41 to 2.37)	0.00	1.00
26 28	Anxiety	2	Working unit (COVID-19 isolation centre)	Pharmacy	3.02 (1.67 to 4.37)	0.00	0.634
10 12	Anxiety	2	Contact with confirmed cases	No contact	1.98 (1.04 to 2.92)	0.00	0.857
26 28	Stress	2	Sex (female)	Male	2.02 (1.23 to 2.80)	0.00	0.825
14 28	Stress	2	Working unit (COVID-19 isolation centre)	Pharmacy	2.38 (0.79 to 3.96)	0.00	0.634
11 43	Stress	2	Age (younger)	age >30	2.50 (0.16 to 4.85)	0.00	0.861
14 26 28	Stress	3	Marital status (married)	Single	2.80 (1.99 to 3.61)	0.00	0.500
26 28	Stress	2	Profession (medical laboratory)	Nurse	2.69 (0.45 to 4.93)	89	p<0.001

HCWs, healthcare workers.

stress than nurses (pooled AOR 2.69, 95% CI 1.45 to 4.93) and ($\tau^2=2.3345$, $I^2=89\%$ and $p=0.003$) indicates that heterogeneity was observed between studies. Also we tried to explore significant factors associated with anxiety [table 4](#) and stress [table 5](#) systematically.

DISCUSSION

Due to COVID-19 pandemic, healthcare professionals were with a variety of mental health problems. There are studies at the single level, but to our knowledge, this systematic review and meta-analysis was the first of its kind that assessed the pooled prevalence and associated factors in Ethiopia. In this systematic review and meta-analysis,

the pooled magnitude and associated factors of anxiety and stress were assessed. The study includes 13 articles focusing on the impact of COVID-19 on mental health problems (anxiety and stress) of healthcare professionals in Ethiopia. We believed that all of the incorporated studies are conducted with the ethical guideline. The pooled prevalence of anxiety and stress, and their associated factors discussed as follows.

The pooled prevalence of anxiety among the HCWs during the COVID-19 pandemic was 46%. This is higher compared with the recent meta-analysis results in Africa 37%,^{6,30} 29%³¹ in China 27%³² in Kenya 36%³³ and global study 34.4%.³⁴ This is lower than study in Egypt 71.8%³⁵

Table 4 A summarised reviews of significant associated factors of anxiety and their magnitude among healthcare professionals during the COVID-19 pandemic in Ethiopia

No	Authors (year)	Variables	AOR (95% CI)
1	Teshome <i>et al</i> (2020) ¹²	No COVID-19 updates	4.816 (2.957 to 7.842)
		No confidence in coping with stresses	2.74 (1.633 to 4.606)
		COVID-19-related worry	1.85 (1.120 to 3.056)
		Not feeling overwhelmed by everyday life	0.529 (0.370 to 0.733)
2	Jemal <i>et al</i> (2021) ²⁶	Working in Oromiya Special Zone	1.85 (1.14 to 2.99)
		Medical laboratory professional	2.75 (1.78 to 4.79)
3	Jemal <i>et al</i> (2021) ²⁸	Working in the surgical unit	3.26 (1.53 to 6.89)
4	Gebreyesus <i>et al</i> (2021) ⁹	Age >40 years	7.983 (1.443 to 44.174)
		Education masters and above	3.243 (1.003 to 10.482)
		Low monthly income	1.868 (1.140 to 3.061)
		Had infected family members	3.296 (1.503 to 7.227)
5	Dagne <i>et al</i> (2021) ²⁵	Visiting 30–150 patients per day	3.44 (1.51 to 7.84)
		Working at private healthcare	2.40 (1.17 to 4.90)
		Not believe COVID-19 is preventable	2.04 (1.04 to 4.03)
6	Kibret <i>et al</i> (2020) ⁸	HCWs have chronic illness	3.43 (1.59 to 7.43)
		Have suspected family members	5.20 (2.11 to 12.78)
		Not having an access to PPEs	2.55 (1.43 to 4.56)
7	Asnakew <i>et al</i> (2021) ¹⁰	Had families with chronic illness	3.15 (1.83 to 5.40)
		Poor social support	2.64 (1.49 to 4.67)

AOR, adjusted OR; HCWs, healthcare workers; PPE, personnel protective equipment.

Table 5 A summarised reviews of significant associated factors of stress and their magnitude among healthcare professionals during the COVID-19 pandemic in Ethiopia

No	Authors (year)	Variables	AOR (95% CI)
1	Teshome <i>et al</i> (2021) ²⁷	Not having COVID-19 updated information	2.41 (1.31 to 4.43)
		Not at all confident on coping with stress	9.94 (3.74 to 26.41)
		Somewhat confident in coping with stress	4.699 (2.81 to 7.84)
		Moderately confident in coping stress	2.36 (1.46 to 3.82)
		Not getting along well with people	4.88 (1.42 to 16.72)
		Feeling overwhelmed by everyday life	0.52 (0.35 to 0.77)
2	Jemal <i>et al</i> (2021) A ²⁶	Working in Oromiya Special Zone	2.14 (1.28 to 3.59)
3	Jemal <i>et al</i> (2021) B ²⁸	HCWs who have bachelor's degrees	3.28 (1.49 to 6.19)
		Working in the surgical unit	3.94 (1.65 to 5.30)
		Have poor perception to COVID- 19	3.27 (1.98 to 4.47)
4	Yitayih <i>et al</i> (2021) ¹¹	Having insomnia	19.2 (6.0 to 61.5)
		Not having a daily update on COVID-19	2.6 (1.0 to 6.6)
		Feeling stigmatised	2.7 (1.1 to 6.4)
5	Tsehay <i>et al</i> (2020) ¹⁴	Current substance users	2.786 (1.912 to 9.015)
		Working in emergency	2.360 (1.108 to 7.730)
		Outpatient departments	1.420 (1.040 to 3.740)
		HCWs have chronic medical illness Health	1.670 (1.101 to 3.500)
		Brief, resilient coping level	5.023 (2.963 to 10.120)
		Low social support level	1.875 (1.025 to 3.542)
6	Gebreyesus <i>et al</i> (2021) ⁹	Working general and referral hospitals	4.835 (2.189 to 10.680)
		Low monthly income	2.289 (1.349 to 3.885)
7	Asnakew <i>et al</i> (2021) ¹⁰	Families with chronic illness	0.91 (0.38 to 2.16)
		Had contact confirmed COVID-19 cases	3.09 (1.53 to 6.17)
		Participants who had poor social support	2.49 (1.40 to 4.43)
8	Hajure <i>et al</i> (2021) ¹³	Have depressive symptoms	10.5 (2.87 to 38.7)
		Used alcohol	6.28 (2.03 to 19.5)
		Khat	5.74 (1.83 to 18.1)
		Tobacco	6.76 (2.15 to 21.2)
9	Chekole <i>et al</i> (2020) ¹⁵	Master's and above in education	6.0 (1.59 to 22.31)

AOR, adjusted OR; HCWs, healthcare workers.

73.3%.³⁶ This difference could be due to the difference on the awareness level of healthcare professionals regarding the potential transmission mechanisms. From the subgroup analysis by region the prevalence of anxiety in Addis Ababa and Oromiya 78% and Amhara region 64% is high compared with other regions. This could be due to the first case was reported in Addis Ababa. From subgroup analysis by instrument used, there is heterogeneity and the pooled prevalence of anxiety on study measured by DASS-21 is 74%. Also, the pooled prevalence by GAD-7 is 37%, this is lower than study by GAD-7 in Sudan 53.3%³⁷ and South Africa 66.1%.³⁸ This might be due to the sensitivity and specificity of the instruments.

The pooled adjusted OR of female HCWs is 1.89, 95% CI (1.41 to 2.37) implies that the odds of female HCWs 1.89 times more to develop the anxiety than males during the pandemic. This is supported by study in Kenya.³³ So that female HCWs need more psychological support.³⁹

Similarly, working at COVID-19 isolation centre adjusted OR is 3.02, 95% CI (1.67 to 4.37), meaning that the odds of healthcare professionals working at emergency/isolation centre three times more to develop anxiety than pharmacy. The pooled adjusted OR of HCWs contact with confirmed cases is 1.98, 95% CI (1.04 to 2.92) implies that the odds of HCWs contact with confirmed cases are nearly two times more than who do not have contact. This is in line with study in Kenya.⁴⁰

The pooled prevalence of stress among HCWs during the COVID-19 pandemic was 51%. This was higher than the prevalence of stress among older HCWs 40.3%³⁴ and 42.1%³² in Chinese HCWs, lower than study in Egypt 66.6%.³⁵ The subgroup analysis by region heterogeneity test indicates that there is significant variability among regions. The prevalence in Oromiya region is 59%, which is higher compared with the other regions. Also, subgroup analysis by instrument measuring stress



indicates there is significant heterogeneity among instruments.

The pooled adjusted OR on female HCWs is 2.02, 95% CI (1.23 to 2.80) implies that the odds of female HCWs are two times more to develop stress than males during the pandemic. This is supported by study in Kenya⁴⁰ and study in South Africa.³⁸ Working at COVID-19 isolation centre the pooled adjusted OR is 2.38, 95% CI (0.79 to 3.96) meaning that the odds of working at COVID-19 isolation centre 2.38 times more to develop stress than their counterparts. This is in line with study reported nurses work place leads to develop stress.⁴¹ Also, younger in age pooled adjusted OR is 2.50, 95% CI (0.16 to 4.85) implies that the odds of younger in age HCWs is 2.50 times more to develop stress than older. This is in line with study South Africa.³⁸ The odds of married HCWs were 2.8 times more to develop stress than single (pooled AOR 2.8, 95% CI 1.99, 3.61), this contradicts with study in South Africa reported married HCWs are less likely to develop stress.³⁸ Profession has its own effect to develop stress. The odds of medical laboratory professional HCWs were 2.69 times more to develop stress than nurses (pooled AOR: 2.69, 95% CI 1.45 to 4.93). This is in line with a study on Mexican nurses stating presence of a confirmed and suspected case of COVID-19 in their workplace worse the mental health outcomes.⁴²

Whereas, this study is with strengths and limitation. Screening, data extraction and methodological quality assessment were performed by two authors independently. The quality of included studies was done by the NOS of the included studies. The absence of sufficient studies on the impact of COVID-19 on the mental health (anxiety and stress) of healthcare professionals in Ethiopia, and sensitivity analysis was not assessed due to no influential study is observed in the DOI plot were the limitation of this study.

CONCLUSION

The COVID-19 pandemic produced a variety of mental health impacts among healthcare professionals in Ethiopia. The prevalence of stress and anxiety among HCWs was significantly high in Ethiopia due to COVID-19 pandemic. There was heterogeneity on the prevalence of anxiety and stress on healthcare professionals among regions and instruments used. The timely establishing programmes that offer awareness on the COVID-19 virus, psychological counselling and intervention should be applied for HCWs to improve the general mental health problems. In addition, further studies on the long-term impacts of COVID-19 pandemic on mental health of healthcare professionals and on the general population should be investigated.

Contributors All authors have made significant contributions to this study. AAH developed the research question, wrote the first draft, designed the search strategy, edited and approved the final version of the article and controlled and managed the overall work. AAS revised the search strategy of databases, developed the data

extraction form edited and approved the final version of the article. AAM revised the data extraction form and edited and approved the final version of the article.

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ORCID iDs

Aragaw Asfaw Hasen <http://orcid.org/0000-0001-6556-805X>

Abubeker Alebachew Seid <http://orcid.org/0000-0002-9171-3211>

Ahmed Adem Mohammed <http://orcid.org/0000-0003-3257-1281>

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Supplementary file 1: Search strategy for PubMed, Cochrane Library, CrossRef and Google Scholar databases

Databases	Search number	Search detail
a. PubMed	#1	“COVID-19”[MeSH Terms]
	#2	“mental disorder”[Mesh Terms] OR “anxiety”[Mesh Terms] OR “stress”[Mesh Terms]
	#3	“COVID-19”[Title/Abstract] OR “2019 novel coronavirus disease”[Title/Abstract] OR “2019 novel coronavirus infection”[Title/Abstract] OR “2019 ncov disease”[Title/Abstract] OR “2019 ncov infection”[Title/Abstract] OR “covid 19 pandemic”[Title/Abstract] OR “covid 19 pandemics”[Title/Abstract] OR “covid 19 virus disease”[Title/Abstract] OR “covid 19 virus infection”[Title/Abstract] OR “COVID19”[Title/Abstract] OR “coronavirus disease 2019”[Title/Abstract] OR “coronavirus disease 19”[Title/Abstract] OR “sars coronavirus 2 infection”[Title/Abstract] OR “sars cov 2 infection”[Title/Abstract] OR “severe acute respiratory syndrome coronavirus 2 infection”[Title/Abstract] OR “SARS-CoV-2”[Title/Abstract] OR “2019 novel coronavirus”[Title/Abstract] OR “2019 novel coronavirus”[Title/Abstract] OR “2019- nCoV”[Title/Abstract] OR “covid 19 virus”[Title/Abstract] OR “covid19 virus”[Title/Abstract] OR “Coronavirus disease 2019 virus”[Title/Abstract] OR “SARS coronavirus 2”[Title/Abstract] OR “SARS cov 2 virus”[Title/Abstract] OR “severe acute respiratory syndrome coronavirus 2”[Title/Abstract] OR “Wuhan coronavirus”[Title/Abstract] OR “Wuhan seafood market pneumonia virus”[Title/Abstract]
	#4	“Mental illness” [Title/Abstract] OR “Psychiatric problem” [Title/Abstract] AND “anxiety” [Title/Abstract] OR “stress” [Title/Abstract] OR “psychology problem” [Title/Abstract] OR “mental health effect” [Title/Abstract] OR “psychological disturbance” [Title/Abstract] “Mental Disorder” [Title/Abstract] OR “Psychiatric Illness” [Title/Abstract] OR “Psychiatric Diseases” [Title/Abstract] OR “Psychiatric Disorders” [Title/Abstract] OR Behavior Disorders” [Title/Abstract] OR “Severe Mental Disorder” [Title/Abstract]
	#5	“health care professionals”[Title/Abstract] OR “health care workers”[Title/Abstract] AND “Ethiopia”[Title/Abstract] OR “Addis Ababa”[Title/Abstract] OR “Amhara”[Title/Abstract] OR “Afar”[Title/Abstract] OR “Oromia”[Title/Abstract] OR “SNNP”[Title/Abstract] OR “Somali” [Title/Abstract] OR “Gambella” [Title/Abstract] OR “Benishangul-Gumuz” [Title/Abstract] OR “Tigray” [Title/Abstract] OR “Harari” [Title/Abstract] OR “Dire Dawa” [Title/Abstract]
	#6	#1 OR #3
	#7	#2 OR #4
	#8	#5 AND #6 AND #7
	#9	Limit to “observational study” OR “cohort” OR “cross-sectional”

b. Cochrane Library, CrossRef and Google Scholar	#1	COVID-19 OR coronavirus disease 2019 OR SARS CoV-2 OR 2019 novel coronavirus disease OR 2019 novel coronavirus infection OR 2019 ncov disease OR 2019 ncov infection OR covid 19 pandemic OR covid 19 pandemics OR covid 19 virus disease OR covid 19 virus infection OR COVID19 OR coronavirus disease 19 OR sars coronavirus 2 infection OR sars cov 2 infection OR severe acute respiratory syndrome coronavirus 2 infection OR 2019 novel coronavirus OR 2019 novel coronavirus
	#2	mental illness OR psychiatric problem OR anxiety OR stress OR psychology problem OR mental health
	#3	health care professionals OR health care workers OR Ethiopia OR Addis Ababa OR Amhara OR Afar OR Oromia OR SNNP OR Somali OR Gambella OR Benishangul-Gumuz OR Tigray OR Harari OR Dire Dawa
	#4	#1 AND #2 AND #3
	#5	Limit to studies published till the end of June, 2022
	#6	Limit to Humans
	#7	Limit to observational study OR cohort OR cross-sectional