



Systematic Review / Meta-analysis

Global prevalence and determinants of mental health disorders during the COVID-19 pandemic: A systematic review and meta-analysis

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ABSTRACT

Background: Coronavirus Disease 2019 (COVID-19) has infected more than 5 million and lost the lives of more than 300 thousand people globally. It is the first-ever deadly pandemic with a significant degree of fear, worry and concern in the population at large. Therefore, this Meta-Analysis aims to assess the global prevalence and determinants of mental health disorders.

Methods: A three-stage search strategy was conducted on PubMed/Medline, Science direct LILACS and PsycINFO databases. The Heterogeneity among the included studies was checked with forest plot, χ^2 test, I² test, and the p-values. Publication bias was checked with a funnel plot and the objective diagnostic test was conducted with Egger's correlation, Begg's regression tests, and Trim and fill method.

Results: The Meta-Analysis revealed that the pooled prevalence of anxiety and depression 33.59% (95% confidence interval (CI): 27.21 to 39.97, 30 studies, 88,543 participants) and 29.98% (95% confidence interval (CI): 25.32 to 34.64, 25 studies, 78,191 participants) respectively.

Conclusion: The review revealed that more than thirty percent of patients developed anxiety and depression during COVID-19 Pandemic. This presages the health care stakeholders to prevent and intervene in mental health disorders.

Registration: This review was registered in Prospero international prospective register of systematic reviews (CRD42020183146).

1. Introduction

Severe acute respiratory syndrome (SARS-CoV-2) belongs to a group of viruses that cause Coronavirus disease 2019 (COVID-19) which affects the respiratory, gastrointestinal, liver and central nervous system of humans, livestock, bats, mice and another wild animals [1,2]. The World Health Organization (WHO) officially declared the COVID-19 epidemic as a public health emergency of international concern as of January 30, 2020 [3,4]. COVID-19 has affected more than 213 countries and regions worldwide (a total of five million and above confirmed cases, and cumulative deaths reached 300 and above deaths) [5].

As the COVID-19 pandemic rapidly sweeps across the world, it is inducing a considerable degree of fear, worry and concern in the population at large and among certain groups in particular, such as older adults, care providers and people with underlying health conditions [6, 7].

The COVID-19 poses challenges in all aspects of life including mental

health for the entire human race [8,9]. During a pandemic, the number of people whose mental health is affected tends to be greater than the number of people affected by the infection [10].

The increasing mental health burden during the COVID-19 outbreak, there have been increasing calls for enhanced mental health support [3, 9–12]. Emotions can be amplified by pre-existing depressive and anxiety disorders, contributing to the increased rumination of contracting the disease, and this can profoundly remodel people's behaviour and social interaction with others. Internationally, stigma and blame targeted at communities affected by the outbreak by other countries due to a fear of infection impedes cross-national trade, fueling further unrest (3).

Novel coronavirus pandemic is associated with shorter and long term mental health problems ranging from minor to severe mental illnesses as depicted with studies conducted since the first coronavirus outbreak in 2002 in China. Studies showed that the psychological impact of the novel coronavirus pandemic is was very high [4,13,14].

A cross-sectional study conducted by Naser et al. in Jordan among

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the general population, health care providers and University students to assess the mental health status revealed that the prevalence of overall depression was 23.8% and among which 11.3% was observed among health care providers [15].

Another study conducted by Zhang et al. in China among medical health workers on mental health and psychosocial related with COVID-19 showed that the prevalence of insomnia, anxiety, depression and somatization was (38.4 vs. 30.5%), (13.0 vs. 8.5%) (12.2 vs. 9.5%), and (1.6vs. 0.4%) respectively as compared to non-healthcare providers [16]. The other finding of the study was conducted in China by Wang C et al. (53.8%) [17]. On the other hand, a study done in china Wuhan by Dai Y et al. was (39.1% vs 51.6%) [18].

A study conducted by Liu et al. in China among 4976 doctors and nurses to assess the impacts of COVID-19 on Mental health showed that the prevalence of psychological distress, anxious symptoms, and depressive symptoms were 15.9%, 16.0%, and 34.6% respectively [19]. However, another study conducted in Singapore by Benjamin et al. among 490 health care providers to investigate the psychological impacts of COVID-19 outbreak showed that the prevalence of anxiety was higher among nonmedical health care workers than medical personnel (20.7% versus 10.8% [20].

The clinical characteristics of psychological distress have not been well established across the populations affected by the COVID-19 pandemic, although a generally increased level of mental distress has been reported from both the general public and frontline personnel [21].

Several studies showed that female gender is identified for the development of depression, anxiety and other mental illness in patients with COVID-19 [15,16,20,22,23].

A study conducted in China revealed that the majority of respondents were in the age range of 21.4–30.8 years (53.1%) and married (76.4%) [17]. Also, a study conducted in China which was six to ten years 1960 (45%) [18].

A cross-sectional study conducted in China by Zhang et al. among medical health workers on mental health and psychosocial problems showed that living in rural areas, at risk of contact with COVID-19 patients were the most common risk factors for insomnia, anxiety, obsessive-compulsive symptoms, and depression (16).

Another study conducted in Singapore by Benjamin et al. on Psychological impacts of COVID-19 pandemic on health workers showed that mental health problems were associated with married and those with co-morbidities [20].

Another study conducted in Vietnam by Nguyen et al. among 3497 participants to identify the independent predictors of depression among COVID-19 patients revealed that depression was more likely in patients with older patients aged greater than 60 years, higher educational attainments, presence of morbidities, low social status and low physical activity [24].

A cross-sectional study conducted in Jordan by Naser et al. on the mental health status of the general population, health care workers and university students revealed that mental health problems were more likely in divorced participants among the general population and University Students with a history of chronic disease and those with high income (≥ 1500 JD) were at higher risk of developing anxiety [15].

Another study conducted in China by Ahmed on Epidemic of COVID-19 and associated Psychological Problems showed that young people aged 21–40 years; alcohol use and low mental well-being were more likely to develop mental health problems [23]. A study conducted in China by Kong et al. among Hospitalized Patients with COVID-19 to investigate the prevalence and factors associated with Depression and Anxiety showed that low social support, older age groups were more likely to develop anxiety and depression [22]. Today, evidence on prevalence and determinates of anxiety and depression among the general population is still in demand. Therefore, it is vital to conduct this Systematic Review and Meta-analysis is intended to provide evidence on prevalence and determinates of anxiety and depression among the general population globally.

2. Methods

2.1. Protocol and registration

The systematic review and meta-analysis was conducted based on the Preferred Reporting Items for Systematic and meta-analysis (PRISMA) protocols [25], and the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) checklist [26]. This systematic review and meta-analysis were registered in Prospero international prospective register of systematic reviews (CRD42020183146).

2.2. Eligibility criteria

2.2.1. Types of studies

All cross-sectional studies assessing the prevalence of anxiety and depression among the general population without any language restriction from December 2019 up to April 2020 were incorporated.

2.2.2. Types of participants

The participants were all age groups of the population.

2.2.3. Outcomes of interest

The primary outcome of interest was the prevalence of anxiety and depression among the general population. Sociodemographic characteristics, social history, presence of comorbidities, history of pre-existing mental health disorders were determinants of preoperative anxiety.

2.2.4. Context

This systemic review and Meta-Analysis incorporated observational studies conducted globally and reporting the prevalence of anxiety and depression among the general population during COVID-19 pandemic.

2.2.5. Inclusion criteria

All observation (cross-sectional, case series, Cohort and case-control) studies assessing the prevalence and associated factors of anxiety and depression among the general population from December 2019 to April 2020 without language restriction which were published and unpublished articles conducted globally were included.

2.2.6. Exclusion criteria

Studies other than cross-sectional studies, studies that didn't report the prevalence of anxiety and depression, and cross-sectional studies scored less than fifty percent on quality assessment were excluded.

2.3. Search strategy

The search strategy was intended to explore all available published and unpublished studies on the prevalence of anxiety and depression among the general population globally. A three steps search strategy was employed in this review. An initial search on PubMed/Medline, Science direct LILACS and PsycINFO databases were carried out followed by an analysis of the text words contained in Title/Abstract and indexed terms. A second search was undertaken by combining free text words and indexed terms with Boolean operators. The third search was conducted with the reference lists of all identified reports and articles for additional studies. Finally, the additional and grey literature search was conducted on Google scholars up to ten pages. The result of the search strategy was presented with the Prism flow chart (**Figure- 1**).

2.4. Data extraction

The data from each individual study were extracted by SM and YA independently with Microsoft excel format and imported for analysis in R software version 3.6.1 and STATA version 16. Authors, publication year, mean age of participants, Country, events of anxiety, events of depression, sample size and events in each risk factor for factor analysis

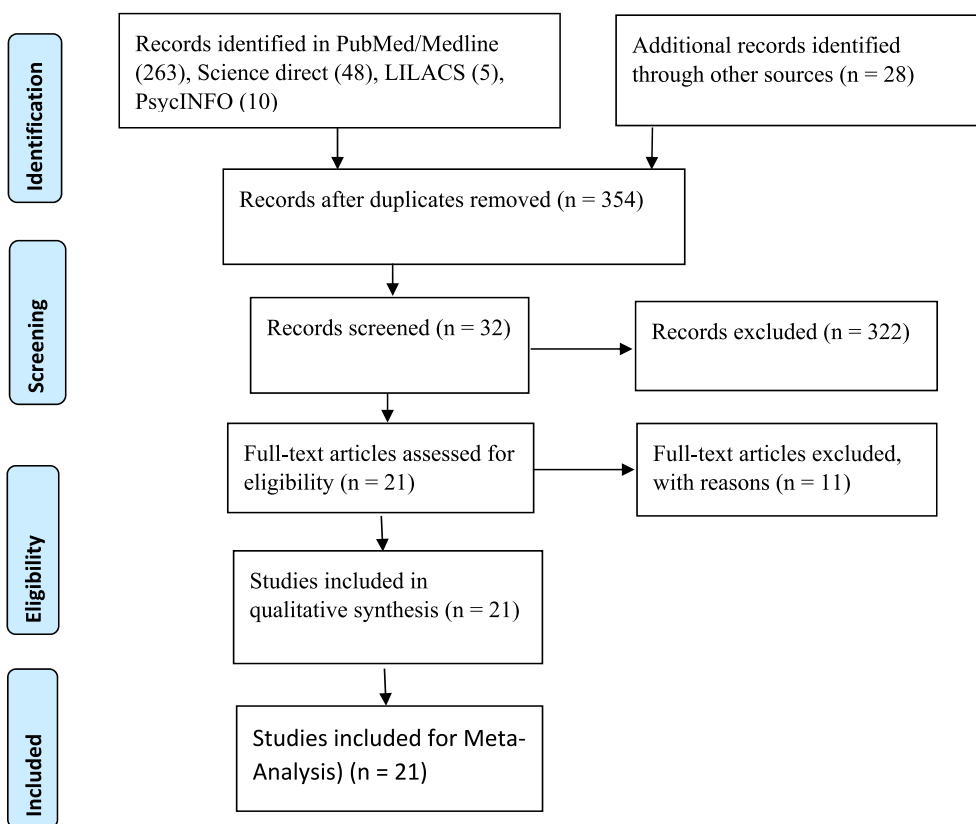


Fig. 1. Prisma flow chart.

Table 1
Description of included studies.

Author	Year	Sample	Country	Population	Quality score	Design
Ahmed et al.[23]	2020	1074	China	general population	8	online survey
Alenazi et al. [39]	2020	4920	Saudi	health workers	4	cross-sectional
Burhamah et al. [40]	2020	4132	Lebanon	General population	6	online survey
Chew et al. [41]	2020	906	Singapore	health workers	7	cross-sectional
Chi et al. [42]	2020	2038	China	Students	4	online survey
Cortes et al. [43]	2020	1105	Mexican	General population	4	online survey
Dai et al.[18]	2020	4357	China	general population	6	online survey
Ettman et al. [44]	2020	1470	USA	general population	4	online survey
Fu et at [45]	2020	1242	China	General population	4	online survey
González et al. [46]	2020	3550	Spain	health workers	5	online survey
Huang et al. [47]	2020	7236	China	general population	7	online survey
Kazmi et al. [48]	2020	1000	India	general population	5	online survey
Kong et al.[22]	2020	144	China	general population	6	cross-sectional
Lai et al. [49]	2020	1257	China	general population	8	cross-sectional
Li et al. [50]	2020	398	China	General population	5	online survey
Liang et al. [51]	2020	864	China	Women	4	cross-sectional
Liu et al. [52]	2020	285	China	Patients	5	cross-sectional
Liu et al. [53]	2020	512	China	medical workers	5	cross-sectional
Ma et al. [54]	2020	770	China	Patents	5	online survey
Mansourieh [55]	2020	7173	Iran	Family of health workers	6	online survey
Maroufizadeh et al. [56]	2020	5328	Iran	general population	7	cross-sectional
Naser et al.[15]	2020	4126	Jordan	health workers	6	cross-sectional
Nguyen et al. [24]	2020	3942	Vietnam	health workers	6	cross-sectional
Peng et al. [57]	2020	2237	China	General population	5	
Pisano et al. [58]	2020	5989	Italy	health workers	6	online survey
Que et al. [59]	2020	2285	China	health workers	5	
Rossi et al. [60]	2020	18,147	Italy	general population	8	online survey
Shevlin et al. [61]	2020	2025	United Kingdom	health workers	6	online survey
Sun et al. [62]	2020	2091	China	Patients	7	cross-sectional
Tadesse et al. [63]	2020	408	Ethiopia	Students	8	Cross-sectional
Wang et al. [17]	2020	1738	China	general population	5	cross-sectional
Ying et al. [64]	2020	822	China	general population	8	cross-sectional
Zhang et al. [65]	2020	1563	China	general population	7	online survey
Zhu et al. [19]	2020	5062	China	general population	6	online survey

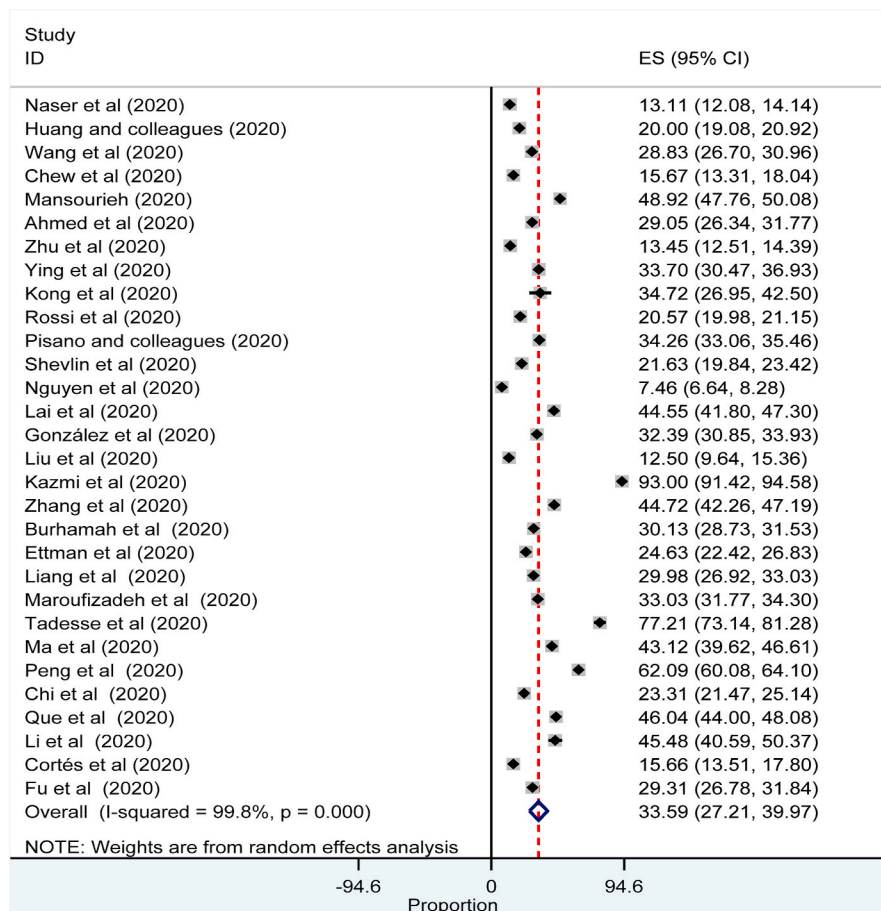


Fig. 2. Forest plot for the prevalence of depression among the general population: The midpoint of each line illustrates the prevalence; the horizontal line indicates the confidence interval, and the diamond shows the pooled prevalence.

were extracted.

2.5. Assessment of methodological quality

Articles identified for retrieval were assessed by two independent Authors for methodological quality before inclusion in the review using a standardized critical appraisal Tool adapted from the Joanna Briggs Institute (Supplemental Table 1). The disagreements between the Authors appraising the articles were resolved through discussion. Articles with average scores greater than fifty percent were included for data extraction. The quality of this systematic review was evaluated with the Assessment of Multiple Systematic Reviews 2 (AMSTAR2) checklist [27].

2.6. Data analysis

The pooled prevalence of anxiety and depression were determined with a random effect model as there was substantial heterogeneity. The Heterogeneity among the included studies was checked with forest plot, χ^2 test, I^2 test, and the p-values. Substantial heterogeneity among the included studies was investigated with subgroup analysis and meta-regression. Sensitivity analysis was done to evaluate the influential studies and further analysis was made after removing the outliers.

Publication bias was checked with a funnel plot and the objective diagnostic test was conducted with Egger's correlation, Begg's regression tests, and Trim and fill method. Furthermore, moderator analysis was carried out to identify the independent predictors of the prevalence of preoperative anxiety among surgical patients.

3. Results

3.1. Description of included studies

A total of 354 articles were identified from different databases as described in the methodology section with the Prisma flow diagram (Fig. 1). Thirty-two articles were selected for evaluation after the successive screening. Twenty-one Articles with 72, 999 participants assessing the prevalence and determinants of anxiety and depression as a primary outcome among the general population were included (Table 1) and the rest were excluded with reasons [28–38].

The included studies were published from January 29 to April 17, 2020, with sample size ranged from 144 to 18,147. The twenty-two included studies were conducted in CHINA (12 studies), India (1 study), Iran (one study), Italy (2 studies), Jordan (1 studies), Singapore (1 study), Spain (1 studies), United Kingdom (1 study) and Vietnam (1 study).

The majority of included studies were conducted on depression and anxiety (seventeen studies) while two studies were conducted to assess only post-traumatic stress syndrome and the other two were conducted with only anxiety.

Twelve studies were conducted on the general population while six studies were conducted among health care workers and other four studies were conducted among patient, children and health care worker families.

The majority of included studies identified the possible risk factors of anxiety and depression among the population which includes but not limited to gender, age, marital status, educational level, and occupation.

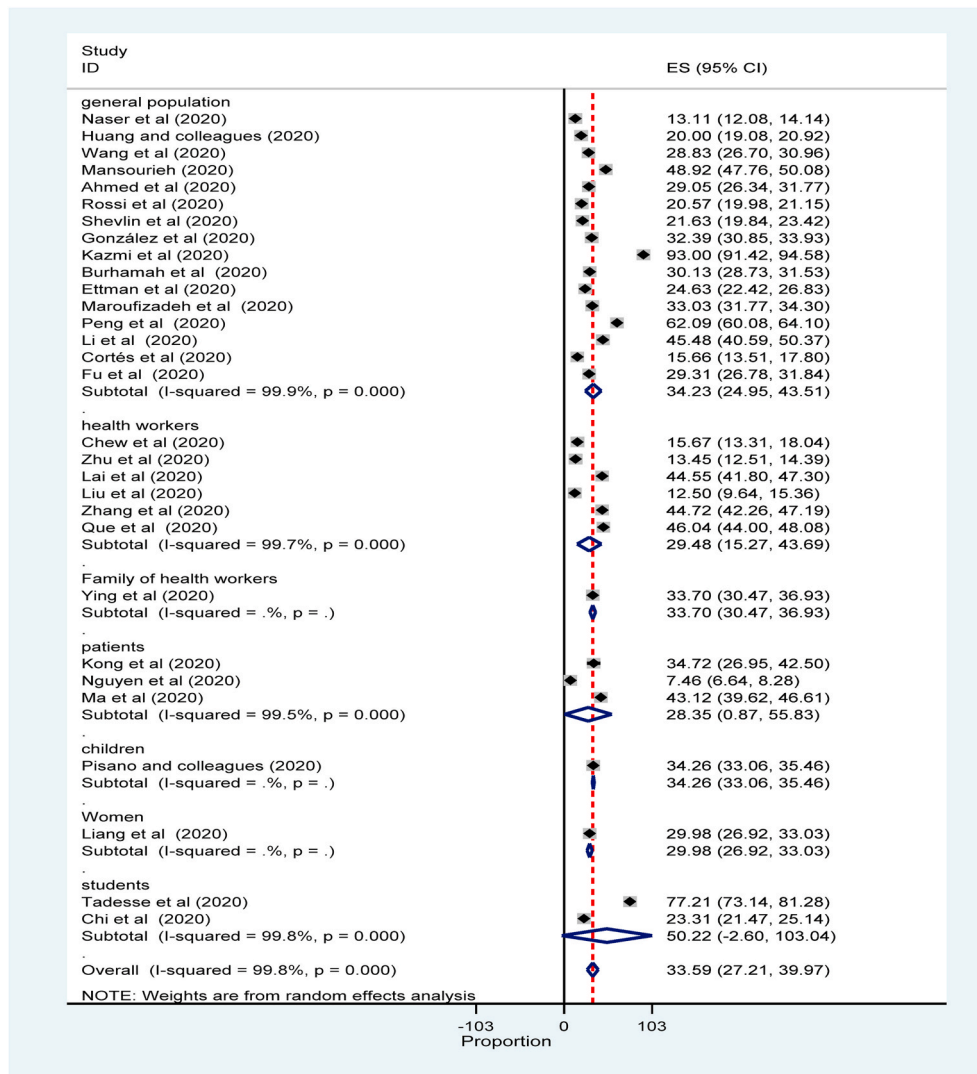


Fig. 3. Forest plot for subgroup analysis of the prevalence of depression by population: The midpoint of each line illustrates the prevalence; the horizontal line indicates the confidence interval; the diamond shows the pooled prevalence.

4. Meta-analysis

This systematic review and Meta-Analysis was intended to provide evidence on anxiety, depression and its deterrents among the general population. Eighteen of the included studies reported the prevalence of anxiety and depression.

The pooled prevalence of depression during COVID-19 Pandemic was 33.59% (95% confidence interval (CI): 27.21 to 39.97, 30 studies, 88,543 participants (Fig. 2).

The subgroup Analysis by population revealed that prevalence of depression among the general population was 34.23% (95% confidence interval (CI): 24.95 to 43.51) while the prevalence of depression among students and children were 50.22% (95% confidence interval (CI): 2.6 to 103.04) and 34.26% (95% confidence interval (CI): 33.06 to 35.46) respectively (Fig. 3).

The Meta-Analysis revealed that the prevalence of anxiety during COVID-19 pandemic was 29.98% (95% confidence interval (CI): 25.32 to 34.64, 25 studies, 78,191 participants) (Fig. 4).

Subgroup analysis by population revealed that the prevalence of anxiety was the highest among students 43.62% ((95% confidence interval (CI): 11.56 to 98.80) followed by patients 34.72% (95% confidence interval (CI): 26.95 to 42.50) (Fig. 5).

The funnel plot for evaluation of publication bias didn't show

asymmetric funnel plot. Besides, the rank correlation and Egger's regression test didn't show a significant difference for small study effect of anxiety (p-value >0.05) (Fig. 6).

The funnel plot for evaluation of publication bias didn't show asymmetric funnel plot. Besides, the rank correlation and Egger's regression test didn't show a significant difference for small study effect of depression (p-value >0.05) (Supplemental Fig. 1).

4.1. Determinants of mental health Disorders (Anxiety and depression)

Literature mentioned different types of risk factors of anxiety and depression population despite the presence of inconclusive evidence on the major independent predictors of anxiety and depression. The most commonly mentioned risk factors of anxiety include gender, marital status, educational level and occupation. On the other hand, the most commonly mentioned risk factors of depression included marital status, occupation and comorbidity.

The systematic review and Meta-Analysis revealed that being female was the risk of anxiety was increased by eighty-eight percent as compared to counterpart males, OR = 1.12 (95% confidence interval (CI): 1.0 to 1.3, ten studies). The systematic review also showed that the risks of anxiety were associated with marital status, occupation and educational level with OR = 1.26 (95% confidence interval (CI): 1.0 to

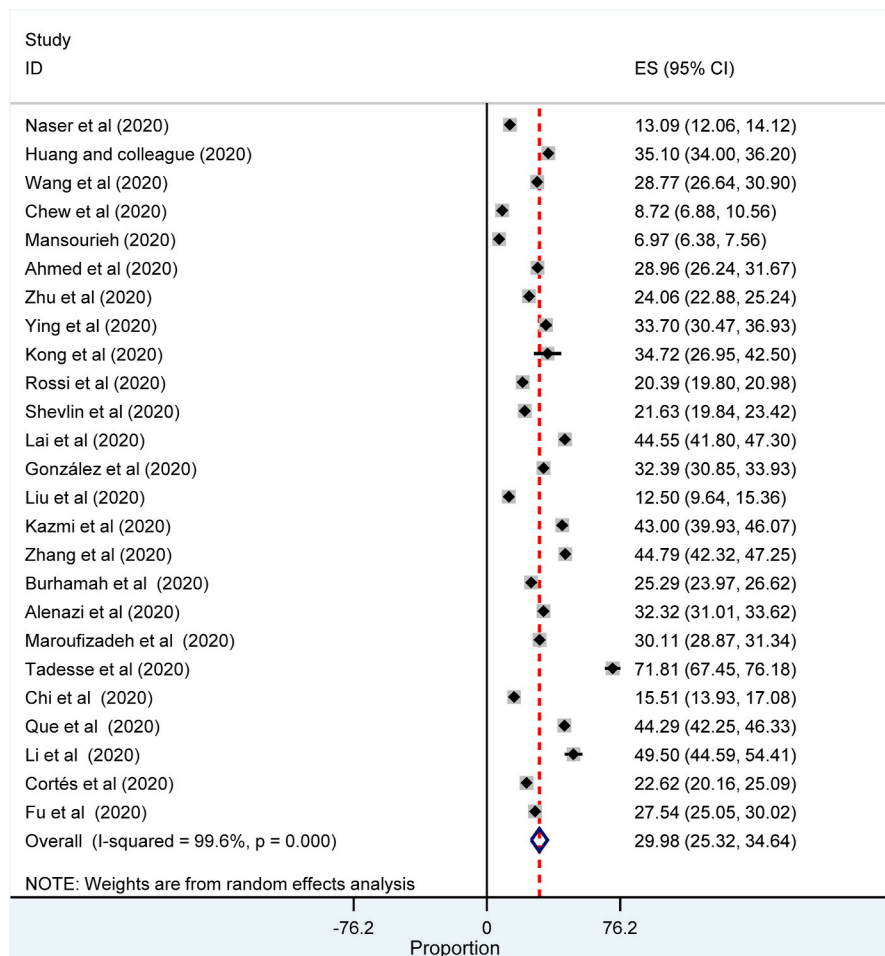


Fig. 4. Forest plot for the prevalence of anxiety among the general population: The midpoint of each line illustrates the prevalence; the horizontal line indicates the confidence interval, and the diamond shows the pooled prevalence.

1.8, four studies), OR = 1.1 (95% confidence interval (CI): 1.0 to 1.2, three studies), and OR = 1.1 (95% confidence interval (CI): 1.0 to 1.2, three studies) respectively (Supplemental Fig. 2).

The systematic review also showed that being married increased the risk of depression by eighty-two percent as compared to singles, OR = 1.18 (95% confidence interval (CI): 0.93 to 1.50, four studies). The systematic review and meta-analysis revealed that the risk of depression was associated with occupation and comorbidity OR = 1.16 (95% confidence interval (CI): 0.86 to 1.6, three studies) and OR = 1.84 (95% confidence interval (CI): 1.41 to 2.41, four studies) respectively (Supplemental Fig. 3).

5. Discussion

The mental health problems of the community during an outbreak crisis are a huge health care issue that necessitates prevention and early intervention [9,66,67].

This systematic review and Meta-Analysis revealed that the pooled prevalence of anxiety and depression were as high as 27% (95% confidence interval (CI): 21 to 33) and 32% (95% confidence interval (CI): 23 to 40) respectively which is in line with the majority of included studies (17, 19, 22, 23, 37, 46, 47, 58, 61, 64).

The prevalence of anxiety and depression in this systematic review and Meta-Analysis is higher than another systematic review and Meta-Analysis conducted among on health care worker during the COVID-19 pandemic, SARS and MERS outbreaks, 27% (95% confidence interval (CI): 14 to 40) and 26% (95% confidence interval (CI): 12 to 40) VS

14.8% (95% confidence interval (CI): 11.1 to 19) and 14.9% (95% confidence interval (CI): 12.1 to 18.2) respectively. This discrepancy might be explained by the inclusion of plenty of case reports and studies from previous coronavirus outbreaks from China and Arabian regions [68].

The subgroup analysis by population revealed that the prevalence of anxiety and depression were the highest among patients with COVID-19 followed by families' of health care workers, health workers and the general population. However, the majority of included studies reported that mental health problems were more prevalent in health care workers [11,16,19,49] as compared to others (23, 46, 47, 61). This discrepancy might be due to the inclusion of the small number of studies assessing the prevalence of anxiety among patients with COVID-19 where in our case, there was only one study.

This Systematic Review identified the independent predictors of anxiety and depression among the population during the COVID-19 pandemic. Female gender, health care workers, married marital status and higher educational level were independent predictors of anxiety while ageing less than forty and comorbidity decrease the risk of developing anxiety. Also, marital status, health care workers, and comorbidity were independent predictors of depression while ageing less than forty and female gender reduction the risk of developing depression.

5.1. Quality of evidence

The systematic review and meta-analysis included plenty of studies

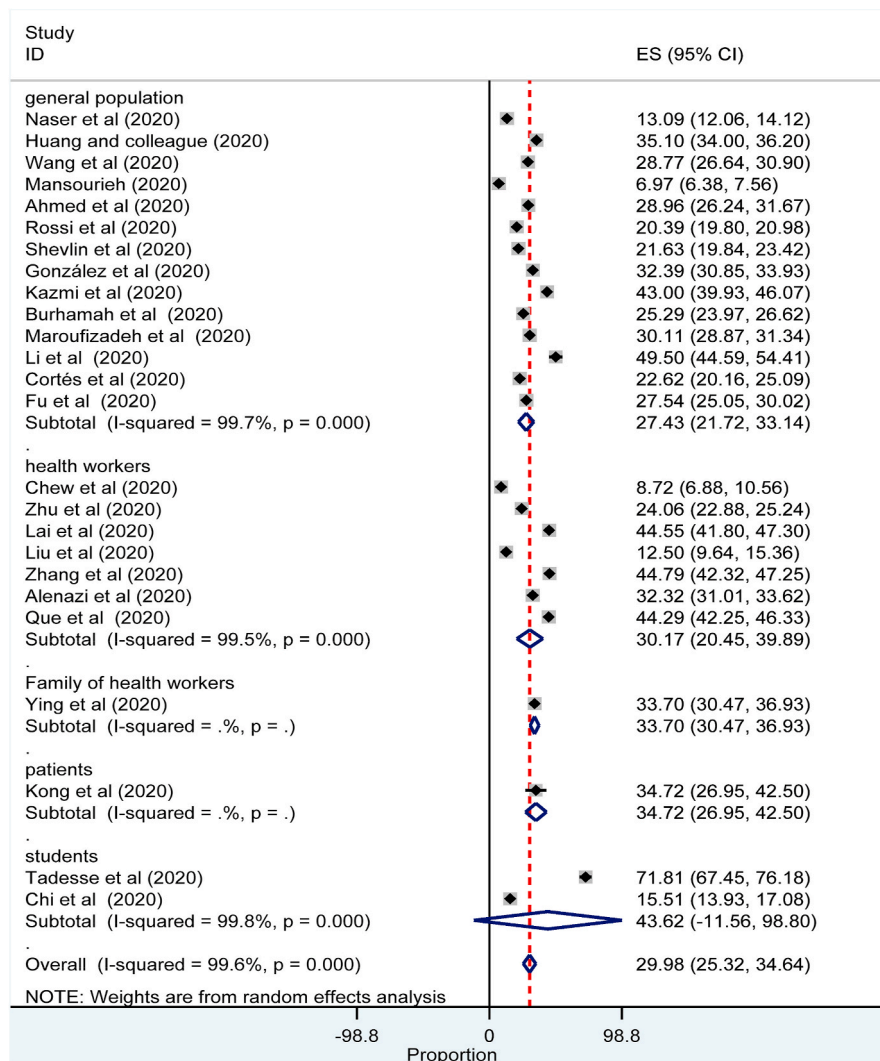


Fig. 5. Forest plot for subgroup analysis of the prevalence of anxiety by population: The midpoint of each line illustrates the prevalence; the horizontal line indicates the confidence interval; the diamond shows the pooled prevalence.

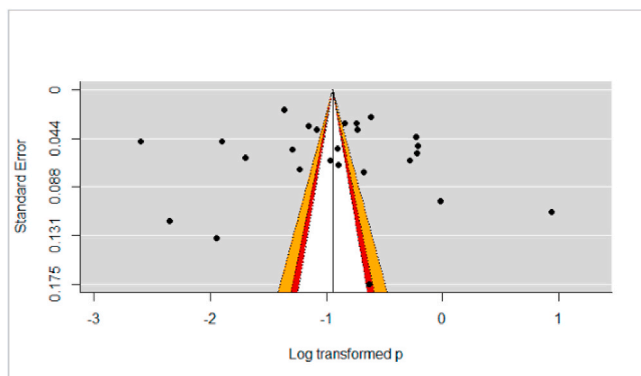


Fig. 6. Funnel plot to assess publication bias. The vertical line indicates the effect size whereas the diagonal line indicates the precision of individual studies with a 95% confidence interval.

with adequate sample size. The methodological quality of included studies was moderate to high quality as depicted with Joanna Briggs Institute assessment tool for meta-analysis of cross-sectional studies. However, substantial heterogeneity associated with dissimilarities of

included studies of general populations, settings, location and anxiety and depression assessment tools which entail further observational and randomized controlled trials by controlling potential confounders.

5.2. Limitation of the study

The review incorporated plenty of studies with a large number of participants but the majority of studies included in this review didn't report risk determinants for factor analysis. The included studies were conducted in a different setting, and population which caused substantial heterogeneity. Besides, there were a limited number of studies in some countries and it would be difficult to provide conclusive evidence with results pooled from a fewer study.

5.3. Implication for practice

Evidence revealed that the global prevalence of anxiety and depression during COVID-19 is very high. If these acute mental health problems are left untreated early, there could be huge long term mental, social and economic impacts of the community.

This day, people who seek mental health care might not visit the health institutions due to fear of the deadly COVID-19 pandemic, lack of awareness about mental health problems, reduced delivery care system, poor perception of mental health care and inadequate mental health

care. Therefore, mental health care advocacy to the community is required to prevent and intervene in mental health problems.

5.4. The implication for further research

The meta-analysis revealed that the prevalence of anxiety and depression were very high and the major independent predictors of anxiety and depression were outlined. However, the included studies were too heterogeneous and cross-sectional studies also don't show the temporal relationship between anxiety and depression and their determinants. Therefore, further observational and randomized controlled trials are in demand on COVID-19 by stratifying the possible independent predictors.

6. Conclusion

The global prevalence of anxiety and depression among the general population was very high which entails special attention. The Meta-Analysis revealed that the prevalence of anxiety and depression was the highest inpatient followed by the family of health workers while the lowest was seen in the general population followed by health workers.

The Meta-analysis revealed that gender, marital status, occupation and educational level were showed significant predictors of anxiety; but the independent variables age and comorbidity were not showed significant predictors of anxiety.

The systematic review and meta-analysis also showed that marital status, occupation and comorbidity were revealed significant predictors of depression; but the independent predictor's age and gender were not showed significantly associated predictors of depression.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

Data and material can be available where appropriate.

Funding

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Provenance and peer review

Not commissioned, externally peer-reviewed.

Authors' contributions

SA and YC conceived the idea design of the project. SA, YC, BB, SN, and BM were involved in searching strategy, data extraction, quality assessment, analysis, and manuscript preparation. All authors read and approved the manuscript.

Declaration of competing interest

The authors declare that there are no competing interests.

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Abbreviation

OR	Odd Ration
CI	Confidence Interval
COVID-19	Coronaviruses Disease 19
HCWs	Health Care Worker
LILACS	LatinAmerican and the Caribbean on Health Sciences Literature
MERS	the Middle East respiratory syndrome
PsycINFO	Psychological Information Database
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SARS	Severe Acute Respiratory Syndrome
WHO	World Health Organization

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.102634>.

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