

# Mental Health Status of University Students During the Covid-19 Pandemic: a Systematic Review and Meta-analysis.

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## Abstract

**IMPORTANCE** Under the global Covid-19 epidemic circumstances, the mental health problem is a serious issue for the general population, especially for college students.

**OBJECTIVES** To examine the popularity of moderate to severe depression and anxiety among college students.

**DATA SOURCE** PubMed, Embase, and Google Scholar are searched from December 2019 to December 2020. Search terms included Coronavirus, COVID-19, students, college students, university students, mental illness, mental health problems, distress, anxiety, and depression.

**STUDY SELECTION** All articles include anxiety and depression proportions, and these results are derived from globally accepted diagnostic measures. Articles focusing on other mental issues or using informal diagnostic measures were excluded.

**MAIN OUTCOMES AND MEASURES** Moderate to severe level in depression and anxiety is a combination of moderate", "moderately severe" and "severe" levels. For evaluating the mental health status, random effects model are utilized to estimate the proportion moderate to severe depression and anxiety. Heterogeneity is accessed by  $I^2$ , and publication bias is accessed by Begg's and Egger's tests.

**RESULTS** 10 relevant studies are included in the meta-analysis. It shows that globally, the prevalence of moderate to severe depression among college students is 32.7% (95%CI, 24%-43%), and the prevalence of moderate to severe anxiety is 29.0% (95%CI, 21%-38%). Heterogeneity between each studies are pretty high ( $I^2$  : 99.9%), and the publication bias is not high.

**CONCLUSIONS AND RELEVANCE** The findings of this study shows the mental health issue in college students is very serious, and

some remedy measures are needed.

**Keywords:** Mental health; Collage students; Systematic review; Meta-analysis; Covid-19

## 1 Introduction

In December 2019, the first Covid-19 case was reported in Wuhan, China. Soon after, this rapid spread virus soon becomes a global threat to public health. As of December 2020, Over 70 million people are getting infected by Covid-19, and among them, 1.6 million people have died[1]. Increased cases around the world make people more worried about their own lives. Nervousness and anxiety in a society affect everyone to a large extent, which causes a big challenge to public mental health. Quarantine and social isolation has been showed can protect the population and mitigate the spread of COVID-19 [2]. However, studies showed that prolonged social isolation and loneliness are associated with potential public health problems, such as increased mortality risk and cognitive functional status decline [3]. Recent evidence suggests that people who are kept in isolation and quarantine experience significant levels of anxiety, anger, confusion, and stress[4]. Among the general population, university students appear to be particularly susceptible to the negative impacts of quarantine[5]. Students were found to experience a higher level of anxiety and depression[6]. This study focuses on relevant researches about college students in a worldwide rage, aiming to explore the mental health status of college students under this pandemic. For evaluating the mental health status, moderate to severe depression and moderate to severe anxiety is accessed to find the popularity of the relatively severe mental status.

## 2 Method

### Search Strategy

As the first step of this systematic review and meta-analysis, the search is conducted on Pubmed, Embase and Google Scholar databases. In order to identify the articles, the search terms of Coronavirus, COVID-19, students, college students, university students, mental illness, mental health problem, distress, anxiety, depression, and the possible combinations of all these keywords are used.

### Inclusion and exclusion criteria

The criteria for entering the systematic review included: 1) Studies that examined the anxiety, depression among college students during the COVID-19 pandemic, 2) Studies that use worldwide recognized diagnosis measurements, 3) Studies that their full text was available, 4) The language of the research is English.

The criteria for excluding a study were: 1) Unrelated research works, 2) Studies without sufficient data, 3) Duplicate sources, 4) Pieces of research with unclear methods 5) Unrelated intervention studies 6) Case reports, and 7) Articles that their full text was not available.

### **Data collection and results**

Studies with search strategy are identified and duplicated studies are removed. Screen the titles and abstracts of the studies retrieved during the searches to identify those that may meet the inclusion criteria, and to exclude irrelevant studies. It shall be screened by reading the full text if necessary. Then the full text are review in the filtered studies from the previous step. Besides the inclusion and exclusion criteria, study quality is carefully assessed. After the review step, the key data is extracted in each study, which includes: authors, number of participants of the included studies, proportion of moderate to severe depression, proportion of moderate to severe anxiety and the corresponding diagnosis methods.

### **Statistical analysis**

In this meta-analysis, although different tests are used as depression and anxiety measurements, levels of each tests are indicated in the research. There are five levels: "normal", "mild", "moderate", "moderately severe" and "severe" [4, 5, 7, 8, 9, 10]. The "moderate to severe" level of this meta-analysis is a combination of "moderate", "moderately severe" and "severe" levels. The main study of interest is to find the proportion of the "moderate to severe" in both depression and anxiety issues.

Due to the studies was conducted in different regions, different tests, and different scales, random-effects model are used to estimate the overall proportion. The  $I^2(\%)$  test was used to assess the heterogeneity of the selected researches. In order to assess publication bias, graphical illustration and formal tests are utilized. Funnel plot is applied to access the publication bias. In the tests part, the Begg's and Egger's tests are conducted with the significance level of 0.05. The corresponding Forest plots are drawn as well. Data analysis is performed using the R software, and the R code are included in the Appendix.

## **3 Results**

### **Study Selection and Characteristics**

In this research, the moderate to severe depression and anxiety among college students during this pandemic are assessed. Articles with this focus were collected from Dec.2019 to Dec. 2020 and are systematically reviewed according to

the PRISMA guidelines. Following the initial search, 168 possible related articles are identified. Among these articles, 20 papers are duplicates, and therefore excluded. At the screening stage, out of the remaining 148 studies, 112 articles are removed after assessing their title and abstract with the inclusion and exclusion criteria. At the eligibility evaluation phase, out of the remaining 36 studies, 14 articles were removed after the examination of their full text, and similarly by considering the inclusion and exclusion criteria. At the quality evaluation stage, through the evaluation of the full text of the articles, out of the remaining 22 studies, 12 studies, that were assessed as low methodological quality works, were eliminated. Finally 10 studies reached the final analysis stage (Fig.1). Details and characteristics of these articles are provided in Table 1. Seven of the studies are from Asia, two of them from France, and one of them is from USA. The scale in each studies are quite different. Some studies are pretty big, over 7 million responses, while one of the study from India only have 128 individual responses.

Study	Author	Country	N	depression test	depression	anxiety test	anxiety
1	Wathelet	France	69,054	BDI-13	16.10%	STAI-Y2	27.5%
2	Zhao	K,C,J	821	PHQ-9	20.94%		Not indicate
3	Kalok	Malaysia	772	DASS 21	25.10%	DASS 21	36.9%
4	Ma	China	746,217	PHQ-9	21.10%	GAD-7	11.00%
5	Disord	France	8,004	PHQ-9	43%	GAD-7	39.10%
6	Islam	Bangladesh	476	PHQ-9	53.70%	GAD-7	42.90%
7	Res	US	2031	PHQ-9	48.14%	GAD-7	38.48%
8	Balhara	India	128	PHQ-9	26.90%	GAD-7	16.92%
9	Naser	Jordan	1165	PHQ-9	61.40%	GAD-7	45.90%
10	Xiao	China	933	PHQ-9	25.30%	GAD-7	17.10%

### Investigating heterogeneity and publication Bias

To investigate the heterogeneity of the studies, the  $I^2\%$  statistics for the moderate-severe depression ( $I^2 : 99.9\%$ ) and anxiety ( $I^2 : 99.9\%$ ) are obtained. Due to the high heterogeneity in the studies, the random effects model was used in the analysis of findings. Funnel plot of depression (Fig.2) and anxiety (Fig.3) shows most of the studies have significant results. But it is not clear whether the plot is symmetry. To conduct a more rigorous assessment, the Begg's and Egger's test was conducted. For moderate-severe depression, the p-value for Begg's test is 0.7884, and for Egger's test is 0.1613, which are kind of consistent and both indicate the publication bias was not significant for moderate-severe depression. For moderate-severe anxiety, however, the number of studies ( $k=9$ ) is too small to test for small study effects. Due to the innocent covid-19, the publication bias should not be very big.

### Meta-analysis

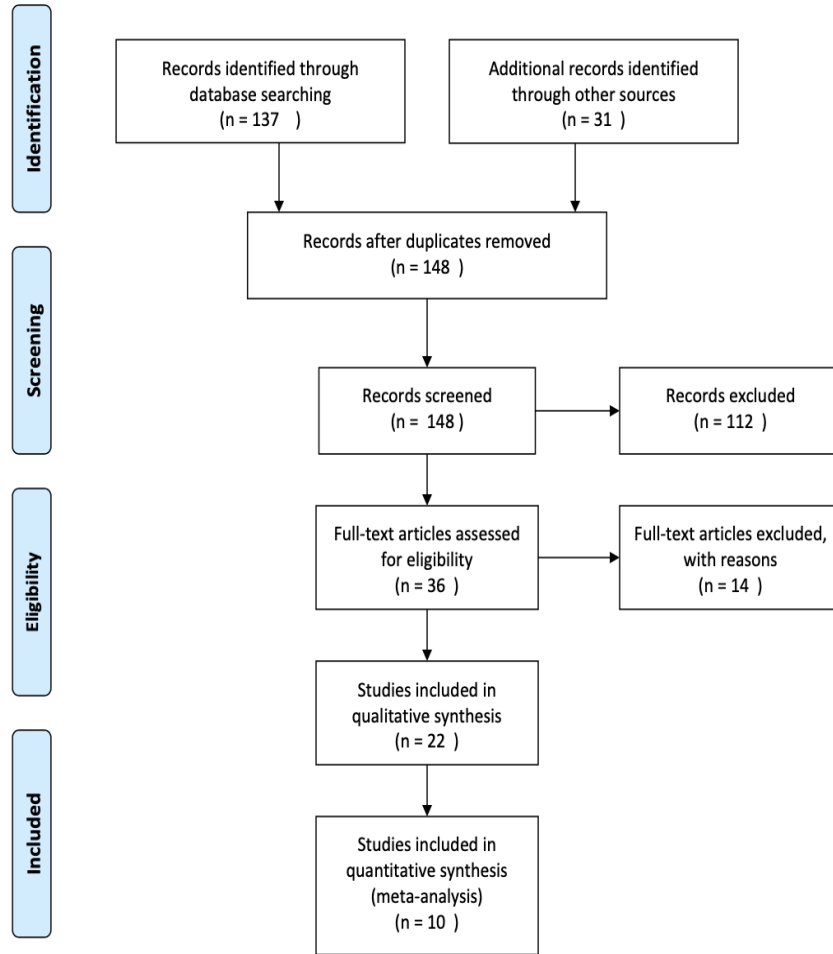


Figure 1: PRISMA Flow Diagram

The moderate-severe depression proportion in 10 of the studies is 32.7% (95% CI: 24.0; 42.7)], and the forest plot is in Figure 4. The moderate-severe anxiety proportion in 9 studies is 29.0% (95% CI: 21.1; 38.4) (Fig.5). Figures 4 and figures 5 present the Forest plots for the depression and anxiety based on the random effects model, in which each gray square is the proportion rate, and the length of the line on which the square is located denotes 95% confidence interval. The gray diamond shape represents the overall prevalence rate for the symptoms.

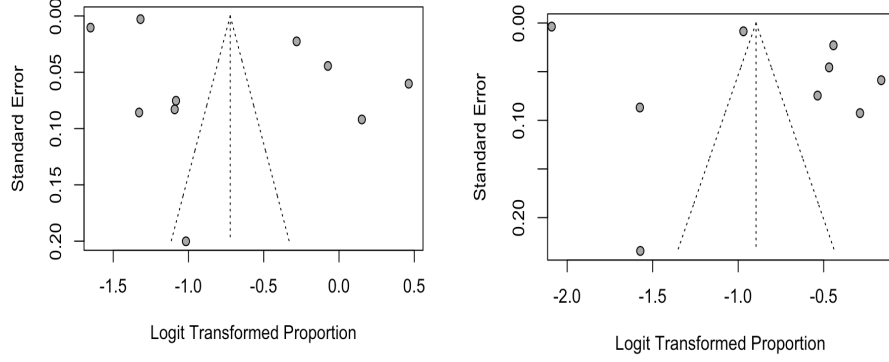


Figure 2: Funnel plot of depression (left) and anxiety (right)

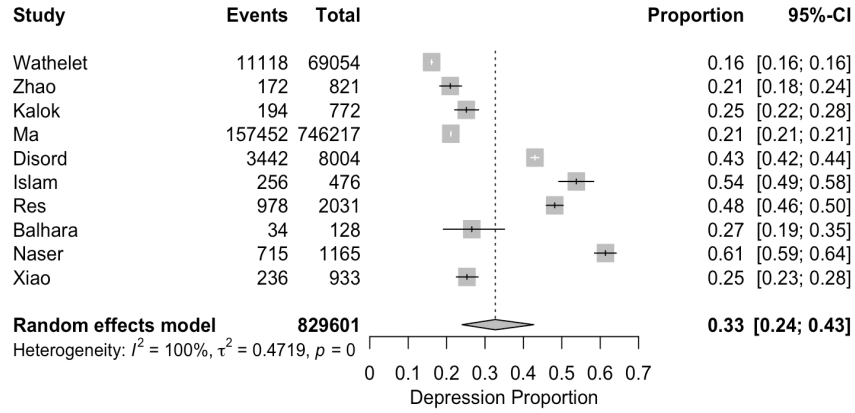


Figure 3: Forest plot for depression

## 4 Discussion

This research is a systematic review and meta-analysis on the proportion of moderate-severe depression and anxiety in college students following the COVID-19 pandemic. According to our analysis, the proportion of moderate-severe depression and anxiety are 32.7% and 29.0% respectively. This is an indication that popularity of depression and anxiety is very high.

Some studies shows that they found a significant increased mental problems occurs among college students[11]. A study from France shows they found that the mental health condition in Covid-19 is much worse than a study they conducted one year ago [10]. Some online survey also shows students can hardly

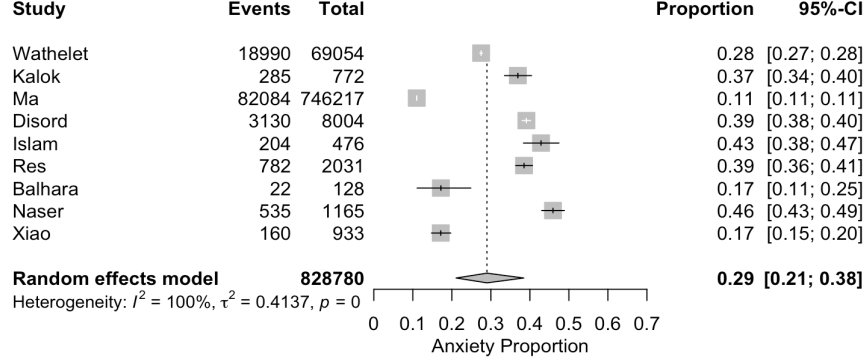


Figure 4: Forest plot for Anxiety

concentrate in online class[12]. Some students worried more about their online class quality and their academic performance, because it’s harder for them to communicate with professors and TAs[13].

The emergence of COVID-19, with its rapid spread, has exacerbated anxiety in populations globally, leading to mental health disorders in individuals. Therefore, it is necessary to examine and recognize people’s mental states in this challenging, destructive, and unprecedented time[14]. Some assistance is needed to help the students who are mentally in surfer at this time, thus some bad circumstances may be prevented.

### Limitations

There are several limitations to this study. First, some studies could be undiscovered. This research only search for three databases, and some studies which are only from other databases might be missed. In addition, because it is a worldwide estimation, some studies may conducted in a foreign language, and hence cause a bias for estimation. Second, although most of the mental assessment systems among these studies are similar. Most depression measurement is PHQ-9 and most anxiety measurement is GAD-7. But still other studies use other measurements, which may cause the bias of the estimation result. Last, most mental condition assessments are conducted via an online format, and some self-report bias may exist in each study. Moreover, the low response rate in some studies also shows a biased result. The non-response individuals might be very satisfied about their lives, or they might too upset in this pandemic time and unlikely to do the online survey. As we have no information about the non-response individuals, the results from each study might be biased.

## 5 Conclusion

The outcome of this meta-analysis indicates the mental status of college students is not satisfactory. Some students may go through severe mental health troubles, and they may handle this with burden academic assignments and isolated social connections. Therefore, a relatively higher quality of online mental service is needed for students who require mental help.

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## Appendices

```

## R code for meta-analysis
## Input Data
author=c("Wathelet", "Zhao", "Kalok", "Ma", "Disord", "Islam", "Res", "
        Balhara", "Naser", "Xiao")
country=c("France", "Korea", "China", "Japan", "Malaysia", "China", "France",
        "Bangladesh", "USA", "India", "Jordan", "China")
N=c(69054, 821, 772, 746217, 8004, 476, 2031, 128, 1165, 933)
Depression=c
(0.161, 0.2094, 0.251, 0.211, 0.43, 0.537, 0.4814, 0.269, 0.614, 0.253)
depression=round(N*Depression, digits = 0)
Anxiety=c(0.275, NA
        , 0.369, 0.11, 0.391, 0.429, 0.3848, 0.1692, 0.459, 0.171)
anxiety=round(N*Anxiety, digits=0)
mydata=data.frame(author=author, country=country, N=N, depression=
        depression, anxiety=anxiety)

## Meta-analysis with random effects model
mcl = metaprop(depression, N, data=mydata, comb.fixed=FALSE, studlab =
        paste(author))
mcl
forest(mcl, comb.random=TRUE, xlab="Depression Proportion", xlim=c
        (0, 0.7),
        hetstat=FALSE, smlab="",
        leftlabs=c("Method", "Between-study\nheterogeneity"),
        print.byvar=FALSE)

## Small effect illustration
funnel(mcl)
args(funnel.meta)
funnel(mcl, comb.random = TRUE, pch=16,
        contour=c(0.9, 0.95, 0.99),
        col.contour=c("darkgray", "gray", "lightgray"))
legend("topleft", legend=c("0.1 > p > 0.05", "0.05 > p > 0.01", "<
        0.01"),
        fill=c("darkgray", "gray", "lightgray"), bty="n")
radial(mcl)

## Small-sample effect tests
## 1. Begg and Mazumdar Test
metabias(mcl, method="rank")
## 2. Eggers Test
metabias(mcl, method="linreg")

## Data for anxiety
mydata1=mydata[-2,]
## Meta-analysis with random effects model
mal = metaprop(anxiety, N, data=mydata1, comb.fixed=FALSE, studlab =
        paste(author))
mal
forest(mal, comb.random=TRUE, xlab="Anxiety Proportion", xlim=c
        (0, 0.7),
        hetstat=FALSE, smlab="",
        leftlabs=c("Method", "Between-study\nheterogeneity"),
        print.byvar=FALSE)

```

```

## Small effect illustration
funnel(ma1)
funnel(ma1,comb.random = TRUE, pch=16,
       contour=c(0.9, 0.95, 0.99),
       col.contour=c("darkgray", "gray", "lightgray"))
legend("topleft", legend=c("0.1 > p > 0.05", "0.05 > p > 0.01", "<
0.01"),
       fill=c("darkgray", "gray", "lightgray"), bty="n")

```