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The Psychological Wellbeing of University Students Amidst COVID-19 Pandemic

A scoping review, systematic review and a meta-analysis

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Abstract

This review aims to summarize the current evidence relating to university students' psychological wellbeing amidst the COVID-19 pandemic. A scoping review using PRISMA-ScR guideline (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) was first conducted to determine if the evidence can be systematically reviewed and meta-analyzed. The search was executed via Google Scholar (Google LLC, Mountain View, CA, USA), MEDLINE/PubMed (US National Library of Medicine, Bethesda, MD, USA), Science Direct (Elsevier, Amsterdam, the Netherlands), Scopus (Elsevier, Amsterdam, the Netherlands), and Web of Science (Clarivate Analytics, Philadelphia, Pennsylvania, USA). A total of 90 original articles were selected for the scoping review. Meta-analysis of a total of 46284 cases revealed an overall pooled prevalence rate for anxiety symptoms was 29.1% [95% CI: 20.9, 39.0] (K=9, N=22357), and 23.2% [95% CI: 15.7, 32.9] (K=12, N=23927) for depression symptoms. COVID-19 had a significant impact on university students' psychological wellbeing.

***Keywords*:** Adolescents; Psychological distress; Mental health; Pandemic; nCov; SARS-COV-2

Introduction

The 2019 novel coronavirus disease (COVID-19), a newly emerged strain in the coronavirus family, induced a public health emergency of international concern (PHEIC) as declared by the World Health Organization (WHO).[1] The threats associated with the pandemic outbreak of this virus have been multiple and varied. The challenge extends from monitoring the transmissibility and fatality of the disease to the enormous socioeconomic and psychological ramifications harming people's life quality and standard of living.[2-5] According to the WHO figures for 2020, over 79 million cases were confirmed worldwide, and nearly 1.7 million deaths were reported globally due to the pandemic.[6] Many countries have adopted strict measures encompassing wide-scale lockdowns, school closures, isolation, quarantine, travel restrictions, and social distancing to combat the outbreak.[3] Since the beginning of the COVID-19 epidemic at the end of 2019, nations have been suffering from the consequences of the deadly virus and its evolving waves. Also, sustained efforts from individuals, communities, and Governments are still required to control and suppress the disease and overcome its devastating impacts.

The COVID-19 has raised the risk of encountering a parallel epidemic of psychological disturbances like stress, panic, fear, anxiety, and depression.[4,7-11] Social isolation and constrained connectedness, and intimate relationships among community members are emotionally destructive. They necessitate coping behavioral changes like adopting online socializing, maintaining physical distancing, and mitigating outdoor activities intended for sport, shopping, leisure, or anything else.[12] The spread of COVID-19 disease has tightened social interactions, freedom of movement, and routine life functioning. The COVID-19 spillover effects extend to physiological and physical health; the psychological burdens and imbalance may negatively affect many people’s metabolic, cardiovascular, and immune health through direct and indirect mechanisms.[13-16] Sleep disturbance, nutritional deficiencies, and reduced physical activity are also common problems that may associate with the uncertainty of the current pandemic.[17-21]

Recent studies targeted global populations show that the COVID-19 pandemic has been linked with elevated psychological distress rates and early warning signs of mental illnesses.[21-25] Common psychological consequences of the pandemic included depressive symptoms, anxiety, stress, and post-traumatic stress disorder (PTSD) symptoms. However, the vulnerability to and severity of these psychological problems varied among population

segments based on many individual and textual factors, including but not limited to the nature of restrictions on daily living, risk of exposure to the virus, gender, COVID-19 information-seeking behavior, education level, income level, and age.[24,26] Although older adults are more vulnerable to the COVID-19 infection-fatality risks, a study in the United States in the early stage of the outbreak has found that the prevalence of psychological distresses was more prevalent in young individuals.[27] Such findings indicate the importance of shedding further light on investigating the mental health impacts of the COVID-19 pandemic on young adults. University students represent one of the essential community building blocks deserving to be paid adequate attention to during this pandemic. According to the United Nations, more than one billion students are now no longer physically in school after educational institutions' closure across many countries.[28] Besides the uncertainty of COVID-19 on the general student population, the situation could be more challenging for University students regarding their life engagement, contentment, dreams attainment, career outlook, and even their typical academic progression.[29,30] Moreover, there is emerging evidence on how college students encounter extraordinary changes in the learning process and examination mechanisms and its impact on their wellbeing.[31,32] According to recent evidence, the mental health problems experienced by students in Israel and Russia during the pandemic have increased their vulnerability to substance misuse.[33] Further, the higher scores of the fear of COVID-19 amongst students were associated with a higher level of sustaining maladaptive health-related behaviors like smoking and drinking.[34] From another aspect, a study in New York indicated that the high rates of financial instability and resource (food and housing) insecurity due to the pandemic had exacerbated college students' psychological distress like anxiety and depression.[35] Consequently, during such a multidimensional crisis, studying university students' psychological wellbeing has become a priority in the academic researching field, particularly in a few countries. However, there is ambiguity about the extent and type of studies conducted to discuss and investigate university students' psychological wellbeing during the COVID-19 pandemic, especially with the lack of studies based on systematic mapping or review. Hence, this study contributes to addressing such a research gap by identifying, classifying, and describing the broad bodies of evidence of university students' mental health amid the COVID-19 pandemic. We aim to provide knowledge for future researchers to help them steer a rationale for scholarly attention on uninvestigated areas relating to university students' psychological wellbeing during pandemics or other potential crises.

This study was guided by the following research questions: Where and what type of original research was carried out to study the impact of COVID-19 on the psychological wellbeing of university students? What aspects/domains of students' psychological health were investigated? What are the characteristics of selected student populations investigated by these studies? What do the key findings of these studies imply? What are the overall pooled estimates of major psychological distress?

Methods

PROTOCOL DEVELOPMENT

Initially, a scoping review was conducted considering the methodological guidelines and consultation given by Munn *et al*. and Arksey and O'Malley.[36,37] To standardize the scoping review process, PRISMA-ScR guideline (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) was adopted.[38] Scoping review is a methodical approach to map evidence sources and describe their characteristics in a field of interest. It also tends to address broader topics with the potential of being undertaken as a stand-alone project in its own right without necessarily describing research findings in any detail.[36] Scoping reviews serve as a valuable tool for synthesizing evidence and assessing the scope of literature on a topic.[37] Also, they gain increasing recognition as pertinent precursors to systematic reviews and meta-analyses.[39]

The searched and identified key literature was systematically mapped and analyzed through six fundamental stages: 1) formulating the study questions; 2) configuring and proving a specific set of keywords and selecting electronic databases; 3) identifying original research investigating the psychological wellbeing of university/college students amidst the COVID-19 outbreak; 4) reviewing the identified publications according to the endorsed procedure of data abstraction and charting; 5) aggregating, summarizing, and reporting findings; and 6) articles that met high similarity were further synthesized and meta-analyzed quantitatively.

ELIGIBILITY CRITERIA

All COVID-19 related articles that were carried out to empirically study university students' psychological wellbeing were considered for eligibility. In other words, to be specific, only those studies which 1) had original research merits – i.e., were primary sources whether based on quantitative, qualitative, or mixed-method designs, 2) included/targeted specific sample of university/college students, 3) explicitly proposed a relationship between the

psychological wellbeing construct and the COVID-19 pandemic, were eligible for inclusion. The psychological wellbeing concept is multidimensional due to the various philosophical and psychological theories underpinning its conceptualization. Thus, it is essential to mention how this concept has been understood and dealt with in this review. In the first level, the researchers have referred to and embraced the psychological wellbeing dimensions described by Huppert *et al*. and Ryff.[40,41] Secondly, the researchers' expertise in psychological wellbeing has intervened to determine the convergence or divergence of any identified dimension that may relate to the concept of psychological wellbeing.

Both published (peer-reviewed) and accepted articles in the press and made available as pre-print online were included. Non-peer reviewed studies have also been considered for providing a quantitative snapshot of the current research trend but were not included in this study's reported results. Published studies that have reported university students' psychological wellbeing through inferences from a general population were excluded. The inclusion of these studies requires a complex search mechanism and could complicate the screening and the charting process intended for the scoping review approach. Such studies are usually deficient regarding the information relating to the participating university students' context and characteristics. Non-English language studies were also excluded.

DATA SOURCES, SEARCH & SELECTION STRATEGY

In September 2020, an inclusive electronic search was carried out since inception in Google Scholar (Google LLC, Mountain View, CA, USA), PubMed/MEDLINE US National Library of Medicine, Bethesda, MD, USA), Science Direct (Elsevier, Amsterdam, the Netherlands), Scopus (Elsevier, Amsterdam, the Netherlands), and Web of Science (Clarivate Analytics, Philadelphia, Pennsylvania, USA). The process was done without language or type of article restrictions and more specific by the principal investigator and another autonomous reviewer individually. Grey literature was excluded. A consistent search mechanism was adopted to identify studies that addressed the literature relevant to university students' psychological wellbeing during the COVID-19 era. Search terms were used in combinations and configured as four sets as following: “COVID19 Students Psychological”, “COVID19 Students Mental”, “COVID19 Students Cognitive”, and “COVID19 Students Emotional”. No time filter was applied in the search processes. A sample search strategy in the PubMed engine for one set was as follows: “COVID19[tiab] AND Students[tiab] AND Psychological[tiab]”; this

strategy was replicated for the other three remaining sets as well. The final search results were exported into a Microsoft Excel spreadsheet 2019 to be refined and remove duplicates.

CHARTING, SCREENING, AND REVIEWING PROCESS

The principal investigator had initially scrutinized the titles and abstracts of the yielded studies, which another reviewer cross-checked for eligibility rules. The justification for excluding any publication was documented. For eligible studies, a complete review and appraisal of the evidence were jointly performed by two reviewers who also independently charted the data and constantly discussed the results. Disagreements were settled by mutual revision, and in case of non-resolution, a third assigned reviewer had to give a conclusion. Microsoft Excel spreadsheet 2019 was used for abstracting and charting data with the following variables classification: peer-review status, study methodology (quantitative, qualitative, or mixed-methods), study design (cross-sectional or longitudinal), the country at which the study has been conducted, student population type (locals, international students, etc.), number of included universities, university type (public or private), students discipline, year of study, program level, age group, sample size, number of male and female students, the scope of the investigation, studied variables, used measures, method/s of data collection, and the key findings.

SYSTEMATIC REVIEW AND META-ANALYSIS

The scoping review activity revealed that two screening instruments were predominant in the studies; these were the Patient Health Questionnaire-9 (PHQ-9) to screen for depression and Generalized Anxiety Disorder-7 (GAD-7) to screen for anxiety. Data for these studies were autonomously extracted by two investigators and verified by a third investigator. A methodical extraction and tabulation were executed for the following information: authors and citation, country, % male and female, sample size, and event rate for each screening instrument. Data were synthesized for the meta-analysis using the random-effects model according to DerSimonian–Laird method. We reported the results of the overall prevalence rate and corresponding 95% confidence intervals. P values of < 0.05 were regarded as statistically significant for heterogeneity. We performed a detailed analysis of the heterogeneity using I^2, Cochran (Q) statistic test, H test, tau (τ), and tau^2 (τ^2). A jackknife sensitivity analysis was applied by iteratively eliminating one study at a time to ratify that the results were not influenced by any single research.[42] The jackknife method as a cross-validation technique has the merit of lessening the bias of an estimator with fast computation

and consistent variance estimation. It has been widely cited for its practical applications when compared to other alternatives like the bootstrap method. However, Jackknife analysis is associated with crude approximations for the confidence intervals and inconsistency of the N−1 model (leave-1-out), which may in return yield inconsistent results across the parameters.[43] To further assess the impact of 'outliers' analysis was repeated after deleting all of the outliers to determine if the results will change. Funnel plots were used as a visual tool for scrutinizing study bias in meta-analysis.[44] Egger's linear regression of the effect estimates on their standard errors weighted by their inverse variance was furthermore used to determine possible publication bias in a meta-analysis via funnel plot asymmetry.[45] P-curve analysis was performed to correct meta-analytic estimates due to overwhelming evidence of publication bias and the presence of outliers.[46]

The risk of bias was assessed in this review using the Quality Assessment of Diagnostic Accuracy Studies version 2.0 (QUADAS-2).[47] The QUADAS-2 is an evidence-based instrument for assessing the efficiency of diagnostic accuracy tests. It consists of 14 questionnaire items posed as questions, each of which should be answered with a "yes," "no," or "unclear" to determine if the analysis is biased. Two authors, acting independently, made judgments about evidence quality ("low risk," "some concerns," or "high risk"). The questionnaire consists of four key domains: patient selection, index test, reference standard, and flow and timing. Each is weighed in terms of bias risk, with the first three being weighed in terms of applicability issues. Signaling questions are used to help with bias risk assessments. Results of the risk of bias are presented visually using publication-quality risk-of-bias assessment. Summary simple unweighted bar plot and a detailed risk of bias "traffic light" plot was used in this review.[48,49]

All data analyses were performed using the R programming language for statistical computing version 4.0.3.

Results

LITERATURE SEARCH

The preliminary search in the selected electronic databases generated 304 citations, 122 of which were duplicates and removed. The additional search yielded 93 citations, 21 of which were duplicates and removed as well. Based on the initial screening of the remaining 254 studies, 75 citations were excluded as they were not original researches (e.g., review articles,

letters to the editor, commentaries). Hence, 179 studies were critically appraised. It was found that 89 articles did not meet the eligibility criteria; most of these studies were either conducted on the general population or did not study the psychological wellbeing factor for the university student's segment. Ultimately, the remaining 90 articles were included for the scoping review [Table 2]. The selection of sources of evidence is demonstrated through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart in Figure 1.

SOURCES OF EVIDENCE CHARACTERISTICS

The summary of the characteristics of evidence sources is presented in Table 1. Among the included 90 studies, 80 (89%) were peer-reviewed published papers, while only 10 (11%) papers were pre-print versions. 89% of the selected studies relied mainly on quantitative methods, while the remaining percentage was shared between qualitative research (4%) and mixed methods research (7%). Eighty-four studies were based on a cross-sectional design, and only six studies adopted longitudinal research design. Remarkably, the method of online self-administered questionnaires was a dominant data collection strategy (87% of selected studies). Regarding the number of studies carried out in different regions and countries; China had the highest research work relating to university students' psychological wellbeing, with 30 studies identified and majorly taken place during the first quarter of the year 2020. It is followed by the Middle East and North Africa (MENA) (n= 22), Europe (n= 16), Indian subcontinent (n= 9), Southeast Asia (n= 4), Northern America (n= 4), and Latin America (n= 3).

INVESTIGATION SCOPE OF IDENTIFIED STUDIES

A total of 57 studies (63%) principally focused on investigating the prevalence of psychological distress and pertinent risk factors. The remaining studies investigated predictors, consequences, and psychosocial correlates of university students' psychological wellbeing. The most frequently investigated domains in the selected studies (n = 33, 37%) were depressive symptoms majorly assessed by the PHQ-9 instrument and anxiety symptoms majorly assessed by the GAD-7 instrument. Worth noting, few studies had focused on the following areas of investigation: sleep quality (n= 9, 10%), e-learning experiences (n= 8, 9%), and mindfulness practices (n= 6, 7%).

CHARACTERISTICS OF SAMPLED UNIVERSITY STUDENTS

As shown in Table 1, around two-thirds of the studies were conducted on specific universities/colleges. In contrast, the remaining one-third of the studies were based on surveying the general university student populations in selected provinces or nationwide. The vast majority of the studies targeted the local university students (93%), but overseas students had a much lesser research focus. There was a high degree of divergence between the studies' sample size in quantitative investigations, ranging between 25 and 304167. Thirty-five studies specifically targeted undergraduates, forty-one studies involved both undergraduates and postgraduates, but only two studies paid exclusive attention to postgraduates. Moreover, forty-nine (54%) studies had involved students from different academic programs. Based on classifying students' academic disciplines, medical students came first with the highest share of 12 studies.

UTILIZED MEASURES AND MAJOR FINDINGS

The PHQ-9 scale was the most psychometric measure used in the selected studies to assess the depressive symptoms of sampled students (n= 18, 20%], followed by the GAD-7 scale (n= 15, 17%) to assess anxiety symptoms. GAD-7 is a valid and sensitive self-reported measure to screen and assess an individual's generalized anxiety disorder severity.[50] PHQ-9 is a reliable instrument for the screen of the presence and severity of depressive symptoms.[51] These two tools' psychometric properties, ease of administration, and conciseness 'briefness' could make them one of the most frequent and preferred options for psychological state assessment and analysis. In addition to PHQ-9 and QAD-7, other outcome measures used to assess depression and anxiety symptoms included Depression, Anxiety and Stress Scale - 21 Items (DASS-21) (n= 8, 9%), Abbreviated Beck Anxiety Inventory (n= 5, 5%), The Kessler-10 (K10) (n= 4, 4%), Self-rating Anxiety Scale (SAS), (n= 3, 3%), and PHQ-4 Patient Health Questionnaire-4 (PHQ-4). However, the majority of remaining studies were based on measures for assessing the dimensions of resilience (n= 4, 4%) using the Connor–Davidson Resilience Scale (CD-RISC), and mindfulness (n= 5, 5%) using the Cognitive and Affective Mindfulness Scale-Revised (CAMS-CR), Mindful Attention Awareness Scale (MAAS), and Five Facets Mindfulness Questionnaire Short Form (FFMQ-SF).

In a large segment of the selected studies, the investigation scope was not limited to one facet of psychological distress, but a combination of factors was assessed. Anxiety and depression problems were placed at the center of attention and studied regarding their interrelation with other disorders like PTSD, emotional disturbances, and sleep distortions. Low students' self-

perceived mental health, negative emotions, and worsening depressive and anxiety symptoms were associated with poor sleep quality.[52-54] In another study, students' sleep duration of fewer than 6 hours per night during the pandemic was as a significant predictor for depression and PTSD.[55] During lockdowns, the emotional and mood quality of a high percentage of university students were found in a state of disturbance and mixed feelings of frustration, boredom, and disappointment.[56] Further, it was found that students reporting probable depression or PTSD were at a higher risk of experiencing more severe alexithymia.[57] However, variations in terms of prevalence level between different psychological disorders were observed among studies. Through a nation-wide survey amongst Chinese university students during the early stages of the pandemic,[58] clinically-relevant PTSD was amongst the most prevalent psychological distresses (30.8%), followed by anxiety (15.5%), and depressive symptoms (23.3%). However, during the same period and country, another study involved across a sample from selected universities found that PTSD and depression prevalence rates were 2.7% and 9.0% respectively.[55] Further studies are needed to understand the reasons behind such variations.

GAD-7 based studies indicated the prevalence of anxiety symptoms among students and that similarly,[59-69] PHQ-9 based studies indicated the prevalence of depressive symptoms.[55,57,58,60,62-66,68-72] Nevertheless, differences in the style of reporting and investigated correlates were observed, besides the variances in the reported results, which could relate to socio-cultural factors, sample nature, the timing of the study, imposed social distancing, lockdown and isolations periods, contraction of infection status, and the extent of pandemic severity in the country/district of study.

Meta-analysis of GAD-7 revealed that nine studies, including a total of 22357 participants, contributed to the analysis. The overall pooled prevalence rate of anxiety symptoms was 29.13% [95% CI: 20.90, 39.00], $\tau^2 = 0.4434$ [95% CI: 0.3047, 3.3701]; $\tau = 0.6659$ [95% CI: 0.5520, 1.8358]; $I^2 = 99.3\%$ [95% CI: 99.1, 99.4]; H = 12.05 [95% CI: 10.79, 13.45]; and Q (d.f.=8) = 1161, p-value < 0.0001 [Figure 2]. The funnel plot indicated no publication bias; furthermore, Eggers' regression confirmed the absence of publication bias, β=7.119 [95% CI: 6.68, -20.92] t=-1.011, p=0.35. Sensitivity analysis revealed that if one study was removed at the time, pooled results would have remained within ±2%, suggesting that no studies are indicated for removal; refer to sensitivity analysis plot. P-curve analysis revealed that the Null of no effect tests for right−skewness: p Full < 0.0001, p Half < 0.0001 to further suggest

retaining all of the studies in the final analyses; refer to P-Curve plot. Forest plot after deleting all 'outlier' studies shows that an overall pooled prevalence of anxiety is 24% [95% CI: 22%, 26%], I^2 = 78%, τ = 0.0106, $p < 0.01$. After removing three outlier studies;[59,68,69] the overall pooled results for anxiety symptoms did not change by <5%, and 95% CI remained overlapping; thus, the discussion was based on all of the analysis of studies, especially that random-effects modeling was used.

Meta-analysis of PHQ-9 revealed that 12 studies including a total of 23927 participants contributed to the analysis. The overall pooled prevalence rate of depressive symptoms was 23.2% [95% CI: 15.7, 32.9], τ^2= 0.7297 [95% CI: 0.4704, 3.1395]; τ = 0.8542 [95% CI: 0.6858, 1.7719]; I^2 = 99.5% [95% CI: 99.4, 99.5]; H = 13.59 [95% CI: 12.46, 14.81]; and Q (d.f.=11) = 2030, p-value, < 0.0001 [Figure 2]. Funnel plot indicated no publication bias, furthermore Eggers' regression confirmed the absence of publication bias, β= 8.629 [95% CI - 9.21, - 26.47] t= 0.948, p=0. 0.37. Sensitivity analysis revealed that if one study was removed at the time, pooled results would have remained within ±2%, suggesting that no studies are indicated for removal; refer to sensitivity analysis plot. P-curve analysis revealed that the Null of no effect tests for right−skewness: p Full < 0.0001, p Half < 0.0001 to further suggest retaining all of the studies in the final analyses. The observed p−curve includes 12 statistically significant ($p < 0.05$) results, of which 12 are $p < 0.025$; there were no non−significant results entered; refer to P-Curve plot. Forest plot of 'outlier' studies shows that an overall pooled prevalence of depression symptoms is 22% [95% CI: 19%, 25%], I2 = 78%, τ^2 = 0.0106, $p < 0.01$. After removing seven outlier studies; [55,57,62,64,68,69,72] the overall pooled results for depression symptoms did not change by <1%, and 95% CI remained overlapping; thus, the discussion was based on all of the analysis of studies, especially that random-effects modeling was used.

RISK OF BIAS ASSESSMENT

As far as the quality assessment among included studies, overall, most of the studies ~>85% had a low risk of bias, while ~7% had some concerns and ~8% had a high risk of bias. Most of the concerns ~45% were in the case (subject) selection dimension due to the use of convenient sampling. Detailed risk of bias traffic light plot using QUADAS-2 and its summary plot is shown in Figure 3. Just one of the studies included had a high risk of bias, owing to limited sampling paradigm and weak data collection standard, condition recognition, and evaluation.[57]

Discussion

Since the first identification of a novel corona virus-infected case in late 2019, the COVID-19, a rapidly spreading pandemic, has worsened and involved recurrent waves of infections globally in around 219 countries and territories.[75] Further, the pandemic's significant and overwhelming health and economic consequences are still exacerbating in many nations worldwide and have led to long-lasting transformational changes in life.[76] Given the importance of people's mental health during such a crisis, particularly on vulnerable community segments like university students, this study was conducted to describe the current knowledge on COVID-19 impact on university adults' psychological wellbeing. Its key result indicates that the overall pooled prevalence rate of anxiety symptoms was 29.1% [95% CI: 20.90, 39.00] according to GAD-7. In contrast, the overall pooled prevalence rate of depressive symptoms was 23.2% [95% CI: 15.7, 32.9] according to PHQ-9. The large heterogeneity measured by I^2 >99% is a common issue in epidemiological systematic reviews and meta-analyses. [20, 21] Other than clinical differences, methodological issues such as difficulties with randomization, early termination of studies, use of absolute rather than relative risk assessments, and publication bias might all contribute to heterogeneity. Anxiety and depression are often comorbid disorders, and anxiety could potentially devolve into depression.[77,78] Possible explanations associated with the prevalence variations between anxiety and depression symptoms amongst university students could be based on the significant predictors of uncertainty and uncontrollability.[79] The pandemic has been a severe threat to many students' academic progress and aspirations.[80] Therefore, the prevailing situation of future uncertainty, together with stressful events of illnesses, confinement, and economic obstacles, has played a vital role in aggravating anxiety symptoms.[81,82] Simultaneously, with the increasing coping capacity, social support, and remodeled education strategies, depression symptoms may have less potential to proliferate.[83,84] In this context, worth noting that a meta-analysis study that reviewed community-based studies on depression during the COVID-19 reported a pooled prevalence of depression of 25% (95% CI: 18, 33) among the general population,[85] compared to the current study findings at 20.45% [95% CI: 9.90, 21.01] among university students. Such figures underscore the importance of differentiating the severity of the COVID-19 crisis on the different community segments' psychological health. Further, epidemiological investigation intended for the second year of the pandemic should shed light on the extent and nature of students' vulnerability that may differ across academic disciplines, socioeconomic and cultural contexts.

As the first COVID-19 outbreak began in China, it is noticeable that a third of the selected studies on university students' psychological wellbeing were carried out in China. Further, the prevalence of psychological symptoms amidst Chinese populations could be a determinant factor for such relatively high research activity, particularly considering the different stages of the COVID-19 outbreak in this country.[86] According to Wang *et al*.,[87] in a cross-sectional study that enrolled 5,676 individuals nationwide in China, the respondents reported high incidences of depression (53.8%) using PHQ-9, anxiety (46.7%) using GAD-7, and insomnia (29.7%) using Insomnia Severity Index (ISI). Hence, steering a particular focus on university students has valid inquiry roots in China. On the other hand, the number of conducted original research concerning the students' psychological wellbeing is generally limited considering the extensive spread of the pandemic over the world and the presence of thousands of universities worldwide.

The low percentage of found qualitative research (4%) and mixed methods research (7%) in this review sample indicates the deficiency of in-depth and explorative knowledge within the context of students' psychological wellbeing. Worth noting, the importance of qualitative elements in the psychological field could not be undermined whether for psychopathology investigations or psychotherapy purposes.[88,89] Also, the use of longitudinal designs was limited to 7%. However, following a year since the emergence of the COVID-19 disease, there is greater feasibility to consider the adoption of longitudinal studies. Such designs could act as powerful aids in differentiating psychological symptoms, shifting across the different stages and waves of the COVID-19 pandemic.[86,90]

Despite the higher risk surrounding international students and their susceptibility to serious psychological burdens compared to other populations, they had a much lesser research focus than the local university students (93%). Such significant disparity urges the research community to pay attention to this particular segment's socio-psychological needs. Reviewed research indicated significant incidence rates of psychological distresses amongst international students during the pandemic in association with different risk factors like gender, exposure to pandemic-related information, double-bind situation, sleep quality, and graduation uncertainty.[91-93]

Amid the COVID-19 pandemic, university students' level of depression and anxiety was a prevailing research area with significant attention exhibited by interested researchers to

assess the associations between specific covariates and these two psychological disorders. Major covariates included protection behavior, disease awareness, beliefs and thoughts, regional differences, graduate student status, economic status, living environment, and access to telecommunication technology.[66,67,69,72] However, there is a shortage of studies investigating many important variables that impact university students' psychological wellbeing. These could include the information-seeking behavior, exposure to media, online learning strategies, social connectedness behaviors, and remodeled education approaches adopted by universities during the pandemic. From a geographical angle, there is an obvious need to encourage research assessing university students' psychological wellbeing in the different countries affected by the pandemic, with more focus required in the African and Middle Eastern countries suffering severe economic and health burdens.

Conclusion & Recommendations

As shown in the scoping review, there is limited original research studying college students' mental health worldwide. One of the significant identified gaps is that there has been a shortage in research addressing the impact of the COVID-19 pandemic on this community segment's psychological wellbeing through an in-depth and holistic inquiry approach, which reflects the need for qualitative research. The meta-analysis findings indicate that anxiety symptoms are more prevalent than depression symptoms in the first year of the pandemic. Hence, following up and controlling the situation during the second wave demands academic decision-makers and interested researchers to deploy sustainable metrics beyond cross-sectional methods and consider action research models. Future research should focus on identifying and studying the risk factors of mental distress among university students, particularly in linkage with online education and changing learning trends. Students' contextual and individual factors also represent a vital area for current psychology to be scientifically investigated between high and low-income countries.

Further, research investigating students' mental health and subjective wellbeing on a longitudinal basis should be placed at the forefront of universities' management priorities. Imperatively, universities' efforts at different academic disciplines to foster a psychological wellbeing-friendly environment for their students must be studied and reported through research; hence positive experiences and learned lessons could be inspired to optimize mental health and counselling programs. Universities should also ensure that their counseling centers have accessible services and structured mitigation strategies for protecting and enhancing students' psychological wellbeing. These services could include providing online resources

and conducting active virtual group discussion sessions, which should be largely focused on positive coping, mindfulness practices, physical activity, adaptive lifestyle and health behavior, healthy diet, good sleep hygiene, and safe alternatives of social connectedness.

Authors' Contribution

AE and HJ contributed to the conception and design of the work. AE, AD and MH involved in search strategy, search methodology, article reviews, data curation and extraction, and assessment of quality studies. HJ performed all formal analyses. All authors involved in writing the paper and approved the final version of the publication.

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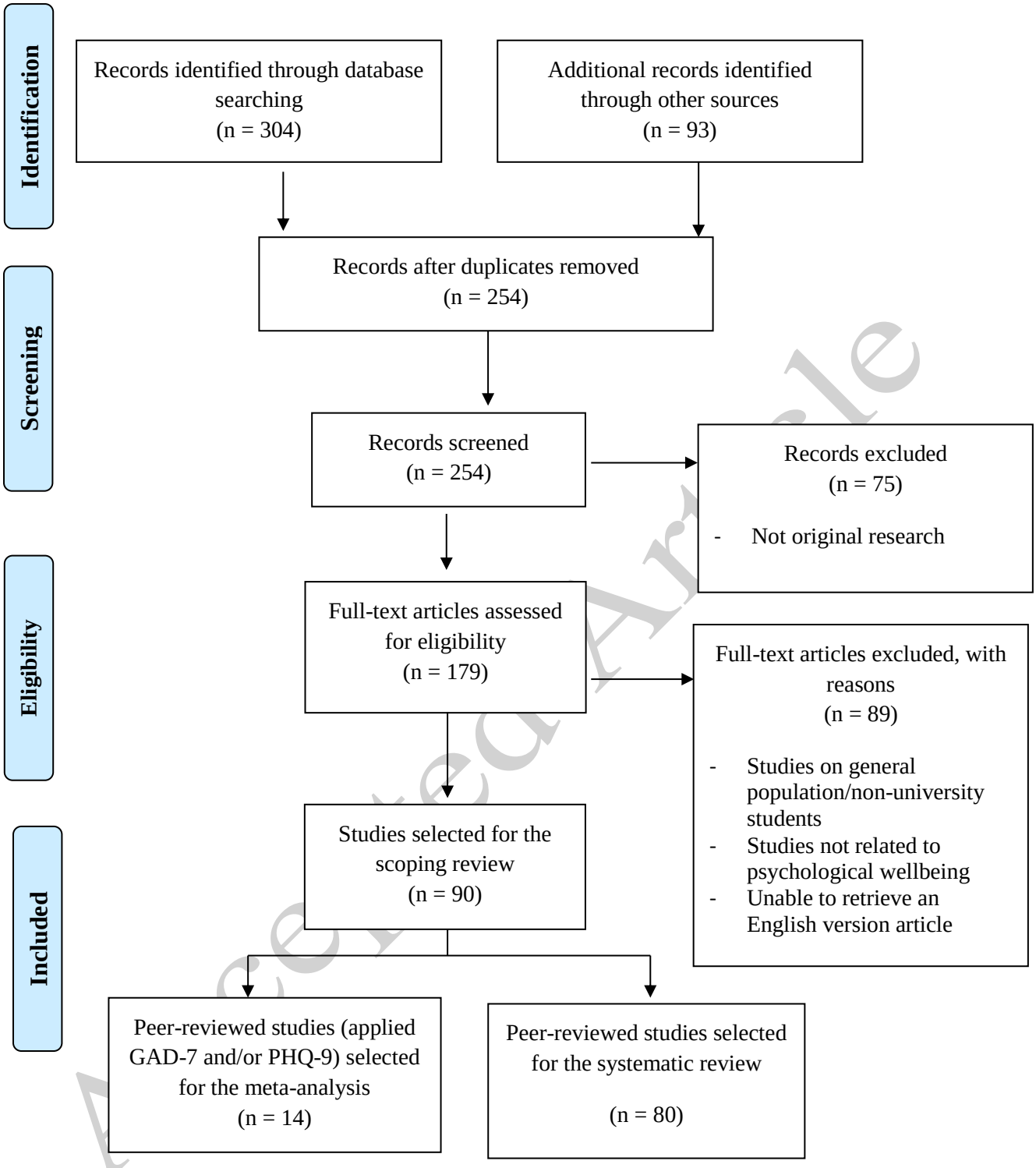

Figure 1: PRISMA diagram to show the literature identified.[38]

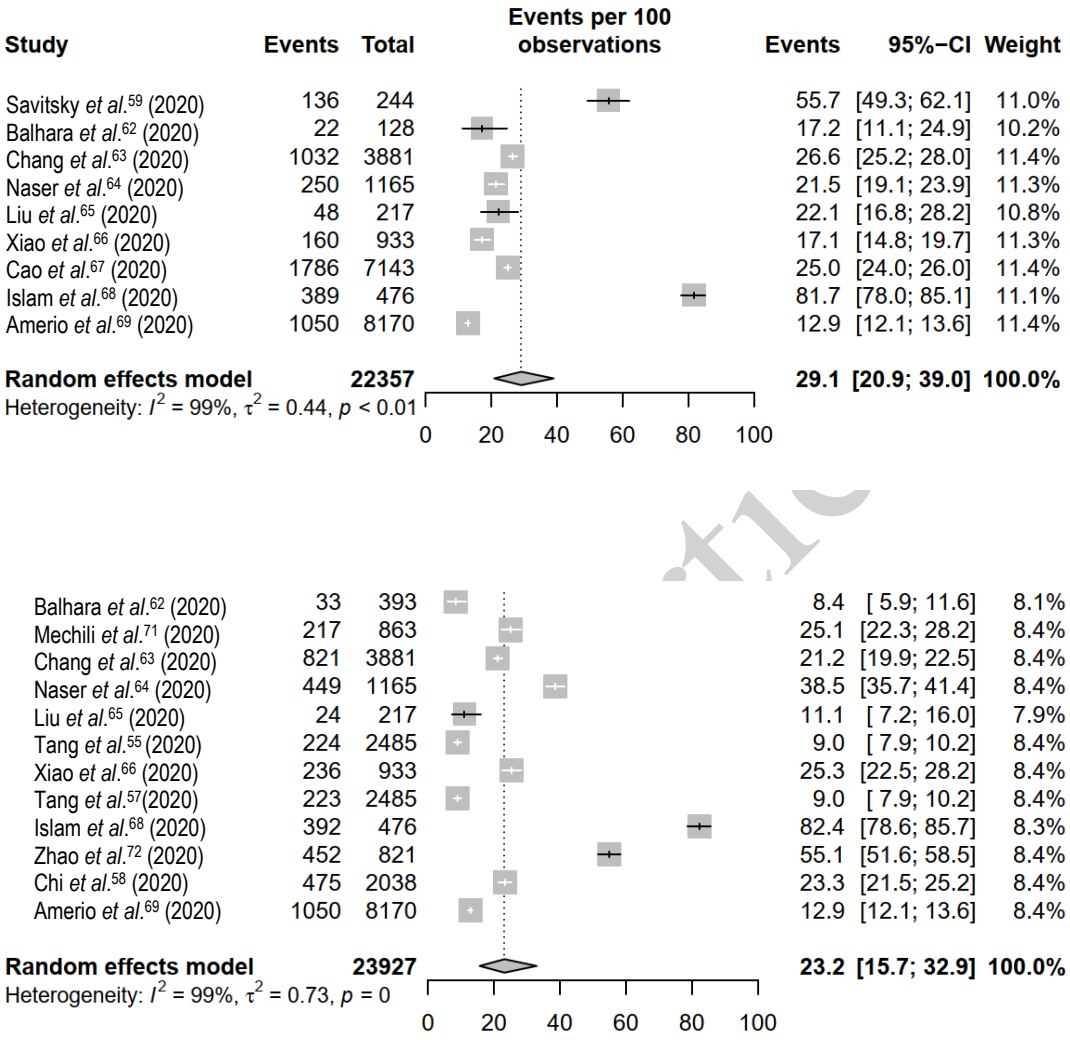

Figure 2: The prevalence rate of anxiety and depression symptoms using DerSimonian-Laird OR meta-analysis (random effects).

Note: 1) Observations: observed odds ratio (95% CI). 2) The GAD-7 scale score ranges from 0 to 21, and the anxiety levels are categorized as 'non-minimal = <5,' 'mild = 5–9,''moderate = 10–14, and 'severe ≥15'.[73] The total PHQ-9 score ranges from 0 to 27, with scores ≥10 indicating possible depression.[74] 3) Non peer-reviewed articles were not included in this summary of results. Studies intended to validate measures without reporting prevalence data were also excluded.

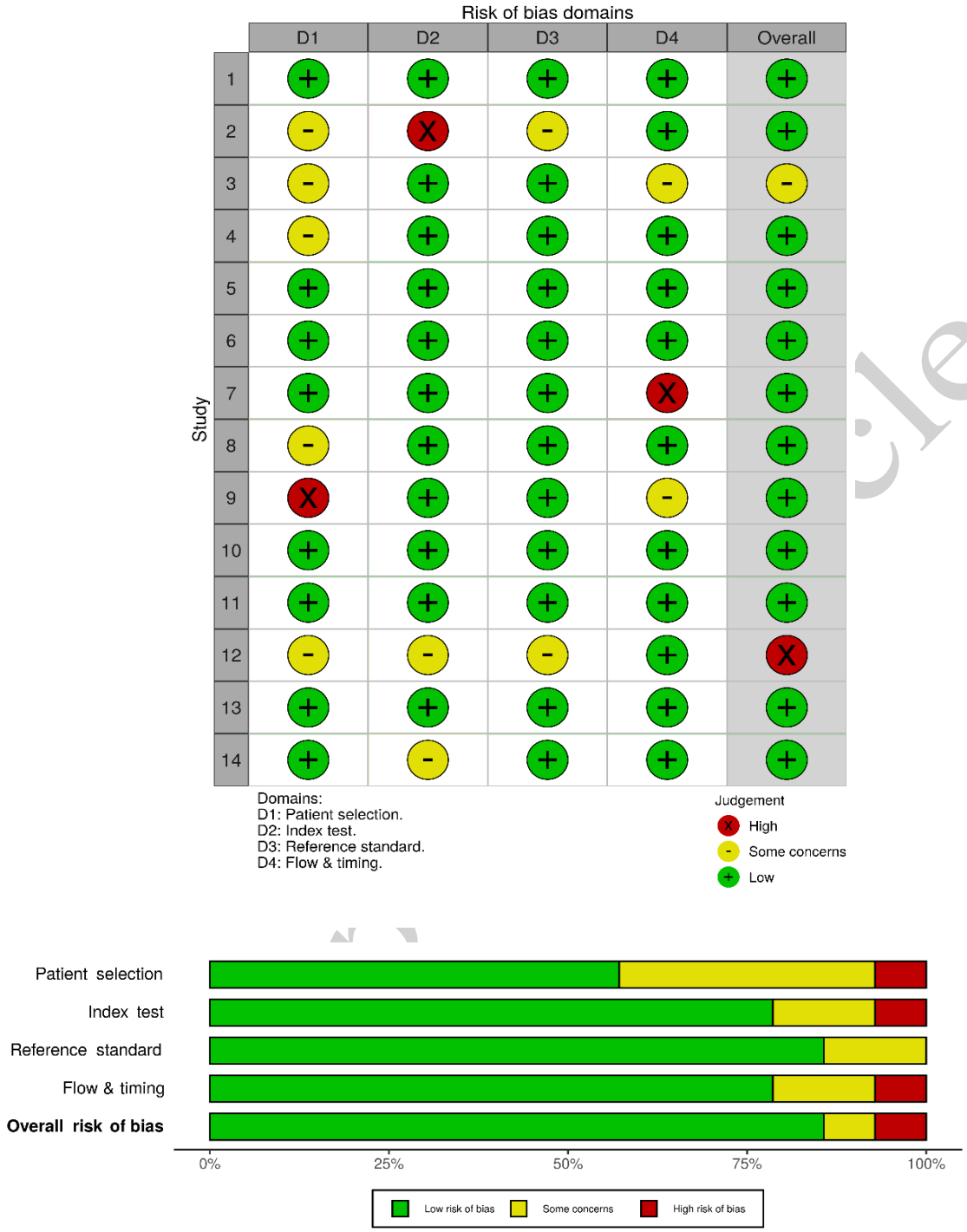

Figure 3: Detailed risk of bias traffic light plot using QUADAS-2 and summary plot. Studies: 1-Savitsky *et al.*[59] (2020); 2-Balhara *et al.*[62] (2020); 3-Chang *et al.*[63] (2020); 4-Naser *et al.*[64] (2020); 5-Liu *et al.*[65] (2020); 6-Xiao *et al.*[66] (2020); 7-Cao *et al.*[67] (2020); 8-Islam *et al.*[68] (2020); 9-Amerio *et al.*[69] (2020); 10-Mechili *et al.*[71] (2020); 11-Tang *et al.*[55] (2020); 12-Tang *et al.*[57](2020); 13-Zhao *et al.*[72] (2020); 14-Chi *et al.*[58] (2020).

Table 1: Characteristics of the research and sampled university students in selected studies (n = 90).

	Domain	n (%)
Research Characteristics	**Peer-reviewed**	
	Yes	80 (89%)
	No (pre-print)	10 (11%)
	Research methods [Sample size range]	
	Quantitative [25 – 304167]	80 (89)
	Qualitative [15 – 32]	4 (4)
	Mixed-methods [80 – 3611]	6 (7)
	Research design	
	Cross-sectional	84 (93)
	Longitudinal	6 (7)
	Method of data collection	
	Online self-administered structured questionnaires	78 (87)
	Online semi-structured interviews	2 (2)
	Online in-depth interviews	1 (1)
	Online questionnaires of close- and open-ended questions	7 (8)
	Structured-questionnaire administered by interviews	1 (1)
	Phenomenology method (Unstructured interview & documentation)	1 (1)
Sampled University Students Characteristics	**Sample source**	
	From selected/targeted universities	61 (55)
	General population/nationwide	29 (35)
	Category of sampled students	
	Local students	84 (93)
	International students	3 (3)
	Mixed (Local and immigrants or international)	3 (3)
	Academic level	
	Undergraduate	35 (39)
	Postgraduate	2 (2)
	Undergraduate & postgraduate	41 (46)
	Not identified	12 (13)
	Academic disciplines	

	Across different disciplines	49 (54)
	Medicine	12 (13)
	Not identified	8 (9)
	Health sciences	7 (8)
	Nursing	4 (4)
	Psychology	3 (3)
	Dentistry	2 (2)
	Management/business studies	2 (2)
	Others	3 (3)

Table 2: Selected studies for the scoping review (n= 90)

SR NO.	Study Reference	Country	Age	Sample	# Male	Research Tools
1	Pham, N. C., & Shi, J. R. (2020). A qualitative study on mental distress of Vietnamese students in the USA in the COVID 19 era. *Asia Pacific Journal of Health Management*, *15*(3), 45.	USA	19-33	20	8	NR
2	Satpathy, B., & Ali, E. A study on psychological well-being of final year management students during COVID-19 pandemic lockdown in India.	India	-	80	NR	NR
3	Akdeniz, G., Kavakci, M., Gozugok, M., Yalcinkaya, S., Kucukay, A., & Sahutogullari, B. (2020). A survey of attitudes, anxiety Status, and protective behaviors of the university students during the COVID-19 outbreak in Turkey. *Frontiers in Psychiatry*, *11*.	Turkey	18-33	3040	685	Abbreviated Beck Anxiety Inventory, questionnaire
4	Savitsky, B., Findling, Y., Ereli, A., & Hendel, T. (2020). Anxiety and coping strategies among nursing students during the covid-19 pandemic. *Nurse Education in Practice*, 102809.	Israel	<26	244	55	GAD-7, items from Coping Behavior Questionnaire (COPE)and resilience/ self-esteem assessment
5	Lechner, W. V., Laurene, K. R., Patel, S., Anderson, M., Grega, C., & Kenne, D. R. (2020). Changes in alcohol use as a function of psychological distress and social support following COVID-19 related University closings. *Addictive behaviors*, *110*, 106527.	USA	Mean 24.94	1958	392	Timeline Follow-Back Interview to document alcohol use during 2 weeks prior to and post campus closure. The Patient Health Questionnaire-9 (PHQ-9), GAD-7, Multidimensional perceived Support Scale (MSPSS)
6	Vahedian-Azimi, A., Moayed, M. S., Rahimibashar, F., Shojaei, S., Ashtari, S., & Pourhoseingholi, M. A. (2020). Comparison of the severity of psychological distress among four groups of an Iranian population regarding COVID-19 pandemic. *BMC psychiatry*, *20*(1), 1-7.	Iran	27.37 ± 3.92 (20–38)	207	143 (69.1)	Mental health status was measured using the Depression, Anxiety, and Stress Scale (DASS-21)

7	Sallam, M., Dababseh, D., Yaseen, A., Al-Haidar, A., Ababneh, N. A., Bakri, F. G., & Mahafzah, A. (2020). Conspiracy beliefs are associated with lower knowledge and higher anxiety levels regarding COVID-19 among students at the University of Jordan. *International journal of environmental research and public health*, *17*(14), 4915.	Jordan	Mean age 22 years (median: 21 years, interquartile range (IQR): 20–22 years).	1540	394 (25.6)	Generalized Anxiety Disorder Scale (GAD-7),
8	Lyons, Z., Wilcox, H., Leung, L., & Dearsley, O. (2020). <? covid19?> COVID-19 and the mental well-being of Australian medical students: impact, concerns and coping strategies used. *Australasian Psychiatry*, *28*(6), 649-652.	Australia	mean age of respondents was 24 years, range 20–46, median 23 years	297 students	NR	The Kessler-10 (K10) measured psychological distress.
9	Yehudai, M., Bender, S., Gritsenko, V., Konstantinov, V., Reznik, A., & Isralowitz, R. (2020). COVID-19 fear, mental health, and substance misuse conditions among university social work students in Israel and Russia. *International Journal of Mental Health and Addiction*, 1-8.	Israel and Russia	mean age is 24.4 years (SD = 5.5)	291 social work students from Israel (N = 170) and Russia (N = 121).	15.8 (46)	seven-item Fear of COVID-19 Scale (FCV-19S) (Ahorsu et al. 2020) + open-ended questions
10	Zolotov, Y., Reznik, A., Bender, S., & Isralowitz, R. (2020). COVID-19 fear, mental health, and substance use among Israeli university students. *International journal of mental health and addiction*, 1-7.	Israel	Median 25.0 Range 18–56	370 participants	20.8 (77)	seven-item FCV-19S (Ahorsu et al. 2020).
11	Li, X., Lv, S., Liu, L., Chen, R., Chen, J., Liang, S., ... & Zhao, J. (2020). COVID-19 in Guangdong: Immediate Perceptions and Psychological Impact on 304,167 College Students. *Frontiers in Psychology*, *11*.	China	the majority (84.4%) were 19–22 years old.	304167	0.401	IES-6 The Impact of Event Scale 6

12	Meo, S. A., Abukhalaf, A. A., Alomar, A. A., Sattar, K., & Klonoff, D. C. (2020). COVID-19 Pandemic: Impact of Quarantine on Medical Students' Mental Wellbeing and Learning Behaviors. *Pakistan Journal of Medical Sciences*, *36*(COVID19-S4).	KSA	mean age for females was 21.2 years, and for males was 22.56 years	530	236 (44.52%)	Researcher developed
13	Bakkar, M. (2020). COVID-19 Spread and psychological stress between Egyptian students. *Available at SSRN*.	Egypt	NRl	384	119	Researcher developed
14	Rzymski, P., & Nowicki, M. (2020). COVID-19-related prejudice towards Asian medical students: A consequence of SARS-CoV-2 fears in Poland. *Journal of Infection and Public Health*.	Poland	(mean ± SD age 23.8 ± 3.8;	85	36	Researcher developed
15	Haider, A. S., & Al-Salman, S. (2020). Dataset of Jordanian university students' psychological health impacted by using e-learning tools during COVID-19. *Data in brief*, *32*, 106104.	Jordan	18–24 (697) (89.9%)	775	159 (20.5%)	designed by researchers
16	Silva, P. G. D. B., de Oliveira, C. A. L., Borges, M. M. F., Moreira, D. M., Alencar, P. N. B., Avelar, R. L., ... & Sousa, F. B. (2020). Distance learning during social seclusion by COVID-19: improving the quality of life of undergraduate dentistry students. *European Journal of Dental Education*.	Brazil	mean age of 22.4±4.8 years that ranged from 17 to 46 years	230		WHOQOL-bref
17	El Morr, C., Ritvo, P., Ahmad, F., Moineddin, R., & MVC Team. (2020). Effectiveness of an 8-week web-based mindfulness virtual community intervention for university students on symptoms of stress, anxiety, and depression: randomized controlled trial. *JMIR Mental Health*, *7*(7), e18595.	Canada	22.55 (6.1); 18-55	159	125 (78.6)	Patient Health Questionnaire-9 (PHQ9), the Beck Anxiety Inventory (BAI), the Perceived Stress Scale (PSS), and the Five Facets Mindfulness Questionnaire Short Form (FFMQ-SF).

18	Yu, Y., Yu, Y., & Li, B. (2020). Effects of mindfulness and meaning in life on psychological distress in Chinese university students during the COVID-19 epidemic: A chained mediation model. *Asian J Psychiatr*, 102211-102211.	China	with ages ranging from 17 to 25 years (Mean = 20.69, SD = 1.65)	932	144	Chinese versions of 21-item Depression Anxiety Stress Scales (DASS-21, Gong et al., 2010), Cognitive and Affective Mindfulness Scale-Revised (CAMS-CR, Chan et al., 2016), and Meaning in Life Questionnaire (MLQ, Wang and Dai, 2008).
19	Khattar, A., Jain, P. R., & Quadri, S. M. K. (2020, May). Effects of the disastrous pandemic COVID 19 on learning styles, activities and mental health of young Indian students-a machine learning approach. In *2020 4th International Conference on Intelligent Computing and Control Systems (ICICCS)* (pp. 1190-1195). IEEE.	India	-	516	NR	designed by researchers
20	Huang, L., & rong Liu, H. (2020). Emotional responses and coping strategies of nurses and nursing college students during COVID-19 outbreak. *MedRxiv*.	China	(mean 19.00 ±0.84 years)	430 participants	NR	Emotional responses. Referring to the positive and negative emotion (PANAS) scale; Coping strategies. The tool for measuring the coping strategies during the outbreak of COVID-19 was revised based on the Brief COPE prepared by Carver (1997)
21	Zhang, X., Li, X., Liao, Z., Zhao, M., & Zhuang, Q. (2020). Evaluation of psychological stress in scientific researchers during the 2019–2020 COVID-19 outbreak in China. *PeerJ*, *8*, e9497.	China	-	159 (63.4%)	NR	Modified questions from the stress response questionnaire (SRQ) and the Pittsburgh sleep quality index scale (PSQI) (Pilz et al., 2018) and considered the current COVID-19 epidemic (i.e., emotional state, somatic responses, sleep quality and behavior).

22	Ashraf, F., Lee, S. A., & Elizabeth Crunk, A. (2020). Factorial validity of the Urdu version of the obsession with COVID-19 scale: Preliminary investigation using a University Sample in Pakistan. *Death studies*, 1-6.	Pakistan	18 to 56	240	107	Obsession with COVID-19 Scale (OCS-Urdu version)
23	Nguyen, H. T., Do, B. N., Pham, K. M., Kim, G. B., Dam, H. T., Nguyen, T. T., ... & Duong, T. V. (2020). Fear of COVID-19 Scale—Associations of Its Scores with Health Literacy and Health-Related Behaviors among Medical Students. *International Journal of Environmental Research and Public Health*, *17*(11), 4164.	Vietnam	NR	5423	NR	Fear of COVID-19 scale (FCoV-19S)
24	Pastor, C. K., Orlanda-Ventayen, C. C., Ventayen, T. J. M., Ventayen, L. M., & Ventayen, R. J. M. (2020). Home Activities of Students to Counter Psychological Disturbances during COVID-19 Pandemic. *International Journal of Psychosocial Rehabilitation*.	Philippines	20	998	NR	NR
25	Chen, B., Sun, J., & Feng, Y. (2020). How have COVID-19 isolation policies affected young people's mental health?–evidence from chinese college students. *Frontiers in psychology*, *11*.	China	NR	992	NR	Questionnaire is to assessed seven dimensions of mental health:mental status, knowledge of stress management, behavioral patterns, risk perception, academic stress, family relationships as well as peer relationships
26	Rahali, K., Abidli, Z., Khohmimidi, A., Elhamzaoui, M., Seghiri, R., Jabari, K., ... & Chaouch, A. (2020). Ibn Tofail's University students' satisfaction evaluation towards distance learning and its impacts on the students' mental health during the Covid 19 Confinement. *Bangladesh Journal of Medical Science*, 51-S.	Moroccan	NR	NR	NR	KMO Index and Bartlett's test

27	Marelli, S., Castelnuovo, A., Somma, A., Castronovo, V., Mombelli, S., Bottoni, D., ... & Ferini-Strambi, L. (2020). Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *Journal of Neurology*, 1-8.	Italy	19 to 67	400	NR	Pittsburgh Sleep Quality Index (PSQI) and Beck Anxiety Inventory (BAI) (Italiain version)
28	Sartorao Filho, C. I., Rodrigues, W. C. D. L. V., de Castro, R. B., Marcal, A. A., Pavelqueires, S., Takano, L., ... & Neto, C. I. S. (2020). Impact Of covid-19 pandemic on mental health of medical students: a cross-sectional study using GAD-7 and PHQ-9 questionnaires. *MedRxiv*.	Brazil	19 to 30	347	89	GAD-7 for anxiety and PHQ-9 for depression questionnaires
29	Balhara, Y. P. S., Kattula, D., Singh, S., Chukkali, S., & Bhargava, R. (2020). Impact of lockdown following COVID-19 on the gaming behavior of college students. *Indian Journal of Public Health*, *64*(6), 172.	India	average age of the participants was 19.6 years (standard deviation [SD]: 1.9) (median - 19 [inter-quartile range (IQR) 18–20.75) years].	128	52 (40%)	"Patient Health Questionnaire (PHQ)-9 and Generalized Anxiety Disorder (GAD)-7 scales were used for the measurement of depression and anxiety, Internet Gaming Disorder Short Form-9 (IGDSF) scale was used to assess the severity of disordered gaming; concern about the academics in the form of end-semester examination and stress experienced due to COVID-19 were assessed using ten-point Visual Analog Scales (VAS) "
30	Waseem, M., Aziz, N., Arif, M. U., Noor, A., Mustafa, M., & Khalid, Z. (2020). Impact Of Post-Traumatic Stress Of Covid-19 On Mental Wellbeing Of Undergraduate Medical Students In Pakistan. *Pakistan Armed Forces Medical Journal*, *70*(1), S220-24.	Pakistan	18-23	450	103	Impact of Event scale revised version (IES-R).

31	Lin, Y., Hu, Z., Alias, H., & Wong, L. P. (2020). Influence of mass and social media on psychobehavioral responses among medical students during the downward trend of COVID-19 in Fujian, China: Cross-Sectional study. *Journal of medical Internet research*, *22*(7), e19982.	China	18-29	2086	NR	Health Belief Model (HBM)
32	Zhi, X., Lu, L., Pu, Y., Meng, A., Zhao, Y., Cheng, F., ... & Zeng, Y. (2020). Investigation and analysis of psychological stress and professional identity of nursing students during COVID-19 pandemic.	China	18-23, ≥24	420	43	General information questionnaire and The Perceived Stress Scale of Chinese Version, PSS-C
33	Anan, C., Chunfeng, X., Shuxin, L., Lirui, K., Jingjing, Y., & Chang, L. (2020). Investigation on the mental health status and risk factors among Chinese overseas students under COVID-19 outbreak.	china	18-30	252	102	9-item Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder 7-item Scale (GAD-7) and 15-item Patient Health Questionnaire (PHQ-15)
34	Ala'a, B., Akour, A., & Alfalah, L. (2020). Is it Just About Physical Health? An Internet-Based Cross-Sectional Study Exploring the Psychological Impacts of COVID-19 Pandemic on University Students in Jordan Using Kessler Psychological Distress Scale. *medRxiv*.	Jordan	18-38	381	182	10-item Kessler Psychological Distress Scale (K10)
35	Mechili, E. A., Saliaj, A., Kamberi, F., Girvalaki, C., Peto, E., Patelarou, A. E., ... & Patelarou, E. (2020). Is the mental health of young students and their family members affected during the quarantine period? Evidence from the COVID-19 pandemic in Albania. *Journal of psychiatric and mental health nursing*.	Albania	18 ≥ 25	863	98	Patient Health Questionnaire (PHQ-9) to measure depression levels and monitor severity

36	Khodabakhshi-koolaee, A. (2020). Living in home quarantine: Analyzing psychological experiences of college students during COVID-19 pandemic. *Journal of Military Medicine*, *22*(2), 130-138.	Iran		15	NR	"Van Manen Phenomenology" approach
37	Huckins, J., Hedlund, E. L., Rogers, C., Nepal, S. K., Wu, J., Obuchi, M., ... & Campbell, A. T. (2020). Mental Health and Behavior During the Early Phases of the COVID-19 Pandemic: A Longitudinal Mobile Smartphone and Ecological Momentary Assessment Study in College Students.	USA	18 to 22 years	217		Patient Health Questionnaire-4.
38	Wang, X., Hujjaree, K., & Wang, F. (2020). Mental Health Impacts for International Students During the COVID-19 Pandemic in China.	China	20-40	285	NR	the 9-item Patient Health Questionnaire-9 (PHQ-9), 7-item Generalized Anxiety Disorder-7 (GAD-7) scale and Sleep duration
39	Zhang, Y., Zhang, H., Ma, X., & Di, Q. (2020). Mental Health Problems during the COVID-19 Pandemics and the Mitigation Effects of Exercise: A Longitudinal Study of College Students in China. *International Journal of Environmental Research and Public Health*, *17*(10), 3722.	China	around 20 years old	66	25	International Physical Activity Questionnaire (IPAQ-S), Pittsburgh Sleep Quality Index (PSQI), Depression Anxiety Stress Scale and Buss-Perry Aggressive Questionnaire (BPAQ)
40	Suryadevara, V., Adusumalli, C., Adusumilli, P. K., Chalasani, S. H., & Radhakrishnan, R. (2020). Mental Health Status among the South Indian Pharmacy Students during Covid-19 Pandemic Quarantine Period: A Cross-Sectional Study. *medRxiv*.	India	18-24	500	174	21-item DASS questionnaire

41	Chang, J., Yuan, Y., & Wang, D. (2020). Mental health status and its influencing factors among college students during the epidemic of COVID-19. *Nan fang yi ke da xue xue bao= Journal of Southern Medical University*, *40*(2), 171.	China	19-22	3881	1434	Generalized Anxiety Disorder 7 (GAD-7) and Patient Health Questionnaire 9 (PHQ-9
42	Naser, A. Y., Dahmash, E. Z., Al-Rousan, R., Alwafi, H., Alrawashdeh, H. M., Ghoul, I., ... & Dagash, A. (2020). Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: a cross-sectional study. *medRxiv*.	Jordan	18–29 years (n=1,056 90.6%)	1165	538	Patient Health Questionnaire (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7)
43	Xin, M., Luo, S., She, R., Yu, Y., Li, L., Wang, S., ... & Lau, J. T. F. (2020). Negative cognitive and psychological correlates of mandatory quarantine during the initial COVID-19 outbreak in China. *American Psychologist*, *75*(5), 607.	China	19.9 1.6	24378	7865	structural equation modeling
44	Liu, J., Zhu, Q., Fan, W., Makamure, J., Zheng, C., & Wang, J. (2020). Online Mental Health Survey in a Medical College in China During the COVID-19 Outbreak. *Frontiers in Psychiatry*, *11*, 459.	China	18-27	217	90	Patient Health Questionnaire-9 (PHQ-9) and Generalized Anxiety Disorder-7 (GAD-7) scale
45	Tang, W., Hu, T., Hu, B., Jin, C., Wang, G., Xie, C., ... & Xu, J. (2020). Prevalence and correlates of PTSD and depressive symptoms one month after the outbreak of the COVID-19 epidemic in a sample of home-quarantined Chinese university students. *Journal of affective disorders*.	China	18-27	2485	960	The 17 item PTSD Check List-Civilian Version (PCL-C), the Patient health Questionnaire-9 (PHQ-9),Sleep duration, Duration of home-quarantine and Exposure

46	Wang, Z. H., Yang, H. L., Yang, Y. Q., Liu, D., Li, Z. H., Zhang, X. R., ... & Mao, C. (2020). Prevalence of anxiety and depression symptom, and the demands for psychological knowledge and interventions in college students during COVID-19 epidemic: A large cross-sectional study. *Journal of affective disorders*, *275*, 188-193.	China	16-50	44447	20217	The Zung's Self-rating Anxiety Scale (SAS) and the Center for Epidemiologic Studies Depression Scale (CES-D Scale)
47	Li, Y., Wang, Y., Jiang, J., Valdimarsdóttir, U. A., Fall, K., Fang, F., ... & Zhang, W. (2020). Psychological distress among health professional students during the COVID-19 outbreak. *Psychological Medicine*, 1-3.	China	NR	1442	NR	Kessler 6-item Psychological Distress Scale (K6), acute stress reaction (ASR) and the Impact of EventScale-Revised (IES-R)
48	Odriozola-González, P., Planchuelo-Gómez, Á., Irurtia, M. J., & de Luis-García, R. (2020). Psychological effects of the COVID-19 outbreak and lockdown among students and workers of a Spanish university. *Psychiatry Research*, 113108.	Spain	NR	2530	858	Depression Anxiety Stress Scale (DASS-21) and the Impact of Event Scale (IES)
49	Hernández-Sánchez, B. R., Cardella, G. M., & Sánchez-García, J. C. (2020). Psychological Factors that Lessen the Impact of COVID-19 on the Self-Employment Intention of Business Administration and Economics' Students from Latin America. *International Journal of Environmental Research and Public Health*, *17*(15), 5293.	Latin America	18 and 69 years	934	NR	Self-report questionnaires, Entrepreneurial Orientation Questionnaire (EOQ; COE in Spanish), Psychological need satisfaction and optimism scale of the (PROE) questionnaire
50	Salman, M., Asif, N., Mustafa, Z. U., Khan, T. M., Shehzadi, N., Hussain, K., ... & Khan, M. T. (2020). Psychological Impact of COVID-19 on Pakistani University Students and How They Are Coping. *medRxiv*.	Pakistan	21.7 ± 3.5 years	1134	NR	Anxiety (GAD-7), depression (PHQ-9), sources of distress (14-items) and the coping strategies (Brief-COPE)

51	Tadesse, A. W., Mihret, S., Biset, G., & Muluneh, A. (2020). Psychological Impacts of COVID-19 among College Students in Dessie Town, Amhara Region, Ethiopia; Cross-sectional Study.	Ethiopia	16-20	408	214	DASS-21 (i.e. the Depression, Anxiety, and Stress Scales), 20-items for knowledge, eight items for attitude, and 12-items for the practice of preventive measures
52	Irawan, A. W., Dwisona, D., & Lestari, M. (2020). Psychological Impacts of Students on Online Learning During the Pandemic COVID-19. *KONSELI: Jurnal Bimbingan dan Konseling (E-Journal)*, *7*(1), 53-60.	Indonesia	NR	30	15	NR
53	Dangi, R. R., & George, M. (2020). Psychological Perception of Students During COVID-19 Outbreak in India. *High Technology Letters*, *26*(6), 142-144.	India	16-35	1562	NR	12 items Likert scale to assess psychological perception on terms of anxiety
54	Islam, M. S., Sujan, M. S. H., Tasnim, R., Sikder, M. T., Potenza, M. N., & Van Os, J. (2020). Psychological responses during the COVID-19 outbreak among university students in Bangladesh. *PloS one*, *15*(12), e0245083.	Bangladesh	18-29	3122	1857	DASS-21 scale assessed depression, anxiety, and stress
55	Ojewale, L. Y. (2020). Psychological state and family functioning of University of Ibadan students during the COVID-19 lockdown. *medRxiv*.	Nigeria	21±2.9	386	154	The Hospital Anxiety and Depression scale (HADs)
56	Liu, X., Liu, J., & Zhong, X. (2020). Psychological State of College Students During COVID-19 Epidemic. *Available at SSRN 3552814*.	China	≤22	509	176	Self-Rating Anxiety Scale and Center for Epidemiological Studies Depression Scale
57	Arënliu, A., & Bërxulli, D. Rapid assessment: Psychological distress among students in Kosovo during the COVID-19 pandemic.	China				

58	Pagnini, F., Bonalda, E., Montrasi, E., Toselli, E., & Alessandro, A. (2020). Reframing the psychological impact of the COVID-19 outbreak through a social media community for students.	Italy	18-34	436	133	NR
59	Ye, Z., Yang, X., Zeng, C., Wang, Y., Shen, Z., Li, X., & Lin, D. (2020). Resilience, social support, and coping as mediators between COVID-19-related stressful experiences and acute stress disorder among college students in China. *Applied Psychology: Health and Well-Being*, *12*(4), 1074-1094.	China	22	7800	3001	Acute Stress Disorder (ASD), nine-item scale adapted from the checklist of SARS-related stressors, 10-item Connor-Davidson Resilience Scale, an eight-item scale adapted from the Multidimensional Scale of Perceived Social Support, and eight-item scale adapted from the revised version of the Ways of Coping
60	Olmos-Gómez, M. D. C. (2020). Sex and careers of university students in educational practices as factors of individual differences in learning environment and psychological factors during COVID-19. *International Journal of Environmental Research and Public Health*, *17*(14), 5036.	spain	22	441	NR	NR
61	Xiao, H., Shu, W., Li, M., Li, Z., Tao, F., Wu, X., ... & Hu, Y. (2020). Social distancing among Medical students during the 2019 Coronavirus disease pandemic in China: Disease awareness, anxiety disorder, depression, and behavioral activities. *International journal of environmental research and public health*, *17*(14), 5047.	China	17-25	933	654	self-administrated, 84-item questionnaire, Generalized Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9)
62	Liu, S., Liu, Y., & Liu, Y. (2020). Somatic symptoms and concern regarding COVID-19 among Chinese college and primary school students: A cross-sectional survey. *Psychiatry Research*, *289*, 113070.	China	NR	198	68	SSS includes 20 items (scored from 1–4) that cover somatic, anxiety, depression and mixed anxiety-depression symptoms.

63	Husky, M. M., Kovess-Masfety, V., & Swendsen, J. D. (2020). Stress and anxiety among university students in France during Covid-19 mandatory confinement. *Comprehensive Psychiatry*, *102*, 152191.	France	18-19	219	72	5-point Likert scale
64	Elmer, T., Mepham, K., & Stadtfeld, C. (2020). Students under lockdown: Assessing change in students' social networks and mental health during the COVID-19 crisis.	Switzerland	NR	212	NR	Somatic Self-rating Scale (SSS)
65	Yang, D., Tu, C. C., & Dai, X. (2020). The effect of the 2019 novel coronavirus pandemic on college students in Wuhan. *Psychological Trauma: Theory, Research, Practice, and Policy*, *12*(S1), S6.	china	NR	384	178	Scale of the 2019-nCoV coronavirus victimization experience, scale of the positive thinking, scale of the resilience, and scale of the mental health
66	Khan, A. H., Sultana, M. S., Hossain, S., Hasan, M. T., Ahmed, H. U., & Sikder, M. T. (2020). The impact of COVID-19 pandemic on mental health & wellbeing among home-quarantined Bangladeshi students: A cross-sectional pilot study.	Bangladesh	20 to 24	505	NR	Depression Anxiety and Stress Scale 21, Home-quarantine activities and extra-physical stressors perceived as psychological discomfort, Self-reported physical symptoms and Impact of Event Scale
67	Aqeel, M., Shuja, K. H., Abbas, J., Rehna, T., & Ziapour, A. (2020). The Influence of Illness Perception, Anxiety and Depression Disorders on Students Mental Health during COVID-19 Outbreak in Pakistan: A Web-Based Cross-Sectional Survey.	Pakistan	16 to 25	500	NR	Beck Depression Scale, Beck Anxiety Inventory, Revised Illness Perception Questionnaire, and The Warwick-Edinburgh Mental Well-being Scale
68	Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., & Zheng, J. (2020). The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry research*, 112934.	china	NR	7143	2168	The 7-item Generalized Anxiety Disorder Scale (GAD-7)

69	Torun, F., & Torun, S. D. (2020). The psychological impact of the COVID-19 pandemic on medical students in Turkey. *Pakistan journal of medical sciences*, *36*(6), 1355.	Turkey	22.10 ± 2.69	275	108	Impact of Events Scale-Revise and Perceived Stress Scale
70	Li, H. Y., Cao, H., Leung, D. Y., & Mak, Y. W. (2020). The Psychological Impacts of a COVID-19 Outbreak on College Students in China: A Longitudinal Study. *International Journal of Environmental Research and Public Health*, *17*(11), 3933.	China	19.6	555	NR	The 10-item Positive and Negative Affect Schedule (PANAS) [15] and the 4-item Patient Health Questionnaire (PHQ-4)
71	Sögüt, S., Dolu, İ., & Cangöl, E. (2020). The relationship between COVID-19 knowledge levels and anxiety states of midwifery students during the outbreak: A cross-sectional web-based survey. *Perspectives in psychiatric care*.	Turkey	19-22	972	NR	"Survey Form" and the "Beck Anxiety Inventory
72	Tang, W., Hu, T., Yang, L., & Xu, J. (2020). The role of alexithymia in the mental health problems of home-quarantined university students during the COVID-19 pandemic in China. *Personality and Individual Differences*, *165*, 110131.	China	16 to 27	2501	NR	20-item Toronto Alexithymia Scale (TAS-20), the Posttraumatic Stress Disorder, Checklist-Civilian Version (PCLeC), and the Patients Health Questionnaire-9 (PHQ-9)
73	Aker, S., & Mıdık, Ö. (2020). The Views of Medical Faculty Students in Turkey Concerning the COVID-19 Pandemic. *Journal of Community Health*, 1.	Turkey	NR	2051	NR	40 open- and close-ended questions
74	Ma, H., & Miller, C. (2020). Trapped in a Double Bind: Chinese Overseas Student Anxiety during the COVID-19 Pandemic. *Health Communication*, 1-8.	China	18 to 53	182	NR	5-point Likert scale, State-Trait Anxiety Inventory (STAI) and Perceived Social Support Scale (PSSS)

75	Patsali, M. E., Mousa, D. P. V., Papadopoulou, E. V., Papadopoulou, K. K., Kaparounaki, C. K., Diakogiannis, I., & Fountoulakis, K. N. (2020). University students' changes in mental health status and determinants of behavior during the COVID-19 lockdown in Greece. *Psychiatry research*, *292*, 113298.	Greece		NR	431	CES-D as the measure for depression and an algorithm were used to identify cases of major depression
76	Feng, Y., Zong, M., Yang, Z., Gu, W., Dong, D., & Qiao, Z. (2020). When altruists cannot help: the influence of altruism on the mental health of university students during the COVID-19 pandemic. *Globalization and Health*, *16*(1), 1-8.	China	19.76 ± 2.23	1346	364	The Self-Report Altruism Scale (SRA scale)
77	Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., ... & Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Children and Youth Services Review*, *116*, 105194.	India				
78	Islam, M. A., Barna, S. D., Raihan, H., Khan, M. N. A., & Hossain, M. T. (2020). Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey. *PloS one*, *15*(8), e0238162.	Bangladesh	(17–20) 115 24.2 (21–24) 319 67.0 (>24) 42 8.8	476	male (67.2%),	Patient Health Questionnaire (PHQ-9) & Generalized Anxiety Disorder (GAD-7).
79	Ataş, O., & Yildirim, T. T. (2020). Evaluation of knowledge, attitudes, and clinical education of dental students about COVID-19 pandemic. *PeerJ*, *8*, e9575.	Turkey	-	355	165 (46.4%)	General questionnair

80	Rajab, M. H., Gazal, A. M., & Alkattan, K. (2020). Challenges to online medical education during the COVID-19 pandemic. *Cureus*, *12*(7).	KSA	not identified, howver, of total repondents: 125 (60.1%) were born between 1997-2012 (Generation Z or Post-Millennials),	208 responses, (139) 66.8% were medical students; (31) 14.9% were master's students, and 18.3% were faculty.	NOT IDENTIFIED, ONLY FROM TOTAL: 208 responses (94) 45.2% of the respondents were males	General questionnair
81	Zhao, B., Kong, F., Aung, M. N., Yuasa, M., & Nam, E. W. (2020). Novel coronavirus (COVID-19) knowledge, precaution practice, and associated depression symptoms among university students in Korea, China, and Japan. *International journal of environmental research and public health*, *17*(18), 6671.	Korea, Japan and China	390 indivuduals were from Korea (mean age: 23.14 ± 0.15, 41.54% male and 58.46% female), 281 from China (mean age: 23.63 ± 0.18, 29.54% male and 70.46% female), and 150 from Japan (mean age: 23.08 ± 4.78, 40% male and 60% female). The study was conducted collectively in the three countries.	821		
82	Romero-Blanco, C., Rodríguez-Almagro, J., Onieva-Zafra, M. D., Parra-Fernández, M. L., Prado-Laguna, M. D. C., & Hernández-Martínez, A. (2020). Physical activity and sedentary lifestyle in university students: Changes during confinement due to the Covid-19 pandemic. *International Journal of Environmental Research and Public Health*, *17*(18), 6567.	Spain	20.5 (4.56)	213	19.2% (n:41)	International Physical Activity Questionnaire—Short Form (IPAQ-SF); EuroQol 5D; PREDIMED questionnaire; Prochaska and DiClemente's Transtheoretical Model (TTM) (EQ-5D) questionnaire

83	Sundarasen, S., Chinna, K., Kamaludin, K., Nurunnabi, M., Baloch, G. M., Khoshaim, H. B., ... & Sukayt, A. (2020). Psychological impact of COVID-19 and lockdown among university students in Malaysia: Implications and policy recommendations. *International journal of environmental research and public health*, *17*(17), 6206.	Malaysia	majority (85%) were in the age group of 19–25	983	330 (33.6%)	Zung's self-rating anxiety questionnaire
84	Chi, X., Becker, B., Yu, Q., Willeit, P., Jiao, C., Huang, L., ... & Solmi, M. (2020). Prevalence and psychosocial correlates of mental health outcomes among chinese college students during the coronavirus disease (covid-19) pandemic. *Frontiers in psychiatry*, *11*, 803.	China	20.6 (SD 1.90)	2038	755 (37.0%)	Zung Self-Rating Anxiety Scale (Z-SAS);Patient Health Questionnaire (PHQ-9);The Abbreviated PTSD Checklist (PCL);The PostTraumatic Growth Inventory (PTGI);Sociodemographic Correlates;The Adverse Childhood Experiences (ACEs) Questionnaire;The Adult Attachment Scale (AAS);The Connor–Davidson Resilience Scale (CD-RISC);The Subjective Socioeconomic Status (SES) Scale
85	Vanaken, L., Scheveneels, S., Belmans, E., & Hermans, D. (2020). Validation of the impact of event scale with modifications for COVID-19 (IES-COVID19). *Frontiers in psychiatry*, *11*, 738.	Belgium	T1: age was M = 19.44, SD = 1.40, range = 17–28.; T2: age of M = 19.51, SD = 1.31, range = 18–27.	T1: 380; T2: 246	T1: 45 (11.84%)MEN men, ; T2: 25 (10.16%) men.	The Impact of Event Scale With Modifications for COVID-19 (IES-COVID19); The Depression Anxiety and Stress Scales (DASS-21); Psychological Well-Being (PWB); The Social Support List (SSL); The Stress-Reactive Rumination Scale (SRRS)
86	Amerio, A., Brambilla, A., Morganti, A., Aguglia, A., Bianchi, D., Santi, F., ... & Capolongo, S. (2020). Covid-19 lockdown: Housing built environment's effects on mental health. *International journal of environmental research and public health*, *17*(16), 5973.	Northern Italy	22.02 +/- 2.88	8177	4095	The 9-item Patient Health Questionnaire (PHQ-9); The 7-item Generalized Anxiety Disorder scale (GAD-7); The 7-item Insomnia Severity Index (ISI); The Barratt Impulsiveness Scale–11 (BIS-11);The Short Form 12-Item Health Survey (SF–12)

87	Baiano, C., Zappullo, I., & Conson, M. (2020). Tendency to worry and fear of mental health during Italy's COVID-19 lockdown. *International journal of environmental research and public health*, *17*(16), 5928.	Italy	T0: 23.84 +/- 2.4 T1= 23.84 =/-2.5	T0: 31 T1:25	T0: 17 T1:15	Worry (Penn State Worry Questionnaire, PSWQ), anxiety (Anxiety Sensitivity Index, ASI-3), and trait mindfulness (Mindful Attention Awareness Scale, MAAS)
88	Ramos-Morcillo, A. J., Leal-Costa, C., Moral-García, J. E., & Ruzafa-Martínez, M. (2020). Experiences of nursing students during the abrupt change from face-to-face to e-learning education during the first month of confinement due to COVID-19 in Spain. *International journal of environmental research and public health*, *17*(15), 5519.	Spain	18 to 50 years	32	8	-
89	Wang, C., & Zhao, H. (2020). The Impact of COVID-19 on Anxiety in Chinese University Students. *Frontiers in Psychology*, *11*, 1168.	China	18-24	3611	1454	Self-Rating Anxiety Scale – SAS
90	Kecojevic, A., Basch, C. H., Sullivan, M., & Davi, N. K. (2020). The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PloS one*, *15*(9), e0239696.	USA	Mean ± SD, 20.4 ± 2.9 Median, Range 19, 18–37	162	46	Descriptive questions and to assess levels of depression, anxiety and somatic distress, we used the Brief Symptom Inventory, BSI-18