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Evaluation of the impact of COVID-19 on the mental health of Indian students: A systematic review

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ABSTRACT
Background: The COVID-19 pandemic has disrupted social life leading to increased physical, economic and social stress that ultimately leading to psychological and mental abruptions. Mental health issues such as Stress, depression, and anxiety, skyrocketed during and post-pandemic.
Objective: This systematic review aims at evaluating the incidence of mental distress conditions in college students associated with COVID-19 further providing the prevalence of mental health complications among Indian students.
Methods: A thorough literature search was performed through databases such as Google Scholar, PubMed by using predefined MeSH terms. All cross-sectional studies reporting mental health of Indian students associated with COVID-19 were included according to Preferred reporting Items for Systematic review and meta-analysis (PRISMA).
Results: In this systematic review, a total N=651 studies were identified, where n=4 studies were considered for final analysis with a sample size of n=1179 students. Overall, this study results revealed that depression was found in 45.5% (n=554), anxiety 41.8% (n=492), and stress 29.95% (n=353) associated with COVID-19 were significant during pandemic situations among Indian students.
Conclusion: This study put forward a comprehensive systematic analysis on the prevalence of depression, anxiety, and stress associated with COVID-19. The included studies for systematic reviews revealed that the mental health issues among Indian students attending college were facing elevated stress, depression, and anxiety, were allied with SARS-Cov-2 pandemic and accompanying factors such as virtual education, quarantine, and less physical activity.

Keywords: COVID-19, Mental health, depression, anxiety, stress, Indian students, DASS- 21

I.   INTRODUCTION

The human kind has witnessed multiple epidemics and pandemics from Black death in the medieval 1300's to Spanish flu during a century earlier in 1918 to COVID-19 a century later. The repercussions of the Corona virus-2 infection have shattered all the previous pandemics' records, giving a signal of endangerment to the mankind. [1,2] Since the outbreak of SARS-CoV-2in China this deadly virus has rapidly transmitted across geographical boundaries, numerous nations have implemented emergency lockdowns and have banned all social gatherings. Furthermore, the COVID-19 pandemic has disrupted and collapsed most of the social and public care-providing systems which are ultimately deranging the day-to-day life of the global population. [1] Extreme stringent preventive protocols were instigated by governments all around the world to restrict the spread of the infection by suspending most of the non-essential lines of work, and shutting down educational institutes, thus beginning the era of virtual education. [2,3] Majority of the studies around the world elucidated the prevalence of mental health disorders such as depression and anxiety and stress associated with COVID-19. [4-8] These are mainly due to the trepidation of the infection, lifestyle disruption, and socio-economic instability. Especially in

students, plummet in social interactions, home durance, and increase in physical distancing followed by concern about their academics leading to irregular and disrupted sleep patterns, elevated emotional irregularities, cognitive imbalances finally resulting in mental health issues.[9, 10] Additionally, quarantine has been reported to induce acute stress disorder in the pediatric population, lack of access to medical care, and alterations in socioeconomic status during the infection may further increase the stress. [9, 11] Worsening of these conditions may further result in suicidal tendencies. [12] Cumulatively, maintaining mental health became one of the major challenges during and after the post-COVID-19 era. [13] For individuals that have experienced crisis and catastrophes, providing psychological first aid is a crucial aspect of care prior, though, and latter of the occurrence of any such events.[14] There is a need for evidence to initiate tailored treatment strategies to counter any specific disease conditions. The heterogeneity in economic and social status and demographics of populations around the world demands differential real-world evidence to evaluate the real-world scenario to build public health policies and develop tailored treatment strategies to tackle psychological crises among the targeted population.[15,16]Therefore, the systematic evaluation of the prevalence of mental health disturbance can provide a valid and strong conclusion to assist policy building to deal with psychological distress among students. This systematic review aimed at evaluating the incidence of mental distress conditions associated with COVID-19 further providing the prevalence of mental health consequences among Indian students.

II.   METHODS:

Study protocol was registered in the International Prospective Register of Systematic Reviews with registration number CRD42022334749. We adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [17].

Data sources and Search strategy:

The databases searched for retrieval of literature include PubMed and Google Scholar. Different search strategies were prepared by using MeSH terms. The following search terms were used to retrieve literature from the database "2019 novel coronavirus-infected pneumonia" or "2019 novel coronavirus" or "2019 novel coronavirus pneumonia" or "COVID-19 pneumonia" or "COVID-19" or "2019-nCOV" and "undergraduate or university student(s)" or "college student(s)" or "higher education students and mental health" or "mental disorder" or 'mental wellbeing' or "psychological health" or "psychological distress" or "mental illness" or "mental disorder" or "mental health problem "or "depression" or "anxiety". Citations of the retrieved literature were also searched for the relevant studies.

Inclusion criteria:

Studies evaluating the mental health of Indian students associated with COVID-19. All the cross-sectional and web-based surveys were included. The search strategy was carried out through 2020 till date. Studies assessing mental health by using standard validated questionnaire Depression Anxiety Stress measurement scale (DASS 21). All the studies published in the English language were included.

Exclusion criteria:

Studies have excluded, if students dropped out of college and were temporarily absent from college. Literature other than cross sectional studies (RCT, Case-control studies, and Cohort studies), case reports, narrative & Systematic review articles, and studies with incomplete data were excluded.

Literature screening:

Two authors independently reviewed all the literature (PN and VR), and conflicts and disagreements were cleared with the help of a third reviewer (GV) after the results were cross-checked.

Data extraction:

The following data was extracted from the included studies (i) First author (ii) Year of publication (iii) Study design (iv) Sample size (v) Outcome of the research, and basic characteristics of participants like gender, education level, and tools (DASS- 21 scale) used for measurement of mental health were collected.

Publication bias assessment:

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) checklist [18]. The assessment, which has eight evaluation elements, was used to assess the Quality of the methodology and literature. Each item's assessment was broken down into the following four categories: yes, no, unclear, and not applicable. The judgment was made based on how closely each item complied with the criteria. By combining the rating of eight items, the overall assessment of the included publications was created

(include, exclude, and seek further info). Two investigators individually assessed the quality of the studies that were included. When there were differences, they were settled by dialogue or negotiating with a third party.

III. RESULTS:

Characteristics of the included studies:

A total of four studies were considered for final analysis based on inclusion and exclusion criteria. **Table-01** is a cumulative summary of features of the studies included. All four studies followed analytical quantitative method designs (cross-sectional), and the data collection was done in online mode in all four studies. The data of three studies were accumulated from April 2020 to June 2020 during the first wave of COVID-19, meanwhile, one study was conducted from June 2021 to July 2021. Cumulatively, a total of (N=1179) students were identified from the studies, although the sample size throughout all four studies diverged significantly, from 80 to 500. Out of four studies, n=3 studies have not alluded to any specifics about the age of the participants included but the studies, Satpathy B et.al included MBA (Masters of business administration) [19],Khetan MS et.al [20] included pre-medical students, Tiwari SS et.al [21]included physiotherapy students, this conclusively indicates that the participants in these three studies may be well over 18 years of age considering all these academic courses are over diploma level. Additionally, in a cross-sectional study, Vidhyadara S et.al [22] included pharmacy students aged 18-24 years. Furthermore, the gender divergence in n=2 studies remain undisclosed wherein, both Vidhyadara S., et al. and Khetan MS., et al. females were comparatively higher than males. All the four studies evaluated the prevalence of the psychological consequences related to coronavirus pandemic by using the DASS-21 pre-validated scale which is used for measuring mental states like stress, depression, and anxiety, in adults, and assesses core symptoms of these conditions. The 21 questions in the questionnaire are subdivided into a trio of self-reported measures for evaluating DASS. [23, 24]
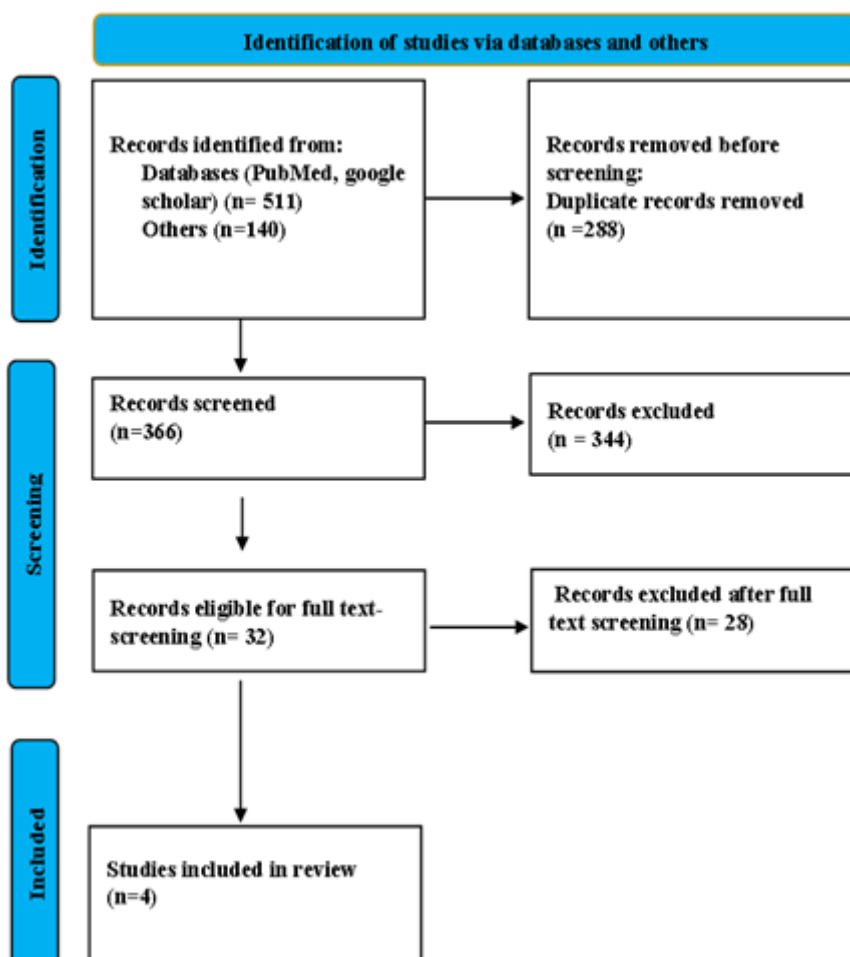
Table-01: Characteristics of the studies

First author	Year of publication	Study design	Sample size	Male/ female	Tools used	Outcome	Survey duration	Age	Education level	JBI evaluative results
Satpathy B., et al.	2020	Online survey	80	NM	DASS 21	Depression, anxiety, stress	5th APRIL 2020 to 15th April 2020	NM	MBA	Include
Khetan MS., et al.	2020	Online survey	324	104/220	DASS 21	Depression, anxiety, stress	10thMay 2020 to 10th June 2020	NM	Pre-medical students	Include
Tiwari SS., et al.	2021	Online survey method	275	NM	DASS 21	Depression, anxiety, stress	June 22 2020 to July 3rd, 2020	NM	Physiotherapy students	Include
Vidhyadara S., et al.	2020	Cross-sectional study	500	174/326	DASS 21	Depression, anxiety, stress	23rd April 2020 to 30th April 2020	18-24	Pharmacy students	include

IV.   DEPRESSION:

A total of N=1179 individuals were surveyed (**Table 02**) where, depression was found to be 45.5% (n=554), where extremely severe depression was identified in 11.2% (n=133) of the surveyed population, followed by Severe depression in 6.4% (n=76), Moderate depression in 14.4% (n=170) and Mild depression in 13.4% (n=158). Cumulative positive depression scores varied throughout the studies, Khetan MS et.al 60.2% (n=195), and multiple degrees of depression, Mild 44 (13.5%), Moderate 87(26.8), Severe 25(7.7%), extremely severe 39(12.0%) were reported. Vidyadhara S et.al, reported depression in 42.5% (n=213) where, Mild 42(8.5%), Moderate 40(8%), Severe 41(8%), extremely severe depression 90(18%) was noted. Additionally, a study by Satpathy B et.al had 34(43%) positive depression diverged into Mild 18(23%), Moderate 11(14%), Severe 5(65), and did not report any cases of extremely severe depression. Depression was found in 34.5% (n=95) of n=275 in Tiwari SS et.al, and Mild 54(19.6%), Moderate 32(11.6%), Severe 5(2%), extremely severe depression 4(1.45%) was recorded. Furthermore, depression scores were found to be normal in n=625 (54.4%) of overall surveyed participants.

Table 02: Prevalence of depression throughout the selected studies

First author	Year of publication	Study design	Sample size	Study tool	Outcome	measurements
Satpathy B., et al.	2020	Online survey	80	DASS 21	Depression	Normal=46(57%) Mild=18(23%) Moderate=11(14%) Severe=5(65) Extremely severe=0(0%)
Khetan MS., et al.	2020	Online survey	324	DASS 21	Depression	Normal=129(39.8%) Mild=44(13.5%) Moderate=87(26.8) Severe=25(7.7%) Extremely severe=39(12.0%)
Tiwari SS., et al.	2021	online survey method	275	DASS 21	Depression	Normal=180(65.45%) Mild=54(19.6%) Moderate=32(11.6%) Severe=5(2%) Extremely severe=4(1.45%)
Vidhyadara S., et al.	2020	Cross-sectional study	500	DASS 21	Depression	Normal=287(57.5%) Mild= 42(8.5%) Moderate=40(8%) Severe=41(8%) Extremely severe=90(18)

Anxiety

The incidence of anxiety in the N=1179 population was found to be 41.8% (n=492) of the total study population. Extremely severe anxiety in 180(15.2%), Severe 67(5.6%), Moderate 163(13.8%), Mild=82(6.9%). Satpathy B et.al did not report any extreme severe and severe anxiety cases whereas a total of 13 (16%) were reported with anxiety out of which Mild 5(6%) Moderate 8(10%) were noted. Additionally, A total of 159 (49.1%) were found to have anxiety wherein, Mild 19(5.9%), Moderate 71(21.9%), Severe 34(10.4%), Extremely severe 35(10.8%). Vidhyadara S et.al reported 138(27.5%) extreme severe anxiety followed by 52(10.5%) moderate, 25(5%) Mild, and 20(4%) Severe resulting in 235 (47%) reported anxiety. A total of 85(31%) were identified with anxiety, with diverged degrees of anxiety, Mild 33(12%), Moderate 32(11.6%), Severe13(5%), and extremely severe7(2.5%). Furthermore, overall, 687(58.2%) were found to be normal anxiety scores.

Table 03: Prevalence of Anxiety throughout the selected studies

First author	Year of publication	Study design	Sample size	Study tool	Outcome	measurement
Satpathy B., et al.	2020	Online survey	80	DASS 21	Anxiety	Normal=67(84%) Mild=5(6%) Moderate=8(10%) Severe=0(0%) Extremely severe=0(0%)
Khetan MS., et al.	2020	Online survey	324	DASS 21	Anxiety	Normal=165(50.9%) Mild=19(5.9%) Moderate=71(21.9%) Severe=34(10.4%) Extremely severe=35(10.8%)
Tiwari SS., et al.	2021	Online survey	275	DASS 21	Anxiety	Normal= 190(69%) Mild=33(12%) Moderate=32(11.6%) Severe=13(5%) Extremely severe=7(2.5%)
Vidhyadara S., et al.	2020	Cross-sectional study	500	DASS 21	Anxiety	Normal=265(53%) Mild=25(5%) Moderate=52(10.5%) Severe=20(4%) Extremely severe=138(27.5%)

Stress

Stress levels were found to be very low in comparison to other mental health outcomes. The occurrence of stress in surveyed population was 29.95% (n=353) **Table 04** which ranged from Mild 121(10.2%), Moderate 88(7.4%) Severe 68(5.7%), extremely severe 76(6.45%). The stress scores varied throughout the studies, Satpathy B et.al (n=80) and Tiwari SS et.al only reported mild stress of 11% (n=9) and 16% (n=44) respectively. Mild stress in 11% (n=9) was reported in Satpathy B et.al and Mild stress 10.9% (n=31), Moderate stress in 6% (n=2), Severe stress 6% (n=2), extremely severe stress in 0.3% (n=1) was reported in Tiwari SS et.al. Higher stress scores were found in Khetan MS et.al (n=324), where 43.3% (n=140) participants had significant stress scores ranging from Mild 61(18.8%), Moderate 37(11.4%), Severe 29(8.9%), extremely severe stress 13(4.01%). Additionally, Vidyadara S et.al (n=500), had reported stress in 32% (n=160) in various degrees of stress, Mild=20(4%), Moderate=45(9%), Severe=33(6.5%), extremely severe=62(12.5%). Furthermore, stress levels were found to be normal in 70.05% (n=826).

Table 04: Prevalence of Stress throughout the selected studies

First author	Year of publication	Study design	Sample size	Study tool	Outcome	measurement
Satpathy B., et al.	2020	Online survey	80	DASS 21	Stress	Normal=71(89%) Mild=9(11%) Moderate=0 Severe=0 Extremely severe=0
Khetan MS., et al.	2020	Online survey	324	DASS 21	Stress	Normal=184(56.7%) Mild=61(18.8%) Moderate=37(11.4%) Severe=29(8.9%) Extremely severe=13(4.01%)
Tiwari SS., et al.	2021	Online survey	275	DASS 21	Stress	Normal= 231(84%) Mild=31(10.9%) Moderate=6(2%) Severe=6(2%) Extremely severe=1(0.3%)
Vidhyadara S., et al.	2020	Cross-sectional study	500	DASS 21	Stress	Normal=340(68%) Mild=20(4%) Moderate=45(9%) Severe=33(6.5%) Extremely severe=62(12.5%)

Cumulative mental health outcomes

The overall mental health outcomes of the included studies n=4 have been summarized in **Table 05**. anxiety, depression and psychological stress allied with COVID-19 were evaluated in students aged above 18 using the DASS-21 scale.

Table 05: Prevalence of Mental health outcomes in all the included studies.

Outcome	Study tool	Sample size	Cumulative depression
Depression	DASS 21	1179	Normal=642(54.4%) Mild=158(13.4%) Moderate=170(14.4%) Severe=76(6.4%) Extremely severe=133(11.2%)
Anxiety	DASS 21	1179	Normal=687(58.2%) Mild=82(6.9%) Moderate=163(13.8%) Severe=67(5.6%) Extremely severe=180(15.2%)
Stress	DASS 21	1179	Normal=826(70.05%) Mild=121(10.2%) Moderate=88(7.4%) Severe=68(5.7%) Extremely severe=76(6.45%)

V.   DISCUSSION:

The COVID-19 pandemic has disrupted life as it is leading to increased physical, economic, and social stress ultimately leading to psychological and mental abruptions. [25, 26] The mental health consequences like stress, depression, and anxiety, skyrocketed during and post-pandemic in comparison to pre-pandemic. [27] Especially in students due to the shutdown of educational institutes, and the increase in virtual education protocols leading to less interaction with friends and family depleted physical activity, and fear of infection. [28-30] This study aimed to systematically examine the psychological well-being of Indian students with observational studies which utilized the DASS-21 scale to determine the occurrence of depression, anxiety, and

stress, through PubMed, and Google scholar regarding the prevalence of mental health issues in Indian students associated with COVID-19.

In this study, out of 651 studies, 4 studies were included for final analysis with n=1179 cumulative samples. We have found that depression 45.5% (n=554), anxiety 41.8% (n=492), and stress 29.95% (n=353) associated with COVID-19 in Indian students were significant when compared to pre-pandemic situations. Madhan et.al concluded in a study on Indian medical students using the DASS-21 scale, that 15.8% of the participants have shown the symptoms of all three co-existed mental health issues of depression, anxiety, and stress. [31] Additionally, a study in 2018 elucidated in a cross-sectional study with undergraduate medical students in northern India has postulated that depression in 9%, anxiety in 18%, and stress in 5% of the study population. [32]

Similar findings were observed in various studies carried out throughout the world. A study published in Palestine in 2021 reported around 35.7% of the students reported severe to moderate stress, compared to the majority who reported anxiety ranging from severe to moderate (89.1%) followed by sadness (72.1%). [4] Another investigation on the coronavirus pandemic's effects on students' psychological health was undertaken amongst Britain students; the findings of this study show that the virus has significantly impacted students' mental health. [5] It is similar in U.S. college students, those who were about to graduate had higher levels of worry (60.8%), loneliness (54.1%), and depression (59.8%). [6] Students' psychological, emotional and behavioral state has been harmed as a result of the prolonged shutdown of academic facilities. When compared to other years, the suicide rate during the pandemic among students in Bangladesh had risen sharply. [7] In a cross-sectional study of n=324 students, it was discovered that 167 51.5% (n=167) had anxiety ranging from severe to mild, followed by 93 28.7% (n=93) were suffering from severe to moderate depression, and 68.8% (n=223) reported high concern over COVID-19. [8]

All the evidence in studies executed around the world points to the increase in mental health-related issues in post COVID-19 era, but similar evidence regarding Indian students needed more exploration. This study bridged that knowledge gap by synthesizing the real-time evidence by systematically analyzing the outcomes to determine the prevalence of depression, anxiety, and stress in Indian students. This can further help in policy building and strategy development to tackle the situation of mental health crisis among the young adult population. The major limitations of this study includes studies that may utilize other scales which measure the psychometric properties to analyze the mental health outcomes were not included in this study. Only two databases such as PubMed, and Google Scholar were considered to retrieve the studies. Other data-based such as Embase and Scopus were not included. Furthermore, the demographic breakdown of the study participants was undisclosed in n=3 studies, which affected the subset analysis of the prevalence of the targeted outcomes in different genders and age groups. The question of prior exposure to the COVID-19 infection remains a confounding factor in all the study participants even though it was not mentioned. Various strategies can be developed to help assist the students in dealing with this crisis. This review makes several recommendations for further research that could aid in our comprehension of the state of young Indian adults' mental health. Even though the evidence for the consequences of psychological health, in particular for depression, anxiety, and stress, appears to be minimal, it is notably obvious that there is a dearth of available high-quality research on this subject. Many additional studies are required, including the development and validation of tests that gauge the effect of COVID-19 on people of all ages and populations' mental and physical well-being. Conclusively, this systematic review has shed a light on the current scenario of psychological disturbance among young adults in the post-COVID-19 era.

VI.   CONCLUSION:

This study put forward a comprehensive systematic evaluation of the prevalence of depression, anxiety, and stress associated with COVID-19. The included studies for systematic review state that the mental health issues such as depression, anxiety, and stress among the young Indian adults who are attending college were facing increased depression, anxiety, and stress associated with the COVID-19 pandemic and accompanying factors such as virtual education, quarantine, less physical activity, etc. Additionally, this study offers various suggestions for additional studies that can improve our knowledge of the mental health of young Indian students. Even while there seems to be little evidence supporting the effects of psychological health, particularly on depression, anxiety, and stress, it is glaringly clear that there is a severe lack of high-quality research on the topic.

Authors Contributions: Pavan Kumar Narapaka, Varun Raj Ponnala, Manisha Singh, Pavan Kalyan Bodige conceptualized the topic, Pavan Kumar Narapaka, Varunraj Ponnala, Kalpana Katikala Conducted the preliminary screening of the literature, Gopal Vishwas, Pavan Sagar conducted the secondary screening of the literature, Pavan Kumar Narapaka and Varunraj Ponnala, Gopal Vishwas conducted the data extraction, final analysis. V Udaya Kumar, Kalpana Katikala wrote the manuscript, Pavan Kumar, Varun Raj Ponnala edited the final manuscript and responsible for the final content. All the authors red and approved the manuscript.

Abbreviations:
COVID-19- Corona Virus Infection 2019
MeSH- Medical Subject Headings.
PRISMA- Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SARS-CoV-2 Severe Acute respiratory Syndrome Corona Virus-2
DASS-21 Depression Anxiety Stress Measurement Scale -21
JBI- Joanna Briggs Institute
RCT- Randomized Controlled Trial.
MBA- Master of Business Administration

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