NARRATIVE REVIEW

Bibliometric analysis of the impacts of COVID-19 on the mental health of college students

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Abstract

The current narrative review was planned to summarise research on the effects of coronavirus disease-2019 on the mental health of college students. A total of 1,695 studies from the Web of Science Core Collections database were accessed using VOSviewer software. China and the United States jointly contributed almost half of the overall publications, while the United States and the United Kingdom demonstrated the strongest collaborative network, and the University of Toronto was the research institution with the highest number of publications; 34(2%) papers and 2,330 citations. The current hotspots could be categorised into four areas, with stress, anxiety and depression being the most prominent. Those effects varied based on their academic major, gender, learning status and social support. The findings underscored the immediate need to cultivate international collaboration and interdisciplinary authorship, alongside the implementation of tailored preventive measures.

Key Words: Depression, Mental health, Pandemic, COVID-19, Bibliometrics, Anxiety.

DOI: https://doi.org/10.47391/JPMA.11284

Introduction

The global spread of coronavirus disease-2019 (COVID-19) resulted in significant detrimental consequences, encompassing not only grave health hazards, but also unforeseeable impacts on mental wellbeing.[1-3] The pandemic induced psychological distress symptoms in individuals without pre-existing psychological conditions, which were further intensified by economic and societal pressures stemming from the outbreak.[4] The impact of the pandemic on individuals' mental health may be more intricate and severe than anticipated as a result of a confluence of factors, such as pandemic-induced instability, population demographics, psychosocial ramifications, and other variables.[5,6] Consequently, it is imperative to evaluate the effects of the COVID-19 outbreak on mental health, and mitigate the consequences for vulnerable groups.[7]

Among such groups, college students were particularly susceptible to psychological and mental health risks associated with the pandemic. The COVID-19 prevention and control measures disrupted normal academic and personal routines of young college students, necessitating their navigation of various challenges, including academic pursuits, social interactions, and activities of daily living, while simultaneously posing health threats.[8,9] Additionally, given their physical and psychological immaturity, young college students may experience incomplete emotional regulation due to underdeveloped neural pathways.[10,11] Consequently, the mental health implications of COVID-19 on college students warranted particular attention. The mental health symptoms of college students under COVID-19 stress included anxiety, depression, distress and emotional instability.[12-15]

Bibliometrics and its visualisation represent a valuable and efficient approach for comprehensively comprehending a research domain through quantitative analysis and visualisation of the data information, collaborative efforts, research focal points, developmental trends, and other relevant factors.[16,17]

The current narrative review was planned to summarise research on the effects of COVID-19 on the mental health of college students with the aim of offering guidance to academics and policymakers for devising more effective strategies and support measures for the students in crisis.

Materials and Methods

The narrative review was conducted in January 2023, and comprised search on the Web of Science Core Collection (WOSCC), a globally recognised and authoritative repository which is considered the optimal database for bibliometric analysis.[18,19] The literature search was based on key words and Boolean operators, including COVID-19

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Submission complete: 20-12-2023 **First Revision received:** 23-02-2024

Acceptance: 26-10-2024 **Last Revision received:** 25-10-2024

OR coronavirus disease-2019 OR SARS-CoV-2 OR 2019-nCoV OR 2019 novel coronavirus AND college student OR university student OR undergraduate OR youth AND mental OR psychological. The search was limited to relevant studies published from January 1, 2020, to December 31, 2022. To ensure data reliability, the retrieval and export of documents in the plain text file and full record in a single day. The following bibliometric information was obtained from the documents: publication year, document type, title, authorship, key words, abstract, institution, country/region, journal, and citation count.

Data was analysed using VOSviewer, which possessed robust graphic display capabilities, and was particularly well-suited for analysing extensive literature.[20] Its unique advantages included the ability to showcase the structure, evolution, collaboration and other relationships of knowledge domains.[21] VOSviewer software was used for constructing key words, cooperation among countries and institutions, and for conducting thematic clustering and visualisation analyses. Figure processing was accomplished using GraphPad Prism and Adobe Illustrator.

Results

Of the 1,704 publications initially located, 1,695(99.5%) papers were retained. The period of April to June 2022 saw the highest number of publications 250(14.75%), representing a 21.95(%) increase compared to the preceding period (Figure 1A). The total number of publications in 2022 was 874, which reflected a 6.46(%) increase compared to the combined output of 2020 and 2021. The period from October to December in 2020 saw a peak in the number of publications, while in 2021 and 2022, the highest number of publications related to the

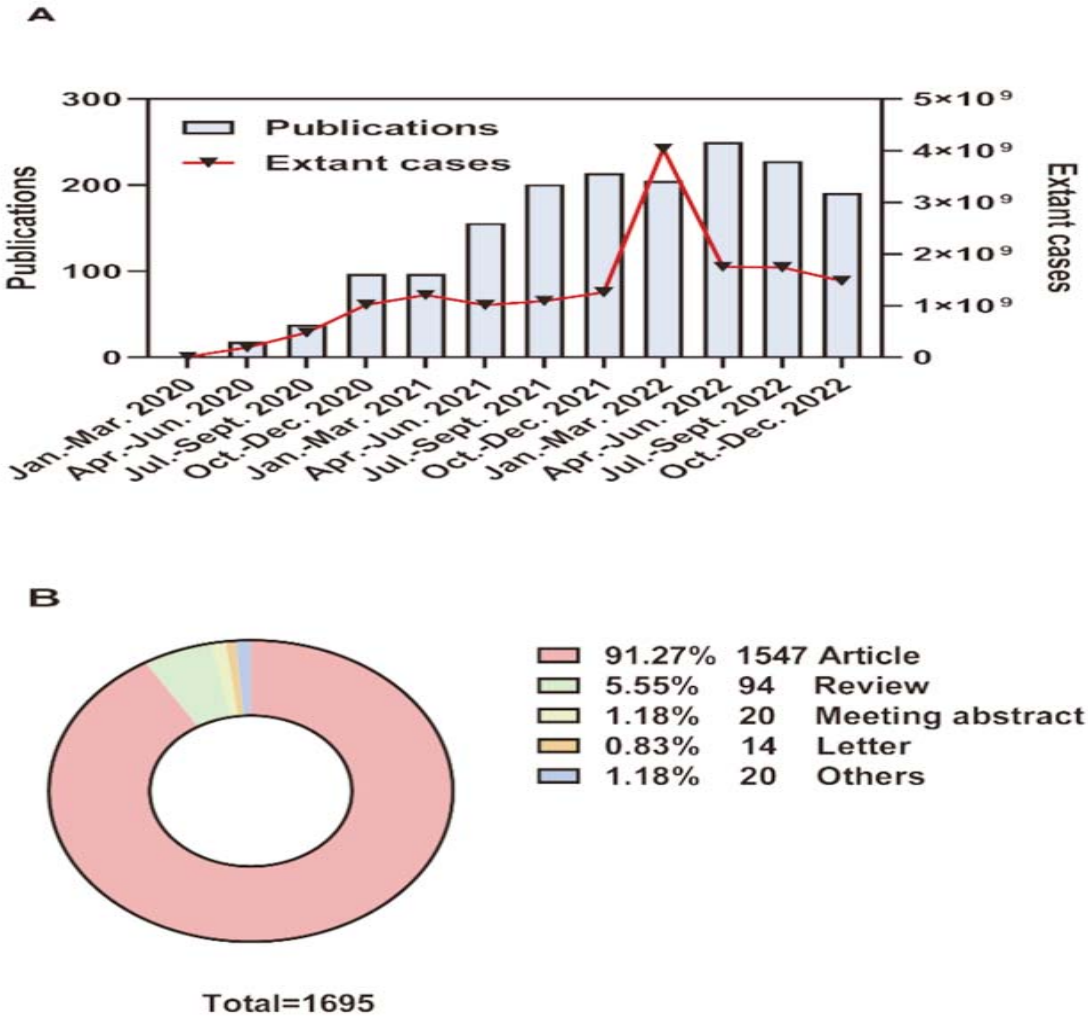

Figure-1: (A) Publication trend of papers on mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic and growth trends of extant cases of COVID-19 from January 2020 to December 2022 (data from the World Health Organisation [WHO]). (B) Distribution of paper types.

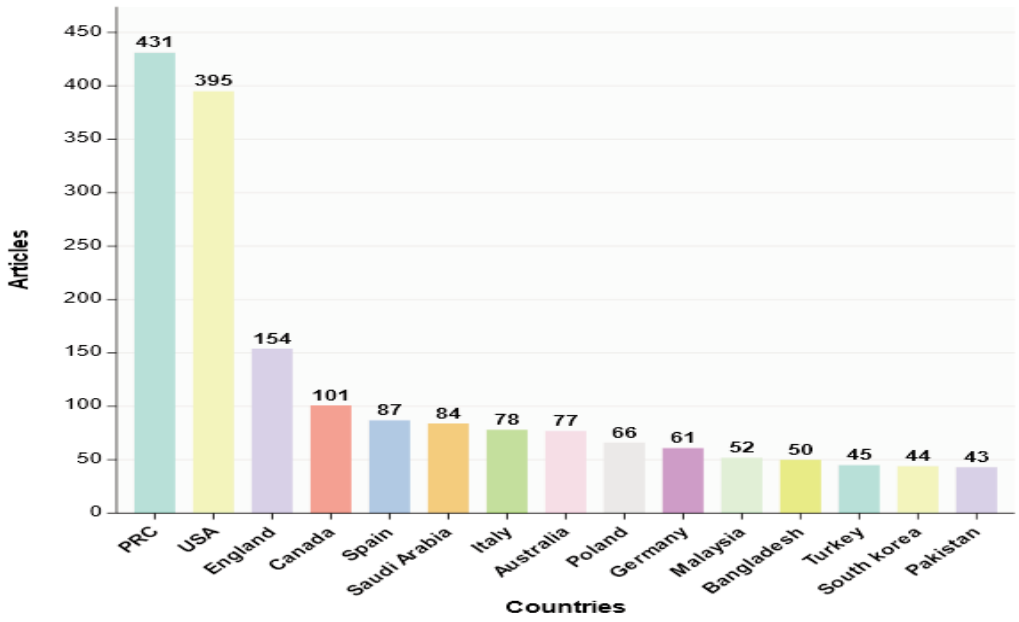

Figure-2: Top 15 countries assessing he mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic

periods of October to October and April to July, respectively. During the October-December period of 2020, studies were conducted in various regions, including China, France and the Philippines. From October to December 2021, research focussed on academic stress, relationships and prevention measures. From April to July 2022, the focus of research shifted to mental health, including sleep, medication, online learning and suggested improvements. Among the studies, there were 1,547(91.27%) articles, 94(5.55%) reviews, 20(1.18%) abstracts, 14(0.83%) letters and 20(1.18%) others (Figure 1B). Of these publications, 1,203(70.97%) were in the English language.

In the analysis of collaborative research, a minimum document threshold of 5 was applied, resulting in 72 countries. The list of top 15 countries/regions that produced the highest number of publications was led by

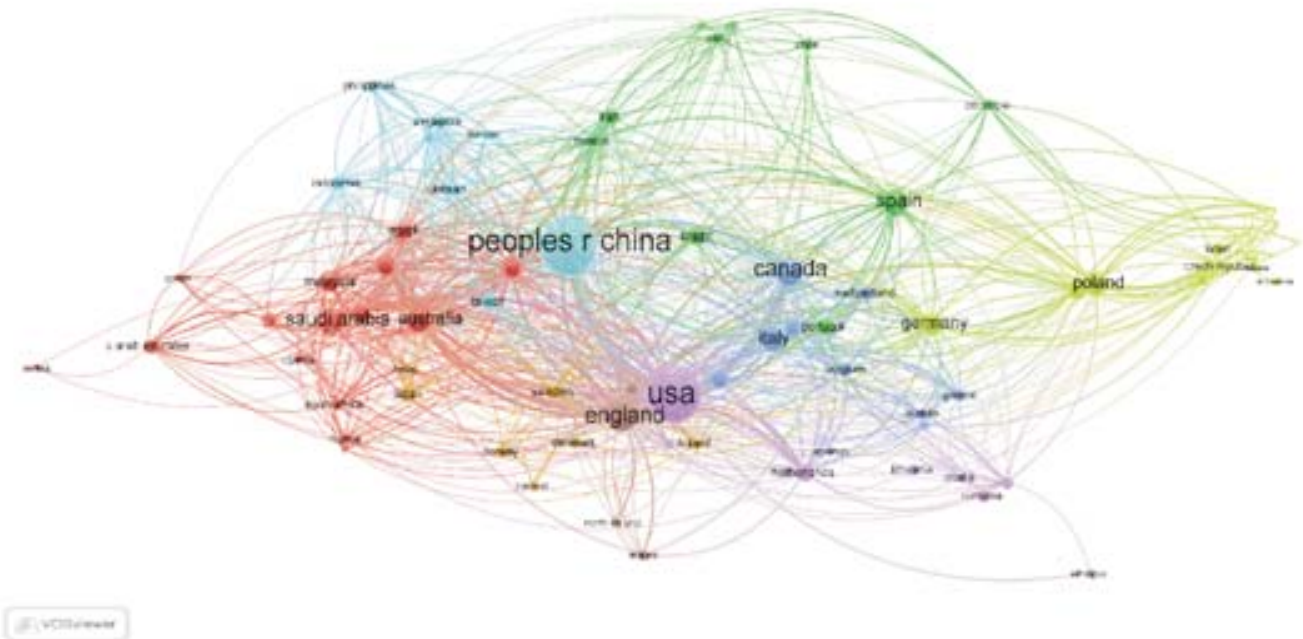

Figure-3: The network map of the collaborative relationship among the major countries working on the mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic.

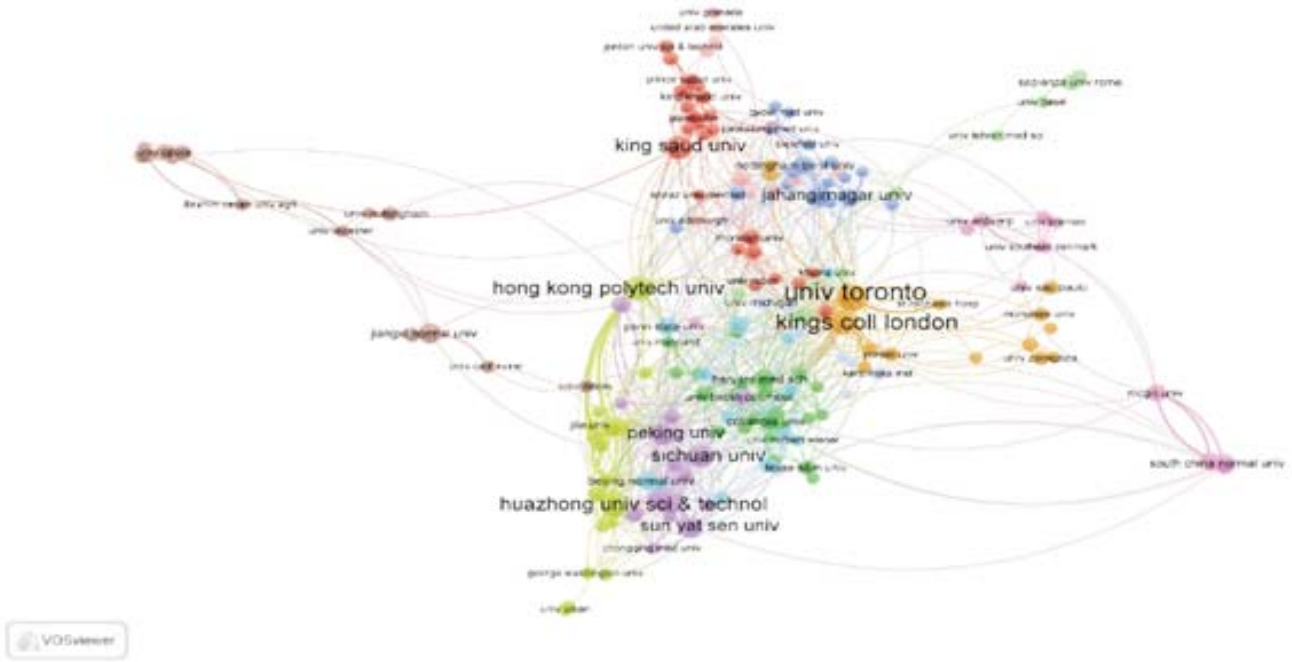

Figure-4: The network map of the collaborative relationship among the major organisations working on the mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic.

China with 431 papers, followed by the United States with 395 papers (Figure 2). The cumulative number of publications from China and the US accounted for 48.73(%) of the total. A network diagram illustrating collaborative associations was drawn, which employed dots to represent distinct countries, with the size of each dot reflecting the number of papers published by the respective country (Figure 3). The strength of collaboration was indicated by the connection between two dots, with thicker lines denoting closer connections. Additionally, the use of colour in the diagram served to cluster countries with similar research directions. The software utilised in the study[16] categorised countries with similar research directions, and countries with the same colour were indicative of shared research directions. The US exhibited the highest degree of connectivity, with a cumulative connection strength of 336, signifying its engagement in cooperative efforts with other nations on 336 occasions. While the number of publications in the United Kingdom was notably lower than that of China, the UK ranked second with 297 collaborations compared to China's 254.

Table 1: Top 10 organisations working on the mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic.

Rank	Organisation	Country	Number of publications	Total cited frequency	Average citation
1	University of Toronto	Canada	34	2330	68.53
2	King's College London	United Kingdom	28	439	15.68
3	Huazhong University of Science & Technology	China	27	629	23.30
4	Hong Kong Polytechnic University	Hong Kong	26	622	23.92
5	Sichuan University	China	25	812	32.48
6	Peking University	China	25	358	14.32
7	Sun Yat-sen University	China	21	195	9.29
8	Jahangirnagar University	Bangladesh	19	418	22.00
9	Zhengzhou University	China	18	383	21.28
10	Central South University	China	17	98	5.76

The scientific research institution with the highest number of publications was the University of Toronto, with 34(2%) papers and 2,330 citations, followed by King's College London and Huazhong University of Science and Technology, with 28(1.65%) and 27(1.59%) papers, respectively.[1] Inter-institutional cooperation exhibited regional differences, with Western countries having closer organisational coordination (Table 1; Figure 4).

The top 10 authors were also identified. The number of published articles ranged 8-12, while the frequency of citations ranged 59-290. Author collaboration was categorised into several clusters, suggesting that authors predominantly collaborated within their own research teams, with limited collaborative relationships outside of the team (Table 2; Figure 5).

Following the pre-processing of key words through the merging of synonyms, key word co-occurrence analysis and clustering initially comprised 4,032 key words that were screened, and of them, 112(2.8%) key words with a frequency of ≥20 were analysed (Figure 6). Four research hotspots were identified (Figure 7). The findings from cluster 1 suggested that the disruption of learning activities, modifications in teaching methods (specifically online learning), alterations in the learning environment, and limited opportunities for practical learning due to the epidemic collectively exacerbated the challenges and psychological strain experienced by the students. The

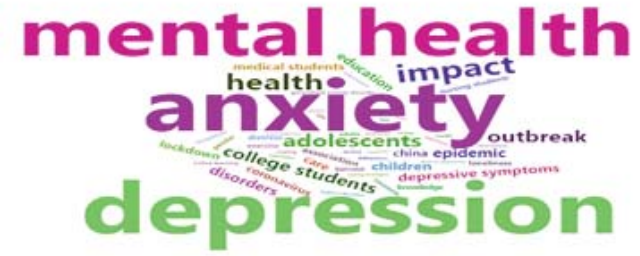

Figure-6: Word cloud showing the top 50 key words with frequency >20. The only exception is the key word 'COVID-19'. The font size corresponds to the frequency of the key word, with larger fonts indicating higher frequency and importance of the key word. Notably, the key words of compression, stress, anxiety and impact garnered significant attention. Different colours represent distinct categories.

second cluster suggested that the reoccurrence of the epidemic, the establishment of routine epidemic prevention and control measures, alterations in campus activities, decreased physical activity, and other contributing factors resulted in diminished sleep quality, insomnia and sleep disturbances among the students. Furthermore, inadequate sleep exacerbated the feelings of depression. Clusters 3 and 4 suggested that a combination of factors, including lifestyle choices, health conditions, academic and employment stress, shifts in interpersonal relationships, inadequate sleep and increased alcohol consumption due to the pandemic, contributed to heightened levels of anxiety and mental health disorders among the students, ultimately resulting

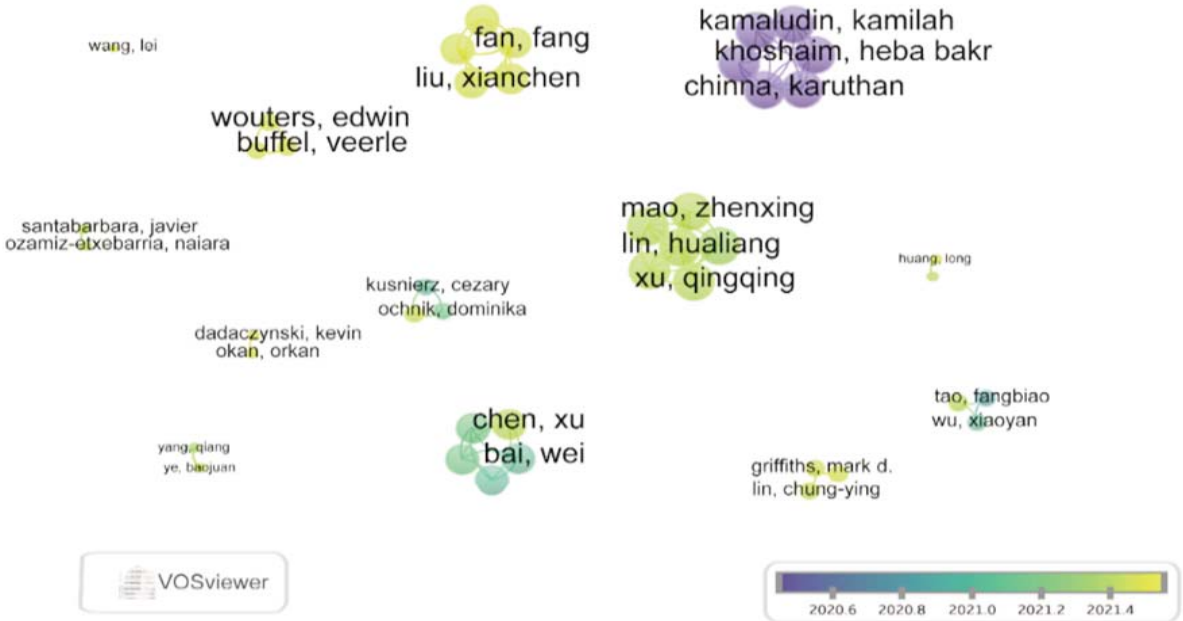

Figure-5: The network map of the collaborative relationship among the major authors working on the mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic.

Table 2: Top 10 authors working on the mental health of college students during the coronavirus –disease-2019 (COVID-19) pandemic.

Rank	Author	Organization Abbreviation	Number of publications	Total cited frequency	Average citation
1	Griffiths MD	Nottingham Trent University	12	278	23.17
2	Ye BJ	Jiangxi Normal University	11	59	5.36
3	Fan F	South China Normal University	10	178	17.80
4	Wang DF	South China Normal University	10	189	18.90
5	Ochnik D	Poznań University of Technology	9	236	26.22
6	Rogowska AM	University of Opole	9	157	17.44
7	Liu XC	University of Pennsylvania	8	175	21.88
8	Zhao JB	Southern Medical University	8	176	22.00
9	Cheung T	The Hong Kong Polytechnic University	8	290	36.25
10	Xiang YT	University of Macau	8	290	36.25

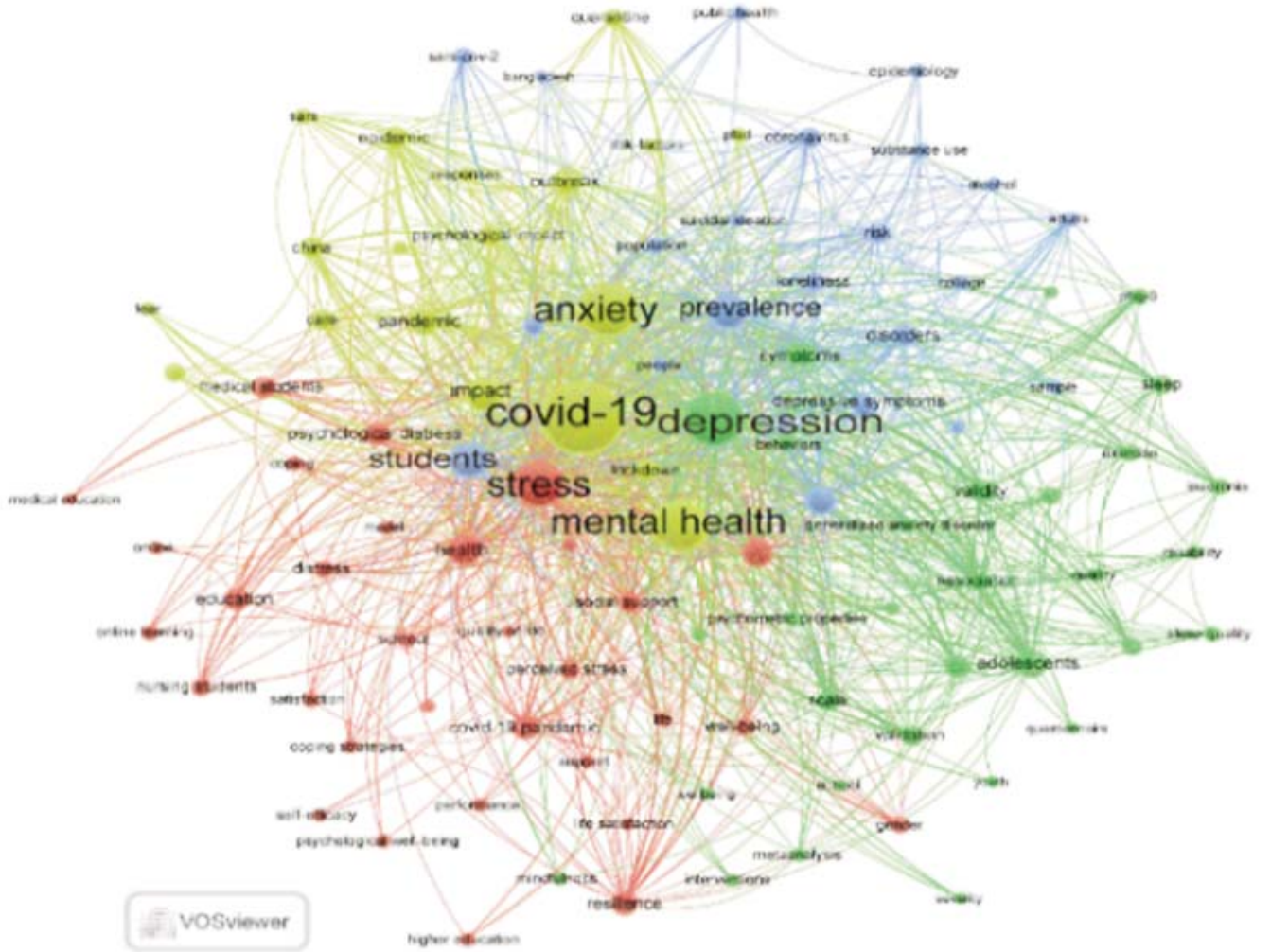

Figure-7: The identified research hotspots. Cluster 1 (red) primarily concentrated on research pertaining to stress and learning. Cluster 2 (green) predominantly investigated depression and sleep. Cluster 3 (blue) and Cluster 4 (yellow) delved into risk and disorder, and mental health and anxiety, respectively. (Key words occurrence ≥20 times).

Table-3: Top 15 researches cited (>200 times)

Ordinal	paper types	Author	Organization	Source	Citations	Research Topics
1	Article	Cao, WJ	Shandong University	Psychiatry Res.	2218	Stress and learning
2	Review	Xiong, JQ	University of Toronto	J. Affect. Disord.	1910	Mental health and anxiety
3	Article	Son, C	Texas A&M University System	J. Med. Internet Res.	651	Mental health and anxiety
4	Review	Singh, S	King George's Medical University	Psychiatry Res.	561	Mental health and anxiety
5	Article	Elmer, T	Swiss Federal Institutes of Technology Domain	PLoS One	475	Mental health and anxiety
6	Article	Odriozola-Gonzalez, P	Universidad de Valladolid	Psychiatry Res.	465	Mental health and anxiety
7	Article	Aristovnik, A	University of Ljubljana	Sustainability	424	Stress and learning
8	Article	Wang, XM	Texas A&M University System	J. Med. Internet Res.	399	Depression and sleep
9	Article	Tang, WJ	Sichuan University	J. Affect. Disord.	358	Depression and sleep
10	Article	Huckins, JF	Dartmouth College	J. Med. Internet Res.	306	Depression and sleep
11	Review	Talevi, D	University of L'Aquila	Riv. Psichiatr.	274	Mental health and anxiety
12	Article	Marelli, S	Vita-Salute San Raffaele University	J. Neurol.	273	Depression and sleep
13	Editorial Material	Reznik, A	Ben Gurion University	Int. J. Mental Health Addict.	254	Mental health and anxiety
14	Review	Dedeilia, A	Natl & Kapodistrian Univ Athens	In Vivo	253	Stress and learning
15	Article	Husky, MM	Univ Bordeaux	Compr. Psychiat.	248	Mental health and anxiety

in psychological health issues. Additionally, the manifestation and intensity of mental health concerns varied based on factors such as race, academic year, gender, field of study, academic programme, and adherence to pandemic prevention and control protocols.

Analysis of representative literature was utilised to select representative literature for each clustering topic, providing a comprehensive analysis of the sequential research advancements across various topics (Table 3). Of the 15 highly cited papers, 10(66.6%) were articles, 4(26.7%) were reviews, and 1(6.6%) was an editorial. The Psychiatry Research and the Journal of Medical Internet Research each published 3(20%) articles, while the Journal of Affective Disorders contributed 2(13.3%). Regarding research topics, there were 8(53.3%) articles pertaining to mental health and anxiety, 4(26.7%) were related to depression, and 2(13.3%) were related to stress and learning, signifying that research in this domain primarily centred on anxiety, depression and learning.

Discussion

A scientific assessment of the detrimental impacts of COVID-19 on the mental wellbeing of college students holds immense importance in terms of ensuring their mental health and development.[22,23] By conducting a quantitative analysis of research papers pertaining to mental health among young college students during the epidemic in the core database of Web of Science, it was discovered that the number of papers aligned with the growth trend of existing COVID-19 cases. Notably, the number of articles accounted for 91.27% of total publications, which surpassed Chen's reports on relevant research conducted on all populations worldwide.[24] This suggested that individuals acknowledged the gravity of the pandemic's effects on the mental wellbeing of college students, leading to an increase in research endeavours. The current review revealed that China and the United States accounted for 50% of the published literature, with the US and the United Kingdom ranking highest in terms of collaborative publication frequency. Despite the relatively frequent and close cooperation among organisations and authors, the current network map indicated that collaborative relationships were constrained by regional and team-specific limitations. Henceforth, it is imperative for future research to enhance academic collaborations between the East and the West, as well as among research institutions and team scholars, while establishing a multifaceted cooperation and mutual benefit mechanism across teams, institutions and disciplines.

Through the utilisation of key word cluster analysis, it was

deduced that the primary factors leading to mental health issues among young college students due to COVID-19 encompassed stress, learning, depression, sleep disorders and anxiety. The first cluster exhibited a preponderance of clustering key words primarily geared towards the investigation of stress and learning. The primary factor contributing to significant anxiety symptoms among college students was the postponement of academic activities due to the COVID-19 pandemic.[25] A worldwide investigation into the effects of COVID-19 on college students revealed that insufficient computer proficiency and the constraints of online learning diminished learning contentment, leading to heightened stress levels.[13] The pandemic resulted in increased learning pressure, and heightened loneliness for college students due to the shift towards online and remote education, ultimately impeding their educational progress.[22] The shift to online learning during the pandemic created new challenges for teachers, such as technical issues, and made it harder for the students to learn due to unequal opportunities and lack of peer support, increasing their learning pressure.[26,27] Additionally, learning satisfaction was significantly impacted by various factors, including student origin, gender, academic level, and the choice of major. Furthermore, the pandemic presented significant obstacles to the mental wellbeing and academic progress of students pursuing medical-related degrees.[28] A study provided evidence to support the assertion that medical-related students may have experienced more severe distress and high symptom burden of acute stress response (ASR) due to COVID-19.[29]

Previous studies have demonstrated that the pandemic resulted in concerning levels of depression symptoms among college students. Research showed a strong connection between depression (odds ratio [OR]=1.96) and anxiety (OR=3.35) with insomnia.[30] Moreover, insomnia and decreased sleep quality can in turn exacerbate depression.[31,32] College students during the pandemic had poor sleep quality and high rates of depression and anxiety, indicating a two-way relationship between sleep, anxiety and depression.[33]A survey of 2,031 American college students revealed that nearly 50% of them exhibited symptoms of depression, while almost 18% reported having suicidal thoughts.[34] The findings using the mixed linear model corroborated the notion that the pandemic led to a significant increase in depression symptoms among college students, particularly in relation to sleep quality.[35] Similarly, in a sample of 2,485 Chinese students, the prevalence rates of depression and post-traumatic stress disorder (PTSD) were 9% and 2.7%, respectively, and the study noted that extending sleep duration could be an effective psychological intervention.[36]

According to recent literature, college students were at a heightened risk of experiencing loneliness during the pandemic compared to pre-pandemic times.[37] Additionally, prolonged campus closures were found to increase alcohol consumption among college students, particularly those with severe symptoms of depression and anxiety, while those with stronger social support tended to consume less alcohol.[38] The epidemic resulted in a surge of emotional disorders, perceived stress and drinking behaviour among college students, underscoring the need for targeted interventions within the college education system.[39]

Research on mental health and anxiety showed that COVID-19 caused 71% of college students to suffer from increased stress and anxiety.[40] Similarly, it was reported that up to 50.90% of individuals, including students, experienced anxiety symptoms during the early stages of the epidemic.[12] Moreover, female students had a higher detection rate of depression and anxiety compared to male college students.[41]

According to a cross-sectional study using the Depression Anxiety Stress Scale (DAS-21) for assessment, a significant proportion of college students (50.43%) reported experiencing moderate to severe psychological health issues, including anxiety and stress, as a result of the COVID-19 pandemic. Furthermore, the study revealed that the impact varied significantly across academic disciplines, with liberal arts students experiencing a more pronounced effect than their science counterparts.[42] These findings underscored the widespread and serious practical challenge posed by the pandemic on the mental health of college students, necessitating the implementation of interventions to address the issue. To address the psychological health needs of adolescents during and after the pandemic, it was imperative to design longitudinal and developmental research and implement effective mitigation measures.[23,43,44] Higher education professionals must develop targeted policies aligned with government strategies, with a focus on key groups, such as girls, students with chronic illnesses, and those with learning difficulties. Simultaneous consideration should be given to the feedback relationship between sources of pressure and policies. The utilisation of online platforms, including social media and online services, can aid student groups in enhancing learning efficiency, engaging in their own mental health management, and accessing mental health support. Conducting a comprehensive targeted sample survey and research based on the influencing factors is of utmost significance. In particular, the delayed impact of the

epidemic on the psychological health and wellbeing of college students necessitates immediate attention.[12,40] The emergence of Long COVID has been identified as a global challenge.[45,46] Therefore, the latent risk of post-traumatic stress among college students caused by the pandemic demands a scientific evaluation and cautious approach.

Conclusion

The escalation of the pandemic led to a significant increase in the number of publications, and the largest contributors were China and the US, with the US and the United Kingdom exhibiting the highest degree of international collaboration. In view of the emergence of Long COVID as a global challenge, it is anticipated that future research will prioritise pointed long-term investigations and targeted prevention and improvement measures.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

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AUTHORS' CONTRIBUTIONS:
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LL, LD, JP: Material preparation.