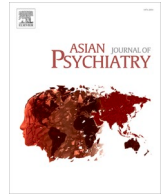




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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## Review article

## Bibliometric analysis of mental health during the COVID-19 pandemic



Ying Chen<sup>a,1</sup>, Xiaojun Zhang<sup>a,1</sup>, Shixiang Chen<sup>a</sup>, Yanwen Zhang<sup>b</sup>, Yulu Wang<sup>a</sup>, Qi Lu<sup>a,\*</sup>, Yue Zhao<sup>a,\*</sup>

<sup>a</sup> School of Nursing, Tianjin Medical University, Tianjin, China

<sup>b</sup> Department of Cardiology, Tianjin Medical University General Hospital, Tianjin, China

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## ABSTRACT

**Background:** As a global pandemic, coronavirus disease 2019 (COVID-19) has had a profound effect on public mental health.

**Methods:** Publications related to mental health during the COVID-19 pandemic from December 1, 2019, to November 13, 2020, were extracted from the Web of Science database. Bibliometric indicator analysis was performed using VOSviewer 1.6.15.

**Results:** In total, 1233 documents from 2020 were retrieved, of which 680 were original articles. The United States contributed the largest publication output (285, 23.1%). Huazhong University of Science and Technology published the most articles in this field (35), while Wuhan University received the most citations (1149). The United Kingdom had the strongest collaboration network. Four keyword clusters representing hotspots in this field were identified.

**Conclusions:** In addition to developed countries, countries seriously affected by the COVID-19 pandemic also made significant contributions to mental health research during the COVID-19 pandemic. This study focused on various aspects, such as mental health during isolation, mental health in healthcare workers, and public mental health issues during the COVID-19 pandemic. In the future, countries should strengthen global cooperation and pay more attention to the mental health of vulnerable groups during pandemics.

## 1. Introduction

As of the writing of this article, the coronavirus disease 2019 (COVID-19) pandemic has led to a total of 45.83 million infections worldwide and 1.18 million global deaths. COVID-19 is multidimensional, creating destructive societal and economic impacts. Adverse psychosomatic outcomes among the public are common and extremely significant due to the pandemic itself and the various forms and constant flow of readily available information online (Dubey et al., 2020). Previous research has revealed that psychosocial effects follow closely on the heels of every pathogen (Jones, 2020; Wang et al., 2020). SARS, smallpox, and hepatitis are all classic examples of this dynamic, and the associated influence may not decrease over time (Siu, 2008; Kang et al., 2010). This is currently the case with COVID-19.

Misleading information and unknown information are regarded as the key drivers of negative psychosocial problems. As a consequence, the newly recognized, unsolved COVID-19 and concomitant contagions

(rapidly expanding mass hysteria and panic) have undoubtedly provoked various mental problems among the public, such as fear, anxiety and stress, as well as social discrimination against anyone who is thought to have come into contact with the virus (Depoux et al., 2020; Mamun and Griffiths, 2020). Isolated patients, frontier health professionals and chronic disease patients who need regular medical follow-up are all vulnerable populations (Kang et al., 2020; Torales et al., 2020). Affected by these psychological problems, medical workers may not focus their attention on fighting against COVID-19 (Kang et al., 2020), and individuals may isolate themselves, refuse to seek health care immediately, be discouraged from adopting healthy behaviors, and even commit suicide (Muela Ribera et al., 2009; Gunnell et al., 2020; Holmes et al., 2020), all of which are potentially even more detrimental in the long run than the virus itself (Chopra and Arora, 2020a).

With respect to the scientific community, publications from various areas are rapidly and exponentially expanding, almost as quickly as the spread of the virus (Kambhampati et al., 2020). A bibliometric analysis

\* Correspondence to: School of Nursing, Tianjin Medical University, No.22 Qixiangtai Road, Heping District, Tianjin, 300070, China.

E-mail addresses: [luqi8674866@hotmail.com](mailto:luqi8674866@hotmail.com) (Q. Lu), [yuezhao35@hotmail.com](mailto:yuezhao35@hotmail.com) (Y. Zhao).

<sup>1</sup> These authors contributed equally to the study.

of publications during this period is, therefore, necessary, allowing us to organize large volumes of information, assess the current status of a certain research domain and help to provide directions or ideas for future research (Alessandro et al., 2019; Han et al., 2019). However, the previously published bibliometric articles on COVID-19 have mostly investigated research activity in environmental fields (Zyoud and Zyoud, 2020), business management fields (Verma and Gustafsson, 2020), and biomedical research areas (Deng et al., 2020; Francesca and Antonella, 2020; Tao et al., 2020). A bibliometric analysis of the psychiatry and psychology field is still needed.

## 2. Methods

### 2.1. Data source and search strategy

The dataset was obtained from the Web of Science (WOS) Core Collection, in which comprehensive and high-quality publications are included; this database is considered the optimal database for bibliometric analysis (Gazzaz et al., 2020). The first COVID-19 case in Wuhan, China, occurred on December 1, 2019, thus, the literature on mental health during COVID-19 was restricted to the period between December 1, 2019, and November 13, 2020 (the date the search process was completed). The following query, which was limited to the topic field (title, abstract, or keywords), was searched in the WOS core database. A detailed search strategy was presented in [Supplementary Material](#). All languages and types of documents were considered in this study. The retrieved publications were exported as “plain text” with the “full record and cited references”. The final step was intensive reading while filtering and removing irrelevant information from each title, abstract, and body. The following information was extracted from the retrieved documents: publication year, title, keywords, abstract, author, country/region, affiliation, document type, journal and counts of citations.

### 2.2. Data analysis

Bibliometric analysis is a statistical tool based on the quantitative analysis of a large amount of literature to provide a comprehensive view of specific research areas (Li et al., 2020). Data including highly-cited authors, journals, countries, and institutions were imported into Microsoft Excel 2016 for analysis, ranking, and counting. Bar charts were graphed by GraphPad Prism 9, and VOSviewer software (version 1.6.15), developed by Netherlands' Leiden University, was utilized to construct and view bibliometric maps and for co-authorship, co-occurrence, bibliographic coupling, and co-citation analyses (van Eck and Waltman, 2010). Each term (keyword, country, institution, and author) is indicated using a circle. The distance between two circles roughly indicates the strength of the link between terms. Different term clusters are represented by different colors. The size of the circles is positively correlated with the appearance frequency of the terms, and the strength of the connection between terms is expressed by the thickness of the line (Perianes-Rodriguez et al., 2016; van Eck and Waltman, 2017).

## 3. Results

### 3.1. Analysis of publication output

In total, 3460 publications were retrieved. Excluding irrelevant articles, 1233 articles published in 2020 were analyzed, which included 680 (55.1%) original research articles, 83 (6.7%) review articles, 184 (14.9%) editorials, 241 (19.5%) letters, and 45 other forms of publications, including meeting abstracts and news. The language of almost all the publications (1203, 97.5%) was English, with authors from 90 different countries or regions. These articles were written by 5873 authors from 2066 organizations and were published in 363 journals. With the COVID-19 pandemic accelerating, the number of publications on mental health grew from February to September 2020, and the

publications output in September was the highest (Fig. 1).

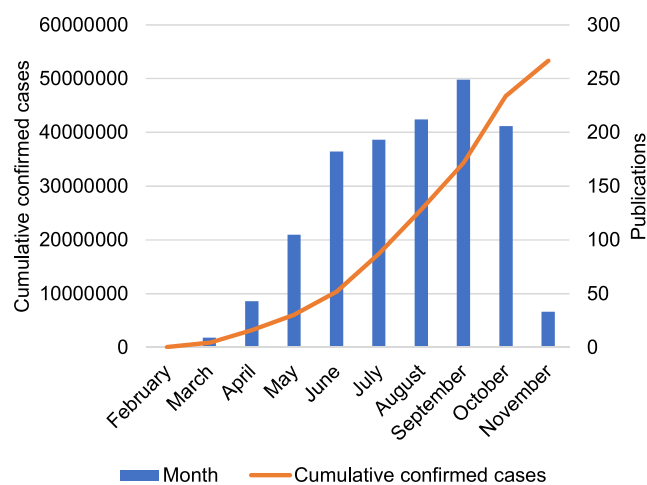
### 3.2. Analysis of countries/regions and institutions

The distribution of mental health during the COVID-19 pandemic of countries/regions is shown in [Table 1](#). Overall, the literature included in the analysis came from 90 different countries or regions. The United States was the most productive country, with 285 publications, and was the country with the highest total number of citations ( $n = 4441$ ). China ranked second (276, 22.4%). The top two countries accounted for nearly half (45.5%) of all articles. [Fig. 2A](#) shows the contributions of all the countries to the field of mental health during COVID-19 and illustrates the global cooperation between countries ([Fig. 2B](#)). In this map, the size of each circle size is related to the number of documents from the corresponding country. Nodes with the same common attributes, such as coauthorship, are classified as a cluster and are shown in the same color. The line thickness represents the intensity of global collaboration. The United Kingdom had the strongest international collaboration network (with 241 total link strengths), followed by the United States (236), China (146), and Italy (145). The strongest country linkages were between the United States and China, followed by China and the United Kingdom, and the United States and the United Kingdom.

The top 10 most productive institutions were from mainland China, the United Kingdom, and North America ([Table 1](#)). Among the top 10 institutions, half were located in China, three in the United Kingdom, one in the United States, and one in Canada. Chinese institutions were the most active; Huazhong University of Science and Technology published the most articles, and Wuhan University received the most citations and average citations. Although it did not publish as many documents, the University of Oxford, with 435 citations and an average citation of 29, also has one of the most prominent places in this domain. One hundred-forty institutes published more than five articles, and the cooperation network of institutions is shown in [Fig. 3](#). The number of collaborators with King's College London was the highest.

### 3.3. Analysis of authorship

A total of 5873 authors contributed to the retrieved articles on mental health during the COVID-19 pandemic. Eighty-two articles were contributed by the top 10 most prolific authors, accounting for 6.7% of all publications. Among them, Griffiths MD from Nottingham Trent University of the UK was the most productive author, with 16 papers ([Table 1](#)). The first-ranked document was published by Wang, CY et al. on March 6, 2020, on the psychological impact on the general



**Fig. 1.** Temporal distribution of publications on mental health during the COVID-19 pandemic and growth trends of confirmed cases of COVID-19 from February to November 2020 (data from WHO).

**Table 1**  
Top 10 countries, institutions, authors with the most publications.

Subject	Number of publications	Count of citations	Average citation
Country			
USA	285	4441	15.6
China	276	1744	6.3
UK	181	1238	6.8
Italy	111	767	6.9
Australia	72	677	9.4
India	67	461	6.9
Canada	66	372	5.6
Spain	55	187	3.4
Iran	40	287	7.2
Turkey	36	88	2.4
Institution			
Huazhong University of Science Technology	35	653	18.7
King's College London	34	454	13.4
University of Toronto	29	253	8.7
Wuhan University	23	1149	49.9
Shanghai Jiao Tong University	21	294	14
Harvard Medical School	21	88	4.2
Hong Kong Polytechnic University	20	294	14.7
Central South University	18	271	15.1
Nottingham Trent University	16	275	17.2
University of Oxford	15	435	29
Author			
Griffiths MD	16	275	17.2
Pakpour AH	11	188	17.1
Liu ZC	9	1120	124.4
Lin CY	8	161	20.1
Xiang YT	7	312	44.6
Mamun MA	7	112	16
Wang Y	6	872	145.3
KANG LJ	6	868	144.7
Mcintyre RS	6	208	34.7
Cheung T	6	95	15.8

population during the COVID-19 pandemic.

Fig. 4 demonstrates the collaboration networks between authors. For better visualization, the author collaboration network depicts only the 167 authors with at least three articles. Liu ZC shared the strongest collaborative network with researchers, followed by Ma SM and Kang LJ.

### 3.4. Analysis of journal

In total, 293 documents were published in the top 10 most active journals, which accounted for 23.76% (1233) of all publications on mental health during the COVID-19 pandemic. The most-cited journal was the Lancet, with 536 citation counts and an IF of 60.392 (Fig. 5A). The journal with the most publications (75) was Psychiatry Research in Fig. 5B.

### 3.5. Analysis of the keyword cooccurrence cluster

The author keywords of the papers that occurred at least 10 times were enrolled in this analysis and clustered into four groups (Fig. 6). Of the 2149 keywords, 103 met the threshold. The keyword "COVID-19" (total link strength 2, 693) appeared most, with 570 (26.5%) cooccurrences, followed by depression (305, 14.2%), anxiety (286, 13.3%), mental health (225, 10.4%) and stress (182, 8.4%). The most frequent topics in publications related to COVID-19 mental health were classified by four colored clusters: Cluster 1 (red) involved keywords related to mental health during isolation, such as "lockdown", "social isolation", "quarantine", "fear", "loneliness" or "insomnia"; Cluster 2 (green) involved keywords related to the impact on the mental health of medical workers, such as "psychological impact", "distress", "burnout", "nurses", "healthcare workers" or "hospital workers"; Cluster 3 (blue) involved

keywords related to public mental health care during COVID-19, such as "COVID-19", "coronavirus", "Sars-Cov-2", "outbreak", "pandemic", "mental health", "impact", "care" or "public health"; and Cluster 4 (yellow) involved keywords related to outbreak-related mental health issues, such as "depression", "anxiety", "stress", "disorder" or "symptom".

## 4. Discussion

Public health emergencies such as the COVID-19 pandemic have far-reaching effects on health, safety, individuals and society. The effects of COVID-19 on mental health have been ubiquitous (Holmes et al., 2020; Pfefferbaum and North, 2020). Using bibliometric and visualization analysis, this study focused on mental health during the COVID-19 pandemic and discussed the current situation and characteristics of publications, including countries or regions, institutions, journals, researchers and hotspots, in this field.

In terms of document types, interestingly, only approximately 50% of publications were articles, letters, editorials, and other types of research that made a great contribution to this domain. This result is similar to the study of Milad Haghani (Haghani et al., 2020). On the one hand, isolation during the outbreak may limit the data collection of the articles. On the other hand, a previous study reported that reviews, editorial materials, letters, and news items were popular with the general public on social media, such as Twitter and other network platforms (Haustein et al., 2015) and that those forms benefited from further broadcasting.

The 1233 research publications were published in 90 countries. This analysis illustrated that the United States and China all play a crucial role in COVID-19 outbreak-related mental health research. These two countries contributed to approximately 50% of the publications, but the average citation of the Chinese publications was much lower than that of the United States publications. The COVID-19 pandemic was first reported in Wuhan, China, in December 2019, and research on outbreak-related mental health appeared in February 2020 owing to the emergency fight against the pandemic and the initial neglect of mental health. China was the principal force of research in the early stage; since April 2020, research on public mental health during the COVID-19 pandemic has increased significantly. The heavy scholarly contribution from China was consistent to what was found in neuroscience (Yeung et al., 2017). Similarly, the overall number of publications on COVID-19 research in the United States increased significantly in April (Wang and Hong, 2020). With the spread of the global COVID-19 pandemic, the United States has become the most productive country in terms of research and publications. This is attributed to the overall strength of American academic research and its economy; meanwhile, taking a broad view of all psychiatry publications, the U.S. has the greatest number of publications (Igoumenou et al., 2014). By January 2021, Europe and North America account for 16% of the world's population, but they account for 64% of the global daily new cases. In contrast, Asia, which accounts for 58% of the world's population, accounts for 11% of the confirmed daily new cases. The outcome in Asia is relatively better (Tandon, 2021a, 2021b). Although the U.S., the UK and other European countries are usually the most active countries in scientific research (Sweileh, 2017), four of the top ten countries with the most publications are from Asia, namely China, India, Iran and Turkey, which shows their improvement in contribution of global research. Similarly, research shows that developing countries have great potential for productivity in psychiatric research (Zhang et al., 2017). It must be acknowledged that the United States, the United Kingdom, Italy, India, and Spain are also among the top countries with the most cumulative number of confirmed cases at present (WHO). This phenomenon shows that the publication output during COVID-19 has a certain relationship with the severity of the pandemic situation.

The results of organizations show that colleges and universities are the prominent backbones of scientific research. With respect to the

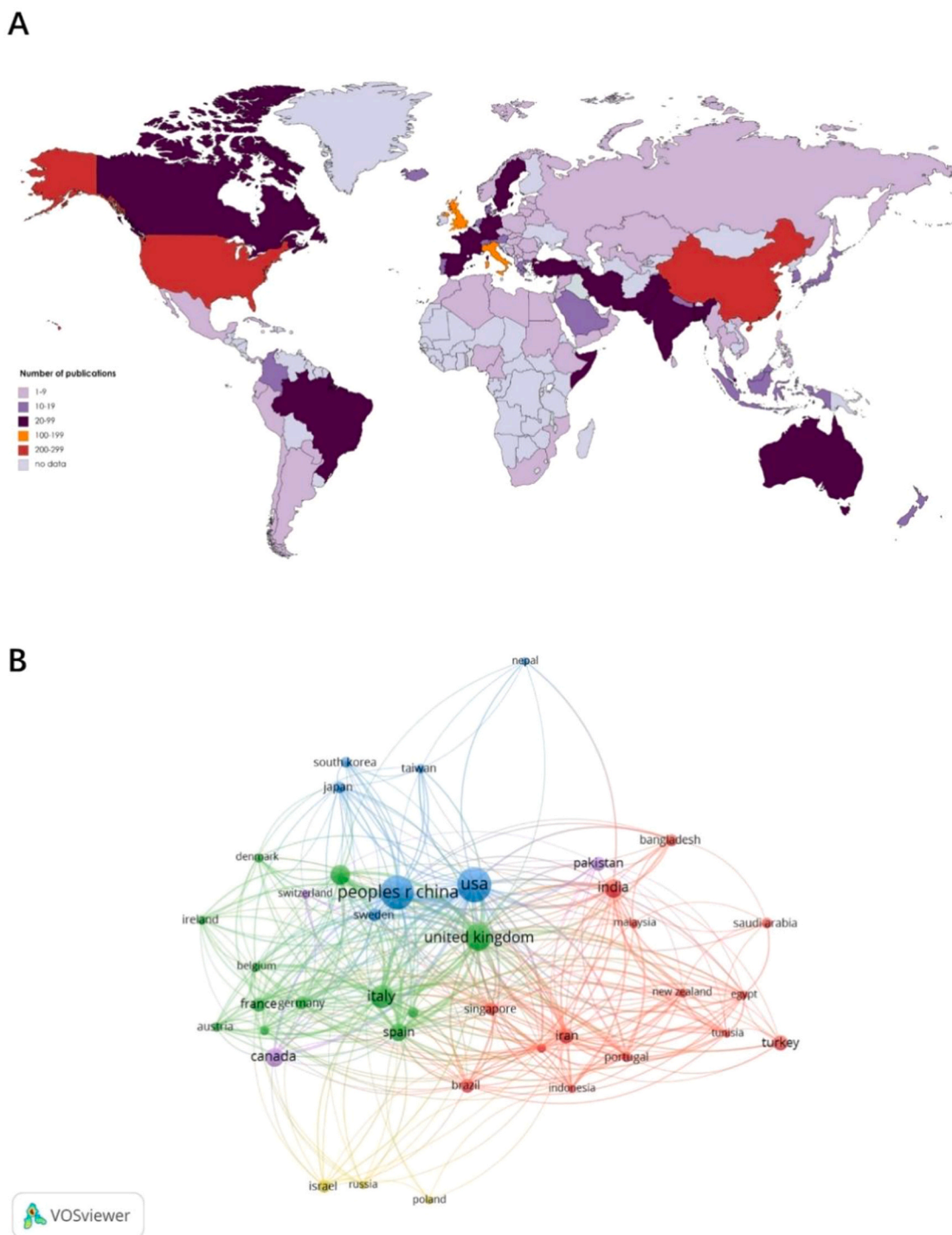


Fig. 2. (A) Geographical distribution of publications on mental health during the COVID-19 pandemic. (B) The collaboration network of countries.

cooperation between organizations, obvious geographical features are evident. In contrast to researchers from abroad, Chinese scholars from different organizations tend to exhibit less international cooperation than domestic cooperation.

Outbreak-related mental health articles were published in 363 different journals, and the top 10 most productive journals published 23.76% of all publications. Two of the most-cited journals were the *Lancet* and *Lancet Psychiatry*, with 536 and 508 citations. Three journals that with the most publications on mental health during the COVID-19 pandemic in psychiatry are *Psychiatry Research*, *Journal of Affective Disorders* and the *Asian Journal of Psychiatry*. All the above journals

render mental health-related studies during the COVID-19 pandemic more reliable and promote dissemination of scholastic evidence. Journals face the dual challenges of balancing timeliness and scientific rigor, dissemination of accurate and valid information becomes critical. For example, discussing suicide during the COVID-19 pandemic, the *Lancet Psychiatry* overturned the dramatic assertion of suicide and insisted on adhering to the facts (*Psychiatry*, 2021). The *Asian Journal of Psychiatry* pointed out that many alarmist reports about the rise of suicide rate during the COVID-19 pandemic and spread correct knowledge to minimize the impact of the pandemic on global suicide deaths (*Tandon*, 2021c).

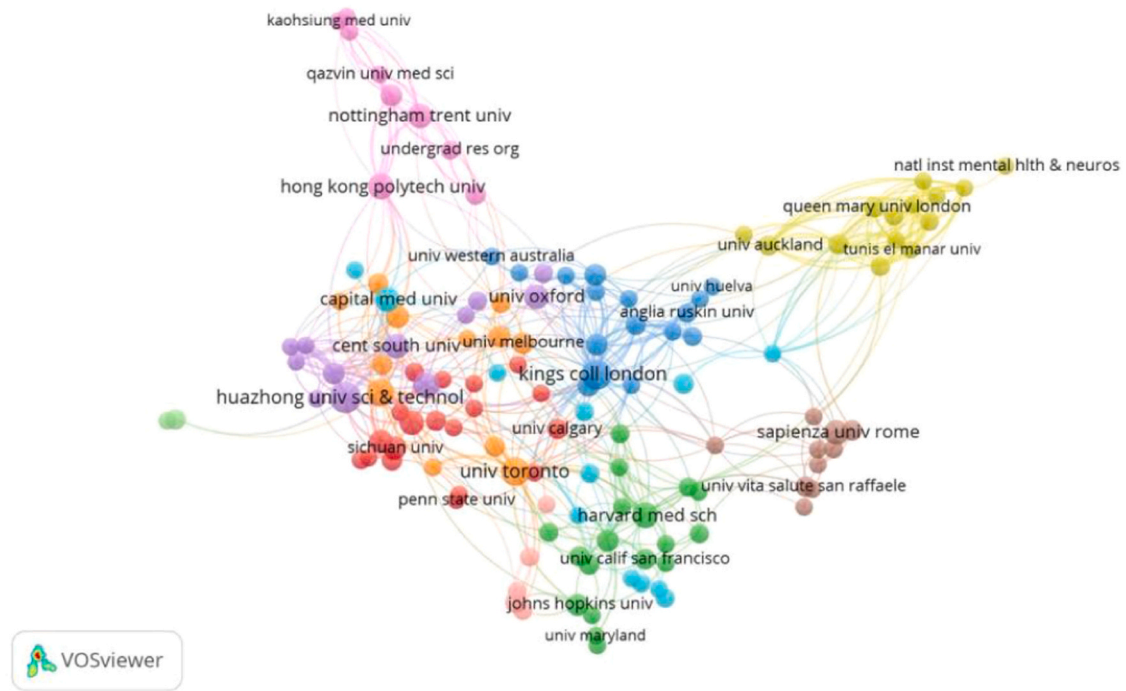


Fig. 3. Cooperation network of organizations.

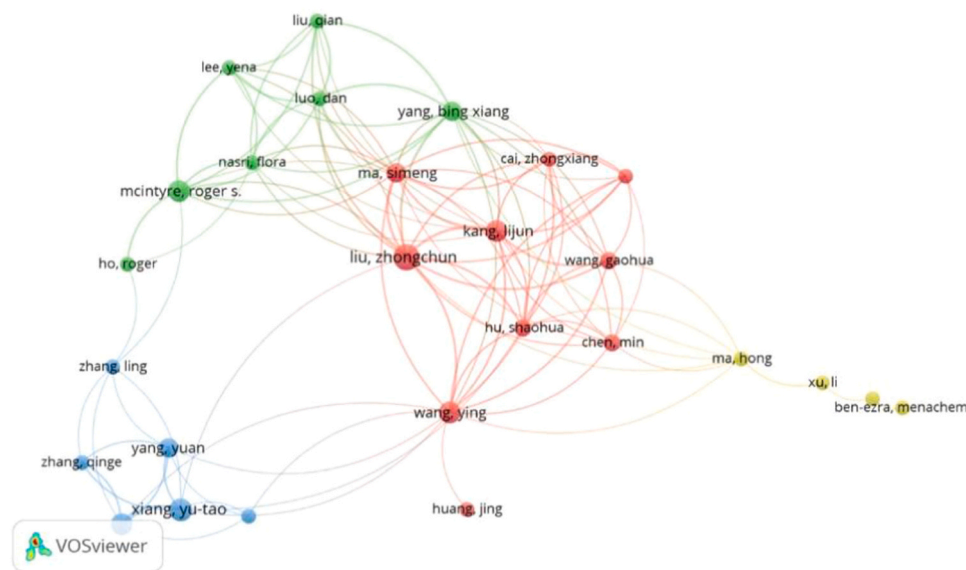


Fig. 4. Cooperation network of authors.

Keywords cooccurrence analysis can reveal the research directions and hotspots in a certain discipline (Zou et al., 2018). The analysis of documents concerning mental health during the COVID-19 pandemic indicated four focus areas. Lockdowns and social isolation during the COVID-19 pandemic can result in people suffering many losses, including families, educational opportunities, jobs, recreation, and freedom, leading to negative consequences, such as loneliness and fear of mental health (Haghani et al., 2020). In cluster 1, in addition to isolating-related words, scale-related terms appeared frequently. Paying attention to public mental health during the COVID-19 pandemic, many countries have developed or applied outbreak-related mental health scales; for instance, the “Fear of COVID-19 Scale” was globally introduced and validated after development (Ahorsu et al., 2020; Soraci et al., 2020; Wakashima et al., 2020; Winter et al., 2020). In the context

of fighting the COVID-19 pandemic, frontline healthcare workers, a special group, were classified as the first level requiring psychological intervention by the Chinese Society of Psychiatry (Jiang et al., 2020). They faced a high risk of exposure, overwork, and moral dilemmas, all of which may lead to mental health problems and even affect overall wellbeing (Kang et al., 2020; Shanafelt et al., 2020), which could explain the terms in cluster 2. Compared with the general population and essential workers, the vulnerable population, which included elderly people (Yang et al., 2020), children and adolescents (Nearchou et al., 2020), pregnant women (Fan et al., 2021), mentally ill people (Thomson et al., 2020), and international Chinese students (Zhai and Du, 2020), seemed to receive insufficient attention in the analysis. Cluster 3 included mostly macroscopic words, such as “COVID-19” and “mental health”, and had a greater emphasis on social psychology terms, such as

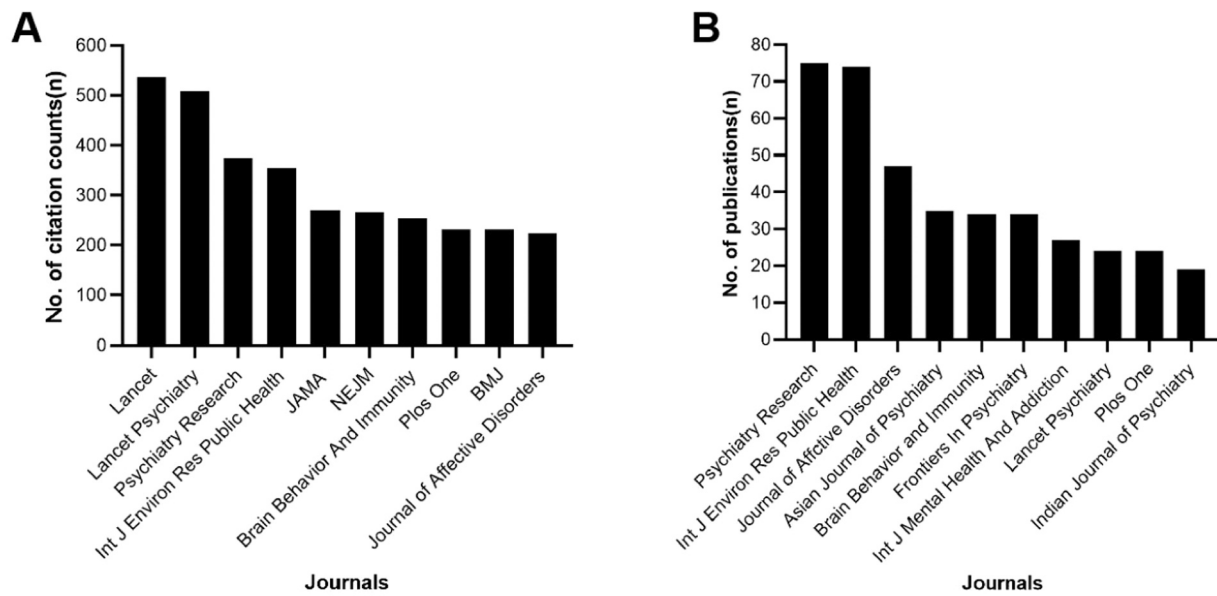


Fig. 5. Plots. (A) The most-cited journals on mental health during the COVID-19 pandemic; (B) the journals with the most publications on mental health during the COVID-19 pandemic.

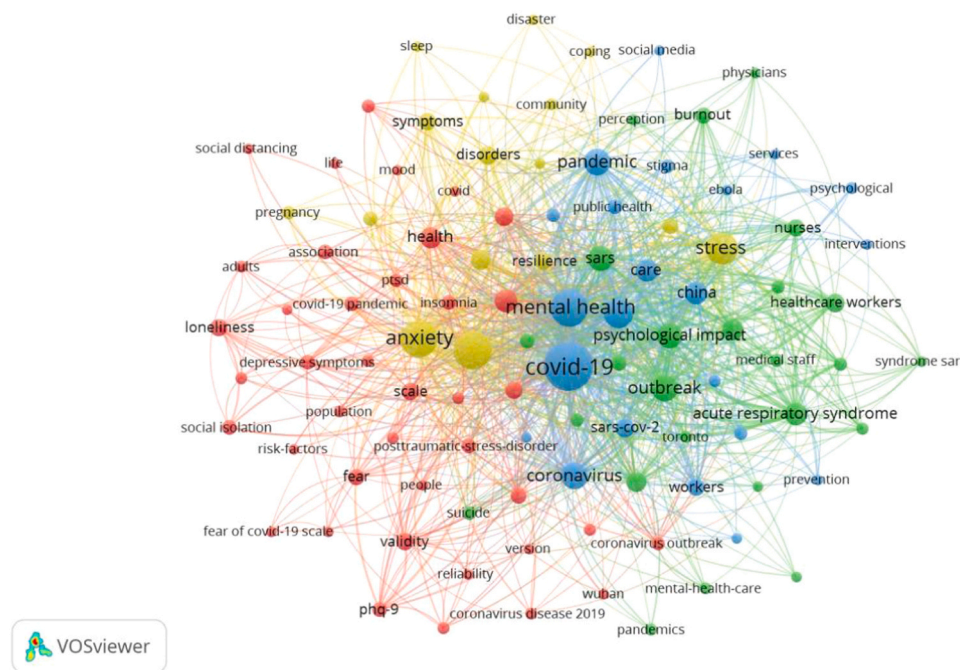


Fig. 6. Cooccurrence map of Keywords.

“stigma”. Stigma may lead healthcare workers, infected patients, and social minorities to poor mental health outcomes, including fear, anger, and intolerance, and may even increase morbidity and mortality (Chopra and Arora, 2020b). Appropriate measures need to be taken to eliminate stigma related to disease, racism and psychosocial impacts. For cluster 4, COVID-19-related mental health issues, including anxiety, depression, stress, and sleep disorders, impacted the whole population’s mental health. The number of intervention studies in this analysis was small; therefore, it is greatly warranted to strengthen the exploration of relevant research and how to carry out psychological and mental interventions during the pandemic. Similarly, Rajkumar’s study discussed the influence of COVID-19 on the general population, healthcare workers and vulnerable groups and mental health intervention measures

to population affected by the COVID-19 epidemic (Rajkumar, 2020).

We chose Web of Science as the database because it is considered to be the paramount source of data for bibliometric analysis, and it has more consistent and standardized records than other databases (THEO VAN, 2006; Chen et al., 2014). Additionally, all languages and types of articles were analyzed for the integrity of the data. Moreover, the supplementary retrieval formula used in this study was relatively detailed, and our researchers carefully screened the literature so that all articles on mental health during COVID-19 would be included. Despite all these measures, our study is not without limitations. Web of Science was the only database from which publications were collected, leading to the possibility of ignoring articles from other databases, which may have resulted in incomplete data. In addition, since the COVID-19 global

pandemic is still not over, our research results do not represent the complete process of the outbreak-related mental health literature.

## 5. Conclusions

There is a time delay in research on mental health during the COVID-19 pandemic after the disease emerged, but the rapid growth of publications after a few months indicates an increasing concern about outbreak-related mental health. Research on mental health still requires that global cooperation among diverse authors, organizations and countries be improved. In future research on pandemics, early attention should be paid to mental health issues, and in particular, more attention should be paid to the mental health of vulnerable groups.

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## Declaration of Competing Interest

None.

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None.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.ajp.2021.102846](https://doi.org/10.1016/j.ajp.2021.102846).

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