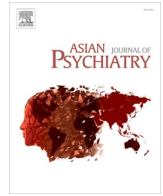




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Bibliometric analysis of global scientific literature on effects of COVID-19 pandemic on mental health

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ABSTRACT

The study provides a comprehensive analysis of trends of the global scientific research on the effects of the COVID-19 Pandemic on Mental health from the first published literature up to June 27, 2021. Relevant documents were searched using mesh terms based on the query of two searches, "COVID-19 & Mental Health" scenarios joined by the Boolean operator "AND" to retrieve relevant literature using the Web of Science (WOS) database. Bibliometric indicators were analyzed using HistCite, Bibliometrix, an R package, and VOSviewer. Var1.6.6. A total of 5449 publications with an h-index of 97 were retrieved from the database. Overall, articles retrieved were written by 24123 authors, published in 1224 journals, 132 countries represented, and 10.01 average citations per document. Kings College London led the list of contributing institutions with 76 articles. The United States Department of Human Health Services, the National Institutes of Health, the USA, and the National Natural Science Foundation of China was the top funding agencies that enhanced research on mental health and supported more than 180 articles. USA contributed the most significant proportion 1157 (21.23 %) of COVID-19 Pandemic on Mental health publication closely followed by China in the number of publications 741 (13.60 %). The study provides insight into the global research perspective for the scientific progress on the COVID-19 Pandemic public health emergency and the mental health issues, thus significantly impacting and supporting intervention towards improving people's mental health post-COVID-19 outbreak.

1. Introduction

The COVID-19 public health emergency has exposed health, social, economic, environmental, and psychological vulnerabilities. Numerous researches conducted investigated the bulk of the COVID-19 global public health emergency vulnerabilities, especially the psychological impact. While the research efforts are acknowledged, it remains pertinent to explore the extent of mental health vulnerabilities globally by

aggregating research trends and milestones for reference and future direction. The psychological vulnerabilities are likely to continue post-COVID-19 Pandemic if significant interventions are not implemented. The investigation of COVID-19 and mental health research's cumulation presents an apt overview of mental health evidence and a template for reducing psychological vulnerabilities globally. Similarly, aggregating the research output on the COVID-19 Pandemic and the effect on mental health may help identify the most vulnerable groups requiring rapid

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global intervention.

Therefore, a bibliometric analysis offers a valuable analytical technique for mapping existing literature concerning a specific research theme broadly used as a trend assessment tool (Deng et al., 2020; Dervis, 2019; Kawuki et al., 2020; Kutluk, 2021; Musa et al., 2021a,b,c; Sun et al., 2020). The approach offers robust analytics to facilitate research retrospection, identify the research hotspots, and assess the publication's historical trends in diverse domains quantitatively and objectively (Falagas et al., 2006). Thus, researchers analyze, visualize, and evaluate the scientific research theme using bibliometric tools and further establish the connections between authors, frameworks, methodology, and practice in various scientific research fields (Song et al., 2019). Moreover, by utilizing diverse research methodology, researchers can assess and evaluate scientific research trends, a research topic and determine the relative importance of publication in a specific research area (Ellegaard and Wallin, 2015).

Many research and reviews have been conducted globally using bibliometric tools, for instance, bibliometrics on scientific outputs for Ebola virus disease (Yi et al., 2016), COVID-19 research within a time-frame (Lou et al., 2020), and malaria research bibliometrics that examine the pattern of growth of malaria research and geographical prevalence (Garg et al., 2009). Other areas include childhood obesity (Kawuki et al., 2021) and scrub typhus due to the rise of zoonotic diseases (Musa et al., 2020b). Although numerous research has been conducted to explore COVID-19, this study is the first bibliometric analysis that examined the effect of the COVID-19 Pandemic on mental health while aggregating and presenting a comprehensive overview of research productivity after the outbreak of the Pandemic globally.

In effect, this paper presents a bibliometric analysis of empirical literature on the impact of the COVID-19 Pandemic on mental health. The analysis's specific objectives include identifying the scientific research growth, publication, and citation trends across time for COVID-19 and mental health. The study aimed to identify the most contributing countries, active journals, authors, institutions, and funding organizations enhancing mental health research. The analysis output unfolds the most frequently used keywords using word-cloud and conceptual structure map-method to provide the scientific research community with a comprehensive understanding of the effect of COVID-19 Pandemic on mental health globally.

2. Methodology

2.1. Study design

The study adopted the bibliometric method to analyze quantitatively and qualitatively documents indexed in the Web of Science (WoS) database. The study period of the current research was limited from the year 2019 to June 27, 2021.

2.2. Search strategy

On June 27, 2021, the WoS database was comprehensively searched in the Science Citation Index Expanded (SCIE) and Social Science Citation Index (SSCI) databases of the Web of Science Core Collection by two reviewers (MH and THM) on relevant publications on Mental health, and COVID-19 using Medical Subject Headings 2021 (<https://meshb.nlm.nih.gov/search>). The search of the applicable mesh terms was based on the query on two search scenarios joined by the Boolean operator "AND" to ensure the appropriate and accurate metadata used in the final analysis (Supplementary file S-1). Only articles published in English were retrieved. A total of 5449 documents were extracted from WoS. Bibliometric indicators include the year of publications, authors, region, subject areas, countries, institutions, journals, and funding agencies enhancing COVID-19, country collaboration. Authorship productivity was presented in the final analysis.

2.3. Data analysis

The metadata of the effect of COVID-19 Pandemic on mental health was exported from WoS and save in Plain.txt format for final analysis. HistCite software was used to analyze and visualize direct citation linkages between scientific papers (Garfield et al., 2006), Bibliometrix, and an R package to perform comprehensive science mapping analysis (Aria and Cuccurullo, 2017) and VOSviewer.Var1.6.6 was used to developed bibliometric maps between documents to examine their characteristics (van Eck and Waltman, 2010).

3. Results

3.1. The Basic Characteristics of COVID-19 Pandemic on mental health documents

The data search result included 5449 articles, cumulatively had 54,515 citations, h-Index 97, and average citations of 10.01 per document. The types of documents included were full research papers 2988 (54.83 %) and reviews 253(4.64), among others (Table S-2).

3.2. Top cited articles

The ten top-cited articles on the effects of the COVID-19 Pandemic on mental health captured as "highly cited papers" were in psychiatry/psychology's academic field based on a highly cited threshold and publication year. The study also identified "Hot Papers" published in the last two years that received enough citations in Psychiatry/Psychology domain, as shown in Table 1. The top-cited articles were mainly in the field of mental health, psychiatry, and public health management (Chen et al., 2020; Holmes et al., 2020; Huang and Zhao, 2020; Lai et al., 2020; Liu et al., 2020; Pfefferbaum and North, 2020; Rajkumar, 2020; Torales et al., 2020; Wang et al., 2020; Xiang et al., 2020). The highest number of citations attained was 1575 for the article titled "Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019," published in JAMA Network Open. The second top-cited was published in the Multidisciplinary research priorities for the COVID-19 Pandemic: a call for action for mental health science" with a total citation of 1137. The article "COVID-19 and mental health: A review of the existing literature" published by the Asian Journal of Psychiatry amassed 742 citations in the Web of Science. The top ten cited articles' citations range from 506 to 1575.

3.3. Most active journals

The 5449 eligible articles were published in 1224 journals based on the search queries, of which 273 were identified published in the International Journal of Environmental Research and Public Health, followed by the Frontiers in Psychology by 186, Frontiers in Psychiatry by 160, and Asian Journal of Psychiatry by 122 articles. The majority of the article was published in a specialized journal for research in mental health. Approximately 1185 articles were published in the top 10 listed journals, with 18,520 total citations and h_index 171. The number of articles published in the top 10 journals ranged from 54 to 273; details about the ten journals with the highest number of articles are h_index, total citations (TC), Journal Impact Factors, and research domain for the top journals are in Table 2.

3.4. Most active authors

A total of 24,123 authors contributed to COVID-19 and mental Health research. The topmost active authors based on the authors h_index, total citations, and the number of publications, institutions are listed in Table 3. Zhang L from Xi'an Jiaotong University, China, had 29 articles with, with total citation times (TC = 1745), h_index (n = 9), followed by Griffiths MD from Nottingham Trent University

Table 1
Top 10 cited articles on effects of COVID-19 pandemic on mental health.

SCR	Title	Source Title	TC	AY	HC	HP
1	Factors Associated with Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019	JAMA Network Open	1575	787.5		
2	Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science	The Lancet Psychiatry	1137	568.5		
3	Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed	The Lancet Psychiatry	885	442.5		
4	Mental Health and the Covid-19 Pandemic	New England Journal of Medicine	746	373		
5	COVID-19 and mental health: A review of the existing literature	Asian Journal of Psychiatry	742	371		
6	Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey	Psychiatry Research	672	336		
7	The outbreak of COVID-19 coronavirus and its impact on global mental health	International Journal of Social Psychiatry	585	292.5		
8	A longitudinal study on the mental health of the general population during the COVID-19 epidemic in China	Brain Behavior and Immunity	574	287		
9	Mental health care for medical staff in China during the COVID-19 outbreak	The Lancet Psychiatry	561	280.5		
10	Online mental health services in China during the COVID-19 outbreak	The Lancet Psychiatry	506	253		

SCR: Standard competition ranking, TC: Total Citations; AY: Average per Year; HC: Highly cited in field; HP: Hot Papers; Hot Paper published in the past two years and received enough citations in the academic field of Psychiatry/Psychology; Highly cited to place it in the top 1% of the academic field of Psychiatry/Psychology based on a highly cited threshold for the field and publication year.

Nottingham, England with 28 articles, with (TC = 497), *h_index* (12), Wang Y from Chinese Academy of Medical Sciences - Peking Union Medical College, Peking Union Medical College with 26 articles, (TC = 3074), and *h_index* (n = 10), among others.

3.5. Most active and productive countries

About 132 countries contributed to COVID-19 and mental health publications. The US was the most productive country (NP = 1157, TC = 9619), followed by China (NP = 741, TC = 13,886), Italy (NP = 349; TC = 4461), and United Kingdom (NP = 337; TC = 5135) were in the top four influential countries. Meanwhile, the US was the most productive country based on the Multiple Country Publications (inter-country collaboration) with (NP = 191) articles, followed by China (NP = 204) and United Kingdom (NP = 117) (Table 4). Furthermore, the Inter-State relationship between the effects of the COVID-19 Pandemic on Mental

Table 2
The top most-cited journal contributed to research on COVID-19 and mental health.

SCR	Source (n = 1224)	<i>h_index</i>	TC	NP	IF (2020)	Research Domain
1	Lancet Psychiatry	22	5484	67	27.083	Psychiatry
2	Asian Journal of Psychiatry	21	2699	122	3.543	Psychiatry
3	Psychiatry Research	25	2495	101	3.222	Psychiatry
4	International Journal of Environmental Research and Public Health	21	2439	273	3.39	Environmental Sciences & Ecology, Public, Environmental & Occupational Health
5	International Journal of Social Psychiatry	12	1188	54	2.625	Psychiatry
6	Journal of Affective Disorders	17	1181	82	4.839	Neurosciences & Neurology
7	PLOS ONE	14	910	84	3.24	Science & Technology-Other Topics
8	Frontiers in Psychiatry	14	813	160	4.157	Psychiatry
9	Psychological Trauma-Theory Research Practice and Policy	11	659	56	3.226	Psychology & Psychiatry
10	Frontiers in Psychology	14	652	186	2.99	Psychology

SCR: Standard competition ranking; TC: Total citations, NP: Number of publications; IF: Impact factor.

Table 3
Top 10 authors contributed on COVID-19 and mental Health research.

SCR	Author (n = 6884)	Insituation	<i>h_index</i>	TC	NP
1	Zhang L	Xi'an Jiaotong University China	9	1745	29
2	Griffiths MD	Nottingham Trent University Nottingham, England	12	497	28
3	Wang Y	Chinese Academy of Medical Sciences - Peking Union Medical College, Peking Union Medical College	10	3074	26
4	Zhang Y		5	620	26
5	Xiang YT	The University of Macau, Faculty of Health Science,	10	2327	24
6	Cheung T	Hong Kong Polytechnic University, China	10	1820	21
7	Liu Y	Shanghai Jiao Tong University, School Media & Community, Shanghai, China	5	84	20
8	Lee J	University Connecticut, Storrs, USA	5	463	17
9	LI Y	Wuhan Mental Health Centre, Wuhan, China	5	550	17
10	Zhang XY	Chinese Academy of Science, Institute of Psychology, CAS Key Lab Mental Health, Beijing, Peoples R China	5	95	17

SCR: Standard competition ranking; TC: Total number of citations, NP: Number of publications.

Table 4
Top 10 most countries that contributed on COVID-19 and mental Health research.

SCR	Country (n = 132)	Articles	TC	AAC	SCP	MCP	MCP_Ratio
1	USA	1157	9619	8.314	966	191	0.1651
2	China	741	13,886	18.740	537	204	0.2753
3	Italy	349	4461	12.782	275	74	0.2120
4	United Kingdom	337	5135	15.237	220	117	0.3472
5	Canada	202	2032	10.059	139	63	0.3119
6	Turkey	195	1035	5.308	182	13	0.0667
7	India	191	2518	13.183	160	31	0.1623
8	Spain	180	1519	8.439	120	60	0.3333
9	Australia	170	1334	7.847	117	53	0.3118
10	Brazil	123	956	7.772	93	30	0.2439

SCR: Standard Competition Ranking; TC: Total number of citations, NP: Number of publications; AAC: Average Article Citations: SCP: Single Country Publication (intra-country collaboration). MCP: Multiple Country Publications (inter-country collaboration).

health between the reported countries is presented in Fig. 1.

3.6. Wordcloud visualization analysis

The frequency occurrence of Keywords Plus is shown in Fig. 2.

Depression with frequency (502), followed by ‘impact’(449), ‘stress’ (335), ‘anxiety’ (294) “mental health” (289) outbreak’(256), “psychological impact’,(231), ‘Health’ (224), ‘prevalence’ (218), ‘sars’ (213),,’ care’ (188) and ‘asymptoms’ (186).

3.7. Conceptual structure

A total of 75 keywords were divided into three clusters with different colors (red, blue, and green), each group with different keywords that adequately explain the concept/s of research effects of COVID-19 Pandemic on Mental fields (Fig. 3).

The relation between affiliations, countries, and “keywords plus” occurrence on the effects of COVID-19 Pandemic on mental health are presented in Fig. 4.

3.8. Most reported web of science categories

Based on the analysis, the majority of research categories were under Psychiatry had (NP = 1738; 31.90 %), followed by Psychology (NP = 993;18.22 %), Public environmental, occupational health (NP = 862; 15.82 %), Neurosciences Neurology had (NP = 844;8.96 %), and General Internal Medicine (NP = 422; 7.75 %) as reported in Table 5.

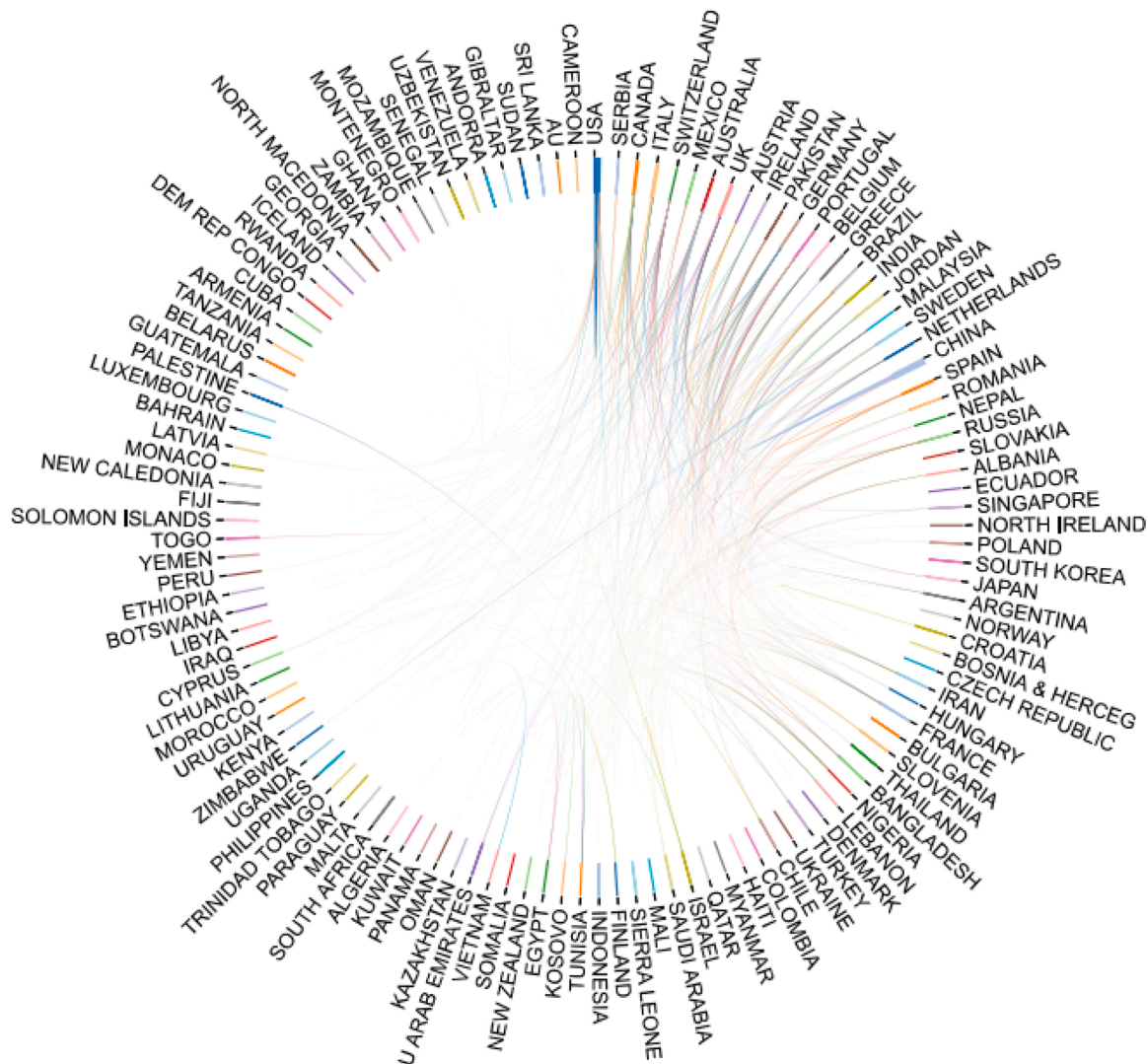


Fig. 1. Inter-State relationship between top 132 countries contributed to COVID-19 pandemic and Mental health research.

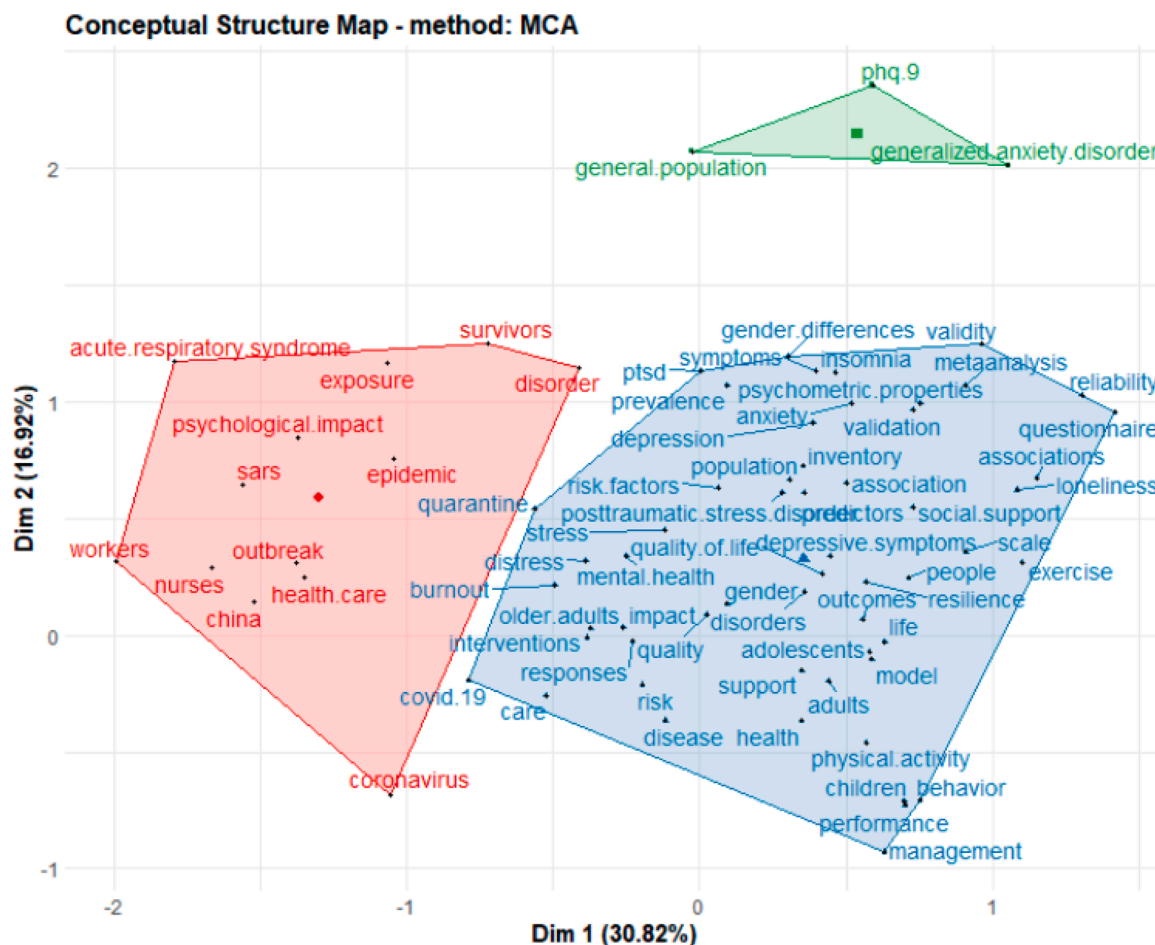


Fig. 3. Conceptual Structure: Map-method Correspondence analysis (MCA) on effects of COVID-19 pandemic on mental health.

articles were specific in their research focus centering on “mental health,” global population, medical/healthcare staff, and the peripherals of mental health symptoms such as anxiety, depression among others.

Two standout and prominent journals that contributed to research on mental health-related vulnerabilities during the COVID-19 public health emergencies were *Lancet Psychiatry* and *Asian Journal of Psychiatry*, with 5584 and 2699 citations. Thus, the contributions from the top-cited journals were impactful and facilitated the dissemination of scholastic evidence to combat the psychological issues emanating from the COVID-19 Pandemic. Most publications on the effects of the COVID-19 Pandemic on mental health were from the USA, China, Italy, and United Kingdom. The USA was the most productive in single country production, followed by China, Italy and United Kingdom. In the top country categories, there was the representation of Asia which shows their advancement in contributing to global research.

The published articles in the WoS were categorized mostly under psychiatry and psychology. Visualization of keywords showed that the mental health-related symptoms and signs occurred, such as mental health, depression, anxiety, stress, care, and psychological impact, due to the challenge of the COVID-19 outbreak (Musa et al., 2020a). However, COVID-19 and research productivity left no research gaps on the mental issues. Whereas, in the conceptualization structure, the mostly themed keyword has psychometric properties supporting various research and validating tools to measures vulnerabilities. Terms such as “Physical activity,” “quality of life,” “PTSD,” and “social support” were among conceptualized constructs focusing on mental health during the COVID-19 public health emergency.

The institution and funding agency supporting research on the COVID-19 public health emergency and mental health impact were

clustered in the United States, the UK, Canada, Australia, and China. For instance, the two top-listed most publishing institutions were the Harvard Medical School and Kings and Kings College London. The prominence of Huazhong University, Wuhan University, and the Hong Kong Polytechnic University was crucial as they jointly published about 185 articles in the WoS. Funding agencies contributed significantly to support research. The United States Department of Health Human Services, National Institute of Health, USA, and the National Foundation of China were some of the top funders of research in the mental health domain.

This study is the first bibliometric study on the effects of the COVID-19 Pandemic on mental health independently without adding other outbreaks such as Ebola and H1N1 as in other studies (Maalouf et al., 2021). The consequence of this retrospective study borders on the distribution of research contribution on COVID-19 and mental health. More specifically, America, Europe, and Asia dominated prominently in all the categories explored, contributing to research through authorship, institution representation, and funding agency published in the WoS. Regions with low contribution need extensive support to improve their research output, especially in low-resource settings.

The current study is the first bibliometric study conducted on COVID-19 and mental health research that profoundly analyzes the productivity of scientific research published after the COVID 19 outbreak. Although it gives the reader complete information on the research productivity and insight characteristics of the research outcome on COVID-19 and mental health, also it has a few limitations inherent in bibliometric methodology. The presence of false-positive and false-negative results is a possibility in any bibliometric study. In the literature, we used only the WoS database focusing only on English publications. The other databases, such as Google Scholar, PubMed, and Scopus, Chinese databases were

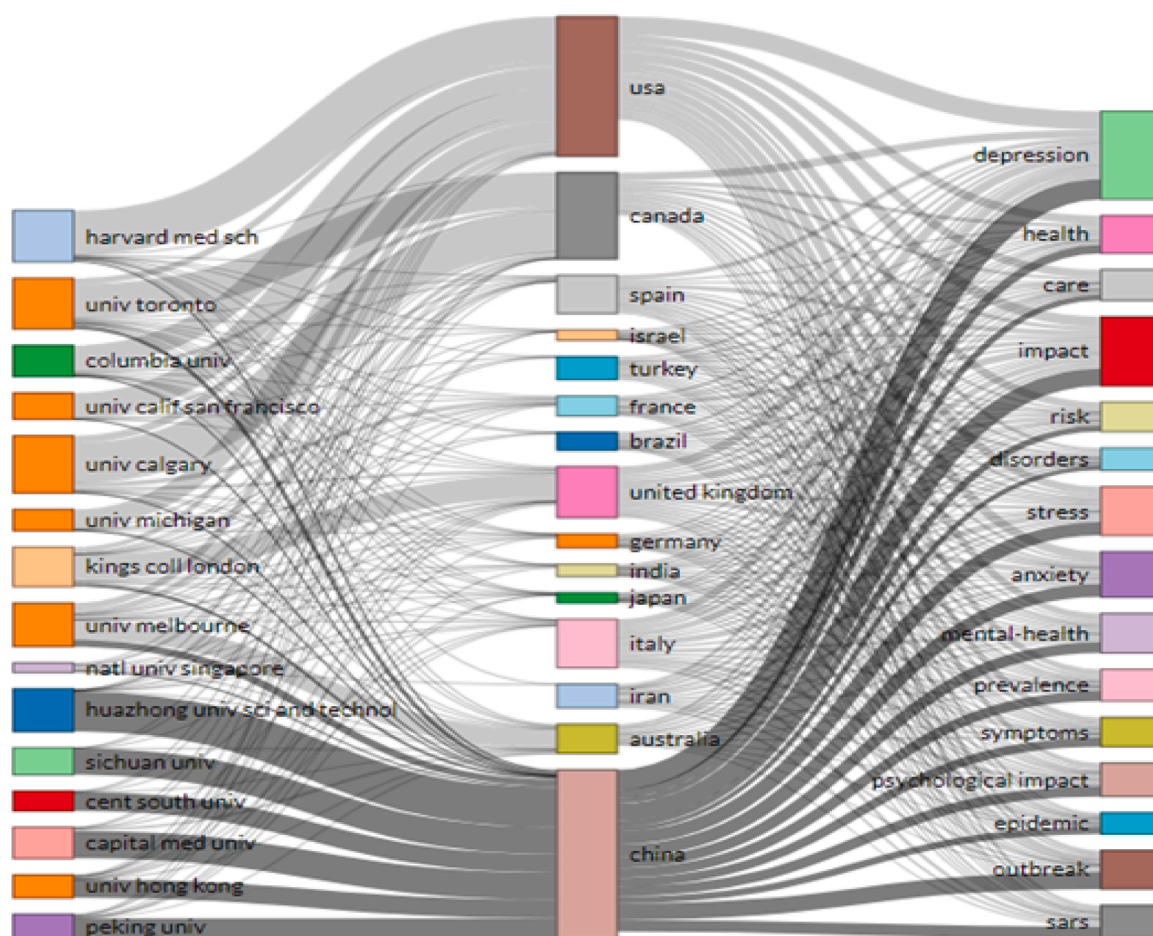


Fig. 4. Three-Fields Plot of the keywords Plus analysis :(Middle field: countries; Left-field: Affiliations; Right-field: Keywords Plus).

Table 5

Top 10 Web of Science categories on effects of COVID-19 pandemic on mental health.

SCR	Record count (n = 19)	NP	(%)
1	Psychiatry	1,738	31.90
2	Psychology	993	18.22
3	Public Environmental Occupational Health	862	15.82
4	Neurosciences Neurology	488	8.96
5	General Internal Medicine	422	7.75
6	Environmental Sciences Ecology	353	6.48
7	Pediatrics	262	4.81
8	Health Care Sciences Services	232	4.26
9	Nursing	213	3.91
10	Science Technology & others topic	176	3.23

SCR: Standard Competition Ranking; NP: Number of publications.

not included. Also, we assessed the top-cited article based on the total citation score. However, authors have self-citations that have an impact on the overall number of citations and h-index.

5. Conclusion and further directions

This study highlights the extent of mental health vulnerabilities experienced globally from the outbreak of COVID-19 and expanded knowledge on the most prominent articles, authors, publishing journals, countries, and funding agencies. From a global perspective, the evidence becomes pertinent to formulating policy interventions to prevent post-COVID-19 mental health vulnerabilities. Support should be accorded to increase publication and funding in low-resource settings with low

Table 6

Top 10 institutions and funding agencies that contributed to COVID-19 and mental health.

SCR	Institutions (n = 6548)	NP	(%)	Funding Agencies (n = 2006)	NP	(%)
1	Harvard Medical School	111	2.037	United States Department of Health Human Services	241	4.42
2	Kings College London	95	1.743	National Institutes of Health, USA	233	4.28
3	University of Toronto	92	1.688	National Natural Science Foundation of China	181	3.32
4	Huazhong University	88	1.615	European Commission	87	1.60
5	Columbia University	69	1.266	National Institute of Mental Health	74	1.36
6	University of Melbourne	63	1.156	Conselho Nacional De Desenvolvimento Cientifico E Tecnologico	43	0.79
7	University College London (UCL)	57	1.046	United Kingdom Research Innovation	42	0.77
8	The Hong Kong Polytechnic University	49	0.899	Canadian Institutes of Health Research	40	0.73
9	University of Washington	49	0.90	Fundamental Research Funds for The Central Universities	34	0.62
10	Wuhan University	48	0.88	National Institute for Health Research	32	0.59

SCR: Standard Competition Ranking; NP: Number of publications.

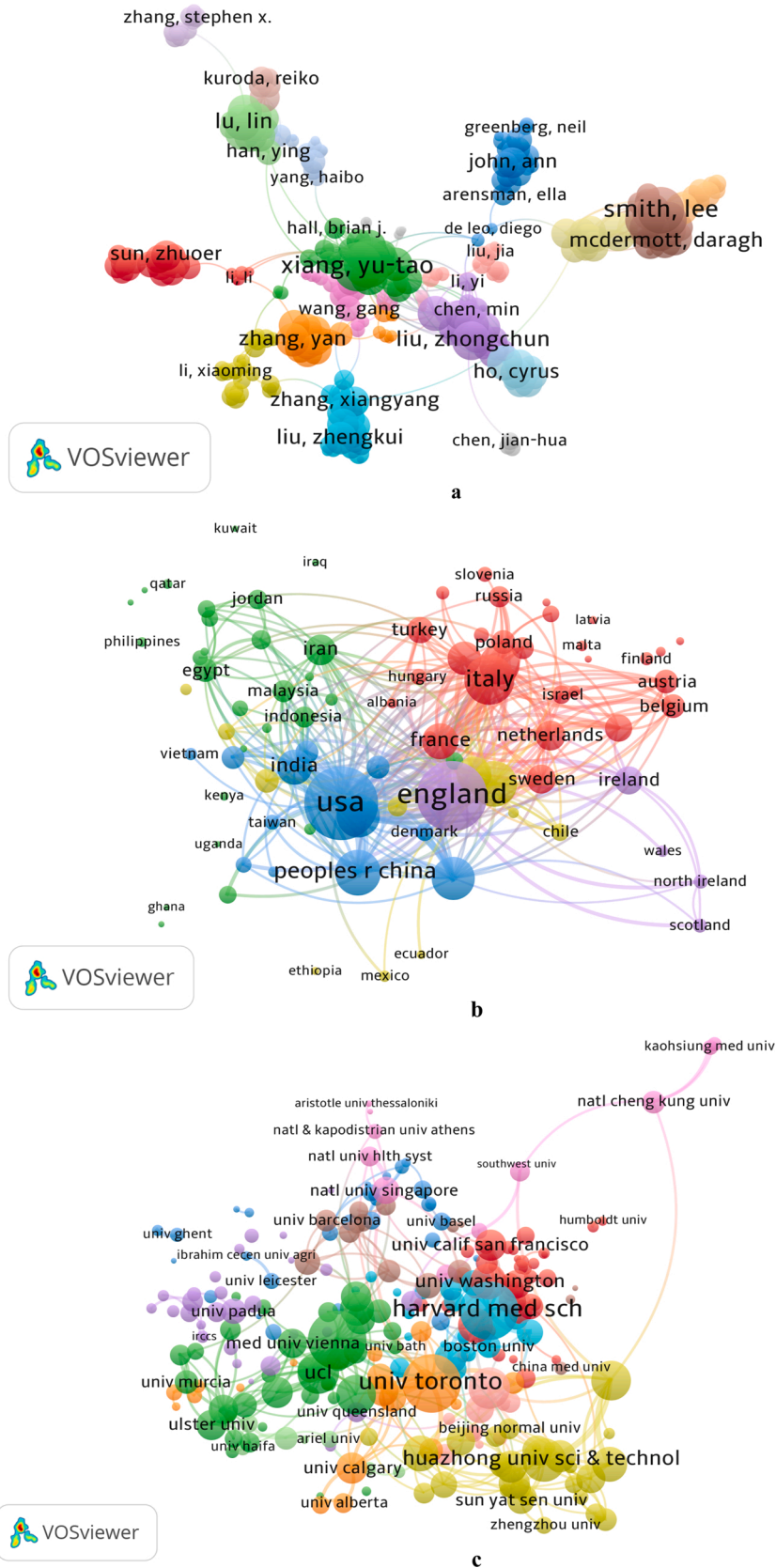


Fig. 5. a) Collaborative research networks between researchers, b) Collaborative research networks between countries, and c) Organizations-based Links (L) and total link strength (TLS) between authors.

publications to understand vulnerabilities' peculiarity and intervene accordingly. However, the funding and research contributions emanating from the developed countries and Asia are considered as they have shown to support the teaming global population in the fight against the mental health impact of the COVID-19 Pandemic.

Author statement contribution

MH, THM and ATY Conceived the idea and designed the study; MH and THM: Searched and collected the data; ATY, EI, and HHM: Wrote the first draft of the manuscript; ATY and THM: Software and formal analysis; MH, ATY, IHM, HHM, EI, AET, SC and THM: Reviewed and edited the final draft. All the authors read and approved the final manuscript for publication.

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Declaration of Competing Interest

The authors declare that there are no conflicts of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ajp.2021.102753>.

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