

MAPPING THE SCIENTIFIC LITERATURE ON COVID-19 AND MENTAL HEALTH

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received: 15.10.2020;

revised: 5.11.2020;

accepted: 2.12.2020

SUMMARY

Background: Within a few months during COVID-19 pandemic, more than a thousand studies on this topic have been published in scientific journals. Hence, the aim of the present study was to review and analyze the publishing trends on mental health literature including top cited documents, productive countries, institutions, journals, authorship and collaboration, the most frequent keywords and funding bodies.

Method: A bibliometric analysis was performed, and data were retrieved from Scopus. The relevant data was harvested and 277 relevant records were imported on July 15, 2020. The data analysis was performed using various bibliometric software.

Results: These documents were published by 195 journals and received 738 citations. USA ranked first with 50 articles and China is the most influential country with the highest Citation Impact. International journal of Environmental research and Public Health is the top journal for mental health studies with highest number of papers and citation impact. The trend of multi-author publications has outnumbered single-author pattern.

Conclusion: Overall research shows that most of the papers published related to mental health care and COVID-19 were in the field of medicine and psychology. This research is first bibliometric study in the field of mental health care related to COVID-19.

Key words: mental health - COVID-19 - depression - anxiety - resilience - Covid mental health - bibliometric

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INTRODUCTION

On 31st December 2019, Chinese health authorities reported an outbreak of a new severe respiratory virus known as the Corona virus. This outbreak marked the first case of human to human transmission in the history of corona (Israil 2020). Since then, the disease has spread to other parts of the globe. The spread of corona was attributed to the movement of infected people out of Wuhan, China, due to interactions with other people for instance at airports, restaurants, trains and buses. On January 30, 2020, the novel Corona virus was declared as a public health emergency of international concern by the World Health Organization (WHO). Later, on 7th February 2020, WHO officially named the novel Corona virus as Corona Virus Disease 2019 - Covid-19. On 11th March 2020, the Corona Virus Disease was declared as pandemic (Kandola 2020) which has rapidly spread through 110 countries. According to real-time statistics from Worldometer, current Corona virus cases and deaths stand at 22,270,737 and 782,796 respectively on 19th August 2020 with U.S.A, Spain, Italy, Iran, Brazil, France, and Germany being the most affected countries (Worldometer 2020). Due to this, countries have been forced into lockdowns and curfews to minimize human interactions crippling all social, economic, and political activities in steps to mitigate the spread of the virus.

The pandemic has not only devastating impact on humans in terms of high mortality rate but caused

psychological unrest and mental catastrophe across the world (Naushad et al. 2019, Spoorthy 2020, Xiao 2020, Zhang et al. 2020). Felman (2002) stated, "Mental health refers to cognitive, behavioral, and emotional well-being. It is all about how people think, feel, and behave. People sometimes use the term "mental health" to mean the absence of a mental disorder." According to Galderisi et al. (2015), the basic ability of a person to participate in meaningful social roles and interactions is an important aspect of mental health which particularly contributes to resilience against distress. Whereas, disturbances of these interactions may result in psychotic experiences, eating disorders, self-harm, body dysmorphic disorder or poor physical health (Galderisi et al. 2015). Common mental health disorders are anxiety, mood disorders, schizophrenia, stress, eating disorders.

As mentioned by Ornell et al. (2020), the number of people whose mental health is affected tends to be greater than the number of people affected by the infection itself during any typical pandemic. Infected people or suspected experience intense emotional and behavioral reactions for example anger, fear, boredom, loneliness, anxiety, eating disorders and insomnia (Shigemura et al. 2020). Self-isolation, quarantine and lockdowns had a negative impact on overall mental health of general population (Javed et al. 2020). A recent study revealed "numerous emotional outcomes, including stress, depression, irritability, insomnia, fear, confusion, anger, frustration, boredom, and stigma asso-

ciated with quarantine, some of which persisted after the quarantine was lifted” (Pfefferbaum & North 2020).

There has been a plethora of Covid related research published in various fields for example medical sciences, social sciences, and psychology in just a 6 months’ time period since the outbreak of the disease. However, there is only one bibliometric study in the mental health area (Alvarez et al. 2020) despite the fact that the psychological unrest is the major outcome of Covid-19 and lockdowns as evidenced by various studies (Holmes et al. 2020, Liu et al. 2020, WHO 2020, Zandifar & Badrfam 2020). Alvarez et al. (2020) conducted a bibliometric study with the purpose of systematizing actions for the management of psychological safety of health personnel in isolation wards. The method was based on the systematic bibliographic review based on protocols for the care of patients with COVID-19, technical documents and scientific articles published in national and international sources in Spanish and English from December 2019 till April 2020, indexed in Sage, Oxford University Press, Elsevier and Science. The PRISMA method was used for searching by combining keywords and Boolean operators and content analysis was performed on the results.

Among more than a thousand papers extracted from two main databases for the current study, Web of Science (WoS) and Scopus, there was only a single bibliometric study related to mental health care. There were a good number of review studies (Dubey et al. 2020, Rajkumar 2020, Xiong et al. 2020, Salazar et al. 2020, Singh et al. 2020, Spoorthy et al. 2020), a few meta-analysis studies (Salazar et al. 2020, Ren et al. 2020), and an exploratory data analysis of published papers (Tummers et al. 2020).

Nevertheless, it is very critical to know about the total number of studies conducted in the mental health care area along with the prolific authors, organizations, collaborations and countries contributions. Besides, knowing which sub areas of the mental health care were studied is also crucial. Sub areas are important because it may relate to the type of mental health issues as by product of Covid-19. Hence, this research will be a first bibliometric study in the field of mental health care to explore and analyze all of the above mentioned elements of published materials related to Covid-19.

Research questions

- What are the most productive countries and organizations?
- What are the favorite journals in which Covid mental health researchers would like to publish their work?
- What is the authorship and collaborative pattern of Covid mental health researchers?
- What are the most frequently used keyword and co-occurrence network in Covid mental health research?

- What kind of relation exists based on three factor analysis (countries, keywords, organizations)?
- Which research papers are highly influential with respect to citation and altimetric on Covid mental health?
- What are the top funding organizations and subjects related to Covid mental health literature?

METHODOLOGY

In order to examine the latest publishing trends and patterns on mental health research related to COVID-19 pandemic around the world, bibliometric data were retrieved from Scopus databases, leading global database of peer review literature. In the Scopus advance search, following search query was run in the title and Author Keyword field.

(TITLE-ABS-KEY-AUTH ("Mental Health" OR anxiety OR depression OR "Mental Stress" OR adolescent OR "Anxiety Disorder" OR "Mental Health Service" OR "Social Isolation" OR stress OR "Stress Psychological" OR "Mental Health Care" OR "Social Support" OR "Mental Disorders" OR trauma OR "Psychological Distress" OR "Psychological Resilience" OR "Psychological Well-being" OR suicide OR resilience OR sleep OR "Anxiety Disorders" OR "Health Service" OR "Social Psychology" OR "Stress Disorders" OR "Post-Traumatic") AND (covid 19 OR coronavirus OR covid19 OR covid-19 OR ncov2019 OR sars-cov-2 OR sars AND cov 2 OR orthocoronavirinae)

The query was further refined by publication years (2020 OR 2019) and document types (article, or review article or book chapter or proceedings paper or early access). The Note, Abstract Meeting, Letter, Review Meeting, Book Review types of documents were excluded. Finally, the 1088 records were imported and downloaded in Plaintext and BibTeX formats on July 14, 2020 at Imam Abdulrahman bin Faisal University, Saudi Arabia. The titles and abstract of each record were again read by two authors and further 811 irrelevant and duplicate records were excluded. The final 277 selected records were used for the analysis.

There are some terms/abbreviations which are used for data analysis in various columns of the tables such as TP stands for a total publication, TC for total citation, IF for impact factor, Q for Journal Quartile. The citation impact describes the average citations received by a specific publication. The citation impact (CI) used in this study was calculated by dividing the total number of citations by the total number of publications. This illustrates the average number of citations that a specific publication has received (Reuters 2018). The data analysis was performed using MS Excel, VOSviewer and Biblioshiny (RStudio).

RESULTS

These records/articles were published by 195 journals, written by 1820 authors who have affiliated with 976 institutions from 68 countries. These documents received 738 citations, 238 published in English and 39 in other languages. In 2020, 277 publications obtained 738 citations. This shows that the COVID-19 pandemic has got remarkable attention from mental health researchers throughout the world.

Most productive countries and organizations

Table 1 indicates the top 10 countries and organizations producing mental health literature related COVID-19, showing their corresponding number of publications and citations. All countries in the table have produced over 12 publications in 2020 to the 2nd week of July 2020. There are only three countries that produced over 40 publications in which United States of America (USA) is on the top of the list with 50 publications, 91 citations followed by Italy with 41, China with 40, and United Kingdom with 32 publications. It has been observed that though the USA has a higher number of publications, the impact of publications by China is highest than any country. The highest CI (10.95) was recorded for the China. The latest published data from 2020 informed that India, Brazil and Australia stand at the bottom of the list with only 18, 17 and 12 publications respectively.

Among the top 10 organizations producing literature on mental health, a minimum of 6 and a maximum of 12 publications were recorded. The Huazhong University Science & Technology is far ahead, producing 12 publications and 53 citations followed by Zhongnan Hospital of Wuhan University with 10 publications and only single citation. King Saud University, KSA and King's College London is at 3rd and 4th rank with 9 and 8 publications respectively. The Shahid Beheshti University of Medical Sciences, Iran is at the bottom of list with 6 publications and 5 citations.

Highly influential research journals

Table 2 presents the top 10 core research journals producing literature on COVID mental health. Five journals produced over five publications out of which only one journal produced over 10 publications. International Journal of Environmental Research and Public Health (IF 2.849) emerged as a leading journal with 12 publications, 3 citations, followed by Brain, Behavior, and Immunity (IF=6.333, Q1) with 7 publications and 79 citations. It is important to note that 9 out of 10 journals are impact factor and half of them come under the Quartile 1 and 2 categories. The Journal with the highest impact factor (6.333) is 'Brain, Behavior, and Immunity'. Most of the journals belonged to Switzerland (3) and Netherlands (2), while USA, Italy, France, Brazil and UK had one journal each to their name.

Authorship pattern

The analysis of authorship pattern shows the range of authorship from a single author to a maximum of 15 authors. The top four dominant authorship patterns were two-authors (38 publications) and four-authors (37 publications). It is noteworthy that single-author has also produced a significant number of publications (19). There was a decline in number of studies for more than 10 authors. Additionally, ten, thirteen and fifteen were less used authorship pattern.

Author's keyword analysis

The keyword analysis informs that a total of 681 different keywords have been used by authors for Covid mental health. A co-occurrence network of keywords has been used with a minimum occurrence of 5 keywords and 22 items containing 6 clusters have been shown in Figure 1. The size of the ball shows a strong network of keywords and total strength links with other items/keywords. Each color represents the separate cluster. The top keywords related to covid mental health have a significant number of occurrences and total link strength. The top 10 keywords were covid-19, pandemic, sars-cov-2, coronavirus, mental health, anxiety, depression, stress, quarantine, resilience, Stigma, with number of occurrences of 154, 43, 43, 41, 33, 28, 17, 15, 8 and 7 respectively.

Highly cited articles on mental health

Table 3 highlights the top ten highly cited articles on COVID mental health. It is interesting that all the top ten articles were published in 2020. Three of those articles were published in "Brain, Behavior, and Immunity" and one each in other six journals. Only four articles got over 40 citations. The article entitled "clinical findings in a group of patients infected with the 2019 novel coronavirus (sars-cov-2) outside of Wuhan, china" by 'Xu XW' published in BMJ got the highest citations (255) and Altmetric score (313), followed by the articles of Torales J (2000) with 265 citations and Kang L (2020) with 43 citations. It is interesting to note that two articles at the bottom of the list by Rogers JP and Matava CT' received only 11 citations but has very good numbers of altmetrics score (212, 128).

Three-factor analyses of major aspects of the data

Countries, keywords, and organizations

Figure 2 presents the three-factor analysis of the relationship among Author keywords (left), affiliated organizations (middle), and country (right). It shows that six countries (China, Italy, France, United Kingdom, Germany and USA) published mental health literature mostly using nine main keywords (stress, sars-cov-2, covid-19, mental health, pandemic, anxiety, coronavirus, depression, and quarantine). These countries

Table 1. Top ten highly publishing countries and organizations

Rank	Country	TP	TC	CI	Rank	Organizations	Country	TP	TC	CI
1	USA	50	91	1.82	1	Huazhong University of Science and Technology	China	12	53	4.42
2	Italy	41	134	3.27	2	Zhongnan Hospital of Wuhan University	China	10	1	0.10
3	China	40	438	10.95	3	King Saud University	KSA	9	1	0.11
4	UK	32	48	1.50	4	King's College London	UK	8	19	2.38
5	Germany	20	26	1.30	5	Universit De Paris	France	7	6	0.86
6	Spain	20	55	2.75	6	University of Pisa	Italy	7	3	0.43
7	France	19	19	1.00	7	Columbia University Irving Medical Center	USA	6	0	0.00
8	India	18	23	1.28	8	Jessa Hospital	Belgium	6	0	0.00
9	Brazil	17	60	3.53	9	Policlínico Tor Vergata University	Italy	6	1	0.17
10	Australia	12	34	2.83	10	Shahid Beheshti University of Medical Sciences	Iran	6	5	0.83

TC - Total Citations; TP - Total Publications; CI - Citation Impact

Table 2. Source Impact

Source	TP	TC	CS	IF	Q	Publisher	Country
International Journal of Environmental Research and Public Health	12	3	3.0	2.849	1	MDPI	Switzerland
Brain, Behavior, and Immunity	7	79	10.7	6.633	1	ELSEVIER	USA
Clinical Neuropsychiatry	6	4	N/A	N/A	N/A	Giovanni Fioriti Editore	Italy
Encephale-Revue de Psychiatrie Clinique Biologique et Therapeutique	6	6	N/A	0.873	4	Masson Editeur	France
Psychiatry Research	5	6	N/A	2.118	3	Elsevier	Netherlands
Asian Journal of Psychiatry	4	22	2.7	2.529	2	Elsevier	Netherlands
Frontiers in Psychiatry	4	0	3.2	2.849	2	Frontiers Media	Switzerland
International Journal of Social Psychiatry	4	48		1.439	3	Sage	UK
Ciencia E Saude Coletiva	3	4		1.019	4	Abrasco-Assoc Brasileira Pos-Graduacao & Saude Coletiva	Brazil
Frontiers in Psychology	3	0	3.2	2.067	2	Frontiers Media	Switzerland

CS - Cite Score; IF - Impact Factor; Q - Quality; TC - Total Citations; TP - Total Publications

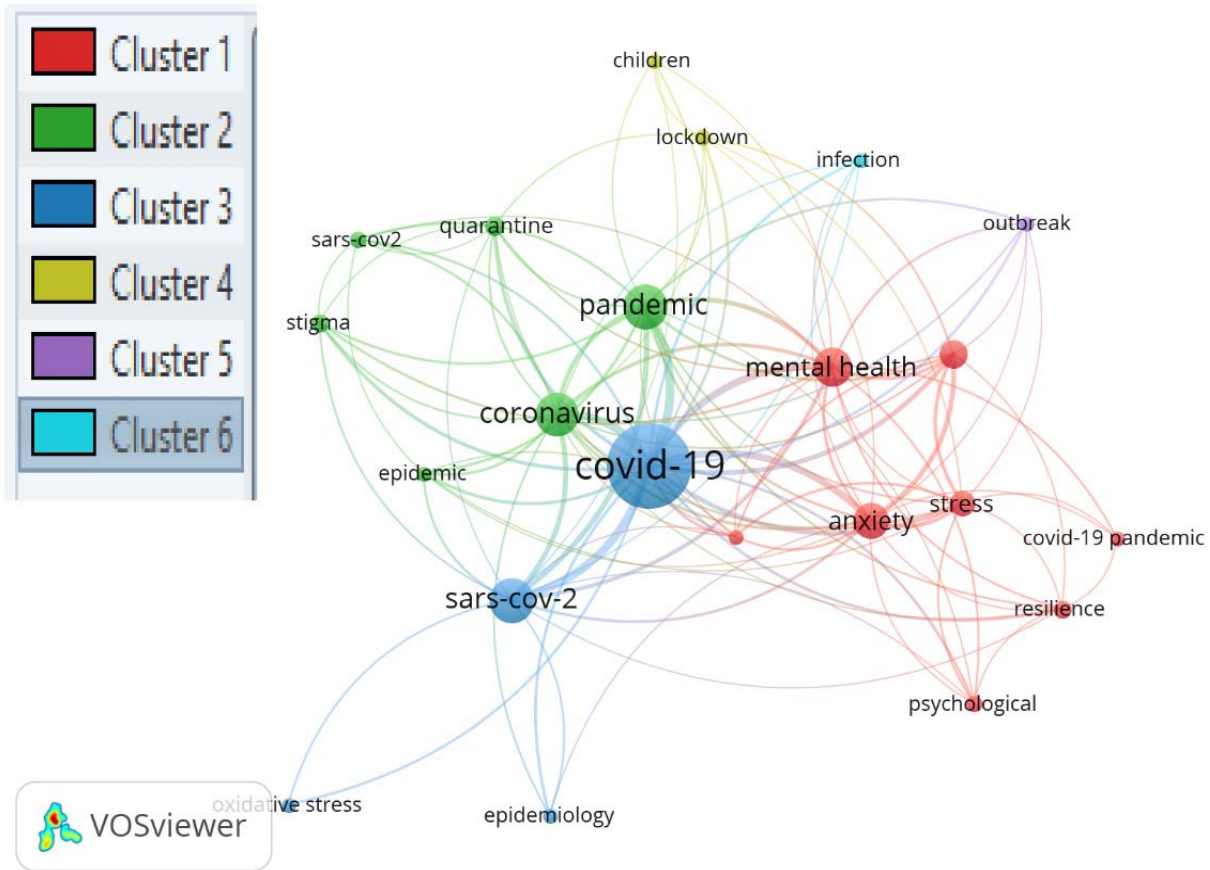


Figure 1. Co-occurrence network of author keywords (minimum number of occurrences: Five)

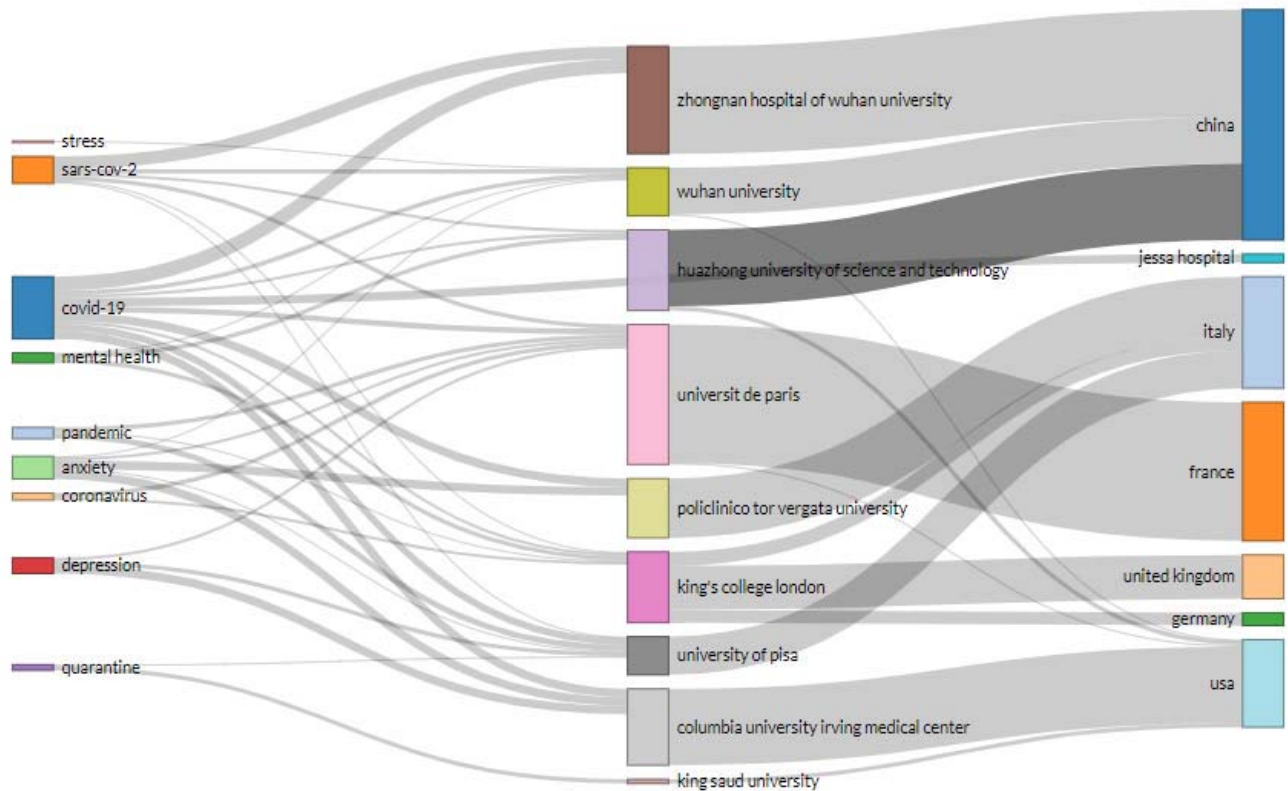


Figure 2. Three factor analysis of relationship among keywords (left) Affiliation (middle) and country (right)

Table 3. Highly cited top ten articles on Mental Health

Title	Author	Source	TC	AS	Year
Clinical findings in a group of patients infected with the 2019 novel coronavirus (sars-cov-2) outside of wuhan, china: retrospective case series	Xu XW	The BMJ	255	313.734	2020
The outbreak of covid-19 coronavirus and its impact on global mental health	Torales J	International Journal of Social Psychiatry	48	265.38	2020
Impact on mental health and perceptions of psychological care among medical and nursing staff in wuhan during the 2019 novel coronavirus disease outbreak: a cross-sectional study	Kang L	Brain, Behavior, and Immunity	43	116.772	2020
Management of Corona Virus Disease-19 (Covid-19): The Zhejiang Experience	Xu K	Journal of Zhejiang University Medical Sciences	42	1.1	2020
The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (Covid-19) In January And February 2020 in China	Xiao H	Medical Science Monitor	39	25.33	2020
Using psychoneuroimmunity against covid-19	Kim SW	Brain, Behavior, and Immunity	17	33.278	2020
Novel Coronavirus Covid-19: An Overview for Emergency Clinicians	Giwa A	Emergency Medicine Practice	14	7.75	2020
Affective Temperament, Attachment Style, and the Psychological Impact of The Covid-19 Outbreak: An Early Report on The Italian General Population	Moccia L	Brain, Behavior, and Immunity	13	14.15	2020
Psychiatric and Neuropsychiatric Presentations Associated with Severe Coronavirus Infections: A Systematic Review and Meta-Analysis with Comparison to The Covid-19 Pandemic	Rogers JP	The Lancet Psychiatry	11	2127.6	2020
Pediatric Airway Management in Covid-19 Patients: Consensus Guidelines from the Society for Pediatric Anesthesia's Pediatric Difficult Intubation Collaborative and The Canadian Pediatric Anesthesia Society	Matava CT	Anesthesia and Analgesia	11	128.38	2020

TC - Total Citations; AS - Altmetric Score

and keywords have a strong relationship with seven organizations (Wuhan university, Huazhong university science & technology, university of Paris, King College, university of Pisa, Columbia university and King Saud university).

Country collaboration map on Covid mental health

There are 405 entries of collaborations among various countries worldwide maximum 12 to one collaboration. Major six collaborations occurred between top six productive countries (Italy, China, Germany, USA, UK, Spain). Italy emerged as a top collaborator with UK (12 publications), Spain (9 publications), Germany (6 publications) and USA (8 publications each), followed by India with USA (6 publications), the UK with Cyprus (4 publications), and others. The least collaborator countries among 10 collaborators were Germany and USA with only 4 publications.

Highly used subject areas

There are four broad subject classifications of Scopus (physical sciences, health sciences, social science, and life science) with 334 subjects. Covid mental health publi-

cations were related to nine subject categories and five notable subject areas have 22 minimum publications. The subject area 'medicine' is on the top of the list with 247 publications, followed by 'Psychology' with 36 publications, 'Neuroscience' with 28 publications and 'Biochemistry, Genetics and Molecular Biology' with 22 publications. The four areas at the bottom of the list were social sciences, immunology and microbiology, nursing, arts and humanities with 19, 17 and 15 publications respectively.

Top funding organizations on Covid mental health

Table 4 highlights the top 10 funding organizations on Covid mental health literature. The range of the funding was from maximum 12 publications to minimum two publications. National Natural Science Foundation of China has emerged a top funding organization with highest 12 publications, 56 citations. The organization 'National Council for Scientific and Technological Development' and National Institutes of Health has 5 publications each, followed by National Institute of General Medical Sciences United States with 18 publications, Health and Medical Research Fund, Food and Health Bureau with 16 publications and others. It is

Table 4. Top Ten Funding Organization

Funding Organization	Country	TP	TC
National Natural Science Foundation of China	China	12	56
National Council for Scientific and Technological Development	Brazil	5	0
National Institutes of Health	USA	5	2
The Coordination for the Improvement of Higher Education Personnel	Brazil	3	0
National Institute for Health Research	UK	3	20
Wellcome Trust	UK	3	12
European Commission	European Union	2	0
European Social Fund	European Union	2	2
Fundamental Research Funds for the Central Universities of China	China	2	39
King Saud University	KSA	2	1
Medical Research Council	UK	2	14

TC - Total Citations; TP - Total Publications

interesting to highlight the World Health Organization is often leading the world in COVID-19 pandemic; however, it did not contribute any publication on Covid mental health.

DISCUSSION

Most productive countries and organizations

The total publications of top 10 most influential countries were 269. All these papers show interest of the authors in the mental health of the people during the COVID 19. Among these papers, the United States of America has the maximum publications and China is the most influential country with the highest CI (Citation Impact). Findings also show that among the top 10 productive organization Huazhong University of Science and technology China is on the top having a total of 12 publications and 4.42 Citation Impact. China's position may be attributed to the earliest outbreaks of the virus suggesting a need for solutions and access to patient populations (Fry et al. 2020a). Our findings are similar to bibliometric studies conducted by Bonilla-Aldana (2020), Nasab (2020), and Fry et al. (2020b) findings which found that the United States and China were the largest contributors in terms of research in COVID-19 related research.

Highly influential research journals in mental health

The 5 out of 10 publications on mental health are listed in the Q1& Q2 ranking of Scopus, from Switzerland, USA, and Netherlands. International journal of Environmental research and Public Health is on the top with 12 articles and 2.84 Impact Factor. Journal of Brain, Behavior, and Immunity is second having 7 articles with 79 citations which is the highest number of citations. The impact factor of the journal is 6.633. Both of these journals are listed in the Q1 rank of Scopus. International Journal of Social Psychiatry has 4 articles with 48 citations. Similarly, Asian Journal of Psychiatry has 4 articles with 22 total citations. All these journals are from developed countries, follow rigorous peer-

reviewing, and publish articles. International Journal of Social Psychiatry is a peer reviewed and specialized journal concerned with the impact of social factors on individual's wellbeing and mental health. However, International journal of Environmental research and Public Health is an interdisciplinary peer reviewed journal.

Authorship, collaborative patterns and frequently used keywords

The authorship pattern shows that mostly papers are written by multiple authors or more than one author. No doubt, the COVID-19 situation resulted in a lot of scientific collaboration (Homolak et al. 2020). The highest number of articles (n=38) are written by two authors. Nineteen (19) papers were written by single author. The range of collaboration is up to maximum 15 authors. High level of collaborations is found between the Italy, UK and Spain. Spain and Italy remain the world two worst-hit countries by the Covid 19 pandemic. Highest collaboration in the case of Italy could be that it experienced the earliest outbreaks of the virus and was affected badly suggesting a need for solutions and access to patient populations (Fry et al. 2020a). Italy was the first country which faced a large number of deaths due to COVID-19 in Europe, followed by Spain, France, Germany, and the United Kingdom (Mavragani 2020).

Similarly, the top 10 keywords include Covid-19, pandemic, sars-cov-2, coronavirus, mental health, anxiety, depression, stress, quarantine, resilience, and stigma. All these key words are the main factors of mental health. Coronavirus SARS-CoV-2 eruption is equally responsible for causing fear, depression, anxiety, and other mental health issues among the mentally challenged individuals in addition to infection. Discrimination, stigmatization, and mental health disorders can increase disease transmission and infection severity among people already dealing with mental health disorders (Yao et al. 2020). The findings are supported by a study conducted by an interdisciplinary group of 24 world-leading experts showing a rise in mental health related symptoms of anxiety, stress, depression, and engagement in harmful behaviours (such as suicide and

self-harm) as a result of COVID-19 related measures (Holmes et al. 2020). The less researched keywords are resilience and stigma. These two constructs need more research in future.

Three-factor analysis was carried out to identify the relationship among keywords, countries and organizations. This analysis shows that resilience and stigma need attention to be researched. Similarly, through this analysis it is also identified that an article from Chinese author/s is the most cited article having 255 citations with 313.734 Altmetric Score (Table 3). It is also evident by the analysis that mostly papers were published in the field of medicine with a total number of 247 publications. Psychology is at the second position with 36 publications. The major reason behind most publication in the field of Medicine could be concerted efforts on clinical aspects of the fight against this pandemic (Haghani et al. 2020).

China is on the top among the 10 funding organizations. Brazil and USA are at the second position in terms of funding organizations. Another study showed that the USA and China were the main funders of Coronavirus related research during the global pandemic (Fry et al. 2020a). New and more funding will be required by other countries in this scenario (Holmes et al. 2020).

Limitation and future research directions

Only Scopus database was used. The database, though comprehensive but it does not represent all literature. Data from other databases or collected at different times can have different results and conclusions. Other databases such as Web of Science, PubMed may be used to extend this work for more comprehensive findings. Secondly, researchers tried to include all possible key terms search to short list the articles, but the analysis can be extended by including some more search terms like quarantine, pandemic as identified in the keywords cluster (Figure 2). Besides these limitations, the present study offers several opportunities for future research. Future research may undertake a systematic review or meta-analysis of the studies related to COVID-19 and mental health care to explore and understand theoretical developments and contributions.

CONCLUSION

Overall research shows that most of the papers published related to mental health care and COVID-19 were in the field of medicine and psychology. Among these papers, the United States of America has the maximum publications and China is the most influential country with the highest CI (Citation Impact). The collaborative research patterns and multiple authorship prevails. International Journal of Environmental Research and Public Health is the top journal for mental health studies with highest number of papers and impact followed by the Journal of Brain, Behavior, and Immunity, International Journal of Social Psychiatry and Asian

Journal of Psychiatry. China is at the top position among the 10 funding organizations followed by Brazil and USA. It is interesting to highlight that the World Health Organization is often leading the world in COVID-19 pandemic, however, it did not contribute (fund) any publication on Covid related mental health research.

Acknowledgements: None.

Conflict of interest: None to declare.

Contribution of individual authors:

Ideation, conceptualization and initial draft writing were done by Seema Gul & Amira Khattak.

Methodology, analysis and results' report writing were done by Shafiq Ur Rehman & Murtaza Ashiq.

Review and overall improvement were done/contributed by all the authors.

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