FINDINGS ON IMPACT OF COVID-19 ON MENTAL HEALTH USING KEYWORD VISUALIZATION

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SUMMARY

Objective: The EU global health priorities focus on ensuring better health and well-being for people throughout their lives as well as on reducing inequalities between countries. The COVID-19 pandemic can be understood as a set of several events that directly or indirectly affected the mental health of people around the world. The aim of this study was to identify the main groupings of co-occurrence of all keywords related to the main keywords "COVID-19" and "mental health" acquired through search in the Scopus database using the VOSviewer tool.

Methods: Descriptive study based on a bibliometric analysis of the occurrence of the keywords "COVID-19" and "mental health" in scientific articles retrieved from the Scopus database on 31 January 2023 covering period from 2020 to 2022 plus January 2023 in the field of medical research. The result was 1,625 articles extracted into a csv file and inserted into VOSviewer tool. By counting the number of co-occurrences of keywords using the VOSviewer, the final result was 1,211 keywords. Out of the 1,211 keywords 44 different keywords with the total power link strength of association with the keywords "COVID-19" and "mental health" were selected.

Results: The presence of high rates and power links of depression and anxiety after the pandemic situation has been confirmed by visualization of keywords in scientific articles retrieved from Scopus database. The keywords "social support", "social isolation", "perceived social support", and "dementia" inform us about potential areas of research and trigger discussion about the impact of the recent pandemic on mental health. Another warning was the occurrence of the keyword "obesity" and its association with health consequences for individuals and society. Among all countries, the United States, the United Kingdom and China contributed the most with scientific publications focusing on pandemic and mental health.

Conclusion: The visualization of the keywords "COVID-19" and "mental health", specifically "depression" and "anxiety" create a new area for further research as well as establishing preventive measures leading to protection from mental health damage in the events of possible dangers of this type.

Key words: VOSviewer, social isolation, anxiety, depression, obesity

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https://doi.org/10.21101/cejph.a8281

INTRODUCTION

The COVID-19 pandemic has changed the lives of people around the world and has created a global crisis across all ages with significant consequences for mental health (1, 2).

Mental health is a fundamental value of human life and is an integral part of an individual's overall health. The World Health Organization (WHO) defined mental health as a state of subjective well-being in which an individual is able to exercise their abilities, cope with the stress of everyday life, work productively, and contribute to society (3). The WHO categorizes risk factors affecting mental health and well-being into three categories: individual characteristics and behaviours, social and economic circumstances, and environmental factors (3).

The experience of the COVID-19 pandemic has shown that health in the world has no boundaries, that it can be characterised as a global social good that manifests itself in the well-being, prosperity, stability of societies and world economies (4). However, COVID-19, which was the great pandemic of the 21st century, showed how this value of human life can be destroyed. An adverse living situation during the pandemic was characterised by a number of restrictive measures that threatened people's mental health. Chronic stress and repeated stressful events during the pandemic were strong predictors of developing depression or anxiety conditions (5). Analyses of research on the COVID-19 pandemic suggest that the lockdown led to feelings of confusion, anger and post-traumatic stress disorder (6).

Before the coronavirus (COVID-19) pandemic, almost 1 billion people worldwide had a mental disorder. Around 50 million people had dementia and about half of all mental disorders started in 14 years of age. Suicide was the second leading cause of death among young people aged 15–29 years (7). People with severe mental illness die 10–20 years earlier than the general population, often from undiagnosed and co-occurring physical illnesses (7, 8). Before the pandemic, less than half of the countries of the European Union (9), including the Slovak Republic, collected data on mental health for the public sector and general health statistics (10).

Nowadays the authors of many studies (5, 11) present the results of the impact of pandemics on mental health in the general population, manifested by high rates of symptoms of anxiety, depression, post-traumatic stress disorder, and nonspecific psychological distress (7, 10).

The prevalence of higher rates of depression after pandemic situation has affected people's mental health.

The WHO long-term collaboration with the Health Emergency Programme (WHE) and other supporting organisations ensures that mental health and psychological support will be an integral part of the response to the COVID-19 pandemic (7).

The objective of this study was to use the VOSviewer tool to visualize a bibliometric analysis of co-occurrence of pandemic and mental health keywords retrieved by searching in the Scopus database (12).

Despite of the VOSwiever limitation displaying bibliometric analysis only from the Scopus database, we used the following research questions focusing on the aim of the study. Which countries have a higher incidence of publications in the Scopus database? What area is a new area of research related to COVID-19?

MATERIALS AND METHODS

The literature search was conducted using the Scopus keyword database, checking for major clusters of co-occurrences of all keywords using VOSviewer. This search included the main keywords "COVID-19" and "mental health". The retrieval and export of publications was carried out within the Scopus database. In order to avoid possible biases caused by the constant updating of the database, we reduced the search and export of publications within the Scopus database to one day (January 31, 2023). The search database was limited to the period from 2020 to 2022 plus one extra month of 2023 (January 2023).

At the time of data collection, a total of 5,243 documents were selected. Then we used filters and selected articles by subject area (medicine), type of document (journal), and excluded all equivalents of the main keyword (e.g., COVID 19; Coronavirus Disease 2019; COVID-19; SARS-CoV-2; Coronavirus Infection; Coronavirus; Betacoronavirus; COVID-19 Pandemic; Severe Acute Respiratory Syndrome Coronavirus 2, 2019 ncov; nCoV2019; nCoV-2019; nCoV 2019; mental disorders; mental disease). After this step, the final number of articles was 1,625.

VOSviewer Tool

Bibliometrics enables objective representation of keywords in scientific papers and facilitates the assessment of pertinent information regarding the study objectives. We used VOSviewer 1.6.8 software* to create the bibliometric visualization that focused on the co-occurrence of keywords (12). By counting the number of co-occurrences of the keywords that appeared in the articles of the selected publications, we made corrections for linguistic differences in the VOSviewer thesaurus, then combined abbreviated terms with full terms, ignoring general terms (conclusion, method, result, qualitative research, etc.).

The final result was 1,211 keywords based on the number of times the same keyword appeared in the articles from the chosen publications (n = 1,625). Out of the 1,211 keywords 44 different keywords were selected with the total power link of association with the keyword "COVID-19" and "mental health".

*www.vosviewer.com

By visualizing the keywords on a digital map, clusters were created that contained a set of keywords that belong to only one cluster. Each cluster has its own colour showing the relationship between the main keywords. Keywords in one cluster did not overlap with another cluster. The lines showed a relation between two keywords, and also the frequency of co-occurrence. VOSviewer determined the score and colour distribution of the keywords from blue (lowest score) through green to yellow (highest score). The more keywords were close to the main keyword, the higher the frequency of their occurrence or use in the publications. Conversely, the smaller the number of keywords near the main keyword, the lower the value of close keywords resulting in blue colouring (13).

In our study, we did not assess the quality of studies in the articles retrieved from the Scopus database but used keywords to inform and provoke discussion about the impact of the pandemic on global health, focusing on mental health.

RESULTS

Descriptive Results

The findings presented in Table 1 offer an overview of the basic information. The majority of the published works are journal articles representing more than half (79%) of all the published documents from the field of medicine.

The co-occurrence analyses of the keywords extracted by the VOSviewer used in the published articles are shown in Table 2. The 44 keywords were selected from 1,211 different keywords with the total power link of association with the keywords "COVID-19" and "mental health".

VOSviewer Analysis of Frequencies, Power Link and Rank of All Selected Keywords

The visualisation of the keywords in the included articles from the Scopus database provides an insight into possible areas of research and reveals information by means of keywords about the pandemic impact on mental health. The network and density visualisation of the keywords that occur together in the same yellow colour cluster and have a close association between them has proven the presence of increased rates of depression due to the pandemic (Fig. 1a, Fig. 1b).

Table 1. *General description of data*

Description	
Documents	1,625
Source type	
Journal	1,594
Book	28
Book series	2
Conference proceeding	1
Subject area	
Medicine	1,625

Source: Authors' calculation

Table 2. *Co-occurrence of the keywords with the total power link strength of association with the keyword "COVID-19" and "mental health"*

Rank	Keywords	Frequencies	Power link
1	COVID-19	235	464
2	Mental health	129	269
3	Human	27	149
4	Depression	48	146
5	Anxiety	44	129
6	Female	10	82
7	Adult	10	75
8	Male	7	64
9	Aged	8	61
10	Stress	19	56
11	Quality of life	14	53
12	Psychology	9	43
13	Comorbidity	5	41
14	Epidemiology	7	38
15	Public health	12	37
16	Telehealth	11	35
17	Adolescent	5	32
18	Social support	9	29
19	Resilience	11	28
20	Coping	10	26
21	Well-being	10	26
22	Obesity	5	25
23	Telemedicine	7	25
24	Loneliness	11	24
25	Older adults	10	24
26	Nurses	9	23
27	Fear	5	22
28	Physical activity	10	22
29	Psychological distress	11	22
30	Trauma	7	22
31	Dementia	6	21
32	Eating disorders	9	20
33	Social isolation	6	19
34	Burnout	11	18
35	ptsd	6	15
36	Lockdown	8	13
37	Pregnancy	5	13
38	Insomnia	5	12
39	Stigma	6	12
40	Health disparities	6	10
41	University students	6	10
42	Post-traumatic growth	6	9
43	Refugees	5	7
44	Perceived social support	5	6

Source: Authors' calculation

The VOSviewer visualization map shows the bibliometric density network (Fig. 1a, Fig. 1b) and the co-occurrence of the keywords that occurred together in the same cluster and with a close power link between them.

The number of keywords (n = 44) was divided into 8 clusters based on a computer algorithm. The relationship lines show that each cluster is closely related. The size of the cluster area indicates the frequencies of the publications, and the colour indicates their value. Cluster 1 (red dots) consists of 13 keywords (adult, aged, comorbidity, epidemiology, female, human, male, obesity, psychology, quality of life, stigma, telehealth, telemedicine) and indicates high occurrence. This is followed by Cluster 2 (green dots), which consists of 12 keywords (anxiety, burnout, coping, depression, insomnia, nurses, physical activity, pregnancy, psychological distress, ptsd, social support, stress). Cluster 3 (blue dots) consists of 11 keywords (COVID-19, fear, health disparities, mental health, post-traumatic growth, public health, refugees, resilience, trauma, university students, well-being). It can be seen that the keywords of COVID-19 and mental health are related and there is a close relationship between them. Cluster 4 (yellow dots) consists of 4 keywords (dementia, loneliness, older adults, social isolation). Finally, there were a few keywords appearing in Cluster 5 (adolescents, eating disorders, lockdown), and Cluster 6 (perceived social support).

Figure 2 shows overlay visualization of the incidence co-occurrence of the keywords in the publications derived from the Scopus database. The darker the blue colour of the keywords, the higher the frequency of articles for a one-year period. The keywords coloured in yellow (telemedicine, epidemiology, obesity, social support, pregnancy, perceived social support) indicate a new area for further research.

Figure 3 demonstrates the networking and international collaboration related to the published articles linking "COVID-19" and "mental health" as keywords. High-income countries, including the United States, the United Kingdom, China, and Australia are the leaders in publishing research in the context of linking COVID-19 and mental health globally. It is evident that the United States are the leader in this area publishing scientific articles conducted in the subject area. The second highest number of articles come from the United Kingdom and China.

DISCUSSION

In today's world, it is not uncommon for people to experience mental health problems throughout their lives, ranging from minor, transient problems to serious mental disorders. Nearly 1 billion people worldwide suffered from some form of mental illness prior to the COVID-19 pandemic (4, 5).

In this study, we describe the issue of the COVID-19 pandemic and its relation to people's mental health based on the co-occurrence of the keywords from the Scopus database in the period 2020–2022 using keywords "COVID-19" and "mental health". Based on these main keywords search and graphical visualization by VOSviewer of the co-occurrence of all the keywords, we have identified power links and groupings of the occurred keywords into 6 common clusters.

Despite the limitations of the Scopus database in the context of coverage of social sciences and humanities journals and the

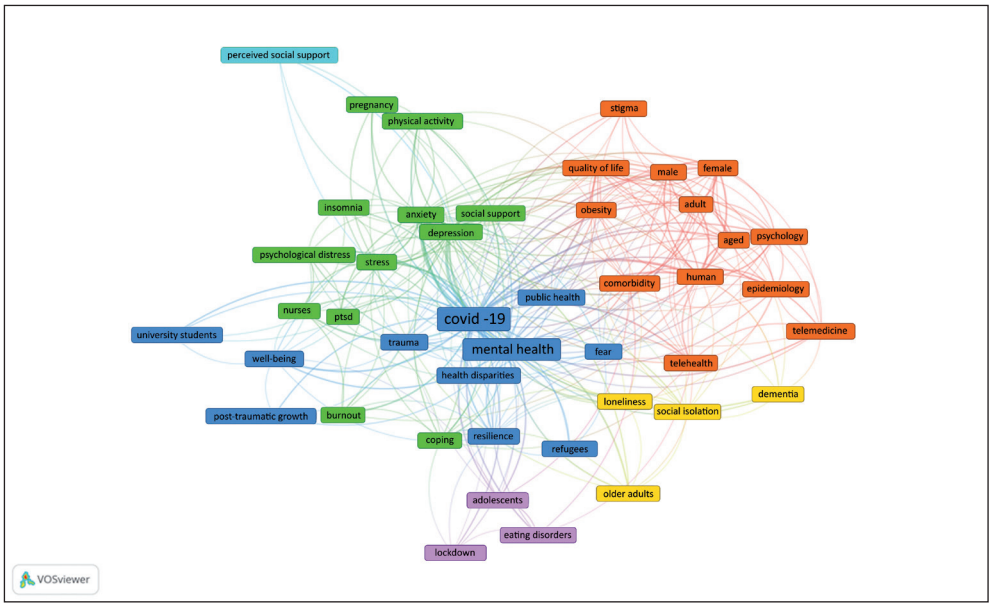

Fig. 1a. *VOSviewer network visualization of co-occurrence of all keywords.*

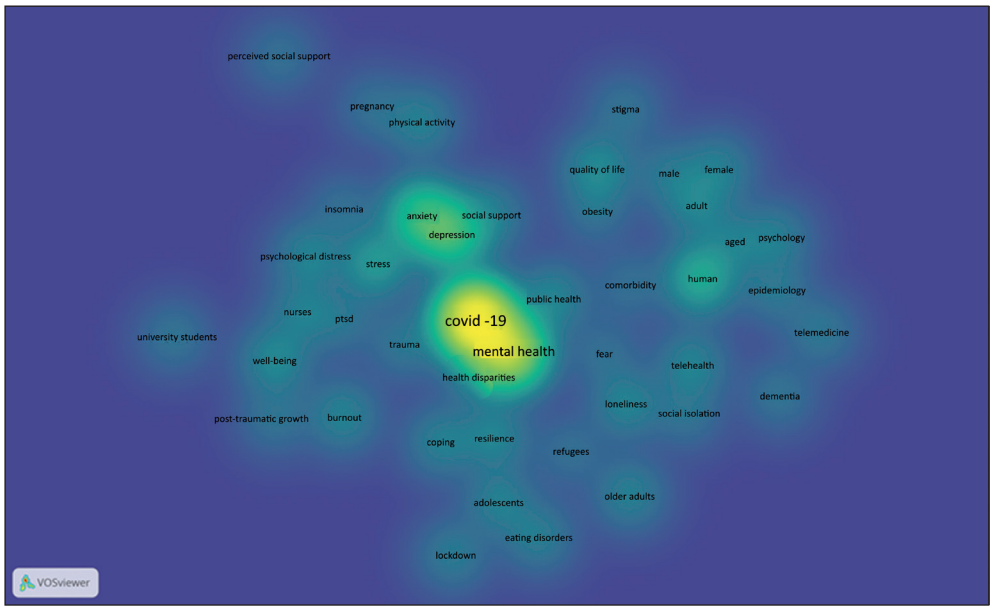

Fig. 1b. *VOSviewer density visualization of co-occurrence of all keywords.*

publication bias in research conducted in non-English languages (14), we did not evaluate the quality of the study articles, but visualized keywords that inform about possible potential areas of research and trigger discussion about the impact of the pandemic on mental health. Considering the clustering of co-occurrences of the keywords and epidemiological data, we conclude that the pandemic situation has dramatically affected people's mental health. The specific keywords defining mental health were "depression" and "anxiety" found very close to the main keyword "COVID-19". Our conclusion confirms that depression has become a common mental health problem and a major cause of the global burden of disease (7, 9, 15). Furthermore, there is evidence of growing number of people with mental health problems each year. Significant risks of mental diseases include death anxiety, fears of the future, economic problems related mainly to job loss, and social insecurity (7, 16, 17).

Many studies show that the death rate of people with mental illness is 2–3 times higher than that of the general population, while the average life expectancy is 13–30 years shorter compared to people without mental disorders (9).

In terms of confirmed deaths due to the pandemic, South, Central and North America have the highest number of confirmed cases, followed by Europe and South-East Asia. Africa has the lowest number of deaths of all continents with the total of 174,738 reported deaths (18).

The co-occurrence of the keyword "obesity" in relation to the keywords "anxiety" and "depression" confirms the results of studies on weight gain in humans during pandemics. It was significantly more prevalent in young men aged 45 years and over (19, 20).

Many people with mental health conditions experience isolation and marginalization from the society due to stigma and dis-

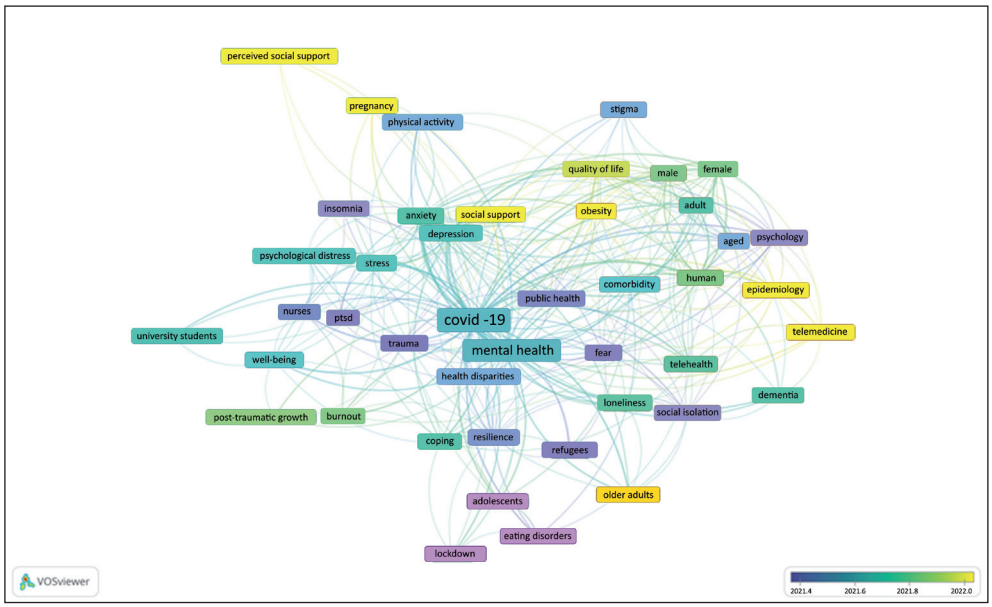

Fig. 2. *VOSviewer overlay visualization map for co-occurrence of all keywords.*

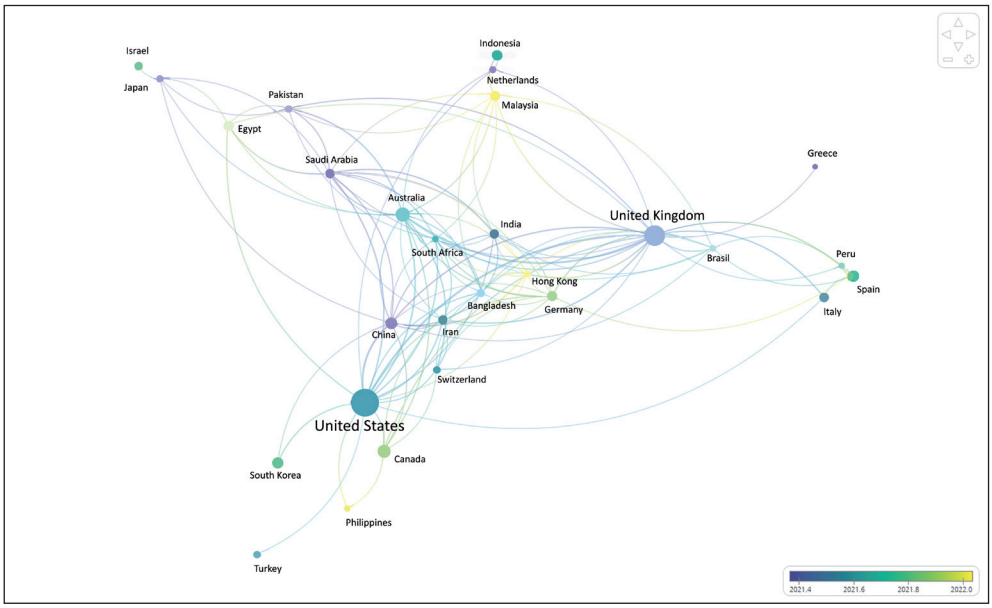

Fig. 3. *Visualisation of international collaboration appearing in VOSviewer network related to published articles linking "COVID-19" and "mental health".*

crimination (21). The keywords "stigma", and "social isolation", which occurred in the cluster of the main keywords, are among the most frequent words in the group of people with mental illness. This is often associated with a person's poor mental health. A significant increase in social isolation and loneliness in Europe, the United States and China were already observed before the pandemic. The pandemic quarantine measures such as curfews, gathering restrictions, travel bans, social events and others were the main triggers of global social isolation. Social anxiety is a rapidly growing human phenomenon worldwide, disproportionately affecting mental health (22) and leading to a "behavioural epidemic" caused by the COVID-19 pandemic (23, 24).

Through keyword visualization, we have confirmed that countries with large geographical area and high income, namely the United States, the United Kingdom, China, and Australia, are leaders in publishing articles focused on the impact of the COVID-19 pandemic on mental health.

Achieving the highest levels of mental health and well-being for everyone is the WHO goal for the 2019–2023 mental health program (GPW13) (3). The number and the level of risks affecting vulnerable population groups and in all work environments need to be improved in order to better prepare the population for possible future pandemics (22). This opens up a new topic of study: the urgent need for establishing preventative strategies that will protect people from anxiety and depression in these situations.

Limitation

The presented study, although offering valuable information about the negative influence of the recent pandemic, is not with-

out limitations. First and foremost, the study includes research publications using one selected database with a time limitation of one-day search targeting a selected field of medicine only. Scopus database limitlessly generates new articles everyday which can end up in vague final results. Focusing on one main field resulted in the most clear and straightforward results.

CONCLUSION

Our study provides a platform for critical thinking about the COVID-19 pandemic as an exceptional, critical period related to mental health and displays findings on the impact of the pandemic on mental health based on the occurrence of keywords in scientific articles of the Scopus database. According to the keywords used by the authors of the scientific publications, the COVID-19 pandemic had a significant impact on mental health, specifically on the incidence of anxiety and depression. The keywords "obesity", "dementia", "social isolation" and "loneliness" that appeared in connection with the main keyword "COVID-19" inform us of a new global problem in the form of a "behavioural epidemic". By developing structured, rational and systematized preventative measures targeting anxiety and depression, we can prevent risks to mental health associated with the new potential threats.

Acknowledgements

This paper was supported by grants KEGA 008UPJŠ-4/2020, 010UPJŠ-4/2021, 001UPJŠ-4/2024, 003UPJŠ-4/2024 of the Ministry of Education, Research, Development and Youth of the Slovak Republic.

Conflicts of Interest

None declared

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Received May 6, 2024
Accepted in revised form October 2, 2024