



Research Article

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Advances in Studies on Psychological Symptoms in Patients Surviving Covid-19: A Bibliometric Analysis

Carlos M. Pérez-Lara

Doris D. Lara-Malca

Luz A. Baltodano-Nontol

Jessica E. Vicuña-Villacorta

Liliana M. Haro-León

Julio A. Rodríguez-Azabache

Universidad César Vallejo,
Trujillo,
Perú

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Abstract

Backgrounds: Currently, more than 700 million people who have acquired the COVID-19 may develop the Post COVID Condition, especially women and people with a history of mental illness, who after the acute phase of the disease will experience physical and psychological symptoms which significantly affect their quality of life. The main objective of this study was to analyze and describe the trends of published research on psychological symptoms in survivors of COVID-19 from 2019 to 2023. *Method:* A bibliographic search was carried out using the Scopus database, where 370 original articles published up to February 9, 2023, were identified, analyzing characteristics such as the country with the highest production, the institution with the highest number of publications, scientific journals and works with the highest number of citations and impact. *Results:* The leading country in the number of publications was the United States with 83 articles (22.43%). The institution with the highest production was Rey Juan Carlos University. The journal with the highest number of articles published was the International Journal Of Environmental Research And Public Health from Switzerland, the total number of citations for all publications was 7,525, of which 10 papers had more than 100 citations. *Conclusions:* An analysis of the scientific production on psychological symptoms in patients surviving COVID-19 was carried out, finding a total of 370 published articles evidencing trends and gaps in scientific production in this field. *Limitations:* The continuous increase in publications and the change in statistics represent a limitation for the present study because the number of publications continues to increase daily.

Keywords: Post-acute sequelae of COVID-19; psychological symptoms; bibliometric analysis; citation count; mental health

1. Introduction

The post-acute sequelae of SARS-CoV-2 infection, commonly referred to as Post-Acute Sequelae of SARS-CoV-2 (PASC), Long-COVID, or Post COVID Condition (PCC), encompass a spectrum of chronic physical and psychological symptoms that significantly impact the quality of life for individuals who have contracted the virus. Certain demographic groups, including women, individuals with a history of poor health, pre-existing mental health conditions, asthma, obesity, and smokers, are at a heightened risk of developing this condition (Pan American Health Organization, 2022). With over 755 million confirmed cases of COVID-19 worldwide (World Health Organization, 2023), the gravity of this issue cannot be overstated due to the substantial number of people susceptible to PASC.

Numerous studies have demonstrated the presence of psychological symptoms, such as anxiety and depression, in patients who have successfully recovered from the acute phase of COVID-19 (Gouraud et al., 2021; C. Huang et al., 2021; L. Huang et al., 2021). Post-traumatic stress symptoms (L. Huang et al., 2022; Sekowski et al., 2021; Xiao et al., 2020), cognitive impairments, and personality changes (Mazza et al., 2021) may persist for several months, impeding various aspects of individuals' lives, including work, social interactions, and family relationships, thereby compromising their overall quality of life and emotional well-being (Hawlder et al., 2021; Malik et al., 2022).

Understanding the evolving landscape of publications and the intellectual framework surrounding the symptoms experienced by COVID-19 survivors is crucial. Such knowledge can serve as a roadmap for future research endeavors, enabling early detection and timely access to appropriate treatments.

This study contributes to the field by conducting a bibliometric analysis and methodological review of journal articles focusing on psychological symptoms among post-COVID-19 patients. While previous studies have systematically analyzed bibliometrics for psychological symptoms in families and healthcare workers in the context of the COVID-19 pandemic, less attention has been given to the patient perspective.

The main objective of the present study was to analyze and describe trends in published research on psychological symptoms in survivors of COVID-19 from 2019 to 2023, which requires scholars to identify knowledge gaps and direct the future direction of research.

2. Method

2.1 Data source and search strategy

A bibliometric analysis was carried out using articles published from 2019 to February 9, 2023, in journals indexed to the Scopus database library (www.scopus.com). We selected 2019 as the start date as the World Health Organization reported the first official cases of coronavirus disease (COVID-19) caused by the SARS-CoV-2 virus that year in the city of Wuhan, which subsequently spread to global level becoming the current Pandemic (World Health Organization, 2021).

The search and identification of the articles were carried out until February 9, 2023. The search strategy used was the algorithm: ("anxiety" OR "depression" OR "emotional trauma" OR "Posttraumatic Stress" OR "Posttraumatic Stress Disorder" OR "Adjustment Disorders" OR "PTSD" OR "Psychological Symptom" OR "mental health") AND ("Post-acute sequelae of COVID-19" OR "Post-COVID-19 conditions" OR "persistent COVID-19" OR " Long COVID-19" OR "COVID-19 survivors") from 2019, included within the article title, abstract, and keywords.

The inclusion criteria for the studies were: original published articles, source type journal, and English language. On the other hand, were excluded review articles, letters, editorials, notes, conference papers, brief surveys, book chapters, errata, and articles in the press.

2.2 Data Analysis

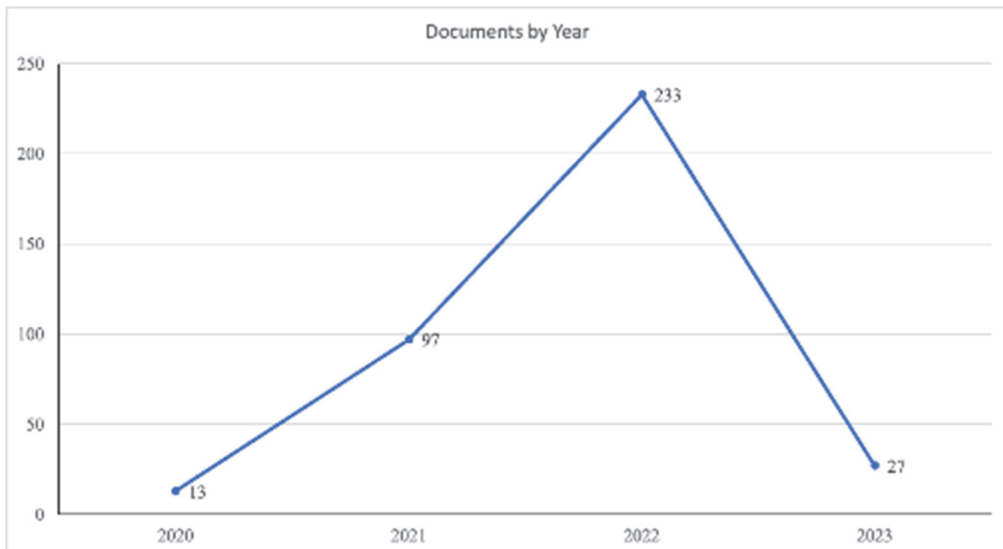
Bibliometric analysis is a statistical tool that allows a comprehensive vision of the advances in specific research areas through the quantitative analysis of the literature published in scientific databases (Donthu et al., 2021). With the selected articles, we created a database in Microsoft Excel that included: Names of the authors and year of publication, the title of the article, the name of the journal, affiliation, the number of citations, and country of publication. This database allowed the preparation of descriptive tables to identify the countries, institutions, and journals with the highest number of articles published, as well as the most cited articles. The bibliometric indicators used were: Standard Competition Classification (SCR), Citation Score 2021 (CS2021), SCImago Journal Classification (SJR), Quartiles (Q), and H Index. Using the VOSViewer Software (van Eck & Waltman, 2022) a network of thematic axes we designed with the co-occurrences of the keywords present in the articles found.

3. Results

3.1 Analysis of the production of publications

The total number of articles retrieved at the beginning was 520 documents. After excluding review articles, letters, editorials, notes, conference papers, brief surveys, book chapters, errata, and articles in press, we found 370 articles.

Although the pandemic began at the end of 2019, during 2020 the first 13 studies on the presence of psychological symptoms in the first survivors were published, by the year 2021 the number of studies increased significantly, reaching 98 published articles, for the year In 2022, the trend continued to increase, more than doubling the number of published studies, as shown in Figure 1. In 2022, the largest number of publications was observed, accumulating 63% of the total number of studies.



Note. The total number of publications of original studies was 370. The year 2023 only presents the results until February 9, 2023.

Figure 1: Number of articles published per year

3.2 Analysis of countries and affiliations

In total, we found that 71 countries have published studies regarding psychological symptoms in patients who have survived COVID-19, the United States has the highest number of publications with 83 (22.43%) articles, and Italy is in second place with 50 (13.51%) publications, and in third place is

China with 40 (10.81%) published works, these three countries have close to half of the published works 173 (46.76%), the United Kingdom and Spain also stand out, as can be seen in the ranking list of the first ten countries, presented in table 1.

Table 1: Classification of the top ten countries with the highest production of research papers on psychological symptoms in patients surviving COVID-19.

SCR	Country	Number of articles
1 st	United States	83
2 nd	Italy	50
3 rd	China	40
4 th	United Kingdom	40
5 th	Spain	37
6 th	Germany	16
7 th	Turkey	16
8 th	Australia	15
9 th	Canada	14
10 th	India	14

Note. SCR = Standard Competition Ranking.

Regarding the number of papers consistently published by the institutions, of the 160 institutions that have published, the first place is occupied by the Universidad Rey Juan Carlos of Spain with 15 (4.1%) published articles. The second and third place are occupied by the *Università Vita-Salute San Raffaele* of Italy with 10 (2.7%) articles published, and the *Imperial College London* of the United Kingdom with 10 (2.7%) publications respectively. In fourth place is *Aalborg Universitetshospital* with 9 (2.4%) publications, as is *Aalborg University* with 9 (2.4%) articles, both from Denmark. Unlike the classification by countries, in the classification of the first ten institutions, the United States appears in 7th position, as can be seen in Table 2.

Table 2: Classification of the top ten institutions with the highest production of research papers on psychological symptoms in patients surviving COVID-19.

SCR	Affiliation	Number of articles	Country
1 st	Universidad Rey Juan Carlos	15	Spain
2 nd	Università Vita-Salute San Raffaele	10	Italy
3 rd	Imperial College London	10	United Kingdom
4 th	Aalborg Universitetshospital	9	Denmark
5 th	Aalborg University	9	Denmark
6 th	Universitat de Barcelona	7	Spain
7 th	Harvard Medical School	7	United States
8 th	University College London	7	United Kingdom
9 th	IRCCS Ospedale San Raffaele	7	Italy
10 th	Universidad Complutense de Madrid	7	Spain

Note. SCR = Standard Competition Ranking

3.3 Analysis of journal

In the ranking of the first ten journals with the most publications on topics related to psychological symptoms in patients surviving COVID-19, the first place is occupied by the *International Journal Of Environmental Research And Public Health* with 17 (4.6%) papers published, followed by *Frontiers In Psychiatry* with 11 (3.0%) published studies, followed by the *Journal Of Clinical Medicine* also with 11 (3.0%) publications, these three journals are from Switzerland. The fourth place is occupied by *Plos One* from the United States with 9 (2.4%) articles published, and in fifth place, *Frontiers In Medicine* from Switzerland with 6 (1.6%) papers, as shown in Table 3.

Table 3: Classification of the top ten journals with the highest production of research papers on psychological symptoms in patients surviving COVID-19.

SCR	Source title	N	CS2021	SJR	Q	H	Country
1 st	International Journal Of Environmental Research And Public Health	17	4.5	0.81	1	138	Switzerland
2 nd	Frontiers In Psychiatry	11	4.6	1.28	1	81	Switzerland
3 rd	Journal Of Clinical Medicine	11	4.4	1.04	1	75	Switzerland
4 th	Plos One	9	5.6	0.85	1	367	United States
5 th	Frontiers In Medicine	6	3.4	1.18	1	54	Switzerland
6 th	Brain Behavior And Immunity Health	5	17.6	-	-	-	United States
7 th	Journal Of Personalized Medicine	5	1.8	0.76	2	32	Switzerland
8 th	BMJ Open	4	3.9	0.98	1	121	United Kingdom
9 th	JAMA Network Open	4	11.1	4.03	1	72	United States
10 th	Journal Of Medical Virology	4	18.8	2.66	1	137	United States

Note. SCR = Standard Competition Ranking, N = Numbers of articles, CS2021 = CiteScore, SJR = SClmago Journal Ranking, Q = Quartil, H = Index H.

3.4 Analysis of cites

The 370 papers published up to the search date have received 7,525 citations in total, however, it is necessary to note that 112 (30.3%) papers have not been cited, while 46 (12.4%) have been cited only once, leaving 212. (57.3%) publications with two or more citations. There are 10 articles with more than 100 citations, highlighting in the first place the study entitled 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study with 1,890 (25.1%) citations, corresponding to the authors C. Huang et al. (2021) published in the scientific journal *The Lancet*, the study with the second highest number of citations is *Anxiety and depression in COVID-19 survivors: Role of inflammatory and clinical predictors* with 630 (8.4%) citations, by the authors Mazza et al. (2020) published in the *Brain, Behavior, and Immunity* journal, third place is occupied by the study entitled *Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation* with 560 (7.4 %) citations, from Halpin et al. (2021) published by the *Journal of Medical Virology*, the ten most cited research papers have the majority of the total citations (61.9%), as can be seen in table 4.

Table 4: Classification of the first ten most cited research papers regarding psychological symptoms in patients surviving COVID-19.

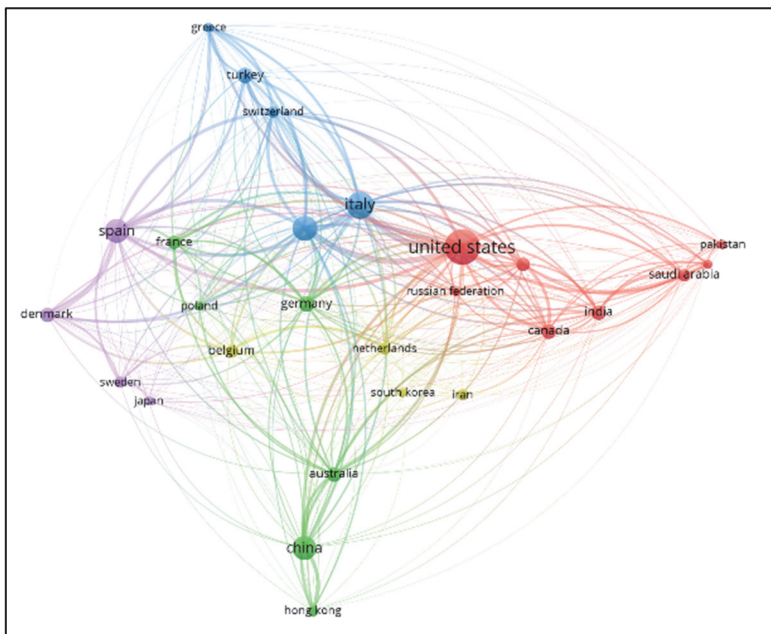
SCR	Autors	Title	Journal	Cites
1 st	C. Huang et al. (2021)	6-month consequences of COVID-19 in patients discharged from hospital: a cohort study	The Lancet	1890
2 nd	Mazza et al. (2020)	Anxiety and depression in COVID-19 survivors: Role of inflammatory and clinical predictors	Brain, Behavior, and Immunity	630
3 rd	Halpin et al. (2021)	Postdischarge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation	Journal of Medical Virology	560

SCR	Autors	Title	Journal	Cites
4 th	Al-Aly et al. (2021)	High-dimensional characterization of post-acute sequelae of COVID-19	Nature	414
5 th	L. Huang et al. (2021)	1-year outcomes in hospital survivors with COVID-19: a longitudinal cohort study	The Lancet	306
6 th	Xiong et al. (2021)	Clinical sequelae of COVID-19 survivors in Wuhan, China: a single-centre longitudinal study	Clinical Microbiology and Infection	293
7 th	Taquet et al. (2021)	Incidence, co-occurrence, and evolution of long-COVID features: A 6-month retrospective cohort study of 273,618 survivors of COVID-19	PLoS Medicine	209
8 th	Mazza et al. (2021)	Persistent psychopathology and neurocognitive impairment in COVID-19 survivors: Effect of inflammatory biomarkers at three-month follow-up	Brain, Behavior, and Immunity	131
9 th	Jacobs et al. (2020)	Persistence of symptoms and quality of life at 35 days after hospitalization for COVID-19 infection	PLoS ONE	124
10 th	Cai et al. (2020)	Psychological Distress and Its Correlates Among COVID-19 Survivors During Early Convalescence Across Age Groups	American Journal of Geriatric Psychiatry	102

Note. SCR = Standard Competition Ranking

3.5 Analysis of country collaborations

Figure 2 presents a map of collaboration networks between different countries with a minimum of five publications. The map shows a total of 27 countries, forming five collaboration clusters, the connections present normalized means. The United States cluster has the strongest collaboration with Canada, India, and Saudi Arabia (red), followed by Italy, Spain, and China. The strongest collaboration network was found between the United States and Italy. There are no collaboration networks with countries in Latin America and Africa.

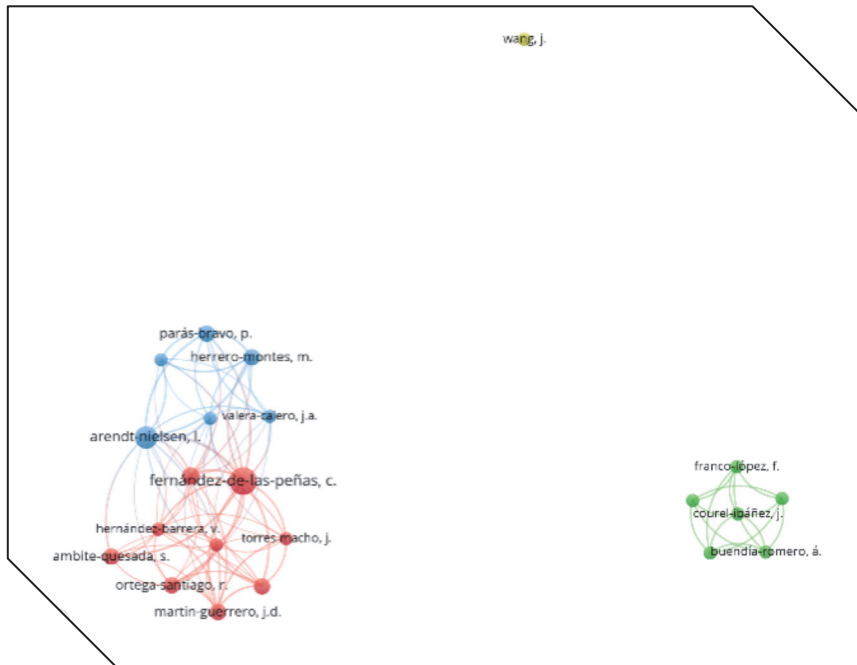


Note. Networks of country collaborations

Figure 2: Visualization networks of author collaborations

3.6 Analysis of author collaborations

Figure 3 shows three clusters of authors with three publications on psychological symptoms in post-COVID-19 patients. Although the number is still small, the most developed cluster is made up of mostly Spanish-speaking authors headed by Fernández-de-la-Peña, C., (Red), followed by Arendt-Nielsen, L. (Blue), with collaboration between both groups. The second cluster where Courel-Ibañez, J. (Green) stands out is under development, currently with six authors. The third cluster is made up of Wang, J. This may be due to the fact that the authors who do not appear have collaborated on up to two papers and therefore significant development of this group has not yet been observed.

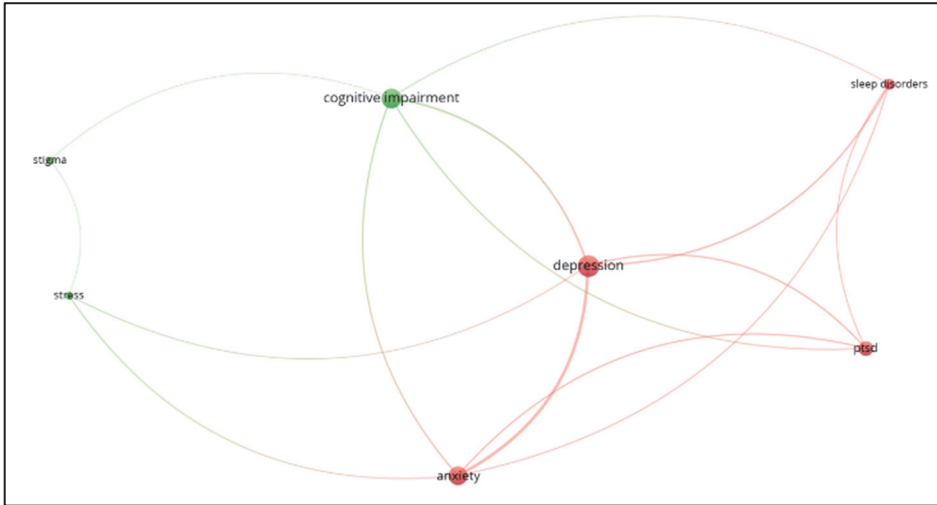


Note. Results obtained with authors and co-authors with three or more publications

Figure 3: Visualization networks of author collaborations

3.7 Analysis of the keyword co-occurrence cluster

The analysis of keyword co-occurrences enables the identification of themes and issues of interest to researchers. This analysis was performed by grouping and standardizing keywords. In Figure 4, three clusters of keywords can be observed. The primary cluster (in red) is comprised of "depression," directly associated with "anxiety," "sleep disorders," and "PTSD." In this cluster, the authors have focused their research on emotional distress. The second cluster (in green) is led by "cognitive impairment," followed by "stigma" and "stress." In this cluster, the authors are directing their attention towards cognitive functioning.

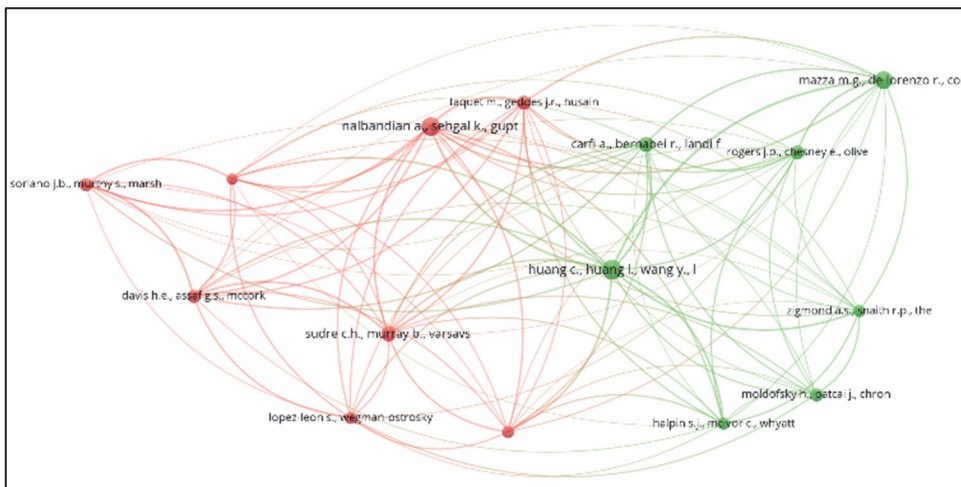


Note: The keyword co-occurrence analysis was conducted while considering a minimum of five occurrences of a word in the published works.

Figure 4: Standardized Keyword Co-occurrence Analysis

3.8 Co-citation Analysis

Co-citation is the citation of two separate publications in a third article (Small, 1973). The objective of this analysis is to identify the underlying relationship patterns among authors based on their publications (Feng et al., 2017). In Figure 5, it can be observed that two main streams of research exist. The first group in red represents studies that consider psychiatric symptoms as sleep disorders and emotional trauma. The second group in green addresses topics from the perspectives of emotions such as depression and anxiety.



Note: The co-citation analysis was conducted with a minimum of 20 citations for a cited reference.

Figure 5: Co-citation Analysis

4. Discussion

There is a time delay in research on the psychological symptoms present in patients who survived COVID-19 after the disease emerged, but the rapid increase in publications after a few months indicates an increasing concern about this topic. Research on this health problem still requires improved global cooperation among various authors, institutions, and countries. In future research on the pandemic, more attention should be paid to the psychological symptoms of survivors and vulnerable groups.

According to the main objective of the present study, which was to analyze and describe the trends of published research on psychological symptoms in patients surviving COVID-19, from 2019 to 2023, according to the results, we found 370 original published articles corresponding to 71 countries. The United States is the first country with 83 papers (22.13%), followed by Italy with 50 publications (13.33%). These results are consistent with those reported in previous analyzes on academic production on the issue of COVID-19 where the United States occupied the first place (Liu et al., 2021). However, the number of studies published on psychological symptoms in patients who have suffered severe COVID-19 still needs to be developed.

The institution with the highest number of publications was the *Universidad Rey Juan Carlos* of Spain with 15 (3.9%) publications. (Benedetti et al., 2022; Crispo et al., 2021; Mazza et al., 2020, 2021; Mazza, Palladini, et al., 2022; Mazza, Zanardi, et al., 2022; Rovere-Querini et al., 2020) This institution does not belong to one of the countries with the highest number of publications, is the institution that to date has been consistently working on the study of this problem that affects millions of people. Similarly, the journal with the largest number of publications was the *International Journal Of Environmental Research And Public Health* from Switzerland with 17 (10.6%) papers, (Gouraud et al., 2021; L. Huang et al., 2022; X. Huang et al., 2022; Murga et al., 2021; Sekowski et al., 2021; Wang et al., 2022; Yuan et al., 2021) both at the institution and journal level, were found few papers published at three years into the pandemic. The number of studies published per institution and journal is limited, which shows that much remains to be known about the effects of COVID-19 on mental health and how the Post COVID Condition may affect several months later.

The work with the most number of citations was titled 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study with 1,890 (24.8%) citations, an article published by the authors Huang et al., in 2021 (C. Huang et al., 2021) in *The Lancet* journal. This research is a cohort study that describes the evolution of post-COVID-19 physical and psychological symptoms, which shows the need for studies to identify the relationship between associated variables, validation of rehabilitation programs of various approaches, as well as others that make it possible to identify, explain, predict, and treat the psychological symptoms of patients who survive COVID-19. This work can serve as a guide for future studies; however, it is necessary to recognize that a single study cannot address all the possible characteristics of the sequelae at a psychological level, therefore that it is necessary to publish other authors that address this problem from different perspectives, both at a descriptive and therapeutic or support level.

The main clusters formed with the co-occurrences of the keywords are: the first cluster with the term's *depression, post-traumatic stress disorder, and insomnia*, and the second cluster made up of *fatigue, pain, and cognition impairment*. The absence of keywords related to treatment programs or therapeutic approaches can be observed, which makes evident the need to expand the studies in this direction, it is still unknown what other important psychological aspects for coexistence in society may be affecting the survivors of the COVID-19, and that can significantly impact family life, and social and work interactions.

The findings underscore the existence of knowledge gaps concerning the efficacy of programs aimed at enhancing these conditions, the psychological techniques and therapies that can contribute to symptom reduction and recovery, and ultimately, the enhancement of the quality of life for COVID-19 survivors. This, in turn, serves as a foundation for the development of novel public health policies aimed at addressing these issues.

This field is developing. Three years after the pandemic, many psychological functions affected

by COVID-19 and the Post COVID Condition, evolution, treatment, and how they can impact the patients and their families, are still unknown, especially if one takes into account that this disease causes significant loss of gray matter (Douaud et al., 2022) which in time could mean the early presence of neurodegenerative diseases such as dementia and Alzheimer's.

5. Implications

Knowing and understanding how scientific knowledge advances in a field allows professionals to make better decisions to establish associations and causalities and formulate approach proposals. With the passing of time, the presence of significant cognitive and emotional alterations due to COVID-19 and the Post COVID Condition is becoming evident, especially in those patients who suffered a severe infection, a situation that affects millions of people around the world. As a theoretical implication of the present study, the results have shown that advances in research are demonstrating an association between severe infection by COVID-19 and the manifestation of symptoms such as insomnia, post-traumatic stress disorder, depression, and cognitive deterioration, which have a great impact on the lives of patients. As a practical implication, the results will allow future researchers to strengthen advanced knowledge and integrate new findings based on early detection.

6. Limitations

The perpetual escalation in publications and the dynamic nature of bibliometric statistics pose notable constraints in the context of this investigation, owing to the unceasing surge in the volume of scholarly output. Furthermore, it is essential to underscore that this scrutiny exclusively concentrated on the Scopus database, introducing limitations regarding the comprehensiveness of the analyzed dataset. Lastly, during the course of the study, it became evident that authors employed divergent nomenclature when referring to the same medical condition, necessitating a meticulous standardization of keywords for the sake of clarity and consistency.

7. Conclusions

The psychological symptoms present in COVID-19 survivors have been gaining considerable attention from researchers globally. However, there is currently no bibliometric review on this topic. In this study, we analyzed the academic contributions regarding psychological symptoms as part of Post COVID conditions, highlighting the most influential research trends through a bibliometric review using data obtained from the Elsevier Scopus database.

A total of 370 articles listed in Scopus and published since 2019 were analyzed, all of which were selected using a specific search strategy. The methodology in this study consists of two main steps. Firstly, we identified the most relevant influential aspects of the publications, including the countries, institutions, journals, authors, and the most influential articles among those found. Secondly, we conducted a bibliometric analysis that provided insights through co-authorship visualization, keyword analysis, and co-citation analysis.

From the co-citation analysis, two closely interconnected research streams were identified. The first stream is focused on the study of psychiatric symptoms such as psychological trauma, cognitive impairment, and sleep disorders. This group provides information about mental disorders that may require pharmacological treatment due to their severity. The second research stream addresses emotional symptoms related to depression, anxiety, and stress. According to the CDC (2022), these streams are still in development, as Post COVID conditions manifestations are heterogeneous, and new symptoms are still being discovered in patients with various infection severities, from severe to moderate, mild, or even asymptomatic.

Our findings contribute to defining the direction of research concerning psychological symptoms as part of Post COVID conditions. This will assist scholars in focusing their attention and

research on less-explored areas and gaining a better understanding of this heterogeneous subject. Due to the societal importance of addressing psychological symptoms as part of Post COVID conditions, our results should be of significant interest.

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