Review Article

Pandemic Critical Care Research during the COVID-19 (2020-2022): A Bibliometric Analysis Using VOSviewer

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This paper has reviewed the global research on the pandemic critical care research during the COVID-19 from 2020 to 2022. To this end, a bibliometric and cluster analysis by full counting has been carried out using VOSviewer software and bibliographic data extracted from the Scopus database. The research found and studied 2778 documents. The types of research documents were limited to an article (81.46%), a letter (9.43%), an editorial (3.92%), a note (3.92%), a conference paper (0.90), and a short survey (0.04%). The results show an incessant increase in the number of research documents published and citations received during the COVID-19 pandemic. The U.S., U.K., Italy, and France have been shown to be the most productive countries, and there is a predominance of European institutions supporting and fostering research on pandemic critical care. Cecconi, M. (Italy) and Shankar-Hari, M. (U.K.) produced the highest number of research documents. Mapping of citation, co-citation, co-authorship, and keyword cooccurrence highlighted the hotspot, knowledge structure, and important themes. Citation dynamics for the top-cited research documents revealed static discourse. By reviewing the evolutionary trends of pandemic critical care research investigated factors, such as the influential works, main research topics, and research frontiers, this paper reveals the scientific literature production’s main research objectives and directions that could be addressed and explored in future studies. This paper reveals the scientific literature production’s main research objectives and directions that could be addressed and explored in future studies after reviewing the evolutionary trends of pandemic critical care research during the COVID-19 and the investigated factors, such as influential works, main research topics, and research frontiers.

1. Introduction

According to the World Health Organization, a health system’s three primary tasks are improving population health, providing financial protection against the expenses of illness, and reacting to people’s expectations [1]. All three of these functions may benefit from critical care. In the United States, the majority of hospitals have one or more critical care units (ICU). Despite accounting for just 5% of hospital beds, ICUs in the United States use 15% to 20% of hospital budgets, equating to 1% of GDP [2]. Coronavirus disease 19 (COVID-19) has offered unprecedented problems to the healthcare system, some of which may result in significant change [3]. As healthcare personnel and policymakers recognize, a successful critical care surge response must be nested within the broader care delivery paradigm [4]. The pandemic of COVID-19 has brought to light important aspects of disaster planning. These include strategic reserves of personal protective equipment, intensive care unit (ICU) devices, consumables, and medications at the national or regional level and efficient supply chains and usage processes [5]. ICUs must also be prepared to handle spikes in patient numbers, and staffing models in ICUs should account for demand changes. Creating, implementing, and updating preexisting ICU triage and end-of-life care standards is necessary. Remote links with diverse healthcare staff and regular contact with family should be included in daily workflow operations. The COVID-19 epidemic reminds us that we must also strive to improve in addition to our responsibility to care [6].

Researchers and scientists do research to help critically sick patients avoid problems and improve their outcomes. They are always looking for novel diagnostic and therapy alternatives for persons suffering from severe diseases and
trauma. Perioperative critical care, trauma, transfusions, modeling of critical care syndromes, life support therapies, patient-important outcomes, and health care delivery and informatics are areas of critical care research [7, 8].

The use of mathematical and statistical approaches to papers, books, and other forms of communication employed in the study of scientific publications is referred to as bibliometrics. Bibliometric approaches are often used to analyze scientific articles to discover research trends. Bibliometric techniques are a typical research tool for the systematic study of publications and have been used to quantify scientific progress in many areas of science and engineering [9, 10]. However, no bibliometric analysis of publications on pandemic critical care and COVID-19 has been published till now. As the COVID-19 pandemic has not been entirely under control and more knowledge should be obtained from these references, a bibliometric analysis is in critical need. Therefore, our study was performed timely to provide a broad understanding of pandemic critical care and future research directions.

2. Materials and Methods

The data for this paper were derived from the online version of the Scopus database. Bibliometric analyses are reflections of the coverage of their underlying databases in that the coverage basically specifies what is included in the study, and bibliometric assessment contextualizes these articles further against the database, which is likewise reliant on the coverage [11]. Scopus was established by Elsevier in 2004. Scopus, according to Elsevier, is the "most comprehensive overview of the world's research outputs," overseen by a team of subject matter experts. Scopus aims to build the biggest feasible database of high-quality research articles. Scopus thus varies from WoS in that WoS prioritizes number above quality, while Scopus seeks a balance between the two. Elsevier and Clarivate Analytics both provide subscription-based databases [12, 13].

The titles of some of the published articles in the Scopus database were checked for a list of the utilized keywords to confirm that the bibliographic data was relevant to the study subject. [TITLE-ABS-KEY ("critical Care" and covid*)] utilized a Wildcard (*) and a Boolean operator (OR) with a combination of keywords [TITLE-ABS-KEY ("critical Care" and covid*)]. Table 1 shows the preliminary findings, including articles, letters, notes, editorials, conference papers, and short surveys (2020-2022). As indicated in Figure 1, the findings were fine-tuned, and bibliometric data for all English-language research papers was acquired. Data for 2,778 articles (2020-2022) was downloaded into a Microsoft Excel spreadsheet in CSV format as the final result.

VOSviewer is a program that was used to create and visualize bibliometric networks. These networks comprise journals, researchers, or individual articles, and they were created based on citation, bibliographic coupling, co-citation, or co-authorship interactions [14]. Text mining capabilities are also included in VOSviewer, which was used to create and display cooccurrence networks of relevant phrases [15] retrieved from these 2,778 research documents.

Table 1: Preliminary research.

| Document type     | Number | 2020–2022 | Percent |
|-------------------|--------|-----------|---------|
| Article           | 2263   | 81.46     |
| Letter            | 262    | 9.43      |
| Editorial         | 109    | 3.92      |
| Note              | 109    | 3.92      |
| Conference paper  | 25     | 0.90      |
| Short survey      | 1      | 0.04      |
| Total             | 2778   | 100       |

When creating a map using bibliographic data, the Create Map wizard in VOSviewer gives you the option of using one of two counting methods. Full counting is used in this study. Another option is to use fractional counting. GraphPad Prism software was utilized to display annual numbers of publications.

3. Results and Discussion

Coronavirus disease 19 (COVID-19) has presented the healthcare system with unprecedented challenges, some of which may result in considerable change [5]. Healthcare professionals and policymakers realize that an effective critical care surge response must be nested into the broader care delivery paradigm. The COVID-19 pandemic has brought to light critical elements of catastrophe preparation. The COVID-19 outbreak serves as a reminder that we must strive to improve in addition to our obligation to care. Researchers and scientists do studies to assist critically ill patients in avoiding complications and improving their prognosis [16]. Bibliometric approaches are a common research tool used to analyze publications and evaluate scientific progress systematically [9]. As a result, our study was conducted at the appropriate moment to give a comprehensive picture of pandemic critical care and future research prospects.

3.1. Overview of Pandemic Critical Care Research (2020-2022). Table 1 shows the preliminary findings from 2020 to 2022, including articles, letters, notes, editorials, conference papers, and short surveys. A total of 2,778 research documents in English were utilized for this bibliometric study (2020–2022). The distribution of research production (2020–2022) is presented in Figure 2, where the year 2021 represented 53.88% of the total research related to critical care during the Corona pandemic. The number of papers for 2022 (N = 228) until the middle of March. The types of research documents were limited to an article (81.46%), a letter (9.43%), an editorial (3.92%), a note (3.92%), a conference paper (0.90), and a short survey (0.04%). The low number of conference papers may result from imposed travel restrictions and social distancing that limited scientific gatherings. It expects to increase due to the presence of electronic platforms that provide all communication needs, including meetings, seminars, and online events.
One hundred and twenty countries participated in the research related to pandemic critical care during COVID-19. The United States (31.5%), the United Kingdom (17.10%), Italy (8.24%), France (6.26%), Spain (5.62%), China (5.26%), Canada (5.22%), Australia (4.61%), India (4.39%), and Germany (4.21%) had more than a hundred scholarly discourses. The geographic density of research documents is shown in Figure 3. The top-productive organization is Harvard Medical School (N = 72), followed by Inserm (USA), University of Toronto (Canada), AP-HP Assistance Publique-de Paris (France), University of Oxford, Imperial College London, and King’s College London (UK) with a threshold of more than fifty research documents. Cecconi, M. and Shankar-Hari, M. produced the highest number of research documents (N = 14). Cecconi is affiliated to the Department of Anesthesia and Intensive Care, Humanitas Clinical and Research Center-IRCCS, Italy. In 2020, Maurizio Cecconi was labeled one of three “pandemic heroes” by the Journal of the American Medical Association. As Italy confronted the first epidemic in the West, his early dedication to knowledge exchange and information dissemination was critical in slowing the virus’s spread [17]. His research interest was on septic shock, hospital-acquired infections, the impact of frailty, use of Lopinavir-ritonavir and hydroxychloroquine, utilization of convalescent plasma, and noninvasive ventilatory support in critically ill patients with COVID-19 [18–21]. Shankar-Hari of King’s College London spent a lot of time researching how to improve outcomes in adult critically sick patients with sepsis and ARDS by integrating disease immunobiology to interventional trial design [22, 23].

3.2. Collaborative Research and Co-Authorship Network. Collaborative scientific research is a critical component of contemporary academic landscapes spanning disciplines and research sectors and a significant research issue. Scientific cooperation may be described as an interaction between two or more scientists that occurs within a social environment and allows the exchange of meaning and accomplishing tasks related to a mutually shared, superordinate purpose. Collaboration may be seen as a technique for addressing the rising complexity and specialization of scientific research and the need for inter-and multidisciplinarity within these networks. Complex issue resolution often transcends typical disciplinary boundaries or necessitates an interdisciplinary approach. From another perspective, collaborative research enables increased productivity, as shown when writers cooperate with many co-authors or diverse research teams [24, 25]. Only under these circumstances is it feasible to maximize efficiency and production. The majority of contemporary research is the result of collaborative efforts, as indicated by the fact that the majority of articles are co-authored by two or more scholars [26]. The overall objective of this research was to evaluate the development and structure of scientific collaboration networks indicated by articles published on pandemic critical care between 2020 and 2022 and visualizes these networks visually. The collaborative research and co-authorship network were evaluated on three levels: authors, institutions, and countries. 29248 authors participated in pandemic critical care research during the COVID-19. The networks of the
main scholars are shown in Figure 4. In certain networks, a central node exists that has a greater number of direct connections to other nodes. The benefit of this depiction of the major networks is that it enables a fast visualization of the major players and their relationships with one another. The significance of networks is determined by the size and...
number of their nodes and the thickness and number of the connections that connect them. 78 scholars were huddled using VOSviewer into three clusters with 46327 Links and a Total Link Strength of 367802. Authors from China assembled in blue the cluster. Shankar-Hari M. Shankar-Hari of King’s College London is also placed in the blue cluster. The green cluster was colonized mostly by researchers from the ISARIC Global Support Centre at the University of Oxford, United Kingdom. ISARIC is the International Severe Acute Respiratory and Emerging Infection Consortium [27]. Scholars in the red clusters are mainly from ISARIC4C (Coronavirus Clinical Characterization Consortium), UK [28]. It could be said that the collaborative network on critical care research during the COVID-19 pandemic is mostly occupied by British and Chinese researchers.

The top-collaborative organization is Roslin Institute, University Of Edinburgh, Liverpool Clinical Trials Centre, University Of Liverpool, National Heart And Lung Institute, Imperial College London, Division Of Epidemiology And Public Health, University Of Nottingham School Of Medicine, Centre For Medical Informatics, Usher Institute, University Of Edinburgh, Centre For Tropical Medicine And Global Health, Nuffield Department Of Medicine, University Of Oxford, Intensive Care Unit, and Royal Infirmary Edinburgh (UK). Figure 5 shows the collaborative network amongst countries (63) with a minimum number of five documents. US, UK, Italy, and China led 349 countries in their international collaboration in critical care research during the COVID-19 pandemic. 63 countries were clustered into six groups with 1292 Links and a Total Link Strength of 4480.

### 3.3. Research Impact: Citation Networking

Highly cited articles have a greater possibility of being seen, drawing the attention of other scholars. Evaluating the content of the most frequently referenced articles is quite beneficial for gaining insight into the trends in certain sectors in terms of research development. It may show scholars how to choose the right area or journal for their publication. Although citations are not a scientific technique for evaluating publications, they are an essential indicator for recognizing research parameters. The citation index, a form of bibliometric approach, indicates how often an article has been cited in other publications. Thus, citation analysis assists scholars in gaining a basic understanding of the articles and research that influence a certain area of study, and it is concerned with the investigation of the documents mentioned in academic works [29, 30]. Figure 6 and Table 2 show the most cited authors. Italy and the United Kingdom have the largest share in terms of the number of scientists’ citations. The top four Italian authors work on noninvasive respiratory assistance outside the critical care unit for Coronavirus-19 disease-related acute respiratory failure [31]. Abbasi et al. [32] shows that researchers related to many diverse academics obtain more citations than researchers with fewer connections. As a result, it is critical to collaborate in successful research networks in performance.

Seven clusters were built using bibliographic data for 86 authors with a minimum citation of eight. Italian authors anchor the red cluster. The green cluster is led by Baillie J.K. of MRC Human Genetics Unit, Institute of Genetics and Cancer, University of Edinburgh, UK. Baillie’s interest is in translational genomics in critical care medicine [33, 34]. Li J., Wang J., Zhang X., Li S. are the top-cited authors in the other clusters. Table 3 presents the twenty most-cited research documents. Eleven of them were directly on the subject of this bibliometric paper. The top-cited article was on the Italian experience in critical care during the COVID-19 outbreak and the prediction during emergency response. This paper was published in the Journal of the American Medical Association, which included four papers from the total papers in Table 4. The citation dynamics for research documents were elicited using overlay visualization. Figure 7 shows that all the top-cited articles began to have their knowledge impact since the year 2020, and it is noted that the nodes were not covered in yellow but instead maintained their purple color. Table 4 represents the top-impactful journals used in knowledge dissemination of
pandemic critical care along with their number of documents, number of citations, WOS’s impact factor, and Sopus’s Citescore. The top-cited one is the Journal of The American Medical Association, with a total citation of 4632. IRCCS San Raffaele Scientific Institute, University of Milan (Italy), University of Edinburgh, and University of Liverpool (UK) are the top-cited organizations. Figure 8 depicts the geographic distribution of impactful research on pandemic critical care. Countries based on citation were grouped into five clusters, but their grouping does not follow the geographical pattern. The Netherlands anchored the red cluster; while the United States led the group in green. China, South Korea, the United Kingdom, and Italy dominated the other clusters.

3.4. Co-Citation Analysis. In order to undertake a complete and systematic study of pandemic critical care research, we also concentrated on bibliometric co-citation analysis. Co-citation analysis connects journals, authors, and other documents using citation methods to determine the origins of the

| Rank | Author | Affiliation | N | C  | C/N  | TLS |
|------|--------|-------------|---|----|------|-----|
| 1st  | Cecconi M. | Department of Anaesthesia and Intensive Care Medicine, Humanitas Clinical and Research Centre-IRCCS, Italy | 14 | 5802 | 414.43 | 193 |
| 2nd  | Grasselli G. | Department of Pathophysiology and Transplantation, University of Milan, Italy | 11 | 3887 | 353.36 | 247 |
| 3rd  | Foti G. | General Intensive Care Unit, Emergency Department-ASST Monza-San Gerardo Hospital, University of Milano-Bicocca, Italy | 10 | 3148 | 314.80 | 119 |
| 4th  | Zangrillo A. | Department of Anaesthesia and Intensive Care Medicine, Humanitas Clinical and Research Centre-IRCCS, Italy | 10 | 2850 | 285.00 | 109 |
| 5th  | Dunning J. | National Heart and Lung Institute, Faculty of Medicine, Imperial College London, London, UK. | 13 | 2010 | 154.62 | 209 |
| 6th  | Baillie J.K. | MRC Human Genetics Unit, Institute of Genetics and Cancer, University of Edinburgh, UK | 15 | 1952 | 130.13 | 222 |
| 7th  | Harrison E.M. | Centre for Medical Informatics, Usher Institute, University of Edinburgh, UK. | 14 | 1950 | 139.29 | 209 |
| 8th  | Docherty A.B. | Centre for Medical Informatics, The Usher Institute, University of Edinburgh, UK. | 14 | 1938 | 138.43 | 209 |
| 9th  | Carson G. | Nuffield Department of Clinical Medicine, ISARIC Global Support Centre, Centre for Tropical Medicine and Global Health, University of Oxford, Oxford, UK. | 11 | 1935 | 175.91 | 196 |
| 10th | Halpin S. | Academic Department of Rehabilitation Medicine, Leeds Institute of Rheumatic and Musculoskeletal Medicine, School of Medicine, University of Leeds, UK. | 10 | 1935 | 193.50 | 182 |

N: number of publications; C: citations; C/N: citation average; TLS: total link strength.
| Rank | Article                          | Title                                                                 | Journal                  | Citation | REF |
|------|---------------------------------|-----------------------------------------------------------------------|--------------------------|----------|-----|
| 1st  | Grasselli G. [35]               | Critical care utilization for the COVID-19 outbreak in Lombardy, Italy: early experience and forecast during an emergency response. | Journal of the American Medical Association | 2596     | [35]|
| 2nd  | Helms J. [36]                   | High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study | Intensive Care Medicine | 1305     | [36]|
| 3rd  | Docherty A.B. [37]              | Features of 20,133 UK patients in hospital with COVID-19 using the ISARIC WHO clinical characterisation protocol: prospective observational cohort study | The BMJ                  | 1263     | [37]|
| 4th  | Grasselli G. [38]               | Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the Lombardy region, Italy | JAMA - Journal of the American Medical Association | 1082     | [38]|
| 5th  | Petrilli C.M. [39]              | Factors associated with hospital admission and critical illness among 5279 people with Coronavirus disease 2019 in New York City: prospective cohort study | The BMJ                  | 1068     | [39]|
| 6th  | Lodigiani C. [40]              | Venous and arterial thromboembolic complications in COVID-19 patients admitted to an academic hospital in Milan, Italy. | Thrombosis Research      | 1001     | [40]|
| 7th  | Kong M. [41]                    | Multisystem inflammatory syndrome in U.S. children and adolescents | New England Journal of Medicine | 935      | [41]|
| 8th  | Alhazzani W. (2020)             | Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19) | Intensive Care Medicine | 918      |     |
| 9th  | Llitjos J.-F. (2020)            | High incidence of venous thromboembolic events in anticoagulated severe COVID-19 patients | Journal of Thrombosis and Haemostasis | 601      |     |
| 10th | Liang W. (2020)                 | Development and validation of a clinical risk score to predict the occurrence of critical illness in hospitalized patients with COVID-19 | JAMA Internal Medicine | 537      |     |
| 11th | Cook T.M. (2020)                | Consensus guidelines for managing the airway in patients with COVID-19: guidelines from the difficult airway society, the Association of Anaesthetists the Intensive Care Society, the Faculty of Intensive Care Medicine and the Royal College of Anaesthetists | Anaesthesia | 454      |     |
| 12th | Pereira M.R. (2020)             | COVID-19 in solid organ transplant recipients: initial report from the US epicenter | American Journal of Transplantation | 419      |     |
| 13th | Cai Q. (2020)                   | COVID-19: abnormal liver function tests | Journal of Hepatology | 390      |     |
| 14th | White D.B. (2020)               | A framework for rationing ventilators and critical care beds during the COVID-19 pandemic | JAMA - Journal of the American Medical Association | 380      |     |
| 15th | Spiezia L. (2020)               | COVID-19-related severe hypercoagulability in patients admitted to intensive care unit for acute respiratory failure | Thrombosis and Haemostasis | 365      |     |
| 16th | Lippi G. (2020)                 | Cardiac troponin I in patients with coronavirus disease 2019 (COVID-19): evidence from a meta-analysis | Progress in Cardiovascular Diseases | 365      |     |
| 17th | Dowd J.B. (2020)                | Demographic science aids in understanding the spread and fatality rates of COVID-19 | Proceedings of the National Academy of Sciences of the United States of America | 362      |     |
| 18th | Murthy S. (2020)                | Care for Critically ill Patients with COVID-19. | JAMA - Journal of the American Medical Association | 361      |     |
| 19th | Spyropoulos A.C. (2020)         | Scientific and standardization committee communication: clinical guidance on the diagnosis, prevention, and treatment of venous thromboembolism in hospitalized patients with COVID-19 | Journal of Thrombosis and Haemostasis | 334      |     |
| 20th | Brenner E.J. (2020)             | Corticosteroids, but not TNF antagonists, are associated with adverse COVID-19 outcomes in patients with inflammatory bowel diseases: results from an international registry | Gastroenterology         | 330      |     |
field and its overall structure. The research is based on previous works to determine where a certain field began [42, 43]. To solve the following study topic, we performed co-citation analysis to identify the field’s core, peripheral, and bridging researchers, and how has the organization evolved over time. Co-citation analysis of the 110 most co-cited authors (visualized in Figure 2) from 2020 to 2022 revealed three clusters. The first cluster (represented in green in Figure 9) consisted of 43 articles. Based on citations, links, and total link strength, the most influential authors in Cluster 1 were Grasselli, G., Arabi, Y.M., Alhazzani, W., Zanella, A., and Mcgoogan, J.M. Researchers in this cluster worked on the guidelines, response, utilization, resources, operationalization, and baseline parameters in pandemic critical care [44–47]. Wang, Y. Li, X., Hu, Y., Zhang, L., and Huang, C. are the to-cited authors in the red cluster. The authors identified the clinical characteristics and outcomes of critically ill patients with COVID-19 [48, 49]. Authors in the blue cluster worked on novel diagnostic and therapy alternatives for COVID-19 patients admitted to ICU [50]. It was noted that the research areas were not defined by clear knowledge boundaries and an intertwining between the three clusters was observed. This is explained by the fact that critical care during the pandemic received research and joint citation of an estimated number, which were insufficient to frame the well-defined research areas due to the short period. Nonpandemic critical care researchers are constantly on the lookout for better diagnostic and therapeutic approaches for patients suffering from severe diseases and trauma. Nonpandemic critical care research fields include perioperative critical care, trauma, transfusions, modeling of critical care syndromes, life support therapies, patient-important outcomes, and health care delivery and informatics [8].

3.5. Lexical Analysis: Keywords’ Cooccurrence. The following analysis was a coword analysis, with a word as the unit of analysis. Coword analysis is a bibliometric technique that identifies relationships between concepts that appear in the same title, abstract, or keyword. The advantage of this strategy is that it can generate a field and structure from the coword. However, the drawback is that words can take on a variety of forms and interpretations. The core premise of coword analysis is that words that frequently occur in documents may imply related concepts. Among the bibliometric methods, coword analysis is the only one that generates

| Rank | Journal                                      | N  | C      | IF   | Citescore |
|------|------------------------------------------------|----|--------|------|-----------|
| 1st  | JAMA - journal of the American Medical Association | 9  | 4632   | 56.30| 24.8      |
| 2nd  | Intensive care medicine                       | 24 | 3095   | 17.44| 4.5       |
| 3rd  | The BMJ                                       | 8  | 2750   | 39.890| 4.0       |
| 4th  | Thrombosis research                           | 9  | 1250   | 3.944| 6.6       |
| 5th  | Journal of thrombosis and hemostasis          | 6  | 1180   | 5.824| 11.3      |
| 6th  | New England journal of medicine               | 5  | 1094   | 91.245| 80.6      |
| 7th  | Anesthesia                                    | 22 | 1032   | 6.955| 10.1      |
| 8th  | Critical care                                 | 57 | 994    | 9.372| 10.1      |
| 9th  | Lancet respiratory medicine                   | 17 | 882    | 30.700| 43.7      |
| 10th | American journal of transplantation           | 7  | 775    | 8.086| 11.4      |

N: number of publications; C: citations; IF: impact factor.

Figure 7: Citation dynamics for twenty research documents.
similarity metrics based on the actual text. Coword analysis scans keywords, titles, and abstracts to produce a semantic map of the field and demonstrate the key constructions around which the field is formed, historically and currently. Coword analysis has developed into a strategically important method for knowledge discovery in databases [51, 52]. We used the same database for the coword analysis that we used for the co-citation study. Only 265 of the 3785 keywords met our criterion of appearing at least five times. Figure 10 shows the overlay visualization of keywords co-occurrences and their survival patterns during 2020 and 2021. 2022 was not included in the analysis. According to the color, scale, and frames Figure 11 with yellow color are emerging keywords. Five groupings emerged from the investigation. “COVID-19”, “critical care”, “pandemic”, “intensive care”, and “mortality” were the strongest phrases in terms of both number of linkages and total link strength. There were a total of 2,949 links and a total link strength of 8299 in all five clusters.

In Cluster 1 (green), the two most dominant words were COVID-19 and mortality. Cluster 2 (red) dealt with pandemic intensive care. Cluster 3 focused on mechanical ventilation, ARDS, pneumonia, and respiratory failure, which emerged as highly visible keywords. Public health and epidemiology anchored the keywords in cluster four (yellow). Cluster five was about mental health, nursing, rehabilitation, and stress.

Narrowing in on the specific topics identified by the coword analysis, besides the previously mentioned clusters, inter and intracluster were recognized as follows:
4. Conclusion

The global Coronavirus disease 2019 (COVID-19) pandemic has resulted in an influx of acute critical illness patients requiring basic and advanced life support in the intensive care unit [53]. To expand critical care capacity and maximize safety for everybody, critical care leaders have battled with difficult decisions about which services should be emphasized, which should be curtailed, and which should be stopped in preparation for the expected surge of patients with COVID-19 [54]. Although critical care research is always vital, it is a top priority worldwide during the COVID-19 pandemic. Quickly assembled or existing research teams, a responsive financing mechanism, speedy ethical and contract approval, and the commitment of research and bedside staff are all required to prioritize pandemic-specific research effectively [55]. To increase our understanding of pathophysiology, immunology, diagnosis,
5. Limitations of the Study

This was the first attempt to map the pandemic critical care studies during the COVID-19 epidemic. However, there are certain limits to our bibliometric analysis to consider. For example, we only used one database (Scopus) and assessed impact based on Elsevier-covered citations. As a result, this procedure was constrained by the indexing requirements imposed by these databases and did not include all scientific journals [58]. Because pandemic critical care research during the COVID-19 is still in its early stages, it will take time for studies to be recognized and cited. We included peer-reviewed papers published in English to ensure sample homogeneity. Other publications in different languages would be useful in the future. Given that this is a young and rising topic, we established a minimal threshold level and built clusters based on that threshold; this is a limitation of this bibliometric research because some potentially intriguing publications may have been eliminated.

Data Availability

Data is available upon request.

Conflicts of Interest

Author declares no conflict of interest.

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