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Original Article

Bibliometric analysis of pediatric extracorporeal membrane oxygen literature

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Abstract

Aim: Consistent innovation is essential given the crucial necessity of extracorporeal membrane oxygenation (ECMO) in patients with respiratory and cardiovascular illnesses that are life-threatening. In the literature so far no bibliometric analysis on pediatric ECMO has been done. We aim to undertake a bibliometric review of the ECMO literature to inform evidence-based innovation, emphasizing key trends and advancements in pediatric ECMO.
Materials and Methods: The Web of Science (WoS) database was used to retrieve articles about pediatric ECMO that were published between 1970 and 2022, and these articles were then examined using statistical and bibliometric techniques. Effective analysis and trending topics were identified using network visualization maps.
Results: The search for pediatric ECMO literature turned up 726 documents. The publications received 7984 total citations, with an average of 11 citations per publication. The Hirsch (H)-Index was 45, and articles made up 55.51% of the publications. The pediatric ECMO papers received an average of 18.03 citations per article, for a total of 7267 and with 44 H-index. The highest publishing year was 2020 (n=80). The majority of the articles (67.906%) originated in the United States. The other top 5 nations were Canada (4.132%), Italy (3.581%), Australia (3.168%), China (3.030%), and Germany (2.893%).
Conclusion: This article can be a useful resource for investigators concerning global output for pediatric ECMO use. The United States ranked first in the number of publications and citations. With the increasing number of publications and implementation, ECMO needs to become more widespread around the world.

Keywords: ECMO, pediatric extracorporeal membrane oxygenation, bibliometric analysis

INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) is an advanced, life-supporting therapy that focuses on the lungs and heart when respiratory and/or cardiovascular failure occurs that is reversible and resistant to conventional therapy (1,2).

ECMO aims to provide a suitable physiological environment in the process of treating the underlying causes of respiratory and/or circulatory failure and normalizing respiratory and circulatory functions. ECMO is a supportive and bridging therapy for diagnosis, clinical decision, recovery, and transplantation while saving the patient time (3). Indications and use of ECMO have increased significantly over the past decade in children as well as adults. Respiratory support treatment can be given in cases of hypoxemia and respiratory failures such as difficult airway surgeries, severe asthma attacks, bronchopleural fistula, and resistant ARDS in children (4,5). Also, ECMO is applied in persistent pulmonary hypertension, congenital pneumonia, meconium aspiration syndrome, and congenital diaphragmatic hernias in the neonatal period (1).

Looking at the historical development of ECMO, Hill et al. first described it in 1971 for an adult patient with post-traumatic ARDS (6), and in 1976 Robert Bartlett et al. reported it for a newborn suffering from meconium aspiration syndrome (7). The Extracorporeal Life Support Organization (ELSO) was founded in 1989. Since this year has been working on the development and dissemination of ECMO in children and adults. It is an organization where records are kept regularly in terms of ECMO indication and results in all ECMO centers around the world. According to these records, pediatric ECMO centers and their practice have increased over the years (8). In this context, neonatal ECMO for respiratory failure accounts for 43% of the ELSO registry, which includes 25 years of patient records from both

adult and pediatric ECMO patients (9). The number of ECMO centers has increased dramatically during the past decade due to the high mortality possibilities of ECMO application. There is an increasing tendency towards specialization in this field. As a result, we have been witnessing significant advances in the vital role of ECMO technology in the last decade (10,11). The use of ECMO in neonatal and pediatric populations has increased with the aid of technological advances such as circuit design and cannulation procedures (12,13).

A general analysis of the publications made on a subject so far determines the framework of that subject and also provides a basis for expanding its scope in the future. For this purpose, bibliometric analyzes are performed. The bibliometric data analysis method is used as a research model with qualitative and quantitative data to review the scientific literature on a specific subject and research area. Large-scale scientific data can be accurately examined and analyzed with the bibliometric analysis technique. With this method, on the axis of various research parameters such as studies on a subject, number of publications, publication years, publishing countries, general characteristics, authors and institutions, co-authorships, national and international collaborations, keywords, fields of study, institutions, citations, journals, methods, and examples; the features and scientific data of the articles can be analyzed mathematically and statistically. In this way, it shows the developments, advances, trends, new perspectives for future studies, references, and bases in a research field and where the subject comes from, and where it is going. At the same time, the relations between the publications are determined numerically by examining the individual or institutional publications in certain periods and regions. Visualizing the results of the analysis of the information contributes to the understanding and prediction of the density of the study areas, future trends, and research areas. They give an idea about which factors such as field of study, journals, and associations have an impact on the publication process. While exploring the intricacies of the evolutionary process in a particular scientific field, also illuminates its limits (14). Bibliometric analyses have already been undertaken in various fields, including ECMO in adults (14,15). Today, publications related to pediatric ECMO are increasing in line with their application areas and numbers, thanks to the developing technology and knowledge (2). However, except for reviews, according to our knowledge, there is no bibliographic study in the field of pediatric ECMO yet (16). Because the literature has changed considerably in the previous two decades, future evidence-based advancement depends on comprehending these changes and the resulting trends. Given the critical importance of ECMO in patients with life-threatening respiratory and cardiovascular diseases, it is critical that innovations consistently increase scientific knowledge. In this study, we aim to highlight evidence-based innovations, key trends, and developments in pediatric ECMO. For this, we performed a bibliometric analysis of the pediatric ECMO literature.

MATERIALS AND METHODS

The study complied with the Helsinki Declaration, which was revised in 2013. The ethics committee waived the study approval because this study was a literature survey. Typically, no ethical approval is needed for bibliometric-type studies because there are no human or animal participants.

The first step in our bibliometric work was to select the best database to use to obtain relevant documents. We applied a bibliometric method using the Web of Science (WoS) Core Collection and analyzed documents on pediatric ECMO. The time frame for the study was 1970–2022. We carried out this study to retrieve data about the journals with a dataset as: ‘’ECMO pediatric (Title)’’ or ‘’Extracorporeal Membrane Oxygenation Pediatric (Title)’’ or ‘’Extracorporeal Membranous Oxygenation Pediatric (Title)’’ or ‘’Extracorporeal Membranous Oxygenation Pediatric (Title)’’ or ‘’Extracorporeal Membrane Oxygenation (Title)’’ or ‘’ECMO and Pediatric/Child’’ in the Web of Science (WoS) search engine. All of the WoS indexes, including SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, and ESCI, were searched.

For more accuracy, English words from the United Kingdom and the United States are included. Data was exported from the obtained literature into Microsoft Excel. The data that was exported contained information on the yearly increases in publications, document kinds, languages, countries, authors, institutions, journals, and citations. To construct network visualization maps in the figures, the acquired literature was also exported to the VOS viewer software (version 1.6.18 for Microsoft Windows).

In this study, the publication types of the current literature, main research areas of the publications, the most publishing countries, the number of citations, the H indexes for the most publishing countries, the most cited keywords, the most published journals, the total publications related to pediatric ECMO and citations were analyzed bibliometrically. Total publications and citations by year were visualized. Network visualization map of co-authorship among countries with a minimum of one publication, network visualization map of citation map among countries with a minimum of one publication, citation visualization map among authors with a minimum of seven publications and 10 citations; and keyword visualization map of articles with a minimum of five mentions on pediatric ECMO was also created.

The number of citations and the Hirsch (H) index were used to gauge the quality of publications. To prevent misunderstanding, both citation analysis and data export were completed on the same day (October 14, 2020).

RESULTS

The search query found 726 documents in pediatric ECMO literature. The publications had an average of 11 citations per article and 7984 citations total. The H index was 45. 55.10% of the publications were articles. The articles on pediatric ECMO

had an average of 18.03 citations per article and 7267 citations total. The H-index was 44. Even if the current study searched the publications in the period between 1970 and 2022, the first article was published in 1987. The distribution of publications is shown in Table 1.

Table 1. Publication types of the current literature on pediatric ECMO

Document Types	n	% of 726
Article	403	55.510
Meeting Abstract	211	29.063
Proceeding Paper	48	6.612
Review Article	46	6.336
Editorial Material	32	4.408
Letter	29	3.994
Early Access	9	1.240
Correction	5	0.689

Most of the publications were published, especially in the last 20 years. Most articles were published in the year 2020, with 80 (11.019%) records; 2021 contained 77 (10.606%) records, which was the second-highest publication year. Figure 1 shows the distribution of documents published on pediatric ECMO research during 1987–2022.

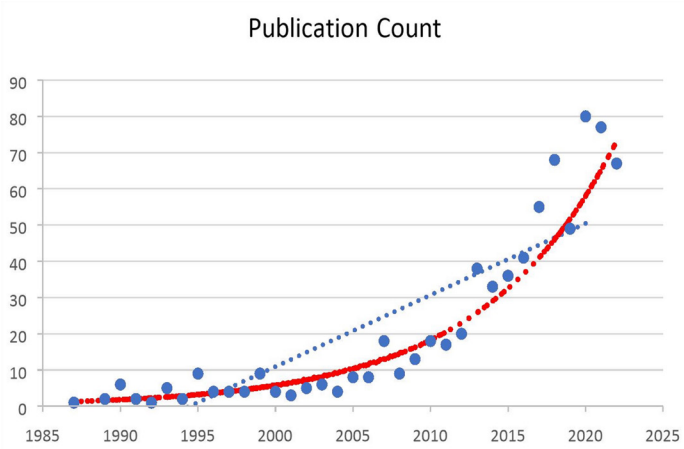

Figure 1. Graphics of total publication by years between 1985-2022. Red dotted line express the moving median. redline expresses the trendline

We see that the number of publications has increased gradually over these years. Figure 2 shows the distribution of citations and publications by year for pediatric ECMO research during 1970–2022. Here, we see that the increase in the number of publications is accompanied by the increase in the number of citations.

Most of the publications on pediatric ECMO were in the research fields of general internal medicine (33.884%) and pediatrics (32.369%) (Table 2).

Most of the articles were from the United States (n=493; 67.916%). Canada (n=30;4.132%), Italy (n=26;3.581%), Australia (n=23; 3.168%), China (n=22; 3.030%), and Germany (n=21; 2.893%) were the other top 5 countries on pediatric ECMO publications. The United States had the highest citation numbers and H index. Canada, the UK, Australia, and Italy are in the top four after the US (Table 3).

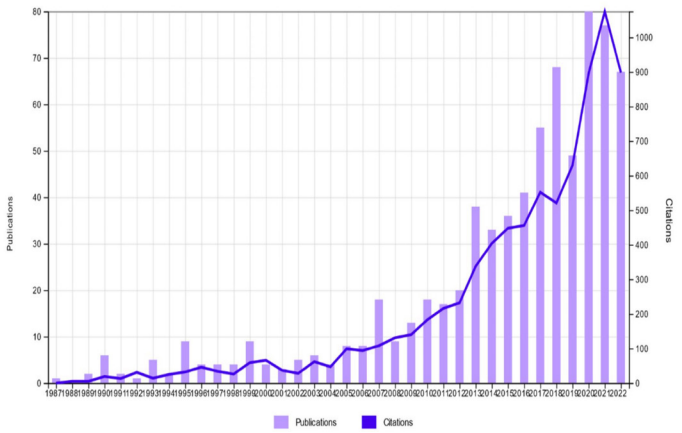

Figure 2. Graphics of total publications and citations by year, 1970–2022

Table 2. List of main research areas of publication on pediatric ECMO

Research fields	n	% of 726
General Internal Medicine	246	33.884
Pediatrics	235	32.369
Cardiovascular System Cardiology	144	19.835
Transplantation	134	18.457
Surgery	114	15.702
Engineering	92	12.672
Respiratory System	78	10.744
Hematology	20	2.755
Anesthesiology	11	1.515

Table 3. List of mostly published countries, number of citations, and h indexes for the mostly publishing countries on pediatric ECMO

Countries/Regions	n	% of 726	Number of Total Citations	H Indexes
The United States	493	67.906	6372	42
Canada	30	4.132	651	12
Italy	26	3.581	212	8
Australia	23	3.168	434	9
China	22	3.030	200	7
Germany	21	2.893	181	7
Netherlands	21	2.893	150	8
England	20	2.755	219	10
Singapore	15	2.066	290	7
France	13	1.791	55	4
Taiwan	13	1.791	153	6
Turkey	12	1.653	31	3
Japan	11	1.515	55	5
Spain	11	1.515	29	2
Austria	10	1.377	50	4

Network Maps

The network visualization map of co-authorship among countries with a minimum of one publication in pediatric ECMO is presented in Figure 3. Collaboration can be seen as lines connecting different countries. Stronger partnerships are represented by thicker lines. A larger font or circle size indicates greater international cooperation among the countries represented. The relative strength of the publication score is

shown in color groups. Here we see that the US has developed the most co-authorship and plays a central role.

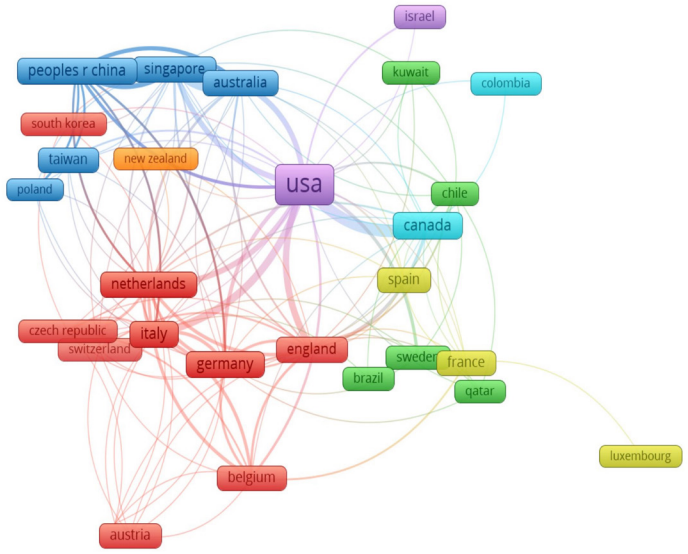

Figure 3. Network visualization map of co-authorship among countries with a minimum of one publication in pediatric ECMO

Figure 4 depicts the network visualization map of citations among countries with a minimum of one publication on pediatric ECMO. Collaboration can be seen as lines connecting different countries. Stronger partnerships are represented by thicker lines. A larger font or circle size indicates greater international cooperation among the countries represented. The relative intensity of the publishing score is shown by three color groups. Here we can state that the US plays a central role in the citation.

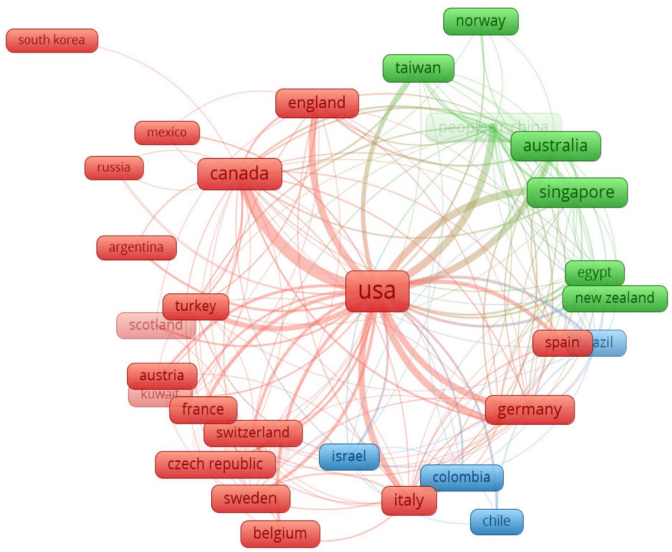

Figure 4. Network visualization map of citation map among countries with a minimum of one publication in pediatric ECMO

The citation visualization map among authors with a minimum of seven publications and 10 citations on pediatric ECMO can be seen in Figure 5. Countries are connected by lines that show citations. Authors represented by larger font or circle sizes generally had more citations. The top 27 authors on the topic have been chosen concerning increased visibility.

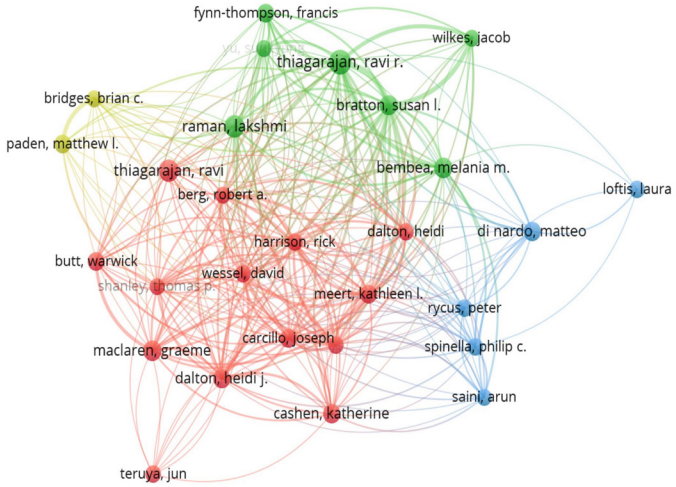

Figure 5. Citation visualization map among authors with a minimum of seven publications and 10 citations on pediatric ECMO

The keyword visualization map of articles with a minimum of five mentions of pediatric ECMO is shown in Figure 6. Keyword analysis was evaluated using cluster analysis, the topics concerning pediatric ECMO formed clusters in five different colors. Indicators of occurrence relations in publications include lines linking.

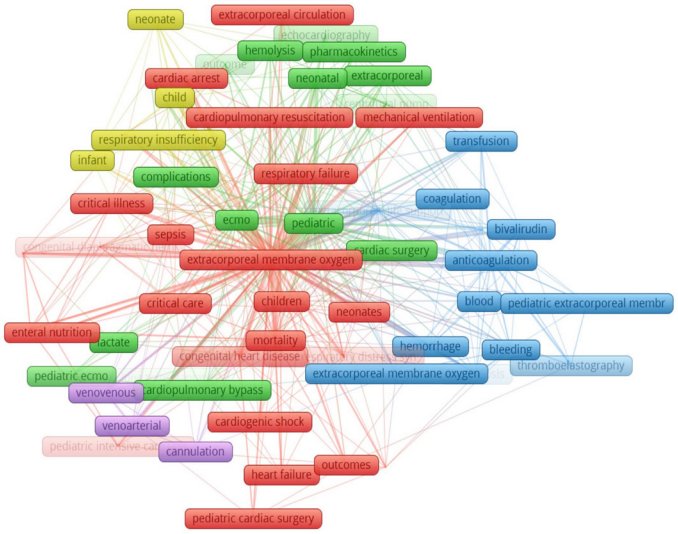

Figure 6. Keyword visualization map of articles with a minimum of five mentions on pediatric ECMO

The size of the shape represents the number of keywords used. Additionally, Table 4 identifies the most frequently cited keywords. The main topics of the subject, "extracorporeal

membrane oxygenation", "pediatric", "ECMO", "pediatrics", "extracorporeal life support" and "mortality" are the most mentioned keywords.

Table 4. The list mostly cited keywords on pediatric ECMO

Keyword	Citations (n)
Extracorporeal membrane oxygenation	258
Pediatric	99
ECMO	77
Pediatrics	62
Extracorporeal life support	29
Mortality	25
Anticoagulation	23
Extracorporeal membrane oxygenation	21
Child	19
Children	19
Respiratory failure	18
Congenital heart disease	14
Critical care	13
Neonatal	13
Cardiopulmonary resuscitation	11

ECMO: Extracorporeal Membrane Oxygenation

Most of the publications on pediatric ECMO were published in the journals of Critical Care Medicine (n=104,14.325%) and Pediatric Critical Care Medicine (n=82,11.295%) (Table 5). Only these two journals contain more than 25% of the publications on pediatric ECMO.

Table 5. The list of mostly published journals *

Journal	n	% of 726
Critical Care	104	14.325
Pediatric Critical Care Medicine	82	11.295
Asaıo Journal	57	7.851
Perfusion UK	31	4.270
Journal Of Pediatric Surgery	28	3.857
Artificial Organs	23	3.168
Journal of Heart and Lung Transplantation	22	3.030
Frontiers Pediatrics	18	2.479
American Journal of Respiratory and Critical Care Medicine	14	1.928
Circulation	13	1.791

*Showing 10 out of 164 entries

DISCUSSION

In this bibliometric analysis, we found that publications in the field of pediatric ECMO were published in journals with high impact value and were highly cited. In the last 2 years, clinical applications, especially COVID-19, and its reflection on publications have increased. Pediatric ECMO is mostly practiced and published in developed countries.

There have been many bibliometric studies in the discipline of medicine (15,16), but few on ECMO. In our literature analysis, we were unable to find any bibliometric research on pediatric ECMO. A recent comprehensive bibliometric study between 2019 and 2022 was on the use of ECMO in COVID-19 (15). According to this study, the trending topics in the use of ECMO in COVID-19 were pediatrics, a multisystem inflammatory syndrome in children, prone position, intensive care, venovenous extracorporeal membrane oxygenation, venous thromboembolism, dexamethasone, thrombosis, anticoagulation, and lung transplantation (15). This thorough analysis that we conducted is the first bibliometric study on this topic. The general state, trends, and hotspots in the field of pediatric ECMO research were identified using this method, which was also visualized.

Among the 726 documents we found in the WOS database, more than half of the publications are articles, and their high H index and citations show that there is a need for new information in this field.

Citation analysis shows that authors, journals, and countries are leading a field of study and contributing to high-impact research (17). When the citations of articles on pediatric ECMO were examined, we found that the number of citations was relatively high. This is an indicator of the quality and importance of pediatric ECMO publications in clinical practice and author activity. At the same time, publications in this field provide a potential basis for future publications and pave the way for future publications. Therefore, pediatric ECMO is a very active field with a high H index and citation potential, as it needs knowledge and experience. Because pediatric ECMO practice and publication of results require advanced expertise and experience, ECMO authors can reach their readers with powerful articles in powerful journals (Figure 5) (Table 5). When we look at the number of citations received by the publications over time we see that the recently published publications receive more citations (Figure 2). There could be several reasons for this. First, the increased awareness and implementation of ECMO in recent years. Second, while previous publications were case series on trauma and respiratory failure in infancy, more recent publications were ECMO reviews in surgery, cardiac arrest, percutaneous coronary intervention, pandemics, and long-term mortality. Third, ECMO has become increasingly popular in recent years.

When we look at the journals in which pediatric ECMO is published the most, we see that these most cited journals are the publication organs of the Society of Critical Care. The ELSO and SCCM (Society of Critical Care Medicine) associations lead the intensive care ECMO organization in the United States in both scientific practice and publishing results, generating new knowledge, and updating it over time. These journals published 25% of the ECMO literature. These intensive care journals are accepted as references in their field. Pediatric ECMO plays an important role in the field of critical care medicine. We see that ECMO studies are frequently conducted in the fields of internal medicine and pediatrics, and they are mostly published in the aforementioned intensive care journals. All specialties seen in Table 2, such as pediatric and adult intensive care, internal medicine, and pediatrics, have a role in ECMO practice. Therefore, pediatric ECMO is a field that requires regular research and development in all these specialties, supported and followed by associations such as multidisciplinary, ELSO, and intensive care associations. Regarding reflecting on the experiences obtained

from adult patients to pediatric patients, the support of adult specialties and associations should not be ignored. In the studies planned during the research and development phase, a literature review should be carried out in the steps of forming hypotheses, methods, and endpoints, the works of the authors in figure-5 and ELSO guidelines should be specially reviewed during the reading phase. These journals and guides are reliable references for researchers to search for documents or submit articles. These associations and the World Health Organization have an essential role to play in further spreading the ECMO practice around the world in the future. In line with the guidelines published by ELSO, it is of life-saving importance that ECMO can be applied to every pediatric patient with ECMO indication, the results are reported and published, and new information is produced (16). This importance will come to the fore, especially in pandemic waves that may affect children.

Pediatric ECMO has been practiced since the 1970s, but no original research paper has yet been published until 1987. It took more than 15 years of time and knowledge to produce an article in this difficult field. The number of publications can reflect the productivity in the field and developments in the scientific research levels over time. We observe that the number of publications has increased in the last 20 years. From this point of view, it should be noted that pediatric ECMO is a relatively new practice, and there is considerable growth in the field of pediatric ECMO. It has not been overlooked that this increase is obvious, especially in the last 2 years. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was a deadly and rapidly evolving global pandemic from the early 2020s. In the event of acute respiratory compromise, such as that brought on by SARS-CoV-2, V-V ECMO can be used as a bridging therapy to lung transplantation or as life-saving rescue therapy for refractory respiratory failure (18); although ECMO has been used for respiratory failure for a long time, We think that both the use of ECMO for respiratory failure due to SARS-CoV-2 and the number of publications on the subject are increasing simultaneously globally. When we look at its trend over time long before the pandemic; after the 2000s, the trend toward higher contribution rates reached a point where it was impossible to ignore it. We can easily state that ECMO remains an active research field, and more and more scholars may participate in ECMO research.

When we evaluate the number of publications most articles were published in the year 2020, with 80 (11.019%) records; 2021 contained 77 (10.606%) records, which was the second-highest publication year. Indications and rates of application have increased in cases of viral respiratory failure such as SARS-CoV-2 (15). In addition, it will not be surprising that we need ECMO more in the new viral respiratory failures in future pandemics.

The top five most productive countries among the countries where publications are produced were the USA, Canada, Italy, Australia, and China. Only China was a developing country, while the other five were developed countries. In terms of the number of articles published, the USA also led this field. The common feature of these countries is that they have hospitals working as ECMO centers in the ELSO Awards of Excellence list. The follow-up of ECMO in certain centers and teams may also affect publications. The economic size of countries can affect how well and how much they can use expensive life support systems such as ECMO (15,16). For example, Turkey, a developing country, does not have sufficient resources for ECMO (19). On the other hand, by pushing the limits of these resources, the highest number of ECMO applications are made at the highest level. As the economic and scientific power increases, the number of researchers and research numbers increases, and ECMO brings with it clinical applications and, as a result, an increase in publications. Considering the increasing indications and clinical usage areas of ECMO (1), it is necessary to provide more scientific, educational, and financial support to the ECMO practice so that pediatric patients in developing and underdeveloped countries can hold on to life and have a last chance of life.

We saw that the United States, Canada, England, Australia, and Italy took the first five places in the H indexes of publications. Considering that ECMO centers are most actively used in these countries (20), we can say that ECMO centers play a role in increasing the number and quality of publications. Meticulous and rapid management of patients with ECMO indications in ECMO centers with an expert multidisciplinary team increases the chances of clinical success (21). There should also be cooperation and exchange of information between ECMO teams and institutions. This customization also contributes to ECMO in these countries by producing high H index articles. Especially in the UK, the high H index compared to the number of publications can result from specialization in ECMO.

The value of international cooperation in supporting innovation and addressing challenges is well-known worldwide. The fact that countries or institutions that cooperate intensively have a high academic level. Cooperation is directly proportional to the strong academic atmosphere of universities, strong scientific research infrastructure, and sufficient funds. In pediatric ECMO, it has been observed that geographical-based collaborations in co-authorship collaborations of countries do not significantly affect article production. In addition, we see that authors in many countries have developed co-authorships closely, increasing the number and quality of publications. The field of pediatric ECMO demonstrates the advantages of multinational partnership as well as multidisciplinarity also. As a natural consequence of this, we can state that the co-authorship relationship and the mutual attribution relationship are parallel. The abundance of collaborations suggests that international collaboration will continue to be a future trend in the field of pediatric ECMO research. However, we believe that the dissemination of life-saving knowledge, collaboration, and experience from authors such as world-renowned experts in the field should be

disseminated to the world to gradually expand pediatric ECMO knowledge.

The most frequently cited keywords were extracorporeal membrane oxygenation (ECMO), pediatric, ECMO, pediatrics, extracorporeal life support, mortality, anticoagulation, extracorporeal membrane oxygenation (ECMO), child, children, respiratory failure, congenital heart disease, and critical care. Apart from the structural features of ECMO, we see that the keyword "mortality" comes to the fore in clinical terms. The ECMO procedure, which we perform in cases with high mortality such as ARDS, septic shock, and heart failure, is a risk factor for mortality (22). However, mortality due to ECMO in the pediatric age group is lower than in the adult age group. When we look at the 2022 ELSO records, we see that mortality is lower in the pediatric age group than in adults. Accordingly, neonatal mortality was 35%, pediatric mortality was 46%, and adult mortality was 51%. In all three groups, respiratory ECMO has better mortality than cardiac ECMO, and cardiac ECMO has better mortality than ECPR (23). Yang et al. stated in the systemic review and meta-analysis, pediatric mortality in resistant septic shock is lower than adult mortality in ECMO compared to the adult group (respectively 18% & 53%) (24). As we can see in ELSO records, pediatric ECMO has lower mortality than adult ECMO (21). However, it has a much higher mortality rate (16.2%) than the general pediatric intensive care unit mortality (25). Therefore, this high mortality rate both relatively limits the application of ECMO and constitutes the primary endpoint in almost all studies on ECMO (2,26). In addition, with the increase in ECMO application over time, we see a decrease in mortality in ECPR, septic shock, congenital heart diseases, and cardiomyopathies, except for neonatal and infant groups (27). From our analysis results it is clear that the main research area and future research main trend of pediatric ECMO may be mortality. In the last decade, ECMO technology and clinical practice success has improved, and survival rates have increased. With the developing technology, therefore, how to reduce the cost and improve portability and mobility will also become the research hotspots and development trends of ECMO. For reducing mortality an ECMO team is critical. Future research will also focus more on the training and establishment of the ECMO expert teams.

The main goal is shifting towards a trend from reducing mortality to preventing long-term morbidity (1). The keywords in Table 4 will have a change and additions over time. For the reduction of long-term morbidity in pediatric patients after ECMO perhaps we will come across the keywords “long-term rehabilitation”, “long-term follow-up”, “long-term effects”, “long-term clinical outcomes” and “long-term neurodevelopment” more often (1). These areas are where there are knowledge gaps that need to be studied.

As stated again in this important review by Sakurai and Singhal, we are approaching the ‘'3rd era'’ of ECMO (1,11). Non-sedated, spontaneously breathing, and mobilized ECMO follow-ups and scientific study results will come to the fore more in this period. For this reason, trending topics may change over time. To save patient time while they wait for their native lungs to recover or for lung transplantation; ECMO is frequently used both throughout therapy and for actual treatment (15). The keywords used can guide future studies on current issues.

LIMITATIONS

We only used the WoS database for our literature evaluation. This can be a drawback to our research. We preferred doing it this way because the PubMed database did not allow for the performance of citation and co-citation analyses. Since journals with low-impact factors were also indexed, we decided against using the Scopus database. WoS has recently been increasingly employed for bibliometric analysis.

It should be noted that this is the first bibliometric analysis of pediatric ECMO. First off, the deadline for research papers was September 16, 2022; however, this study disregarded this information because the WOS Core Collection will continue to update and some of the materials would already be available online in 2022. The facts in this work may only serve as a reference and may not accurately reflect the world in 2022. Second, owing to technical issues, the terms that were chosen only appeared in the title; however, the associated terms in the content were not retrieved and analyzed. Inaccurate document-type labels may also be issued by WOS. Thirdly, certain fundamental terms in these publications are not included in the bibliometric study, and the analysis findings may also be impacted by the insufficient extraction of keywords, as each published article is only allowed 3 to 10 keywords. Fourthly, a few papers that were not part of the WOS Core Collection were overlooked since the search was restricted to WOS Core Collection-indexed journals. The study's main drawback was the exclusion of databases like PubMed, Scopus, and Google Scholar. We believe that this work may still be used to convey the overall position and broad developments in this sector.

CONCLUSION

This bibliometric analysis was the first to review pediatric ECMO articles from all around the world. Particularly over the past ten years, the number of papers has risen steadily. This area has also continuously sparked the interest of many academics, and it will remain a hotspot for study throughout the next ten years. The trend and characteristics of pediatric ECMO research are therefore presented in this paper, providing a useful bibliometric analysis for researchers to conduct additional research. Studies published in important journals with high publication quality on pediatric ECMO provide life-saving information in viral respiratory failure pandemics that we live and may experience in the future. With this information, we believe that it is the right of all children in the world to spread the practical ECMO practice around the World.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical approval
Ethics committee approval is not required as there is no human or animal research in bibliometric analysis articles.

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