Review

Trends in Research on Acute Kidney Injury: A Bibliometric Analysis of Academic Journals Published Between the Years 2000 and 2022

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Acute kidney injury (AKI) is a significant global health concern that was first recognized in 2004 and has subsequently affected more than thirteen million individuals each year, resulting in 1.7 million deaths. The present study explored the evolving of the research on AKI worldwide, specifically addressing the analysis of the trends between the years 2000 and 2022 using the Web of Science Core Collection (WOSCC). CiteSpace software was employed to analyze 19,741 literature sources, which revealed shifts in keyword dynamics from foundational disease research to treatment prognosis and humanistic care. The keyword outbreaks occurred in the years 2004, 2010, and 2019 (i.e., significant occurrences or peaks related to the specified keyword were observed in the years 2004, 2010, and 2019). The present study highlighted the transition of AKI studies from the initial concerns regarding definitions to further comprehensive inquiries regarding biomarkers, etiology, inductors, prediction, and prognosis. The future research focus could include the Corona Virus Disease 2019 (COVID-19), machine learning, and continuous renal replacement treatment within the AKI realm.

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INTRODUCTION

Acute kidney injury (AKI) is a term introduced in 2004 to reflect the entire spectrum of acute renal failure (ARF) and is currently considered a significant global health concern,[1] affecting over thirteen million people annually and leading to 1.7 million deaths worldwide.[2] AKI is characterized by an acute decrease in kidney function, including structural damage and loss of physiological functions. [3, 4] Patient-associated variables comprise mutable factors, including dehydration, hypotension, anemia, hypoxia, and administration of nephrotoxic substances, as well as immutable elements, such as pre-existing chronic medical conditions.[5] Statistically, the in-hospital mortality rate associated with AKI is 24%, and the rate reportedly increases with the severity of the disease. [6]AKI is a frequently encountered complication in hospitalized patients, especially in patients admitted to the intensive care unit (ICU),[7] accounting for 30 - 60% of the critically ill patients.[8] AKI increases the potential risk of progressive or *de novo* chronic kidney disease, resulting in end-stage kidney disease and mortality, thereby leading to prolonged hospital stays and increased healthcare expense burden on the patients.[9–11]

Bibliometrics is a statistical approach for the quantitative analysis of research publications on a certain topic using mathematical methods.[12] Bibliometrics has been applied widely to estimate previous research activities, track the evolution process, and forecast emerging trends in various fields.[12–14] Bibliometrics also allows for tracking citation relationships between academic journals.

The field of bibliometrics has a wide range of visualization tools for the visualization and analysis of emerging trends in scientific articles, including VOSviewer and CiteSpace. The Web of Science (WOS) online database includes almost all-important research papers and also provides built-in tools for analysis. Importantly, it is possible to export the WOS search results to VOSviewer and CiteSpace for further detailed analysis.

Since its introduction, the concept of AKI has been continuously improving through extensive research on AKI. Numerous academic journals have published articles on AKI research. However, to the best of our knowledge, no researcher has applied bibliometrics to analyze the trends of journal publications in terms of nations/regions, institutions, and authors in a systematic manner. In this context, the present study aimed to provide further evidence for the investigation of AKI by visually detecting and assessing the relevant research hotspots, frontiers, and trends.

MATERIALS AND METHODS

Methods

The primary analysis approach employed in the present study was bibliometrics only. Figure 1 depicts the structure of the entire study and the software tools employed for the analysis. Initially, 19,756 records were retrieved from the WoSCC database. After the elimination of thirteen duplicate records and two records lacking keywords, the refined dataset comprising 19,741 records was obtained. This refined dataset was subjected to both descriptive and comparative analyses, including productive journals and nations/regions, publication trends, co-authorship, co-citation, keyword co-occurrence, keywords co-citation timeline, and keywords citation burst. Citation bursts particularly denoted the periods in which a particular paper or author experienced a sudden

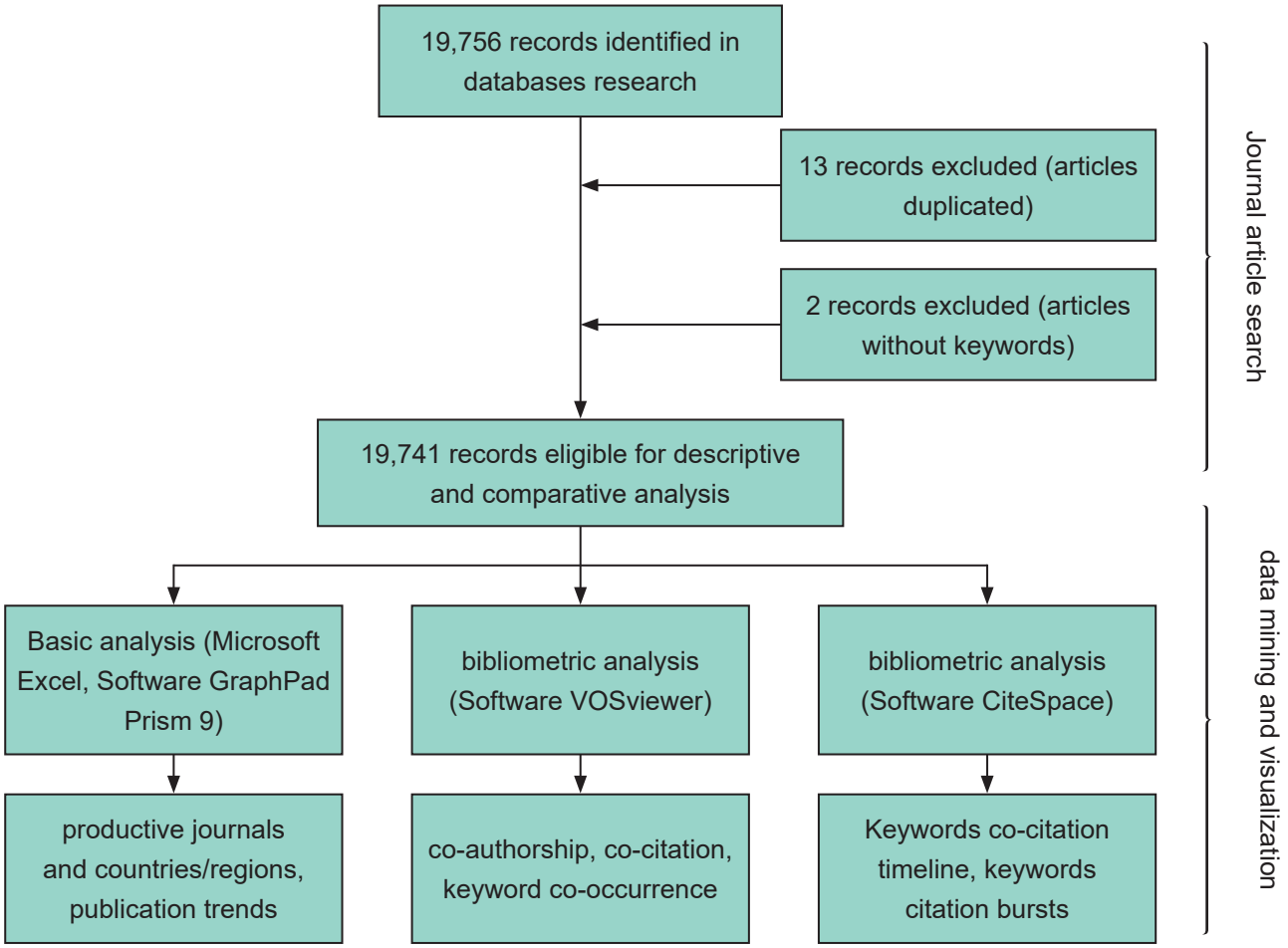

Figure 1. The general research framework of the present study and the tools employed.

and significant increase in citations.

Data

The data for the present study were obtained from the Web of Science Core Collection (WoSCC). WoSCC is the world's leading citation database comprising eleven indices with data from thousands of scientific journals, books, book series, and conferences. Since a public database was used for downloading the data for the study, the requirement of obtaining ethical approval for the study was not necessary.

Search Strategy

The WoSCC database was searched for relevant literature on AKI published globally between January 1, 2000 and December 31, 2022. The search terms "acute renal failure," "acute renal injury," "acute kidney injury," "acute kidney failure," "AKI", and "ARF" were searched to eliminate missing or incorrect results. In order to prevent changes in the citation rates to the extent possible, all electronic searches were performed on December 31, 2022. No restrictions on the type and language of publication were applied, and for each article, the following data were downloaded: authors, author keywords, institution, and cited references.

Data Analysis and Visualization

The datasets of the top-cited or productive nations/regions and publication trends between the years 2000 and 2022 were analyzed and exported by using Microsoft Excel 2019. Histograms and line charts were constructed by using GraphPad Prism 9 (San Diego, CA) to analyze the top-cited and productive journals. Here, the term productive journals refer to journals with a high volume of publications in the relevant field.

VOSviewer is a useful tool for creating and visualizing bibliometric maps and analyzing co-citation and co-authorship in a simple manner.[15] The co-authorship and nation, co-citation of the author and reference, and keyword co-occurrence were analyzed by using VOSviewer (version 1.6.9, Leiden University, Leiden, Netherlands).

CiteSpace is a prominent software for visualizing information in the field of knowledge graphs,[16] which enables the visualization of emerging trends and abrupt changes in specific fields within a particular period. In the present study, CiteSpace (version 6.1. R1 Basic, Drexel University, Philadelphia, PA, USA) was used for visualizing the research on AKI and identifying the research scope in vast amounts of data to create a co-citation timeline view analysis of the keywords.

RESULTS

A total of 19,756 articles were retrieved from the WoSCC database. Among these, thirteen articles with no author keywords and 2 duplicate articles were removed. Finally, 19,741 articles were retained and analyzed.

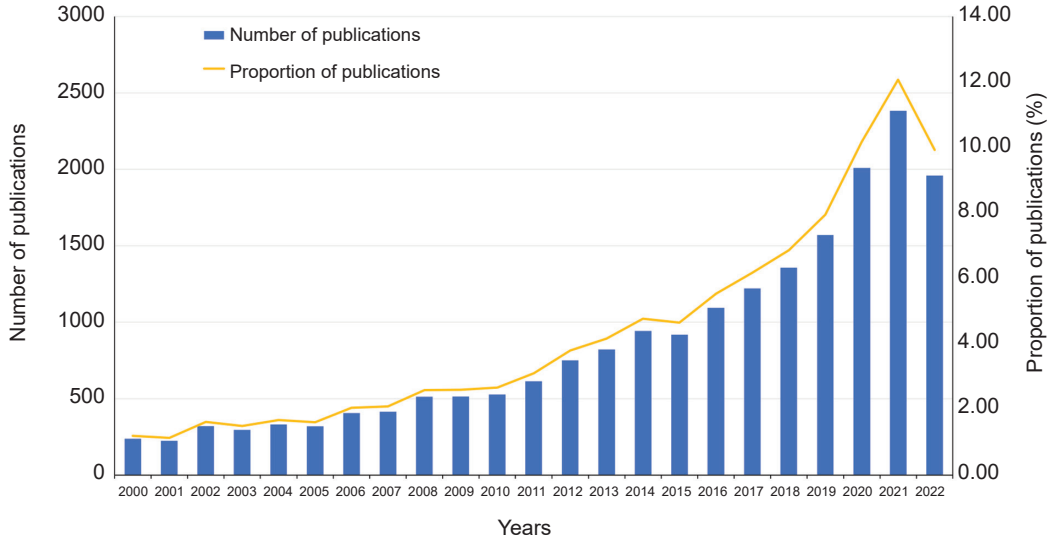

Figure 2. Annual Trends in the Number of Academic AKI-related Publications Between 2000 and 2022.

Annual Trends of Publications

A total of 19,741 publications on AKI research were identified in the literature reported between the years 2000 and 2022. Figure 2 depicts the number of AKI-related articles published annually. As visible, the annual number of publications on AKI has increased steadily over time. An increasing number of researchers have begun studying this topic, particularly after 2015, which has resulted in a rapid increase in the number of publications. However, the number of publications declined in the year 2022.

Journal Analysis

Over 2,000 academic journals published 19,741 articles on AKI research. Table 1 lists the top fifteen journals with the most publications on AKI. Figure S1 presents the ranking of these journals based on the number of publications and citations. Kidney International [impact factor (IF) 2022, 18.998] published the greatest number of articles (542 articles, 2.74%), followed by Renal Failure (IF 2022, 3.222, 511 articles, 2.59%) and Nephrology Dialysis Transplantation (IF 2022, 7.186, 507 articles, 2.57%). The most cited journal was Kidney International (IF 2022, 18.998), followed by Nephrology Dialysis Transplantation (IF 2022, 7.186, 507 articles, 2.57%) and American Journal of Kidney Disease (IF 2022, 11.072).

Table 1. The Top Fifteen Journals With the Most Publications on AKI Between the Years 2000 and 2022

Rank	Journal	Number of articles	Citations	2022 Impact factor	% of total	Cumulative %
1	Kidney International	542	55298	18.998	2.74	2.74
2	Renal Failure	511	5990	3.222	2.59	5.33
3	Nephrology Dialysis Transplantation	507	20769	7.186	2.57	7.90
4	Pediatric Nephrology	482	8398	3.651	2.44	10.33
5	American Journal of Physiology Renal Physiology	391	16301	3.682	1.98	12.31
6	BMC Nephrology	366	4792	2.585	1.85	14.17
7	Critical Care Medicine	338	17929	9.296	1.71	15.88
8	American Journal of Kidney Diseases	284	19010	11.072	1.44	17.31
9	Journal of Nephrology	250	3249	4.393	1.27	18.58
10	Clinical Nephrology	242	3265	1.243	1.23	19.80
11	Blood Purification	230	3995	3.348	1.16	20.97
12	Journal of Clinical Medicine	215	1577	4.964	1.09	22.06
13	Nephron	215	2438	3.457	1.09	23.14
14	Nephrology	190	2672	2.358	0.96	24.11
15	Journal of Critical Care	178	3108	4.298	0.90	25.01

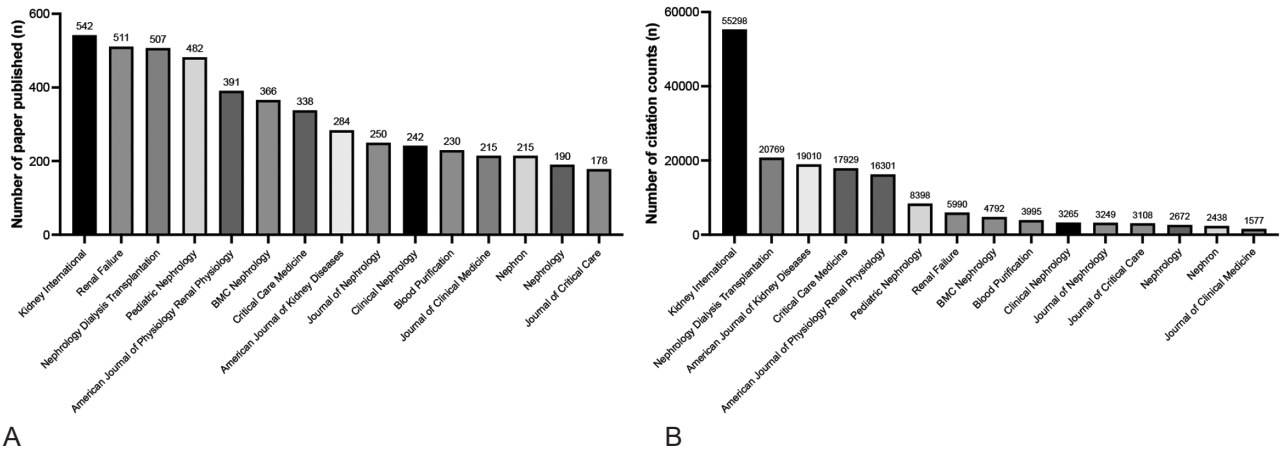

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Figure S1. The Top Fifteen Most Active Journals [(A) The top fifteen journals with the most published articles on AKI research; (B) The top fifteen journals with the most-cited articles in the field of AKI]

Analysis of Nations/Regions and Institutions

The top ten nations/regions with the most publications on AKI research between the years 2000 and 2022 are listed in Table 2. The United States (5,743 articles, 29.064%) published the most articles and was much ahead of China (3,503 articles,

Table 2. The Top Ten Nations/Regions and Institutions With the Most Publications on AKI Between the Years 2000 and 2022

Rank	Subject	Number of articles	% of total
Countries/regions			
1	USA	5743	29.064
2	China	3503	17.728
3	Japan	1390	7.034
4	Germany	1278	6.468
5	Italy	1117	5.653
6	England	954	4.828
7	France	899	4.55
8	Canada	766	3.877
9	Australia	764	3.866
10	South Korea	753	3.811
Institutions			
1	Udice French Research Universities	536	2.713
2	US Department of Veterans Affairs	498	2.52
3	University of California System	495	2.505
4	Veterans Health Administration VHA	490	2.48
5	Pennsylvania Commonwealth System of Higher Education PCSHE	470	2.379
6	Harvard University	400	2.024
7	Assistance Publique - Hôpitaux de Paris	392	1.984
8	University of Pittsburgh	389	1.969
9	Institut National De La Sante Et De La Recherche Medicale Inserm	343	1.736
10	University of London	316	1.599

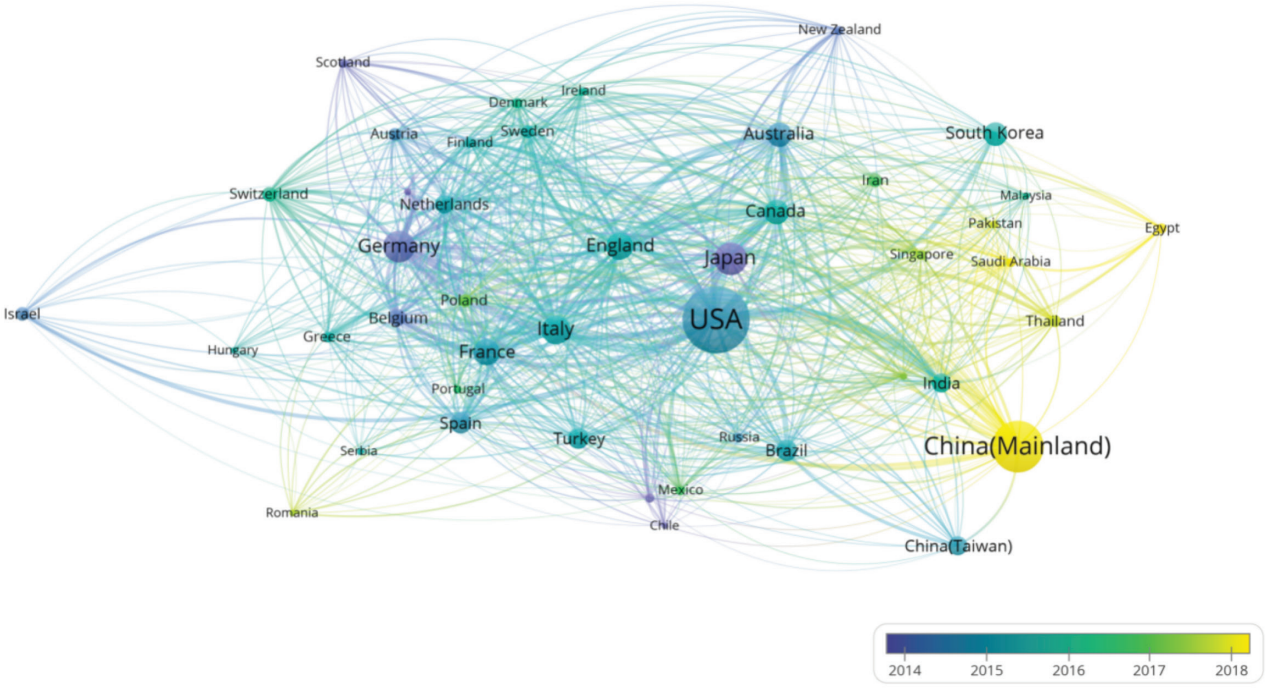

Figure 3. The bibliometrics analysis of different nations/regions. According to the time change from the year 2000 to 2022, the publishing nations' distribution networks in different periods were plotted. The indicator presents the time change from purple to yellow, and the thickness of the lines represents the strength of the relationship.

17.728%) and Japan (1,309 articles, 7.034%), which ranked second and third, respectively.

Furthermore, VOSviewer was employed to create an overlay visualization to observe when AKI research was more active in these nations/regions. Among all the 144 nations/regions that contributed to the research on AKI, forty-five nations/regions that had published over fifty documents were selected to construct the map. As depicted in Figure 3, Germany, Japan, and other nations began research on AKI as early as 2014 and prior. On the other hand, the United States began much later, although it ended up publishing the most research work, as revealed by its largest node. Later, the United Kingdom, France, Canada, and other nations began paying attention to AKI research. After 2018, China (Mainland) began paying greater attention to AKI, although the number of studies reported so far is far from negligible.[17] Different nations/regions presented diverse networks. For instance, the United States was revealed to have close cooperation with Canada, France, Italy, Brazil, India, etc.

The top ten most active institutions are listed in Table 2. The first, second, and third-ranking institutions were Udice French Research Universities (536, 2.713%), the US Department of Veterans Affairs (498, 2.52%), and the University of California

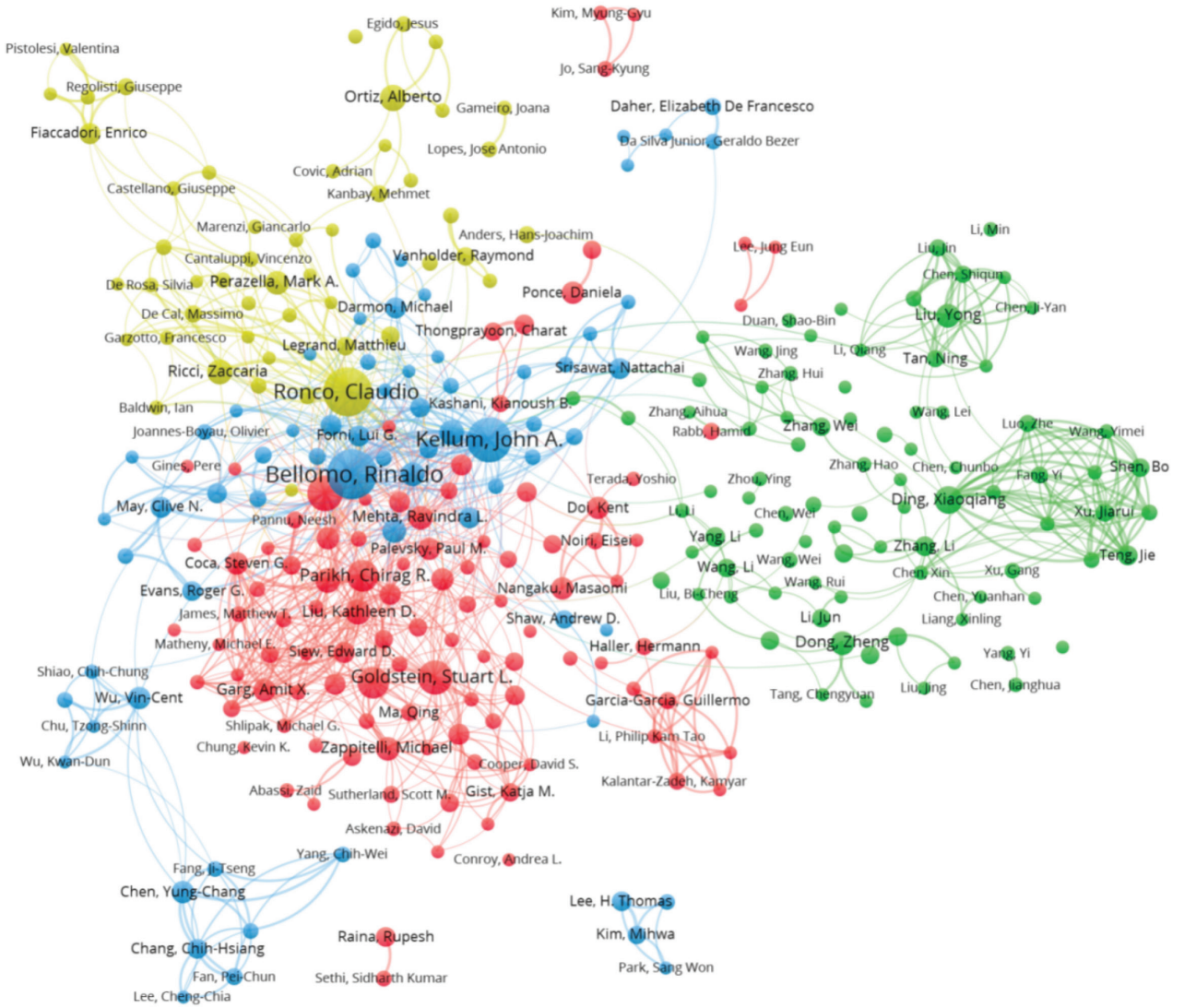

Figure 4. Bibliometric analysis of authorship. The author map presents the writers who collaborated on AKI research. The different colors indicate different clusters, and the size of the circles represents the number of publications. The thickness of the line indicates the strength of the authors' relationship.

System (495, 2.505%). The top ten institutions were distributed in three nations in the two continents of North America and Europe, and over half of these institutions were in the United States.

Analysis of the Authors and Co-cited Authors

Studies on acute kidney injury were authored by 80,060 authors from 19,743 publications, and just three of these authors have, to date, published a minimum of 150 articles. As depicted in Figure 4, Rinaldo Bellomo (n = 210) published the most articles, followed by Claudio Ronco (n = 200) and John A Kellum (n = 174). The authors (350/80,060, 0.43%) with the number of publications over or equal to fifteen (T = 15) were used for generating a network map of the top 350 cooperatively productive authors. Four clusters, indicated with different colors, were identified, with the authors in the same cluster usually studying in the same field and cooperating closely. Owing to their greater number of publications, Rinaldo Bellomo, Claudio Ronco, and John A Kellum had larger nodes in the generated map. Rinaldo Bellomo and John A Kellum were in the same clusters, suggesting that these authors probably had a close collaboration.

A co-citation is defined as the simultaneous citation of two papers by a third one. The higher the co-citation frequency between two authors, the closer their academic relationship and the higher the similarity of the topics they discuss.[18] Among the 179,945 co-cited authors, three authors had over 2,500 co-citations. Rinaldo Bellomo (n = 4,343) ranked first with the most co-citations, followed by Ravindra L Mehta (n = 3,587) and Sean Bagshaw (n = 2,812).

Analysis of Co-cited References

Co-cited references are publications that are cited simultaneously by one or more subsequent papers, forming a co-citation relationship. The correlation between the references grows as the number of co-cited references grows. A total of 319,715 references were cited among 19,741 publications. According to the total link strength, the top ten co-cited references are listed in Table 3, and all of these references were from 6 prestigious periodicals, namely, Critical Care, The Journal of the American Medical Association (JAMA), Kidney International, Journal of the American Society of Nephrology (J Am Soc Nephrol), Intensive care medicine, and

Table 3. The Top Ten Co-cited References From the Research on AKI

The first author	Title	Citation	Total link strength	Publish year	Journal
Rinaldo Bellomo[19]	Acute renal failure – definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group	1864	16532	2004	Critical Care
Ravindra L Mehta[1]	Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury	1944	15361	2007	Critical Care
Shigehiko Uchino[20]	Acute renal failure in critically ill patients: a multinational, multicenter study	1332	13129	2005	The Journal of the American Medical Association
Eckardt KU[21]	KDIGO Co-Chair	2018	12731	2012	Kidney International
Glenn M Chertow[22]	Acute kidney injury, mortality, length of stay, and costs in hospitalized patients	1098	10296	2005	Journal of the American Society of Nephrology
Eric AJ Hoste[23]	RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill patients: a cohort analysis	498	6019	2006	Critical Care
Eric A J Hoste[24]	Epidemiology of acute kidney injury in critically ill patients: the multinational AKI-EPI study	706	5584	2015	Intensive care medicine
Andrea Lassnigg[25]	Minimal changes of serum creatinine predict prognosis in patients after cardiothoracic surgery: a prospective cohort study	477	5314	2004	Journal of the American Society of Nephrology
Jaya Mishra[26]	Neutrophil gelatinase-associated lipocalin (NGAL) as a biomarker for acute renal injury after cardiac surgery	497	5298	2005	The Lancet
Steven G Coca[10]	Chronic kidney disease after acute kidney injury: a systematic review and meta-analysis	429	4858	2012	Kidney International

The Lancet. Rinaldo Bellomo *et al.* published an article titled "Acute Renal Failure – definition, outcome measures, animal models, fluid therapy, and information technology requirements: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group" in Critical Care, and this reference ranked first, with a total link strength of 16,532. The afore-stated article discussed the controversial aspects of the definition of AKI, selection of animal models, and principles of fluid management, provided consensus-based recommendations, and delineated the key concerns to be considered in future research.[19] The second most co-cited reference with a total link strength of 15,361 was reported by Ravindra L Mehta *et al.* and was titled "Acute Kidney Injury Network: A report on the initiative to improve outcomes in acute kidney injury" in Critical Care. The afore-stated article also proposed to develop a unified standard for the definition and classification of AKI while also describing the formation of a multidisciplinary collaborative network focused on AKI, which provided a mechanism for continued efforts to improve patient outcomes.[1]

Keywords Analysis

A total of 37,494 keywords were extracted by using VOSviewer after merging the synonymous keywords in 19,741 publications. These extracted keywords were then used in the subsequent analysis. A total of 153 keywords (153/37494, 0.408%) among the analyzed ones had occurrences greater than or equal to 140. The co-occurrence map of the keywords [Figure 5. (a)] could be divided into 5 clusters. The clusters were considered research themes, and each theme was further divided into subthemes based on the subjects represented by specific keywords. In the blue cluster, which represented the cluster focusing on acute kidney injury and the associated diseases, the keyword with the maximum number of co-occurrences was "AKI." The major keywords in the red cluster, which was related to pathological and pathophysiological pathogenesis, were "ischemia-reperfusion injury", "inflammation", and "expression". The green cluster contained keywords addressing the treatment, prognosis, and complications of AKI, including "critical care," "outcome", and "coninuous renal replacement therapy (CRRT)". The yellow cluster was about risk prediction, causes, triggers, and clinical trials. The purple cluster was related to several biomarkers of AKI.

As visible in Figure 5. (b), in 2013 and earlier years, researchers focused on keywords such as "p14", "p53", "gene", and "protein", which concerned the study related to AKI at the molecular level. As time progressed, the research emphasis gradually shifted to terms such as "risk," "outcome",

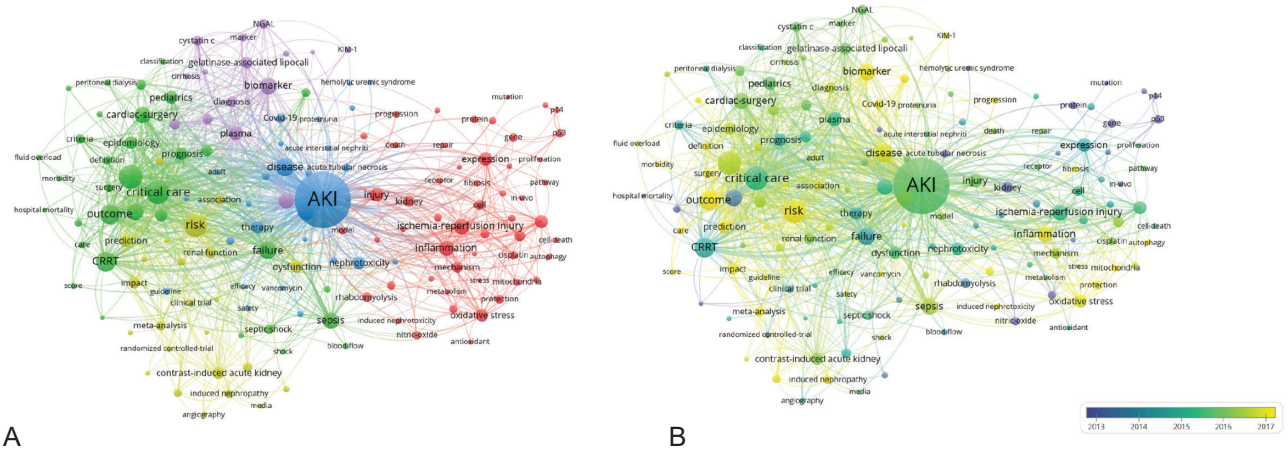

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Figure 5. Bibliometrics analysis of the keywords. (a) Keyword distribution. The map depicts five clusters. As it is shlown, the blue cluster represents the clusters dominated by keywords related to acute kidney injury and the associated diseases. The keywords in the red cluster show that they are related to the AKI pathology and pathophysiological pathogenesis. The green cluster is about keywords related to AKI treatment, prognosis, and complications. The yellow cluster is about risk prediction, causes, triggers, and clinical trials. The purple cluster focuses on several biomarkers of AKI. (b) The network graph of the trends exhibited by keywords from the year 2000 to 2022, from purple to yellow, indicates the time change. The size of the circle indicates how frequently the keyword appear. The distance between the two circles indicates the correlation of the keywords.

"biomarker", and "inflammation" by the year 2019 and other recent years.

Meanwhile, the commencement and frequency of these burst keywords were investigated by using CiteSpace, and visualization of temporal trends was generated (Figure 6). A total of ten clusters were formed on the basis of the results of the time series analysis and cluster analysis of burst keywords, including acute kidney injury, mortality, biomarkers, rhabdomyolysis, p53, oxidative stress, cardiac surgery, hemodialysis, p14, and renal replacement therapy, which were arranged from left to right to demonstrate the change trends. The greater the number of keywords in the clustering, the greater the importance of the clustering domain. The generation of the circle represented the first appearance of the term in the current year, and the size of the circle represented the cumulative frequency of the term subsequent occurrence in the current year, i.e., the higher the frequency of keyword occurrence, the larger the circle. The figure illustrates a similar time distribution. The years 2000 and 2001 represented the initial stage of AKI research. Several keywords emerged during this period, among which the important ones were "acute tubular necrosis," "acute renal failure," and "expression." In the 2004 to 2007 period, further detailed research on the pathogenesis of AKI was conducted, and the keywords shifted to "oxidative stress", "biomarker", etc. The 2010 to 2016 period was important in terms of focus on the AKI treatment programs, and the keywords included "association", "impact", and "real function". The keywords that emerged in recent years were "Corona Virus Disease 2019 (COVID-19)", "prediction", "cisplatin", "pathophysiology", and "recovery".

DISCUSSION

In the present study, a literature search in the WoSCC database was performed, which revealed 19,741 articles published on AKI between 2000 and 2022, after excluding duplicate articles and articles that did not fulfill inclusion criteria. Overall, the number of papers published each year exhibited a rapid growth trend, and this increase was associated closely with the steady increase in the incidence rate of AKI. In the United States, for example, the recent incidence of acute kidney injury is at least three times more than that of recorded 20 years ago, and the number of patients with severe acute kidney injury accounts for over 50% of the total number of severe cases.[27] The hospitalizations related to AKI have also been continuously increasing in the

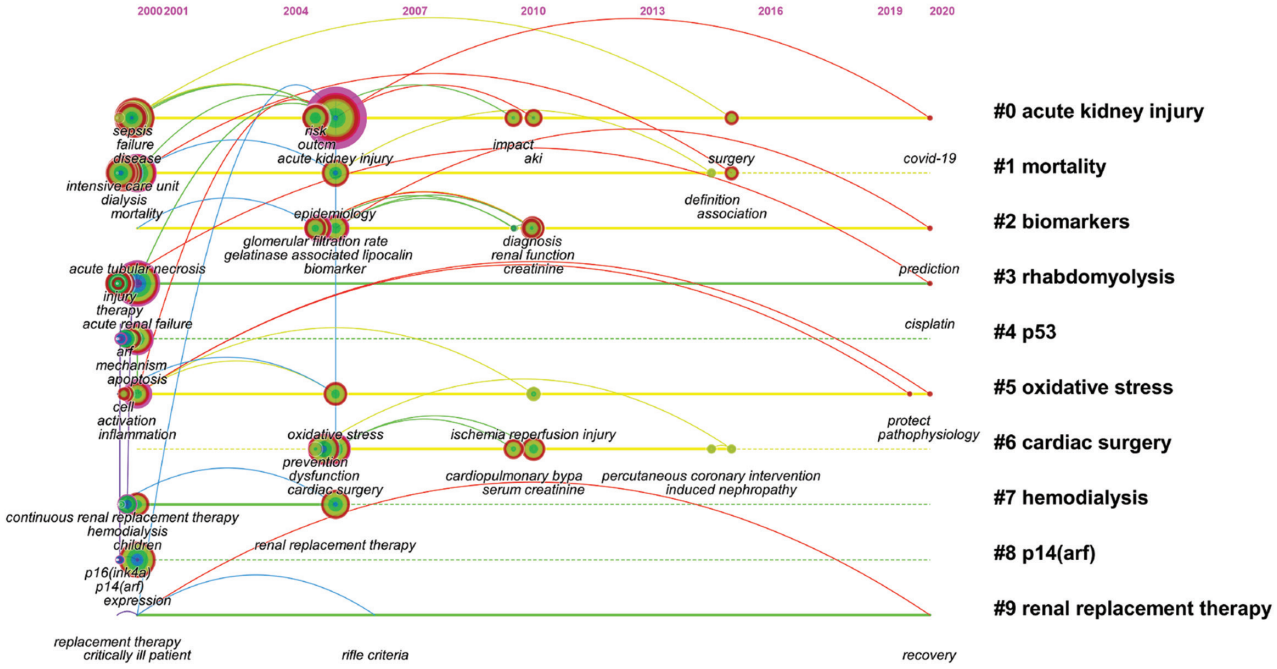

Figure 6. The keyword co-citation map of AKI publications from the year 2000 to 2022 (timeline view). Note: The timeline ended in 2020 as the number of co-citations after the year 2020 was less than that in the previous period.

United States, from 953,926 in 2000 to 3,959,560 in 2014.[28] Meanwhile, the 2005 to 2007, 2010 to 2014, and 2019 to 2021 time periods emerged as three relatively high-speed stages, particularly the last one. The first two periods coincided with the outbreak and reduction time of the keywords. In the COVID-19 pandemic, the virus continued to infect the epithelial cells in the proximal tubules of the human kidney, which could lead to AKI. In addition, to resolve the issue of insufficient urine volume during this viral infection, diuretics were used in excessive amounts, which led to an increase in the incidence rate of AKI to a certain extent.[29, 30] It is noteworthy that the number of published articles decreased in the year 2022. This could be because, on one hand, the research focus has shifted to the derivative field of AKI, while on the other hand, the widespread vaccination against the novel coronavirus vaccine greatly reduced the number of cases of pneumonia associated AKI, which led to a slight decrease in the focus on AKI as a research hotspot.

The impact factor (IF) is defined as the yearly mean number of citations of papers published in a certain journal in the previous two years and is used widely as a proxy for the relative significance of a journal within its field. In their respective fields, journals with higher impact factors are recognized as more important or more prestigious than those with lower impact factors.[31, 32] Four of the top fifteen most active journals are among the top fifteen journals in the field of nephrology. The top three citations were from the top fifteen journals in the field of nephrology. Moreover, 12 among the top 15 active journals had an IF of > 3.000, with 4143 published articles, accounting for 20.99% of the total number of AKI-related papers. According to statistics, journals with IF greater than 3.000 generally accounted for 20.05% (IF > 10.000, 5.39%; 10.000 > IF > 5.000, 4.55%; 5.000 > IF > 3.000, 10.11%) of all journals,[33] which indicated that AKI-related articles were published in journals with relatively higher IF.

All top ten nations/regions with the highest number of publications, except for China, were developed countries. Similarly, the top ten institutions with the highest number of publications were from developed nations, with over half of these institutions located in the United States, which ranked first in terms of the number of published articles. While the developed nations such as the US and developing nations such as China exhibited similar AKI patient characteristics, developed nations appeared to be superior in terms of the number of published documents as their studies were further detailed in terms of data, prospective, conducted at a larger scale, and multi-center in nature.[34, 35] However, with the progress of the Internet technology, including improvements in databases, it has become further convenient to collect and share large amounts of medical data. Therefore, as the incidence rate of AKI increases, developing nations will also have access to a large number of research outputs in the future for better research.[36]

Among 80,060 authors, Rinaldo Bellomo published the highest number of articles. Among the top ten co-cited references analyzed subsequently, the article that ranked first was reported by Rinaldo Bellomo and published in The Lancet, which has an IF of 202.731. These data suggest that Rinaldo Bellomo is quite active with a strong influence in AKI.

Co-citation analysis is used widely for estimating the academic influence of an author. In the present study, Rinaldo Bellomo *et al* reported the most co-cited article., discussing a total of forty-seven questions regarding ARF and reached a consensus along with providing suggestions. Reaching a consensus on the definition of ARF is the most important event. AKI defines ARF in its entirety, with the literature laying a foundation for future research on AKI, and, therefore, its high co-citation is inevitable.

Keywords refine the author's content in the article and represent the essence of the article. The keywords with high frequency and high center degree indicate a research hotspot and the development trend of the concerned research field to a certain extent.

The correlation analysis of keywords revealed the changes in the research trends on AKI and assisted in identifying the relevant research hotspots during different periods. In the beginning, the definition of AKI and its diagnostic criteria were unclear, due to which, during the first five years, the research on AKI focused mainly on the definition, diagnostic norms, and other aspects of AKI. In the next five years, from 2005 to 2010, the research on AKI focused on the basic pathogenesis, including pathology,

pathophysiology, and other basic disciplines. In the 2011 to 2017 period, the research on AKI gradually diversified, with experts beginning to focus on the deficiencies in the current treatment of AKI and seeking standardized treatment schemes.[37] In the period from 2018 until the present, the research on AKI became further humanistic, with the associated risk and prognosis of patients being considered. Meanwhile, research on the derivative fields of AKI was also being conducted, such as the application of artificial intelligence and the potential connection with COVID-19.[38, 39]

LIMITATIONS

As with all research, the present study also had certain limitations. First, since it involved a particular time duration for an article to receive a particular number of citations, certain high-quality studies published in the recent few years might not have received an optimal number of citations, which could have created research divergence. Such a delay might also have delayed the research on a new scientific frontier. In addition, the literature search conducted in the present study was limited to the studies available in the WoSCC database, and certain other relevant and necessary studies might have been missed. Future studies should, therefore, incorporate studies from other databases, such as China National Knowledge Infrastructure (CNKI), as well, to obtain further comprehensive results.

CONCLUSION

The literature on AKI published over the last 20 years was analyzed by using CiteSpace and VOSviewer. In the first five years of the investigation period, the studies on AKI focused on the definition, diagnostic criteria, genes involved, pathogenesis, and other aspects related to AKI. With the publication of the study by KDIGO Co-Chair, the research popularity on the definition and diagnostic criteria declined rapidly. In the last five years, the focus of AKI research shifted from basic studies to clinical ones, with the research hotspots being closely associated with the outbreak of global diseases and the rise of novel technologies. COVID-19, machine learning, continuous renal replacement treatment, etc., could be the AKI research hotspots in the next few years. However, despite the advances in the definition, diagnosis, and prevention opportunities related to AKI over the past two decades, the morbidity and mortality rates associated with AKI have remained high, reflecting lack of understanding and gap in the research on this disease and its impacts. Therefore, it is crucial to assess the quality of such a large number of research papers and obtain valuable information, and in this context, the present study would assist the scientists in better understanding the research trends related to AKI.

AUTHORS' CONTRIBUTIONS

The data were analyzed and the manuscript was written , by YT. The analysis and manuscript preparation, was performed by SX. The conception of the study the analysis with constructive discussions were performed ,by XG . All authors participated in the conference workgroups, the development of the summary statement, and the review of the manuscript. All authors read and approved the final manuscript.

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INFORMED CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in this published article. The data that supported the findings of this study are openly available in [the Web of Science Core Collection] repository, [http://www.webofscience.com].

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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