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The global status of nursing research on hemodialysis
A bibliometric and visualized analysis

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Abstract

Background: Hemodialysis (HD)-related nursing research has been growing over the past 2 decades, providing critical insights into improving patient care and outcomes. This study aimed to visualize the hotspots and emerging frontiers in HD-related nursing research, offering valuable references for future studies.

Methods: A bibliometric analysis was conducted on publications related to HD nursing research from the Web of Science Core Collection database, spanning the years 2002 to 2023, and the characteristics of literature such as authors, co-cited authors, countries, research institutions, journal distribution, keywords, and cited literature were visually analyzed using CiteSpace and VOSviewer.

Results: A total of 1019 publications were included in this study. The major contributors to this field were the United States, China, and Australia. The University of Sao Paulo emerged as the most prolific institution. The principal contributors were the Nephrology Nursing Journal, followed by Journal of Renal Care and Journal of Clinical Nursing. The top 5 co-occurrence keywords included HD, quality of life, dialysis, chronic kidney disease, and end-stage renal disease. The burst detection of keywords showed that current research frontier trends were pain and validation. The top 5 largest clusters of cited references included research on systematic review research, nurse-led disease management program, family caregiver, end-stage renal disease, and self-care intervention.

Conclusion: This study reveals productive authors, countries and institutions, research hotspots, and trends of HD-related nursing research over the past 2 decades, offering a comprehensive overview of this field worldwide.

Abbreviations: CKD = chronic kidney disease, ESRD = end-stage renal disease, HD = hemodialysis, SCIE = Science Citation Index-Expanded, SSCI = Social Sciences Citation Index, USRDS = United States Renal Data System, WOSCC = Web of Science Core Collection.

Keywords: bibliometric, CiteSpace software, hemodialysis, nursing, VOSviewer

1. Introduction

Chronic kidney disease (CKD), defined as a persistent abnormality in kidney structure or function lasting over 3 months, affects 8% to 16% of the global population.[1–3] It is globally the 16th leading cause of death.[4] The United States Renal Data System (USRDS) reported a 41.5% increase in global CKD mortality from 1990 to 2017.[5] End-stage renal disease (ESRD), characterized by a glomerular filtration rate (GFR) of <15 mL/min/1.73 m^2, is the most advanced stage of CKD. This irreversible and progressively worsening condition poses significant health risks.[3,6,7] Major causes of ESRD include diabetic nephropathy, hypertensive nephropathy, glomerulonephritis, and obstructive nephropathy.[8–10] A large-scale international

multicenter study demonstrated a sharp increase in ESRD cases globally, especially in low-income countries such as Somalia and Burundi.[3] The USRDS annual data report revealed that the number of ESRD patients in the United States reached 809,103 by the end of 2019, a 41.0% increase since 2009.[5] Similarly, the Chinese National Renal Data System reported over 3 million ESRD patients in China in 2019, with numbers growing rapidly.[11] ESRD has become a worldwide public health concern due to its high prevalence, mortality, and medical costs.[12–14]

Patients with ESRD depend on renal replacement therapy to sustain their lives, which mainly consists of hemodialysis (HD), peritoneal dialysis, and renal transplantation. Dialysis treatment is predominant worldwide due to the shortage of kidney

donors, immune rejection responses, and the need for long-term drug use.[15,16] Around 89% of dialysis patients globally undergo HD.[17,18] By 2025, an estimated 874,373 patients in China are expected to receive dialysis treatment.[9] By the end of 2019, nearly 500,000 patients in the United States received in-center HD, over 12,000 were on home HD, and 239,413 had undergone renal transplants.[8] The annual increase in the total dialysis population can be attributed to economic improvements and advancements in dialysis technology.[19] Renal care is closely correlated with global health challenges. Improving the nurses' professional knowledge level and patients' life quality and maintaining HD patients' health have become the focus of attention.[20–25] The number of HD-related nursing publications has gradually increased. The bibliometric and visualized analysis of HD nursing research can help identify the research status, trends, and hotspots in this area and provide a reference for future nursing research development in the field of HD.

There are several methods to systematically and comprehensively review a domain of research. Bibliometrics is one of the most popular approaches, allowing for qualitative and quantitative analysis of author contributions and collaborations, highly productive and influential institutions, countries and journals, and assessing the status and burgeoning trends in scientific research.[26,27] To date, bibliometric analyses of HD-related nursing research have been scarce.[28] This study aimed to reveal the knowledge domain and emerging frontiers in HD nursing research between 2002 and 2023 using CiteSpace and VOSviewer, to provide a reference for developing nursing research on HD.

2. Methods

2.1. Aims

This study aimed to: visually analyze the hotspots of nursing research on HD from 2002 to 2023; forecast the frontiers of nursing research on HD.

2.2. Study design

We conducted a longitudinal bibliometric analysis to study HD-related nursing publications from the Web of Science Core Collection (WOSCC) database from 2002 to 2023.

2.3. Participants

This study does not involve human participants directly. Instead, the participants in this research are the documents retrieved and analyzed from the Science Citation Index-Expanded (SCIE) and Social Sciences Citation Index (SSCI) in the WOSCC database.

2.4. Data collection and search strategy

The publications were retrieved from the WOSCC database on December 29, 2023. The WOSCC database is the world's oldest and most authoritative source of research publications and citations, which provides the most influential and reliable information.[29] It is the most frequently used and robust database for bibliometric studies.[30]

The search terms were Hemodialysis or Haemodialysis. The publication period of the literature was from January 01, 2002 to December 31, 2023. The data was sourced from SCIE and SSCI databases in the WOSCC. The categories were restricted to nursing. The document types were article and review. The documents were in English. The search strategy is detailed in Table 1.

Two researchers independently retrieved and screened the publications. Finally, 1019 valid documents were obtained. The flowchart of literature search and screening procedure is presented in Figure 1. All selected documents were exported in a "plain text" format with full record and cited references.

2.5. Data analysis

This study used CiteSpace 5.7.R1 (Philadelphia, PA) to visually analyze the citation bursts, reference co-citation clusters, and timeline view of co-citation clusters.[31,32] The CiteSpace parameters were defined as follows: the CiteSpace parameters of time slicing was set as 2002 to 2023, and time slice was set as 1 year, threshold of "top n" set at 50, selection criteria as "K = 25," and pruning was set as pathfinder.

VOSviewer 1.6.17 (Rotterdam, The Netherlands) was utilized to analyze bibliographic coupling indexes and collaboration between countries, institutions, and authors. Subsequently, it visualized these relationships through network and overlay maps.[33,34] A node represents a specific element, and the node's size is positively linked to the frequencies or quantities of publications. The lines between the nodes imply the intensity of the connections. The varying colors indicate various clusters or years. The VOSviewer parameters were as follows: fractional counting method, the maximum number of authors per document: 25.

2.6. Ethical considerations

Ethical approval was waived as this study involved analysis of publicly available bibliometric data from the WOSCC.

3. Results

3.1. Analysis of annual publications and citations

In total, 1019 documents about nursing research on HD between 2002 and 2023 were analyzed, including 924 articles and 95 reviews. As illustrated in Figure 2, the study plotted the annual publication and citation counts. The publication volume in this field exhibited a fluctuating yet overall increasing trend until 2021, before declining. Similarly, the annual citation count for these publications increased steadily until 2021, thereafter demonstrating a decreasing trend in the subsequent 2 years.

3.2. Authors and co-cited authors

The top 10 most prolific and co-cited authors are presented in Table 2. Bonner A, who published 29 documents, became the most productive author amongst the 3215 authors, followed by Bennett PN (14 publications) and Harwood L (13 publications). Figure 3 displays the authors' co-citation based on VOSviewer. As is shown in Figure 3, the most relevant authors were Davison SN (124 citations), followed by Kimmel PL (105 citations), and Tsay SL (90 citations).

3.3. Analysis of countries and institutions

Altogether 57 countries and 1412 research institutions have paid attention to the nursing research field of HD. Table 3 lists

Table 1

The search queries.

ID	Results	Search strategy
#1	790	TS = (Hemodialysis) AND PY = (2002–2023) AND WOSC = (Nursing) AND LA = (English) AND DT = (Article OR Review)
#2	278	TS = (Hemodialysis) AND PY = (2002–2023) AND WOSC = (Nursing) AND LA = (English) AND DT = (Article OR Review)
#3	1019	#1 OR #2

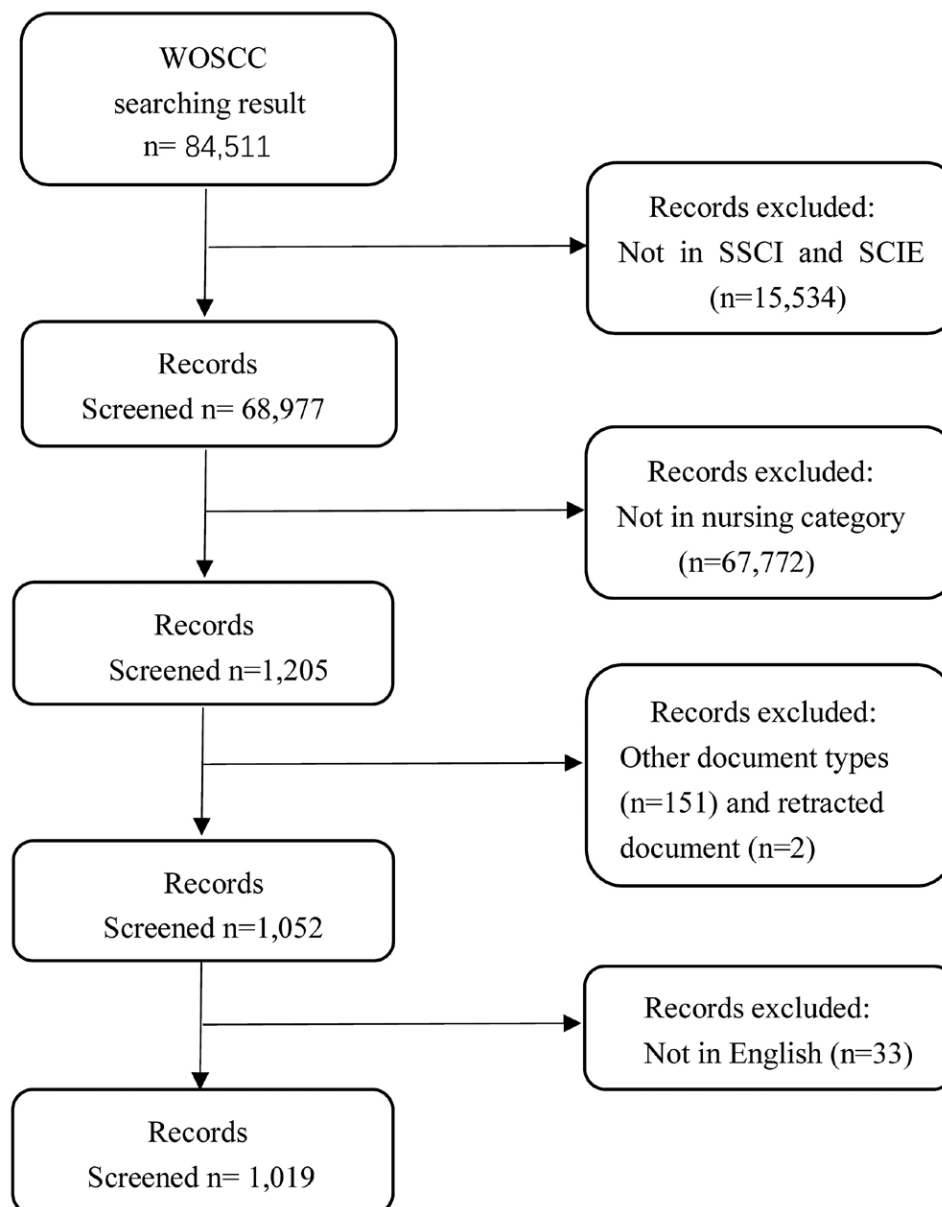DT = document type, LA = language, PY = year published, TS = topic, WOSC = web of science category.

Figure 1. Flowchart of documents selection. WOSCC: Web of Science Core Collection.

the top 10 prolific countries and institutions. Among them, the United States ranked first (342 publications), followed by China (143 publications) and Australia (102 publications). The top 3 countries contributed to more than half of 1019 documents. Figure 4 contains 28 countries with documents of >5. The intensive links of the United States with Australia, Canada, and China indicated that the abovementioned countries cooperated more closely with other countries. The institutions with more than 15 publications were the University of Sao Paulo (31 publications), Queensland University of Technology (22 publications), University of California (18 publications), Deakin University (17 publications), Griffith University (16 publications), and Federal University of Rio Grande Do Notre (16 publications). Figure 5 depicts a network map comprising 43 nodes and 6 clusters, representing institutions with over 7 frequencies. The largest cluster (#1) consisted of Chang Gung University, Chang Gung University of Science and Technology, Chung-Ang University, Duke University, The Hong Kong Polytechnic University, I-Shou University, Kaohsiung Medical University, National Taipei College of Nursing, National Taipei University of Nursing and Health Sciences, Taipei Medical University, The University of Jordan, University of Washington, and Wayne State University.

3.4. Analysis of journals and co-cited journals

Eighty-two journals were involved in the nursing research field of HD. Nephrology Nursing Journal was the most significant contributor (302 publications), followed by Journal of Renal Care and Journal of Clinical Nursing (Table 4). Journal co-citation network analysis was performed to identify journals with a tremendous influence in a domain. American Journal of Kidney Diseases had the most co-citations (541 citations), followed by Nephrology Dialysis Transplantation (453 citations) and Nephrology Nursing Journal (436 citations). Kidney International ranked highest in impact factor of the top 5 co-cited journals (IF = 19.6).
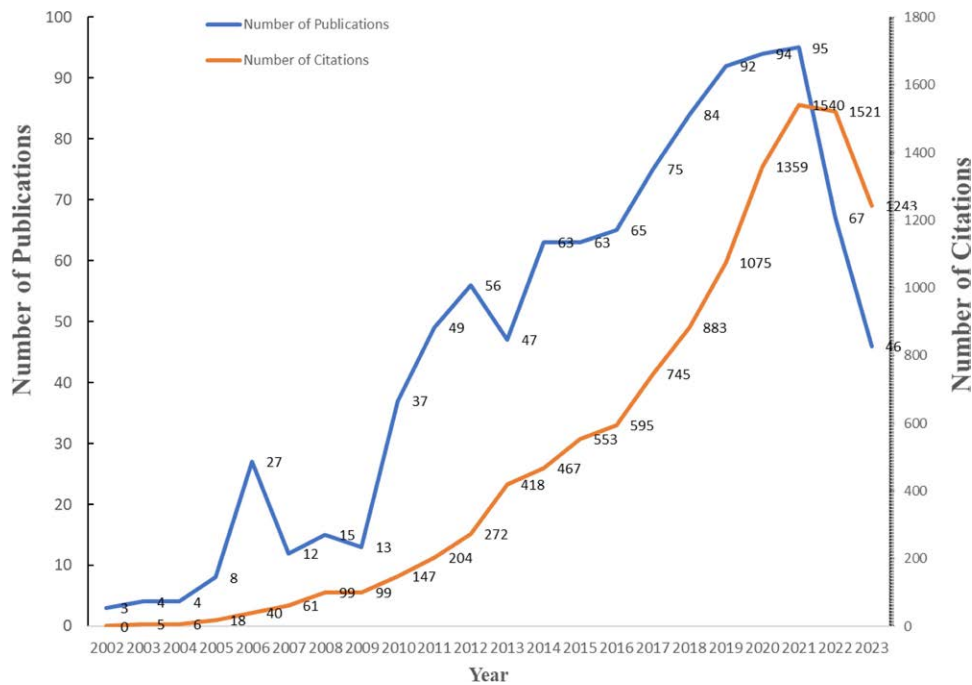
Figure 2. The annual number of publications and citations on hemodialysis nursing research from 2002 to 2023.

Table 2

The top 10 productive authors and co-cited authors of hemodialysis nursing research.

Rank	Authors	Counts	Co-cited authors	Citations
1	Bonner A	23	Davison SN	124
2	Bennett PN	16	Kimmel PL	105
3	Harwood L	13	Tsay SL	90
4	Thomas-Hawkins C	11	Welch JL	89
5	Wilson B	11	Tong A	83
6	Chen L	10	Weisbord SD	77
7	Lira ALBD	10	Johanasen KL	73
8	Khalil AA	8	Almutary H	71
9	Lindberg M	8	Cukor D	71
10	Orlandi FD	8	Griva K	68

3.5. Analysis of keywords

Keywords represent the main research content and topical issues. We unified keywords to obtain a better perspective. For example, "chronic kidney-disease," "chronic kidney disease (ckd)," "ckd" were unified as "chronic kidney disease." A total of 97 keywords were visualized using VOSviewer software, with a threshold of 10, as shown in Figure 6. The node sizes are positively correlated with the frequency of these keywords across 1019 papers. The top 5 most frequent keywords were hemodialysis (292), quality of life (281), dialysis (181), end-stage renal disease (155), and chronic kidney disease (129). An examination of keyword co-occurrence resulted in the identification of 5 distinct clusters: patients' and caregivers' experience (cluster #1), depression and anxiety (cluster #2), self-management and self-efficacy (cluster #3), vascular access (cluster #4), and quality of life (cluster #5). This method is a valuable tool for identifying key research themes and their interconnections within the field, as depicted in Figure 6.

Citation bursts can represent the sudden frequency changes in keywords at a particular time and better identify the evolutionary state, emerging trends, and research hotspots in a specific research field. This study detected the top 25 keywords with the strongest citation bursts using CiteSpace Software (Fig. 7).

The top 3 keywords with the strongest citation bursts were noncompliance (6.83), nursing (6.78), and hemodialysis patient (6.29). The current research frontier trends were pain (4.79) and validation (5.59).

3.6. Analysis of co-cited references

From 1019 documents, 24,803 citations were submitted by Citespace for clustered network analysis. As shown in Figure 8, 22 clustering patterns were generated, with 857 nodes and 1869 links. Each node represents a cited document. The top 5 largest clusters included systematic review research (#0), nurse-led disease management program (#1), family caregiver (#2), end-stage renal disease (#3), and self-care intervention (#4). Figure 9 shows a timeline view map of all 22 clusters, indicating the distribution of topics and their changes over time. Early nursing research in this field primarily focused on renal setting, nurse-led disease management program, and ESRD. However, these topics were gradually replaced by new topics over time. Recently, researchers have focused on systematic review, family caregiver, and self-care behavior. Figure 10 represents the top 40 references with the strongest citation bursts. The red sections indicate the start and end times of specific literature bursts. The
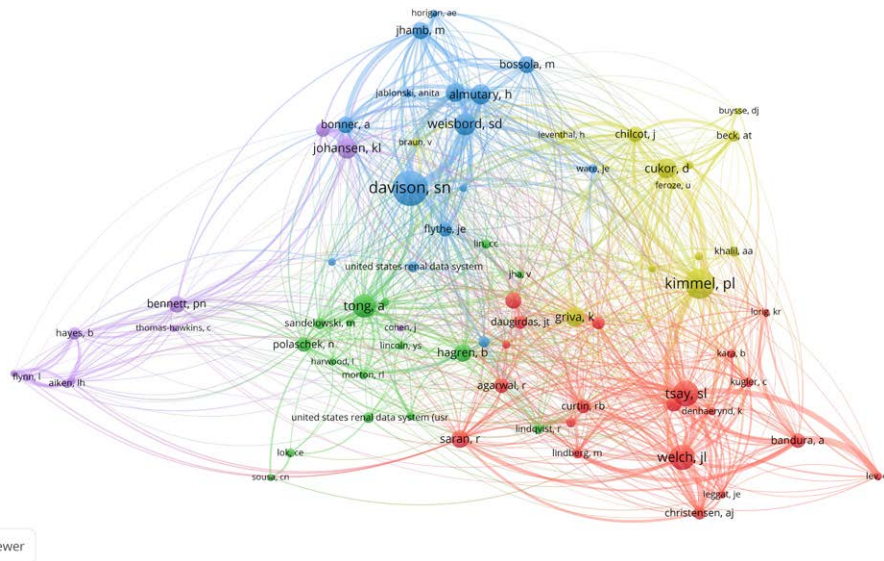
Figure 3. VOSviewer visualization network of collaboration between co-cited authors in hemodialysis nursing research.

Table 3

The top 10 prolific countries and institutions of nursing research in hemodialysis.

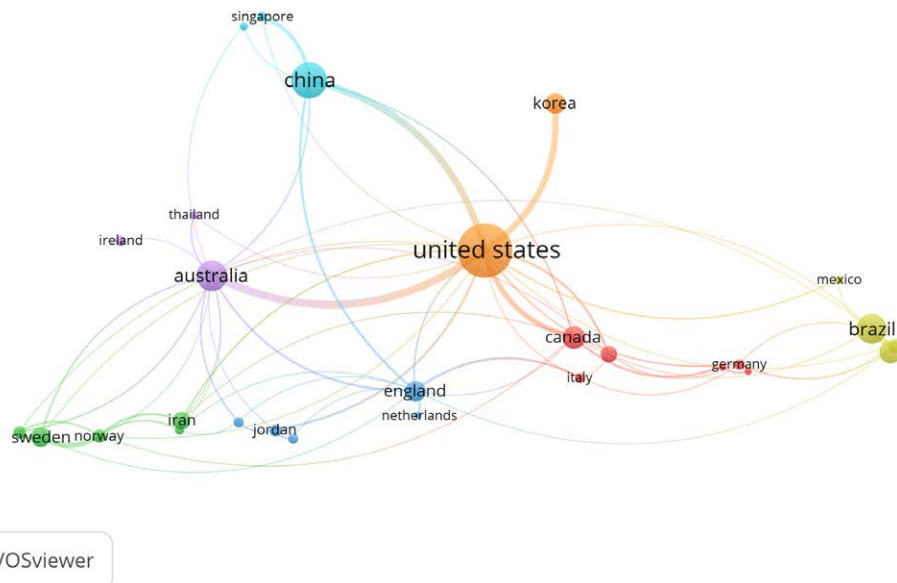| Rank	Countries	Number of documents	Institutions	Number of documents
1	United States	342	University of Sao Paulo	31
2	China	143	Queensland University of Technology	22
3	Australia	102	University of California	18
4	Brazil	96	Deakin University	17
5	Canada	50	Griffith University	16
6	Turkey	50	Federal University of Rio Grande Do Notre	16
7	England	43	Metro North Hospital and Health Service	15
8	South Korea	43	Univ Fed Rio Grande Do Norte	15
9	Sweden	38	University of Texas System	15
10	Iran	31	London Health Sciences Centre	15

Figure 4. A network map of collaboration between countries.

Figure 5. A network map of collaboration between institutions.

Table 4

The top 5 journals and co-cited journals in the nursing field of hemodialysis.

Rank	Journal	Frequency	IF(2022)	Co-cited journal	Citations	IF(2022)
1	Nephrology Nursing Journal	302	0.9	American Journal of Kidney Diseases	541	13.2
2	Journal of Renal Care	118	1.9	Nephrology Dialysis Transplantation	453	6.1
3	Journal of Clinical Nursing	103	4.2	Nephrology Nursing Journal	436	0.9
4	Journal of Advanced Nursing	52	3.8	Kidney International	358	19.6
5	Acta Paulista De Enfermagem	29	0.7	Journal of Advanced Nursing	335	3.8

Figure 6. VOSviewer keywords co-occurrence clustering view.

Top 25 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2002 - 2023
noncompliance	2002	6.8284	**2002**	2010	
dialysis	2002	3.9802	**2002**	2009	
chronic illness	2002	5.0763	**2003**	2011	
quality of life	2002	3.2784	**2004**	2008	
stressor	2002	5.3028	**2004**	2010	
hemodialysis patient	2002	6.2946	**2006**	2010	
nursing	2002	6.7794	**2007**	2009	
coping	2002	3.1543	**2010**	2013	
education	2002	3.6811	**2011**	2013	
peritoneal dialysis	2002	3.5771	**2012**	2014	
renal insufficiency chronic	2002	3.1601	**2012**	2016	
central venous catheter	2002	3.3218	**2014**	2017	
transplantation	2002	3.3218	**2014**	2017	
patient safety	2002	3.9169	**2014**	2015	
malnutrition	2002	3.3409	**2016**	2018	
burden	2002	4.0877	**2017**	2021	
complication	2002	3.1676	**2017**	2018	
interdialytic weight gain	2002	4.1238	**2017**	2019	
pain	2002	4.7928	**2018**	2023	
perception	2002	3.6509	**2018**	2019	
end stage kidney disease	2002	3.4052	**2018**	2020	
sleep	2002	3.6478	**2018**	2019	
barrier	2002	3.4804	**2019**	2020	
job satisfaction	2002	3.1618	**2019**	2020	
validation	2002	5.5943	**2020**	2023	

Figure 7. The top 25 keywords with the strongest citation bursts by Citespace.

Figure 8. The co-cited reference clustering knowledge map of nursing research in renal dialysis from 2002 to 2023. CiteSpace uses the Log-likelihood rate (LLR) to cluster all citations. One pattern represents one cluster.
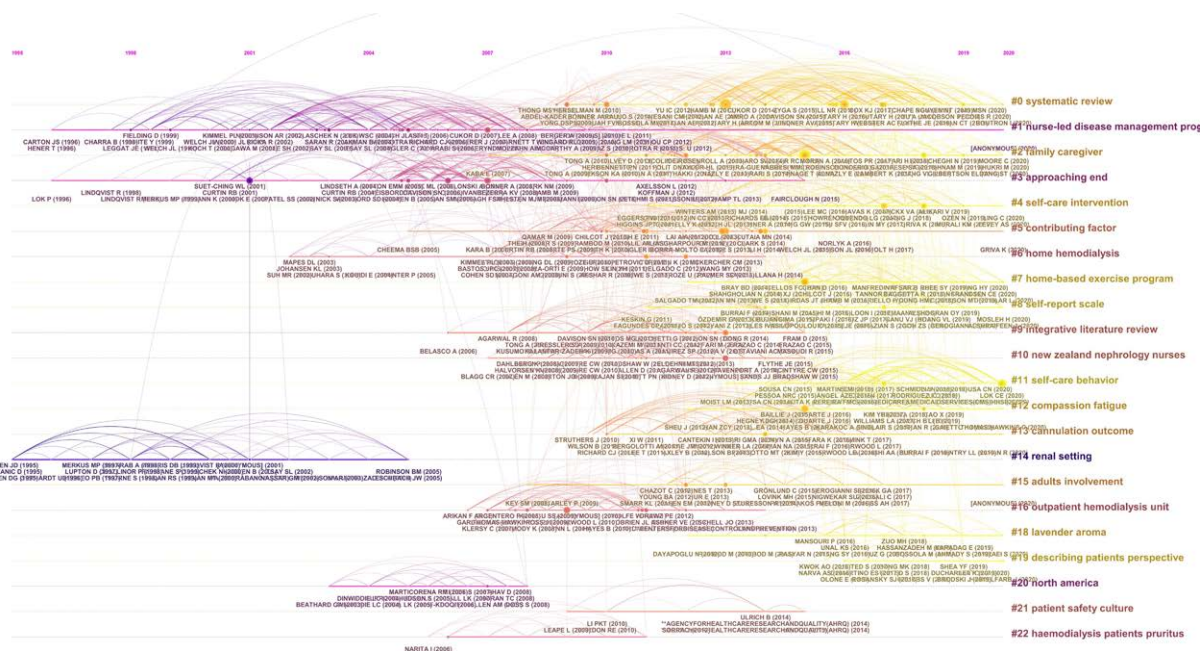
Figure 9. Timeline view of nursing research in renal dialysis from 2002 to 2023. In the timeline view, the citations on the same horizontal line belong to the cluster on the right. The colors of nodes in the view correspond to the colors of the time slice on the bottom left.

strongest burst citation was presented by an article by Mok E et al that explored stressors and coping methods among chronic HD patients in Hong Kong.[35] The earliest paper on outburst detection analysis was an article by Leggat JE et al from the USRDS Coordinating Center, who focused on patient characteristics associated with HD noncompliance and the impact of noncompliance on survival.[36]

4. Discussion

This study presents a comprehensive summary of the literature characteristics in HD within the nursing domain. It includes an analysis of trends in annual publications, authorship details, co-citation patterns, geographic and institutional research origins, journal types, prevalent keywords, and co-cited references. The study employs bibliometric analysis to visualize the current hotspots and evolving trends in this field, drawing upon 1019 records from 82 different journals, which represent the contributions of 3215 authors from 1472 institutes across 57 countries. The United States leads in publication volume, closely followed by China, and the co-occurrence map highlights strong collaboration between the United States, Australia, Canada, and China. Four of the top 10 prolific institutions were in Australia and 3 in Brazil. While 3215 authors have contributed to the domain, only 29 (0.9%) have published more than 5 papers, with the top 5 most productive authors hailing from Australia, London, and the United States. The clustering co-occurrence map of keywords revealed 5 main themes:

4.1. Anxiety and depression in HD patients

Recent studies have concentrated on investigating the prevalence, influencing factors, and impact of anxiety and depression in HD patients.[37–39] Notably, studies show that anxiety and depression are negatively correlated with the quality of life in dialysis patients, with these mental states being influenced by factors such as stressors and coping strategies.[40–42] Furthermore, extensive research has been conducted on diverse interventions such as music therapy, aromatherapy, exercise, and refined nursing

methods to alleviate anxiety and depression in HD patients.[43–46] These results highlight the importance of incorporating mental health support into treatment regimens for HD patients. This approach not only shapes nursing practices but also accentuates the critical role nurses play in recognizing and managing mental health concerns, thus enhancing the comprehensive care of these patients.

4.2. Self-efficacy and self-management in HD nursing

Contemporary HD nursing research has increasingly emphasized self-efficacy and self-management. Bandura self-efficacy theory suggests that individuals' confidence in performing specific behaviors is crucial for achieving desired outcomes.[47] This theory motivates behavior and enhances the individual's ability to regulate and control it. Studies show that applying self-efficacy theory in managing maintenance HD patients effectively improves self-management skills, thereby positively impacting disease prognosis. Wagner concept of self-management, introduced in 1998, emphasizes patients' active role in maintaining and improving their health.[48] The World Health Organization highlights the importance of self-management skills for enhancing chronic disease patients' quality of life.[49] Current HD nursing research focuses on identifying factors influencing self-management and developing interventions to improve it, examining its impact on patients' quality of life, emotional states, and disease control. Li et al identified knowledge, self-efficacy, social support, and depression as key factors influencing patient self-management.[50] An analysis of 18 randomized controlled trials demonstrated that self-management moderately improves self-efficacy, health-related quality of life, and depression symptoms, while significantly reducing anxiety symptoms, and slightly affects weight gain during CKD treatment.[51]

4.3. Quality of life in HD patients

Advancements in HD technology have significantly increased life extension for patients receiving this treatment. However, prolonged dialysis, coupled with its financial burdens, imposes significant physical, psychological, and economic stress on

Top 40 References with the Strongest Citation Bursts

Figure 10. The top 40 references with the strongest bursts of citations between 2002 and 2023.

patients, severely impacting their quality of life.[52,53] Quality of life is a multifaceted concept, encompassing physical, psychological, and social aspects. The World Health Organization defines it as individuals' perception of their position in life, influenced by their culture, value systems, goals, expectations, and personal concerns.[54] Notably, quality of life has been identified as a key predictor of outcomes in HD patients.[55] Recent nursing research has focused on various aspects, including assessing the quality of life of both patients and their caregivers, identifying influencing factors, and developing interventions for enhancement.[56–60] These studies emphasize the holistic approach to patient quality of life, underscoring the need to integrate these elements into the nursing and treatment regimen.

4.4. Patients' and caregivers' experience in HD

Long-term HD significantly prolongs patients' lifespans but also introduces complex physical and psychological challenges. Patients often experience physical discomforts, such as puncture pain, fatigue, and muscle cramps, alongside fluctuations in self-perception and confidence.[61–64] They also need to adapt to changed family roles and cope with potential loss of dignity.[65]

Research indicates that more than 90% of patients rely on family for daily care and emotional support.[66] Nursing research, especially through qualitative methods, thoroughly explores the experiences, emotions, and support needs of both patients and caregivers, providing a comprehensive understanding of their situations.[62,63,65,67–69]

4.5. Vascular access in HD

Vascular access is critical in HD, providing a conduit for blood exchange between the body and the external environment, thereby effectively removing toxic substances from the blood. Arteriovenous fistulas are currently the preferred form of vascular access, with arteriovenous grafts gradually increasing. Central venous catheters, however, are generally used as a transitional access due to their associated disadvantages, such as high power loss, infection rates, venous stenosis, and hemorrhage risk.[70] With the aging of dialysis patients, prolonged dialysis durations, and the influence of peripheral vascular diseases like diabetes, establishing and maintaining vascular access presents significant challenges. There is an increasing incidence of vascular access complications, which escalates both the complexity and cost of treatment. Current research hotspots in nursing for

HD vascular access focus on managing vascular access complications, enhancing patient education and self-care, investigating innovative technologies, and developing nursing interventions to prevent complications.[70–73] These studies aim to improve the long-term stability and efficacy of vascular access, reduce complication rates, and enhance patient survival and dialysis outcomes, ultimately contributing to an improved quality of life.

4.6. Limitations

This study has several limitations. First, the search was limited to the WOS database, a reputable source, which may have led to the omission of relevant publications not included in WOS. Second, the analysis was confined to literature in the nursing category, potentially excluding relevant studies from other categories. Third, some authors in the reviewed studies might have changed their names or institutions. Despite thorough verification of the study process, specific errors were inevitable. Fourth, the search was restricted to English-language studies, which may have resulted in the omission of key terms. Finally, this study used bibliometric methods to macroscopically analyze countries, institutions, journals, authors, and keywords in HD nursing research. This approach revealed potential future research trends and focal points, yet further investigation is essential to inform clinical practice.

5. Conclusion

Citespace and VOSviewer were utilized in this paper to visually analyze the literature on HD nursing research from the SCIE and SSCI databases. Our results reveal productive authors, countries and institutions, research hotspots, and development trends focusing on HD nursing research over the past 2 decades, which provides a reference for future related research to a certain extent. With the increasing demand for dialysis treatment worldwide, nurses should actively learn from the relevant research hotspots and frontiers to carry out in-depth studies and promote patients' health with ESRD.

Author contributions

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Writing – original draft: Yufen Wang, Luhuan Yang.
Writing – review & editing: Yunhong Lei.

References

[1] Jha V, Garcia-Garcia G, Iseki K, et al. Chronic kidney disease: global dimension and perspectives. Lancet. 2013;382:260–72.

[2] Romagnani P, Remuzzi G, Glassock R, et al. Chronic kidney disease. Nat Rev Dis Primers. 2017;3:17088.

[3] Liyanage T, Ninomiya T, Jha V, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. Lancet. 2015;385:1975–82.

[4] Chen TK, Knicely DH, Grams ME. Chronic kidney disease diagnosis and management: a review. JAMA. 2019;322:1294–304.

[5] Johansen KL, Chertow GM, Gilbertson DT, et al. US renal data system 2021 annual data report: epidemiology of kidney disease in the United States. Am J Kidney Dis. 2022;79:A8-A12.

[6] Drawz P, Rahman M. Chronic kidney disease. Ann Intern Med. 2015;162:ITC1–ITC16.

[7] Thurlow JS, Joshi M, Yan G, et al. Global epidemiology of end-stage kidney disease and disparities in kidney replacement therapy. Am J Nephrol. 2021;52:98–107.

[8] Saran R, Robinson B, Abbott KC, et al. US Renal Data System 2019 annual data report: epidemiology of kidney disease in the United States. Am J Kidney Dis. 2020;75(1 Suppl 1):A6–7.

[9] Yang C, Yang Z, Wang J, et al. Estimation of prevalence of kidney disease treated with dialysis in china: a study of insurance claims data. Am J Kidney Dis. 2021;77:889–97.e1.

[10] Zhang L, Long J, Jiang W, et al. Trends in chronic kidney disease in China. N Engl J Med. 2016;375:905–6.

[11] The Expert Group of Zhongguancun Nephrology & Blood Purification Innovation Alliance. Expert consensus on the selection of blood purification mode. Chin J Blood Purification. 2019;18:442–72.

[12] Collaborators GCoD. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet. 2017;390:1151–210.

[13] Collaborators GRF. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet. 2017;390:1345–422.

[14] Lv JC, Zhang LX. Prevalence and disease burden of chronic kidney disease. Adv Exp Med Biol. 2019;1165:3–15.

[15] Brown EA, Zhao J, McCullough K, et al. Burden of kidney disease, health-related quality of life, and employment among patients receiving peritoneal dialysis and in-center hemodialysis: findings from the DOPPS Program. Am J Kidney Dis. 2021;78:489–500.e1.

[16] Raghavan D, Hall IE. Dialysis and transplant access: kidney capitalism at a crossroads. Clin J Am Soc Nephrol. 2021;16:846–7.

[17] Bello AK, Levin A, Tonelli M, et al. Assessment of global kidney health care status. JAMA. 2017;317:1864–81.

[18] Bello AK, Okpechi IG, Osman MA, et al. Epidemiology of haemodialysis outcomes. Nat Rev Nephrol. 2022;18:378–95.

[19] Fuquay R, Teitelbaum I. Transplant outcomes and dialysis modality. Contrib Nephrol. 2012;178:251–7.

[20] Aguiar R, Pei M, Qureshi AR, Lindholm B. Health-related quality of life in peritoneal dialysis patients: a narrative review. Semin Dial. 2019;32:452–62.

[21] Aiyegbusi OL, Kyte D, Cockwell P, Anderson N, Calvert M. A patient-centred approach to measuring quality in kidney care: patient-reported outcome measures and patient-reported experience measures. Curr Opin Nephrol Hypertens. 2017;26:442–9.

[22] Alemayehu YH, Seylania K, Bahramnezhad F. The relationship between health literacy and quality of life among hemodialysis patients: AN integrative review. Hum Antibodies. 2020;28:75–81.

[23] Cheung KL, Schell JO, Rubin A, Hoops J, Gilmartin BJ, Cohen RA. Communication skills training for nurses and social workers: an initiative to promote interdisciplinary advance care planning and palliative care in patients on dialysis. Nephrol Nurs J. 2021;48:547–52.

[24] van der Borg WE, Verdonk P, de Jong-Camerik J, Abma TA. How to relate to dialysis patients' fatigue - perspectives of dialysis nurses and renal health professionals: a qualitative study. Int J Nurs Stud. 2021;117:103884.

[25] Vioulac C, Aubree C, Massy ZA, Untas A. Empathy and stress in nurses working in haemodialysis: a qualitative study. J Adv Nurs. 2016;72:1075–85.

[26] Muslu U. The evolution of breast reduction publications: a bibliometric analysis. Aesthetic Plast Surg. 2018;42:679–91.

[27] Wallin JA. Bibliometric methods: pitfalls and possibilities. Basic Clin Pharmacol Toxicol. 2005;97:261–75.

[28] Zhang HC, Lyu GL. Visual analysis of status quo of hemodialysis care research at home and abroad over past 10 years. Chin J Modern Nurs. 2018;24:4366–71.

[29] Birkle C, Pendlebury DA, Schnell J, Adams J. Web of Science as a data source for research on scientific and scholarly activity. Quantitative Sci Studies. 2020;1:363–76.

[30] Bai M, Zhang J, Chen D, et al. Insights into research on myocardial ischemia/reperfusion injury from 2012 to 2021: a bibliometric analysis. Eur J Med Res. 2023;28:17.

[31] Dong J, Wei W, Wang C, et al. Research trends and hotspots in caregiver studies: a bibliometric and scientometric analysis of nursing journals. J Adv Nurs. 2020;76:2955–70.

[32] Shi Y, Wei W, Li L, et al. The global status of research in breast cancer liver metastasis: a bibliometric and visualized analysis. Bioengineered. 2021;12:12246–62.

[33] Yanbing S, Hua L, Chao L, Fenglan W, Zhiguang D. The state of nursing research from 2000 to 2019: a global analysis. J Adv Nurs. 2021;77:162–75.

[34] Zhang J, Song L, Xu L, et al. Knowledge domain and emerging trends in ferroptosis research: a bibliometric and knowledge-map analysis. Front Oncol. 2021;11:686726.

[35] Mok E, Tam B. Stressors and coping methods among chronic haemodialysis patients in Hong Kong. J Clin Nurs. 2001;10:503–11.

[36] Leggat JE, Jr., Orzol SM, Hulbert-Shearon TE, et al. Noncompliance in hemodialysis: predictors and survival analysis. Am J Kidney Dis. 1998;32:139–45.

[37] Alshogran OY, Altawalbeh SM, Khalil AA. Comparison of two self-report scales to assess anxiety and depressive symptoms in hemodialysis patients. Arch Psychiatr Nurs. 2022;41:208–13.

[38] Masià-Plana A, Juvinyà-Canal D, Suñer-Soler R, Sitjar-Suñer M, Casals-Alonso C, Mantas-Jiménez S. Pain, anxiety, and depression in patients undergoing chronic hemodialysis treatment: a multicentre cohort study. Pain Manag Nurs. 2022;23:632–9.

[39] Semaan V, Noureddine S, Farhood L. Prevalence of depression and anxiety in end-stage renal disease: a survey of patients undergoing hemodialysis. Appl Nurs Res. 2018;43:80–5.

[40] Rubio AR, Asencio JMM, Raventos MEP. Depression, anxiety and health-related quality of life amongst patients who are starting dialysis treatment. J Ren Care. 2017;43:73–82.

[41] Tsay SL, Healstead M. Self-care self-efficacy, depression, and quality of life among patients receiving hemodialysis in Taiwan. Int J Nurs Stud. 2002;39:245–51.

[42] Welch JL, Austin JK. Stressors, coping and depression in haemodialysis patients. J Adv Nurs. 2001;33:200–7.

[43] Kauric-Klein Z. The effect of a yoga intervention on physical and psychological outcomes in patients on chronic hemodialysis. Nephrol Nurs J. 2022;49:335–81.

[44] Kim Y, Evangelista LS, Park YG. Anxiolytic effects of music interventions in patients receiving incenter hemodialysis: a systematic review and meta-analysis. Nephrol Nurs J. 2015;42:339–47; quiz 348.

[45] Rahimi F, Rejeh N, Bahrami T, et al. The effect of the eye movement desensitization and reprocessing intervention on anxiety and depression among patients undergoing hemodialysis: a randomized controlled trial. Perspect Psychiatr Care. 2019;55:652–60.

[46] Zhang QL, Wang S, Zhang Y, Meng F. The effect of refined nursing intervention on patients undergoing maintenance hemodialysis in the hemodialysis center during the COVID-19 epidemic. BMC Nursing. 2021;20:66.

[47] Biglan A. A behavior-analytic critique of bandura's self-efficacy theory. Behavior Analyst. 1987;10:1–15.

[48] Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. Health Affairs (Project Hope). 2001;20:64–78.

[49] Creer TL. Chapter 18 – Self-Management of Chronic Illness Self-Management of Chronic Illness. In: Boekaerts M, Pintrich PR, Zeidner M, eds. Handbook of Self-Regulation. San Diego: Academic Press; 2000. p. 601–29.

[50] Li H, Jiang YF, Lin CC. Factors associated with self-management by people undergoing hemodialysis: a descriptive study. Int J Nurs Stud. 2014;51:208–16.

[51] Lin MY, Liu MF, Hsu LF, Tsai PS. Effects of self-management on chronic kidney disease: a meta-analysis. Int J Nurs Stud. 2017;74:128–37.

[52] Pakpour AH, Safari M, Yekaninezhad M, Panahi D, Harrison AP, Molsted S. Health-related quality of life in a sample of Iranian patients on hemodialysis. 2010.

[53] Burlacu A, Artene B, Nistor I, et al. Religiosity, spirituality and quality of life of dialysis patients: a systematic review. Int Urol Nephrol. 2019;51:839–50.

[54] Bonomi AE, Patrick DL, Bushnell DM, Martin M. Validation of the United States' version of the world health organization quality of life (WHOQOL) instrument. J Clin Epidemiol. 2000;53:1–12.

[55] Mapes DL, Lopes AA, Satayathum S, et al. Health-related quality of life as a predictor of mortality and hospitalization: the Dialysis Outcomes and Practice Patterns Study (DOPPS). Kidney Int. 2003;64:339–49.

[56] Fukushima RLM, Menezes ALC, Inouye K, Pavarini SCL, Orlandi FD. Quality of life and associated factors in patients with chronic kidney disease on hemodialysis. Acta Paulista De Enfermagem. 2016;29:518–24.

[57] Guerra-Guerrero V, Sanhueza-Alvarado O, Cáceres-Espina M. Quality of life in people with chronic hemodialysis: association with socio-demographic, medical-clinical and laboratory variables. Rev Lat Am Enfermagem. 2012;20:838–46.

[58] Pereira CV, Leite ICG. Health-related quality of life of patients receiving hemodialysis therapy. Acta Paulista De Enfermagem. 2019;32:267–74.

[59] Suarez K, Whittington J. Improved quality of life in the pediatric patient on hemodialysis: academic success with implementation of a full-time schoolteacher. Nephrol Nurs J. 2020;47:337–41.

[60] Zyga S, Alikari V, Sachlas A, et al. Management of pain and quality of life in patients with chronic kidney disease undergoing hemodialysis. Pain Manag Nurs. 2015;16:712–20.

[61] Davison SN. Pain in hemodialysis patients: prevalence, cause, severity, and management. Am J Kidney Die. 2003;42:1239–47.

[62] Johnson S. Near-death experience in patients on hemodialysis. Nephrol Nurs J. 2015;42:331–6; quiz 337.

[63] Turner C, Finch-Guthrie P. Experiences of caregivers caring for a family member who is using hemodialysis. Nephrol Nurs J. 2020;47:23–34.

[64] Jenkins PG, Dreher WH. Dialysis-induced muscle cramps: treatment with hypertonic saline and theory as to etiology. Trans Am Soc Artif Intern Organs. 1975;21:479–82.

[65] Al Nazly E, Ahmad M, Musil C, Nabolsi M. Hemodialysis stressors and coping strategies among Jordanian patients on hemodialysis: a qualitative study. Nephrol Nurs J. 2013;40:321–7; quiz 328.

[66] Lowney AC, Myles HT, Bristowe K, et al. Understanding what influences the health-related quality of life of hemodialysis patients: a collaborative study in England and Ireland. J Pain Symptom Manage. 2015;50:778–85.

[67] Bayhakki, Hatthakit U. Lived experiences of patients on hemodialysis: a meta-synthesis. Nephrol Nurs J. 2012;39:295–304.

[68] Bourbonnais FF, Tousignant KF. The pain experience of patients on maintenance hemodialysis. Nephrol Nurs J. 2012;39:13–9; quiz 20.

[69] Jonasson K, Gustafsson LK. You live as much as you have time to: the experience of patients living with hemodialysis. Nephrol Nurs J. 2017;44:35–41.

[70] Fitzpatrick S, Dunlap E. Right access, right time: how nurses can advocate for best practice. Nephrol Nurs J. 2022;49:257–63.

[71] Deaver K. Preventing infections in hemodialysis fistula and graft vascular accesses. Nephrol Nurs J. 2010;37:503–5; quiz 506.

[72] Mbamalu G, Whiteman K. Vascular access team collaboration to decrease catheter rates in patients on hemodialysis: utilization of kotter's change process. Nephrol Nurs J. 2014;41:283–7; quiz 288.

[73] Wright SM. Using evidence-based practice and an educational intervention to improve vascular access management: a pilot project. Nephrol Nurs J. 2017;44:427–+.