

Research Hotspots and Frontiers of Patient Delay: A Bibliometric Analysis from 2000 to 2023

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Objective: This study aimed to examine the global scientific output of research on patient delay and explore the hotspots and frontiers from 2000 to 2023 through bibliometric analysis.

Methods: Publications regarding patient delay published from 2000 to 2023 were extracted from the Web of Science Core Collection (WOSCC). Subsequently, CiteSpace, VOSviewer, and Bibliometrix Online Analysis Platform were used to analyze publications, countries, institutions, authors, journals, and keywords.

Results: A total of 721 papers were included in the study. The publication output increased from 20 papers in 2000 to 64 papers in 2023, a remarkable 220.00% growth. The USA (138 papers) and University of California San Francisco (21 papers) were identified as the most productive country and institution, respectively. Moser (10 papers), and Dracup (10 papers) are the most productive authors. "BMC Public Health" (24 publications) is the most productive journal. "Patient Delay" was the most cited keyword, with high-frequency keywords such as "Prehospital Delay", "Symptoms", "Time", "Care", "Diagnosis", "Acute Myocardial-infarction", and "Mortality" signaling hot topics in Patient Delay.

Conclusion: There are increasingly many papers on patient delay. However, there has been limited development of cooperation between countries and institutions. In the future, collaboration between countries and institutions should be strengthened. In addition, 3 hotspots and 3 frontiers are summarized in this study to provide researchers with future research directions.

Keywords: patient delay, bibliometrics, VOSviewer, CiteSpace, hotspots, frontiers, web of science

Introduction

Health seeking is a continuous process of symptom definition, illness-related shifts in role behavior, lay consultation and referral, treatment actions, and adherence.¹ The extent to which patients seek medical care varies, with some seeking immediate care and others choosing to seek care only when the disease has progressed further or when the pain is severe. Thus, health-seeking behavior is divided into positive and negative health-seeking behavior. Patient delay is negative health-seeking behavior, which largely increases the likelihood of missing out on a medical condition. Anderson's model of health-seeking behavior, proposed in 1995, suggests a definition of patient delay.² Patient delay is defined as the period from the onset of the first disease-related symptoms to the patient's first visit to a healthcare facility; Patient Delay was considered if the interval was more than 3 months.³ However, considering that each type of disease has its specificity, researchers should develop criteria for patient delay that meet the clinical characteristics of patients with each type of disease.

Patient delay cannot be ignored. Patient delay can lead to a serious stage of the disease when the patient seeks medical treatment, which not only greatly reduces the clinical outcome of the disease, but also increases the psychological and financial burden on patients, and even affects patients' short-term and long-term prognosis.⁴ Patient delays may also result in healthcare organizations needing to dedicate more resources later to deal with an already deteriorating condition. This not only increases healthcare costs but may also affect the timely access of other patients. In addition, patient delays

may lead to the spread of disease within the community, increasing public health risks.^{5,6} For example, patients with infectious diseases may become potential sources of infection if they delay seeking medical attention. Medical resources are generally scarce in low- and middle-income countries. Inadequate numbers of medical institutions, poor equipment, and shortages of medical staff are common. As a result, patient delay can make illnesses more difficult to treat and even lead to death. In summary, patient delay have a significant impact on healthcare outcomes globally, particularly in low- and middle-income countries. Therefore, reducing patient delay is critical to improving public health and clinical outcomes. Reducing patient delays means that healthcare resources can be allocated and utilized more rationally, and healthcare providers can arrange patients' consultation time and treatment plans more effectively, reducing the wastage of healthcare resources and the waiting time in queues. In addition, early identification of people at high risk for patient delay and targeting individualized intervention strategies are key to improving the current status of patient delay and clinical outcomes of the disease. Early treatment can significantly increase the cure rate of the disease, reduce the incidence of complications and sequelae, and improve the clinical outcome.

Bibliometrics, a quantitative method used to reveal various characteristics of publications, can easily provide researchers with an overview of the evolution of a particular research topic.^{7,8} Through this analysis, we can effectively characterize the literature and identify hotspots and popular trends in various research areas. Many researchers have applied bibliometrics to reveal hotspots and frontiers in a variety of fields, such as cancer-related fatigue,⁹ rehabilitation robotics,¹⁰ disease management,¹¹ medication adherence,¹² post-stroke dysphagia,¹³ etc. Patient delay has been a subject of public health and clinical interest. However, research trends and prospects of patient delay are not obvious. Currently, there are no studies that analyze the current status and hotspots of research on patient delay in the form of bibliometrics. Therefore, it is crucial to have an in-depth understanding of the hot topics and future research perspectives in patient delay research. To understand the knowledge base of patient delay research over the last 20 years, to identify research hotspots and evolutions in the field, to explore potential trends in future research, and to inform and support future patient delay research, we conducted a scientometric analysis of the field of patient delay. We performed a bibliometric analysis of publications on patient delay by VOSviewer, CiteSpace software, and Bibliometrix Online Analysis Platform from 2000 to 2023. This study aims to provide scholars with research hotspots and future research directions by analyzing data on publications, countries, institutions, authors, journals, and keywords.

Methods

Search Strategy

Publications were retrieved from the Web of Science Core Collection (WOSCC) from January 2000 to December 2023. The search terms were obtained from the MeSH database via PubMed and relevant references. We searched the database with the following search strategy: “patient delay”, “medical delay”, “prehospital delay”, and “pre-hospital delay”. Only articles and reviews were included, explicitly excluding conference papers, editorial material, and conference abstracts. After the first search, all papers were screened and checked separately by 2 researchers to ensure that all the papers used were relevant to the study topic. In the case of a dispute, we consulted a third investigator. The relevant bibliographic information was extracted from the eligible articles: title, author, country, institution, year of publication, journal, keywords, abstract, cited references, etc.

Analysis Tool

CiteSpace is an interactive visualization analysis software developed by Professor Chen Chaomei of Drexel University using Java language.¹⁴ CiteSpace was used to generate a keyword co-occurrence network and to perform cluster analysis, detecting the citation bursts associated with different keywords and speculating on frontiers in this research field. The statistically significant keywords with the strongest citation bursts are used to pick out the hotspots in specific fields and to suggest possible next steps and directions for research shortly. VOSviewer, a free Java software for document mapping, was developed by the Centre for Science and Technology Studies, University of Leiden, the Netherlands.

Data Analysis

External characteristics, including publication counts and total citations, were summarized using the WOSCC's visualization tools. VOSviewer (v1.6.20) was utilized for visual analysis of institutions, authors, journals, and keywords. CiteSpace (v.6.3.R2 Advanced) was used to detect the top 25 burst keywords and construct visualizations of keyword timelines.¹⁴ Bibliometrix Online Analysis Platform was used to visualize international collaboration in patient delay.

Results

Annual Publications on Patient Delay

A total of 1416 papers were retrieved and 721 (50.92%) papers were finally included. The literature screening process and research framework are illustrated in [Figure 1](#). To some extent, trends in the number of publications reflect research trends. The annual publications increased from 20 papers in 2000 to 64 papers in 2023, a remarkable 220.00% growth ([Figure 2](#)). From 2000 to 2018, the annual publications remained below 50 papers. In 2019, the publications reached 50 papers, ultimately exceeding 60 articles by 2023. Generally, the number of publications is on the rise.

Distribution of Countries/Regions

A total of 101 countries/regions participated in the research on Patient Delay between 2000 and 2023. [Table 1](#) shows the top 10 most productive countries, with the USA (138 publications) being the most prolific nation, accounting for 19.14% of the total number of publications. China (75 papers) follows closely, and England (58 papers) is next. The top 10 countries/regions accounted for more than 60.00% of the total number of publications, which shows that the research development in this field is not balanced among countries/regions.

Analyzing cooperations between different countries/regions can also reflect academic exchanges in the field.¹⁵ In general, the more frequent the exchanges between countries, the more outputs are produced. [Figure 3](#) shows the cooperation among countries/regions. The larger the number of articles, the larger the area occupied. The line between countries reflects the cooperation among them, and they are mostly in cooperation with one another. It can be seen that the USA has the largest number of lines, which indicates that the USA has developed the closest cooperation with other countries in this field. At the same time, the USA is also the most productive country.

Distribution of Research Institutions

Institutions were analyzed through VOSviewer and 151 institutions were identified ([Figure 4](#)). Leading publishing institutions are divided into 11 clusters. The light green cluster includes Univ Calif San Francisco, Univ Kentucky, Univ Washington, etc. The green cluster is mainly Univ Massachusetts, Univ Toronto, McMaster Univ, etc. The orange cluster includes Univ Carolina, Univ Illinois, etc. The pink cluster is made up of Yale Univ, Duke Univ, etc. The purple cluster includes Kings Coll London, St Thomas Hosp, etc. The light blue cluster is mainly Monash Univ, Univ Melbourne, etc. The red cluster is mainly Peking Univ, Karolinska Inst, Univ Helsinki, and other institutions. The brown cluster includes Univ Hong Kong, Umea Univ, and other institutions. The relatively distant yellowish-green cluster includes Univ Oslo, Univ Basel, and other institutions. The relatively distant rose cluster includes Univ Amsterdam, Univ Med Ctr Utrecht, and other institutions. The blue cluster includes Seoul Natl Univ, Chonnam Natl Univ Hosp, etc.

[Table 2](#) shows the top 10 most productive institutions, with the University of California San Francisco (n=21, 2.91%) being the most prolific institution, followed by King's College London (n=15, 2.08%), and the University of Kentucky (n=13, 1.80%). In addition, five of the top 10 institutions are located in the USA.

Distribution of Research Authors

The most prolific authors are Moser (University of Kentucky) with 10 publications (1.39%) and Dracup (University of California San Francisco) with 10 publications (1.39%) ([Table 3](#)). Authors were analyzed through VOSviewer and 93 authors were identified ([Figure 5](#)). Authors are divided into 4 clusters, with overlay visualization using publication

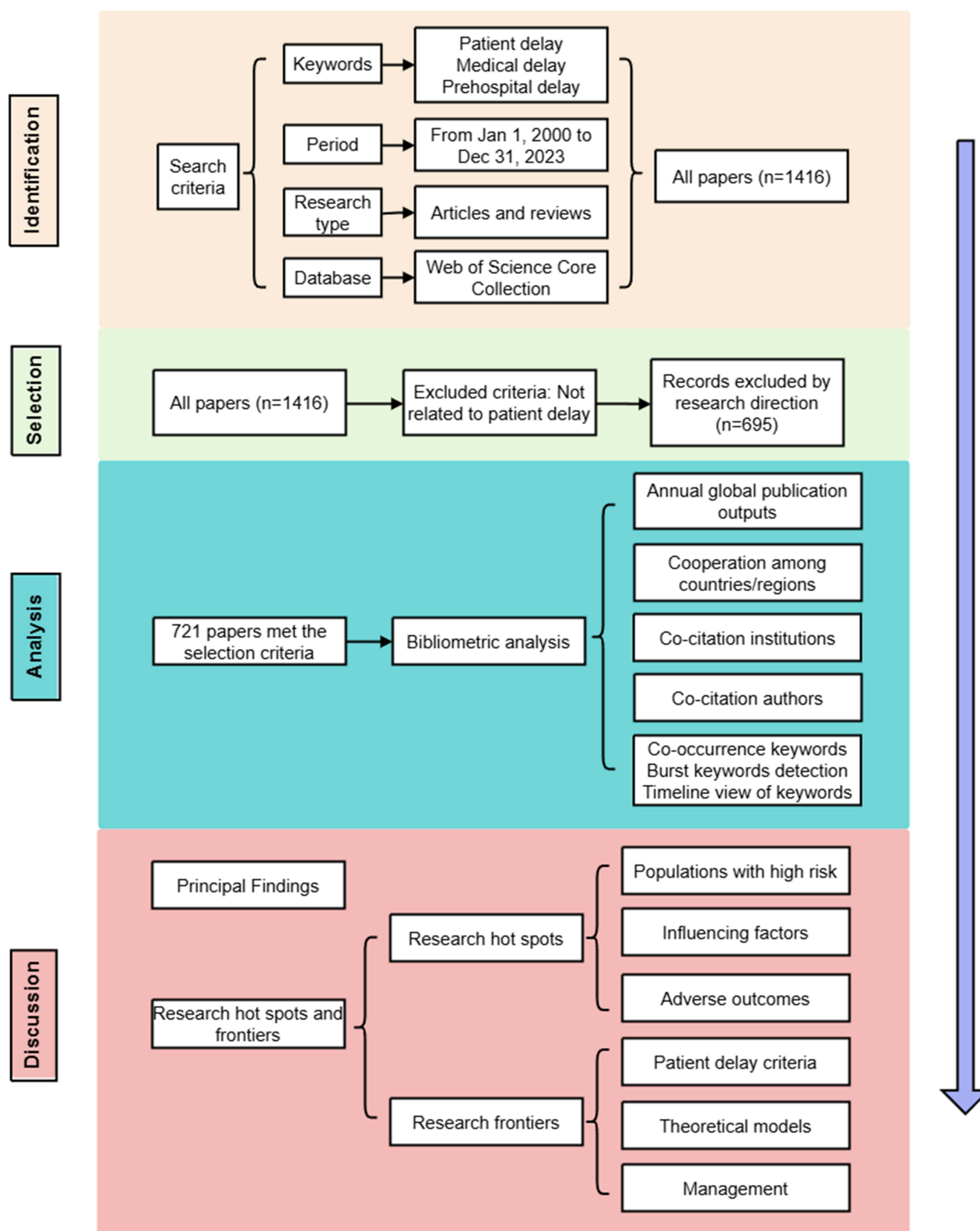


Figure I The literature screening process and research framework.

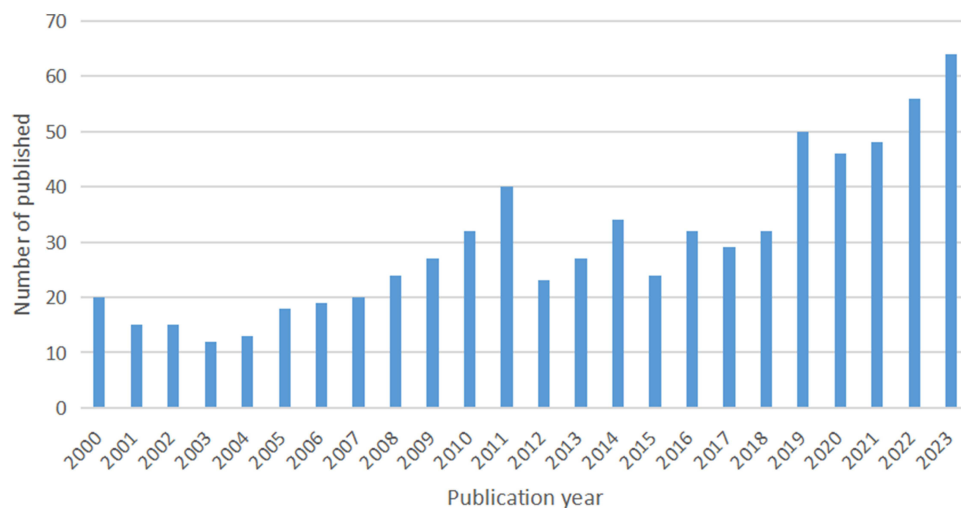


Figure 2 Annual publication counts.

timelines for color annotation. It can be seen that Dracup, Kathleen collaborates closely with Riegel, Mckinley, Baker, and Pelter. Yellow nodes represent authors who have been active recently, such as Mooney, Mckee, and O'Donnell.

Journal Distribution

Table 4 shows the top 10 most productive journals on Patient Delay, with “BMC Public Health” topping the list with 24 papers, followed closely by “International Journal of Tuberculosis and Lung Disease” with 20 and “PLOS ONE” with 17 papers. The top 10 journal publications accounted for 19.56% (141/721) of the total number of publications. Figure 6 shows the co-citation bibliometric map. The top 3 journals with the highest citations are International Journal of Tuberculosis and Lung Disease, Stroke, and Lancet.

Top 10 Most Cited References and Co-Cited References

Table 5 shows the top 10 most cited articles on Patient Delay. The most cited article is

Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council, (531 citations)

followed by

Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial. (419 citations)

Table 1 Top 10 Most Productive Countries

Countries	Article Counts	Percentage	Total Link Strength
USA	138	19.14%	79
China	75	10.40%	16
England	58	8.04%	29
Netherlands	45	6.24%	26
Australia	39	5.41%	33
Canada	28	3.88%	26
Denmark	28	3.88%	5
Sweden	26	3.61%	10
Germany	25	3.47%	7
Ethiopia	23	3.19%	9

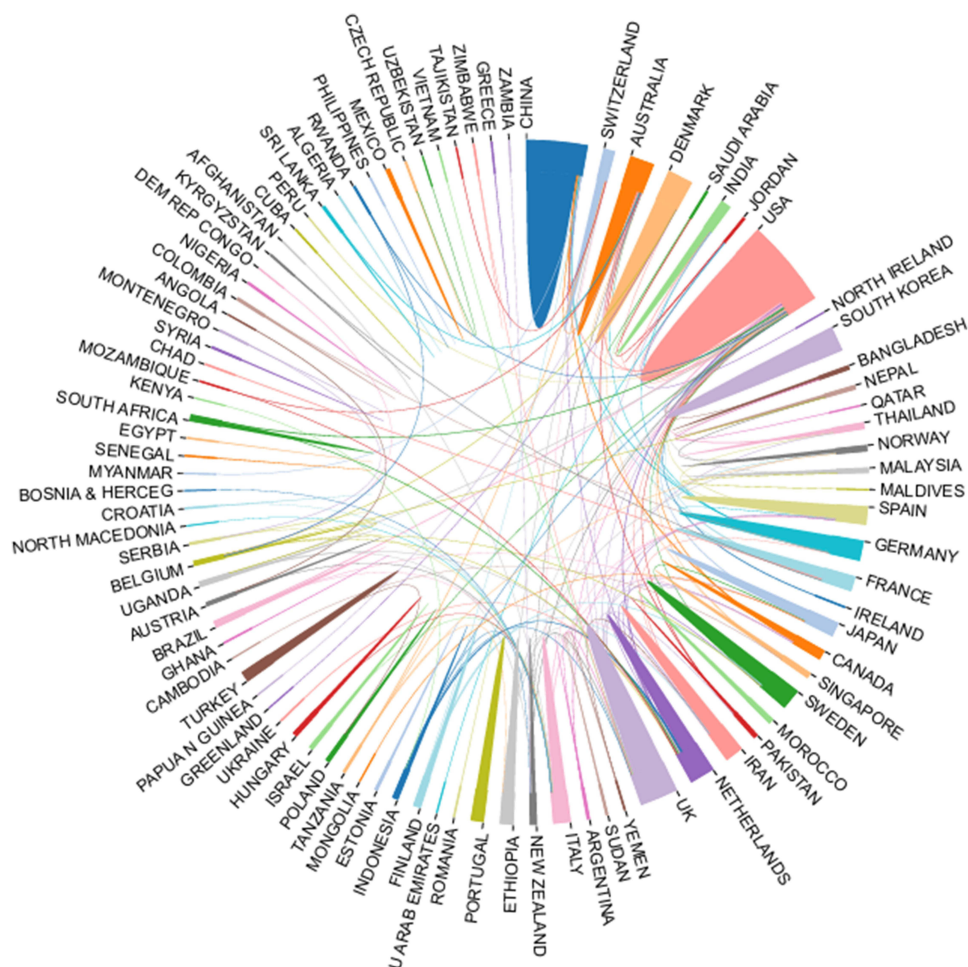


Figure 3 Visualization map of cooperation among countries/regions.

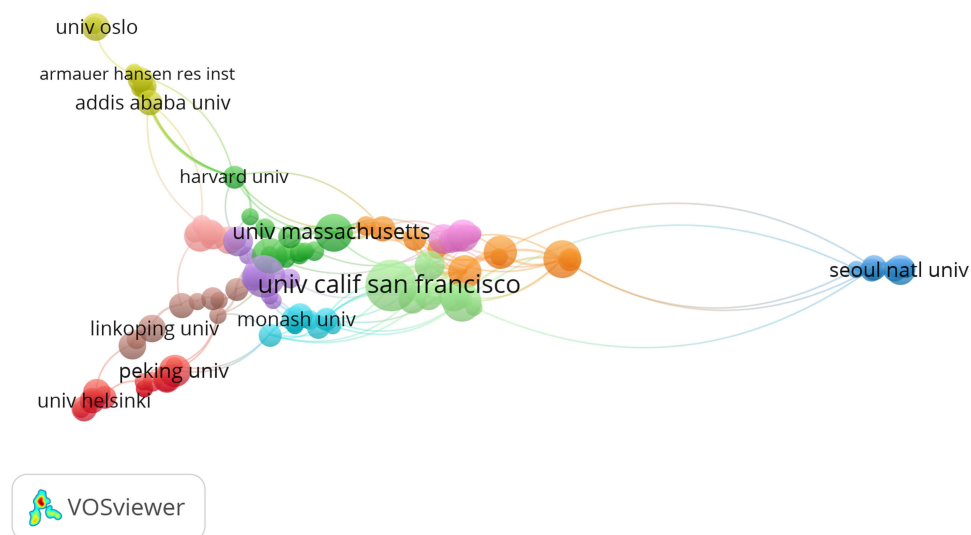


Figure 4 Visualization of research networks of institutions.

Table 2 Top 10 Most Productive Research Institutions

Institution	Country	Article Counts	Percentage	Total Link Strength
University of California San Francisco	USA	21	2.91%	34
King's College London	England	15	2.08%	9
University of Kentucky	USA	13	1.80%	36
Aarhus University	Denmark	12	1.66%	18
University of Massachusetts	USA	12	1.66%	17
University of North Carolina	USA	12	1.66%	17
Aarhus University Hospital	Denmark	11	1.53%	16
University of Toronto	Canada	11	1.53%	12
University of California Los Angeles	USA	10	1.39%	37
Technische Universität München	Germany	10	1.39%	11

Table 3 Top 5 Most Productive Authors

Author	Institution	Article Counts	Percentage	Total Link Strength
Moser, Debra K.	University of Kentucky	10	1.39%	37
Dracup, Kathleen	University of California San Francisco	10	1.39%	33
Riegel, Barbara	University of Pennsylvania	7	0.97%	33
Goldberg, Robert J.	University of Arizona College of Medicine	7	0.97%	23
Gore, Joel M.	University of Massachusetts	7	0.97%	23

The third most co-cited article is “Risk factors for delayed presentation and referral of symptomatic cancer: evidence for common cancers” (384 citations).

The top 10 co-cited references on Patient Delay are displayed in Table 6. The most co-cited article is

Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council, (26 citations)

followed by “2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation” (24 citations). The third most co-cited article is “A systematic review of delay in the diagnosis and treatment of tuberculosis” (21 citations).

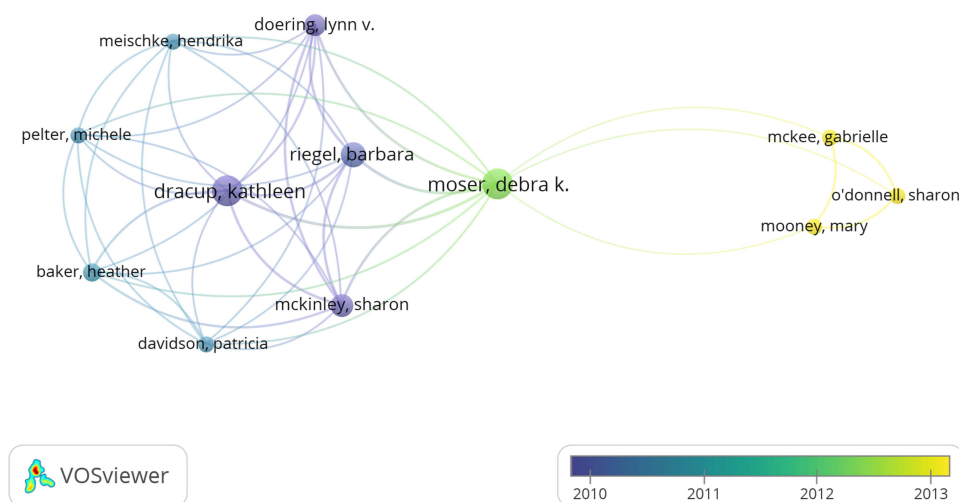
**Figure 5** Visualization of research networks of authors.

Table 4 Top 10 Most Productive Journals

Journal	Article Counts	Percentage	Total Citations	2024 JCR Category Quartile	2024 IF
BMC Public Health	24	3.33%	71474	Q1	3.5
International Journal of Tuberculosis and Lung Disease	20	2.77%	6424	Q2	3.4
PLOS ONE	17	2.36%	807746	Q1	2.9
BMC Infectious Diseases	15	2.08%	27786	Q2	3.4
European Journal of Cardiovascular Nursing	15	2.08%	2961	Q2	2.9
BMJ Open	15	2.08%	82146	Q1	2.4
Journal of Stroke & Cerebrovascular Diseases	10	1.39%	10879	Q3	2
BMC Health Services Research	9	1.25%	36089	Q2	2.7
Stroke	8	1.11%	72261	Q1	7.8
American Journal of Emergency Medicine	8	1.11%	14466	Q1	2.7

In addition, it is worth noting that 3 articles appeared in both the top 10 most cited articles and the top 10 most co-cited articles.

Keyword Analysis

Figure 7 shows a visualization of research networks of keywords. Keyword co-occurrence network graphs show the different frequencies of simultaneous keyword occurrences. Keywords are divided into 3 distinct clusters. The green cluster is mainly “Patient Delay”, “Diagnosis”, “Survival”, “Delay”, “Diagnostic Delay”, “Tuberculosis”, “Pulmonary Tuberculosis”, “Stage”, “Breast-cancer”, “Cancer”, and “Reasons”. The red cluster predominantly includes keywords like “Prehospital Delay”, “Symptoms”, “Acute Myocardial-infarction”, “Acute Coronary Syndrome”, “Mortality”, “Impact”, “Outcomes”, “Trends”, “Intervention”, “Chest-pain”, “Heart-disease”, “Gender”, “Depression”, and

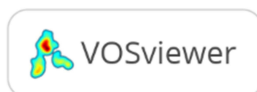
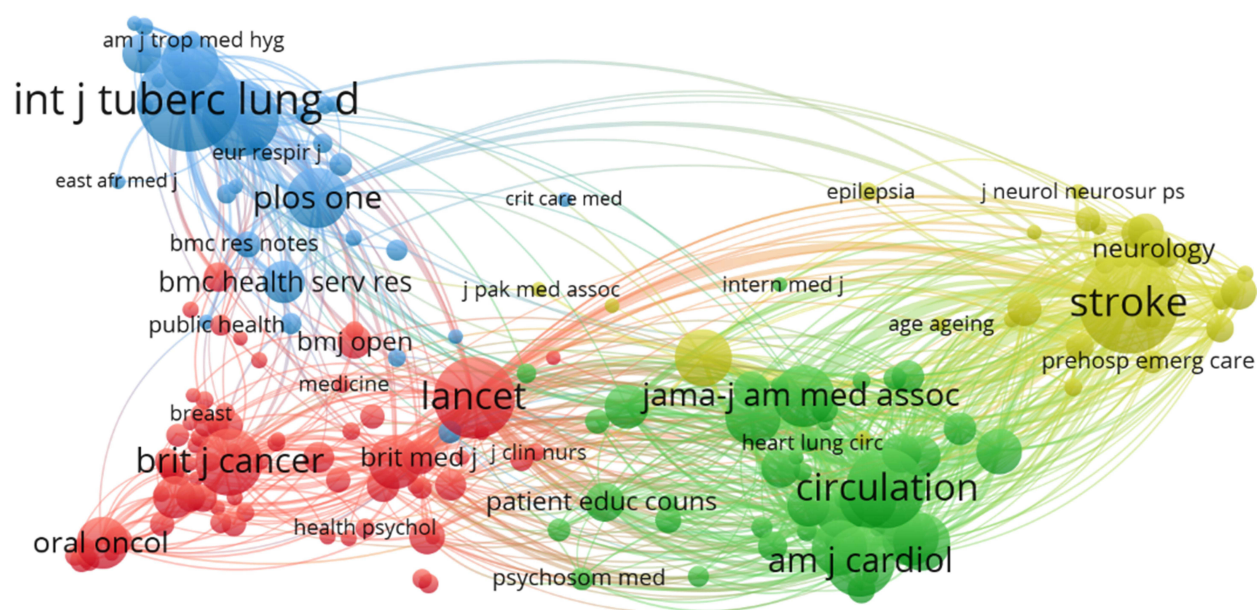
**Figure 6** Co-citation analysis of cited sources.

Table 5 Top 10 Most Cited Articles

Title	Journal	Year of Publication	Total Citations
Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council	Circulation	2006	531
Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial	Jama-journal of The American Medical Association	2000	419
Risk factors for delayed presentation and referral of symptomatic cancer: evidence for common cancers	British Journal of Cancer	2009	384
The Andersen Model of Total Patient Delay: a systematic review of its application in cancer diagnosis	Journal of Health Services Research & Policy	2012	347
Time delays in diagnosis of pulmonary tuberculosis: a systematic review of literature	BMC Infectious Diseases	2009	338
Long-Term Impact of Delay in Assessment of Patients With Early Arthritis	Arthritis And Rheumatism	2010	335
Prehospital and emergency department delays after acute stroke - The Genentech Stroke Presentation Survey	Stroke	2000	268
Delays in diagnosis and treatment of pulmonary tuberculosis in India: a systematic review	International Journal of Tuberculosis And Lung Disease	2014	243
Delays in the diagnosis and treatment of lung cancer	Chest	2005	231
A comprehensive review of prehospital and in-hospital delay times in acute stroke care	International Journal of Stroke	2009	230

Table 6 Top 10 Most Co-Cited References

Title	Journal	Year of Publication	Number of References Co-Cited
Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council	Circulation	2006	26
2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation	Kardiologia Polska	2018	24
A systematic review of delay in the diagnosis and treatment of tuberculosis	BMC Public Health	2008	21
Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial	Jama-journal of The American Medical Association	2000	13
A randomized clinical trial to reduce patient prehospital delay to treatment in acute coronary syndrome	Circulation-cardiovascular Quality And Outcomes	2009	13
Patient delay in cancer studies: a discussion of methods and measures	BMC Health Services Research	2009	13
Delay in diagnosis of pulmonary tuberculosis in low-and middle-income settings: systematic review and meta-analysis	BMC Pulmonary Medicine	2017	13
Trends in prehospital delay time and use of emergency medical services for acute myocardial infarction: experience in 4 US communities from 1987–2000	American Heart Journal	2005	12
Risk factors for delayed presentation and referral of symptomatic cancer: evidence for common cancers	British Journal of Cancer	2009	12
ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation	European Heart Journal	2012	9

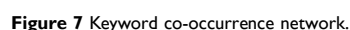


Figure 8 shows the top 25 burst keywords in Patient Delay field. “Chest Pain” topped the list with the highest burst strength (8.8), followed closely by “Management” (6.24), “Thrombolytic Therapy” (6.13), “Squamous Cell Carcinoma” (5.49), “Emergency” (5.4), and “Acute Myocardial Infarction” (4.91). “Chest Pain”, “Thrombolytic Therapy”, “Emergency”, “Cancer”, “Therapy”, “Acute Myocardial Infarction”, and “Decision” drew attention over two decades ago. Instead, “Symptom Onset”, “Management”, and “Health System Delay” represent recent frontiers in Patient Delay research.

Timeline viewer was presented through CiteSpace (Figure 9). The keywords prevalent in 2000 revolved around “Patient Delay”, “Prehospital Delay”, “Time”, “Care”, “Symptoms”, “Acute Myocardial Infarction”, “Diagnosis”, “Breast Cancer”, “Mortality”, “Pulmonary Tuberculosis”, “Management”, “Stage”, “Myocardial Infarction”, “Treatment Delay”, and “Chest Pain”. In the years 2020–2022, emerging keywords include “COVID-19”, “Global Burden”, “Public Health”, “Decision Delay”, “Qualitative Research”, “Disparity”, and “St Segment Elevation”.

Principal Findings

In addition, there is an imbalance in research advancement between countries/regions, potentially influenced by varying levels of economic development. Most of the higher number of publications and closer cooperation are in high-

Top 25 Keywords with the Strongest Citation Bursts

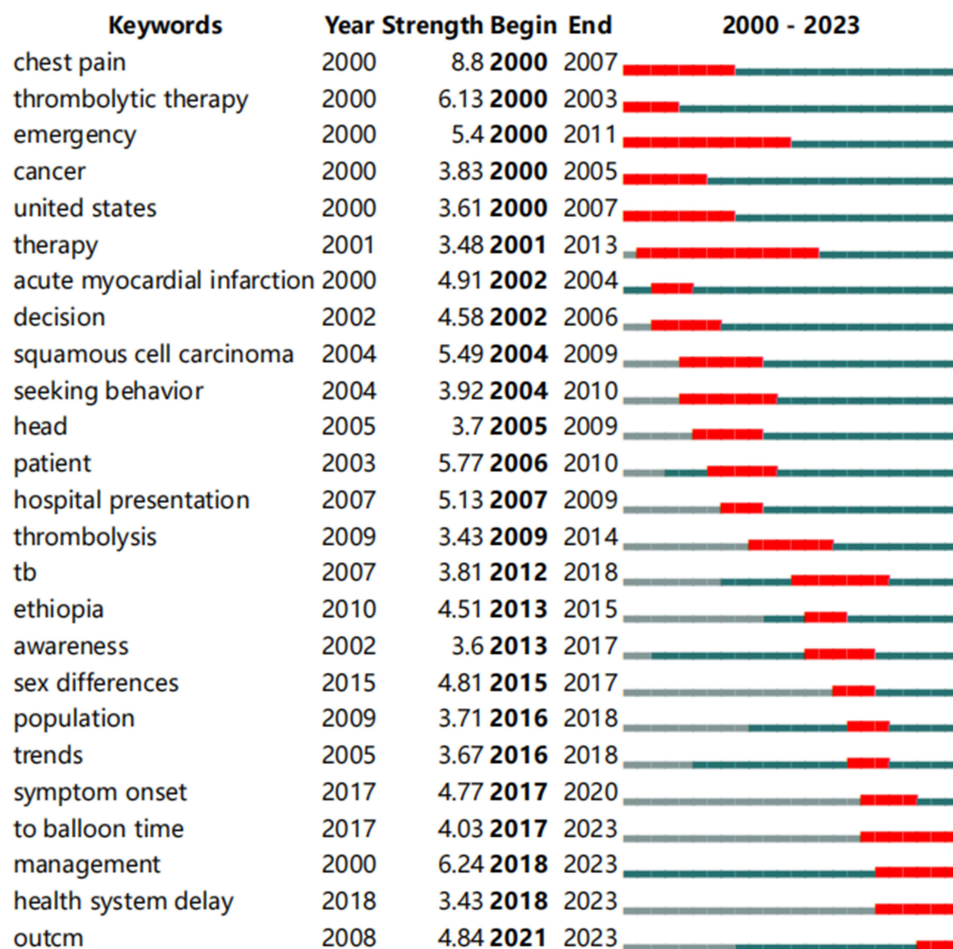


Figure 8 Top 25 keywords with strong citation bursts.

income countries. The USA is the most productive country and the closest cooperation with other countries. It may also be related to its national support. American Heart Association Council on Cardiovascular Nursing and Stroke Council issued a statement: Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke.¹⁶ Moreover, the majority of the top 10 active institutions come from the USA, which might explain why most of the work has been done there.¹⁷ A Meta-analysis showed that patients in low- and middle-income countries in the African region face long delays in pre-hospital and in-hospital management compared to high-income countries.¹⁸ Another study showed, that most of the high-income countries offered a stroke prehospital care used by patients, but this was rarely the case for the low- and middle-income countries.¹⁹ Time to admission was often much longer in low- and middle-income countries, and there was less access to stroke training for EMS and primary care staff. Global patient delays are prevalent and there is inadequate recognition of disease symptoms by the public and professionals, especially in low- and middle-income countries.

Moser is one of the most prolific authors. He focuses on prehospital delays in patients with acute myocardial infarction and stroke. He made a statement as a member of the American Heart Association Council on Cardiovascular Nursing and Stroke Council: Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke.¹⁶ Furthermore, Moser collaborated closely with Dracup, Kathleen, and Riegel, Barbara in Patient Delay research. They investigated the prognostic impact of prehospital delays,²⁰ influencing factors,^{21,22} and interventions^{23,24} in patients with

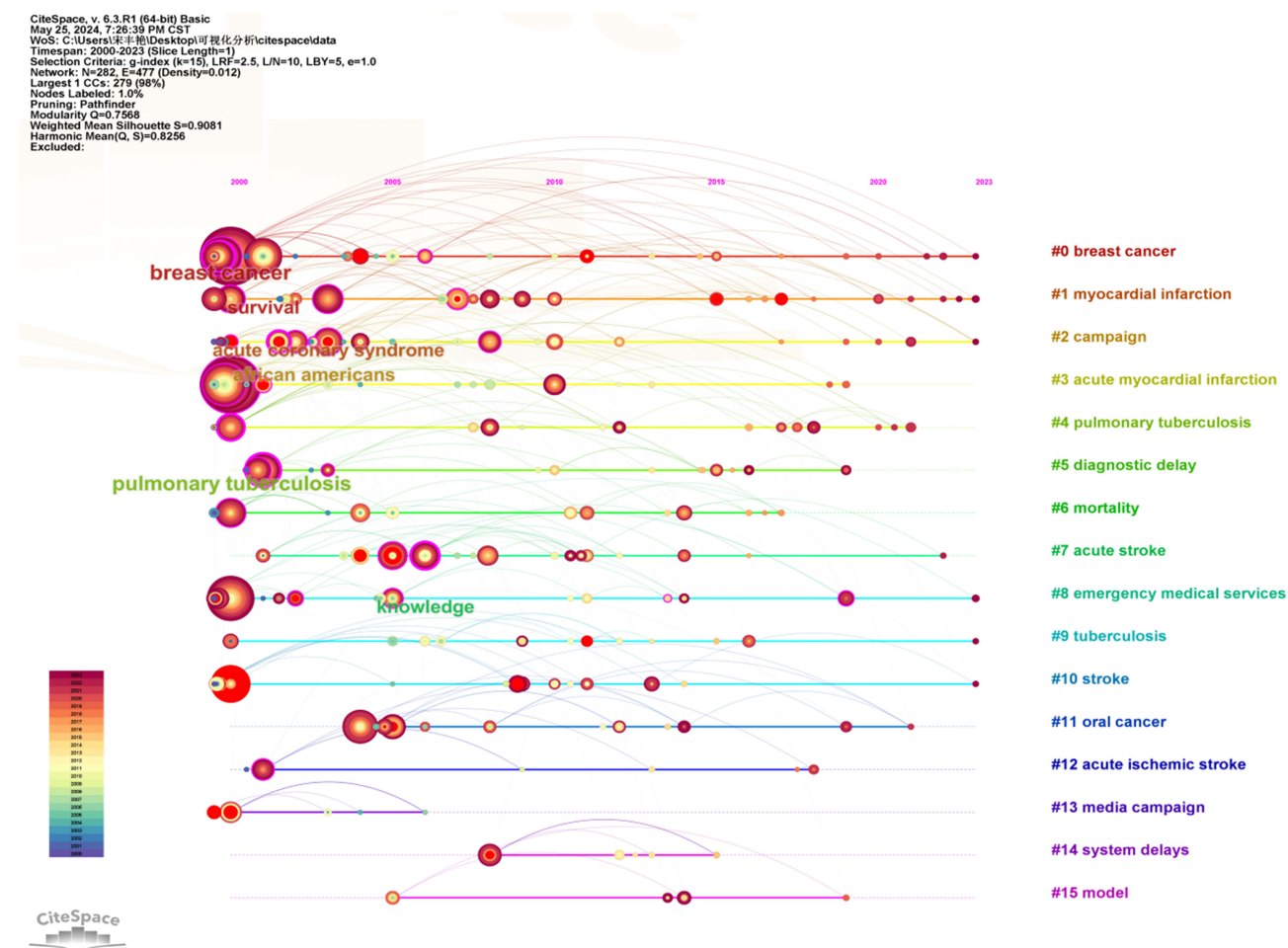


Figure 9 Timeline viewer related to Patient Delay.

acute myocardial infarction. Their research has made a significant contribution to the prevention and management of patient delay in patients with stroke and acute myocardial infarction.

According to a co-citation analysis, highly cited studies in this field are identified. “International Journal of Tuberculosis and Lung Disease” has the most citations, followed by “Stroke” and “Lancet”. This is unsurprising because tuberculosis and stroke have been a key research population in the area of patient delay. In addition, the Lancet can report global data on patient delays. To some extent, the results of these influential publications reflect the current state of the research field.

References are an important part and vital manifestation of a high-quality dissertation, which not only provides a strong argumentative basis but also extends the chain of information.¹⁷ The co-cited references are a statistically significant indicator of the scientific quality of the paper.¹⁴ The top 2 co-citations in the literature are guidelines and statements,^{16,25}

Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on cardiovascular nursing and stroke council

and “2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation”, largely because these guidelines and statements provide decision support and management options for healthcare practitioners. Therefore, these guidelines and statements are authoritative, based on extensive research and scientific methodology, and are widely cited. As a result, these two articles serve as milestones in the field of patient delay research.

Research Hotspots and Frontiers

Research Hotspots

We identified the main directions and hotspots contributing to patient delays through keyword co-occurrence analysis and citation burst maps. This study summarizes the 3 main categories of hotspots in patient delay as follows.

Populations with High Risk for Patient Delay

Keywords “Population”, “Acute Myocardial-infarction”, “Acute Coronary Syndrome”, “Pulmonary Tuberculosis”, “Stroke”, “Breast cancer”, “Cancer”, “Chest-pain”, and “Heart-disease” show this research hotspot. Researchers have focused on high-risk populations for patient delay issues, such as people with acute myocardial infarction, pulmonary tuberculosis, stroke, and people with cancer. A study reported that there were 39% of cancer patients were delayed, with an average delay of 5.4 months. A study reported a 39% incidence of patient delay for cancer patients, with an average delay of 5.4 months.²⁶ Breast, colorectal, cervical, lung, and head and neck cancers are among the more studied cancers in patient delay field.²⁷ Breast cancer is the most commonly reported, and most breast cancer patients have advanced tumors by the time they are diagnosed. However, the high-risk populations that have been studied earlier in patient delay are acute myocardial infarction, tuberculosis, and stroke. A Korean study included 4874 patients with acute myocardial infarction, of whom up to 71.6% had a time from symptom onset to consultation of more than 60 minutes.²⁸ Acute myocardial infarction is an acute condition, so the criteria for patient delay is defined by a time from symptom onset to consultation of more than 60 minutes. As mentioned above, the diagnostic criteria for patient delay are based on the characteristics of patients with different types of diseases. Whereas there is no standardized criteria for patient delay for tuberculosis patients, some studies used 3 weeks, 4 weeks, and a median time from symptom onset to clinic visit as cut-offs for diagnosing patient delay.^{29–31} Due to the highly contagious nature of tuberculosis, research on patient delay for tuberculosis has received much attention. The study showed that 72.3% of tuberculosis patients experienced patient delay.³² Stroke has seen a gradual increase in the number of studies in recent years, mostly studies on the distribution of delayed time, the current situation and influencing factors, and the development of the Delayed Intention to Medical Care Scale.³³ In summary, breast cancer, acute myocardial infarction, tuberculosis, and stroke are the most studied populations in the area of patient delay. Future research could focus on the prevention and management of patient delay for these populations.

Influencing Factors

Keywords “impact”, “risk-factors”, “reasons”, “risk”, “awareness”, “knowledge”, “predictors”, “gender”, and “depression”, show this research hotspot. In recent years, patient delays and influencing factors have generated a growing number of papers. A variety of groups have been involved, and many of them have shown to be patient delays. The factors influencing patient delay included age, sex, educational status, marital status, income, place of residence, distance of address from hospitals,³⁴ medical insurance,³³ frequency of medical check-ups, self-efficacy, social support, coping styles, initial symptom severity, disease perceptions, attitudes to medical care,³⁵ illness perceptions,³⁶ decision delay,³⁷ and so on. These are more general influencing factors, and there may be some disease-specific influencing factors, as well as individualized influencing factors for different individuals. Therefore, it is important to develop individualized intervention programs or health education based on the factors influencing the delay in seeking medical care for different diseases.

Adverse Outcomes

Keywords “mortality”, “survival”, and “depression”, show this research hotspot. Patient delay has been used to predict the length of hospitalization and readmission. Readmission not only affects the patient’s prognosis but also imposes financial and psychological burdens on the patient and his or her family. Studies have shown that patient delay may cause adverse patient outcomes such as all-cause mortality,³⁸ length of hospitalization,³⁹ survival outcome,⁴⁰ relapse rate,⁴¹ and so on. For stroke patients arriving at the hospital to receive thrombolysis within the thrombolytic time window of 4.5 h after onset is the most effective measure to improve prognosis and reduce mortality. Thrombolysis at 6 hours after the onset of stroke is nearly ineffective and may even increase the risk of intracranial haemorrhage. As a result, stroke

patients experiencing patient delay often lead to a range of neurological deficits, such as brain damage and hemiparesis. The delay in seeking medical attention that occurs in cancer patients often results in the cancer being at an advanced stage, which in turn leads to increased difficulty in treatment and poor treatment outcomes. Given that patient delay is more widely discussed, further scientific research is needed on the adverse effects of patient delays on the physiology and psychology of patients and on global public health.

Research Frontiers

Citation burst keywords indicate emerging trends and the latest keywords may predict the frontiers of research as follows:

Patient Delay Criteria

The latest keywords “symptom onset” (2017–2020), “to balloon time” (2017–2023), and “health system delay” (2018–2023) suggest this research trend. Pack first proposed the definition and classification of delay in 1938.³ They consider delay time to be the period between when a patient first notices a suspicious symptom and when the diagnosis is confirmed, which can be divided into two parts: patient delay and system delay. Patient delay refers to a period longer than three months between the time a patient first notices a suspicious symptom and the time he or she first visits a healthcare facility. System delay refers to the time between the patient’s first visit and the initiation of treatment being more than 1 month. However, sometimes the criteria for patient delay is different for different diseases. For example, the National Institute for Clinical Excellence (NICE) in the UK has given guidelines stating that patient delays for the diabetic foot are considered to be more than 24 hours after the appearance of a new ulcer, swelling, or discoloration.⁴² In contrast, a cancer patient with more than three months between the time a patient first notices a suspicious symptom and the first visit to the doctor is considered to be patient-delayed. Generally, the criteria for patient delay for different diseases is based on high-level evidence such as guidelines and policies or is based on theoretical models.

Theoretical Models of Patient Delay

This frontier can be surmised by the timeline viewer. Previous studies have focused on the relationship between delay and patient survival, and factors associated with patient delay, while fewer studies have examined theoretical models related to patient delay. In recent years, research on the theoretical model of patient delay has gradually increased. Anderson’s model of health-seeking behavior, proposed in 1995, divides the time from the detection of suspicious symptoms to the initiation of treatment for cancer patients into five stages.² (1) Appraisal delay refers to the stage between when a patient first notices symptoms and when a judgment is made about their severity; (2) Illness delay denotes the stage between the patient’s judgment of the severity of the symptoms and the decision to seek medical help; (3) Behavioral delay is the period between a patient’s decision to seek medical help and the first time they make an appointment; (4) Scheduling delay refers to the period between a patient’s first appointment and their first visit to the hospital; (5) Treatment delay is defined as the period from the patient’s first visit to the start of treatment. The model has been more widely disseminated and applied in studies of delays associated with cancer patients.^{43,44} Another well-studied theory is the grounded model of help-seeking behavior for breast cancer, which was proposed by Unger-Saldana in 2011.⁴⁵ The model includes the entire process from symptom discovery to consultation and consists of four components: context, woman’s symptom interpretation and decision-making processes, social network influences, and health services utilization. The theory has also been widely used in studies of patient delay for breast cancer.⁴⁶

Management of Patient Delay

The keywords “management” (2018–2023) and “outcome” (2021–2023) indicate this future trend. Effective management of people at high risk of delayed access can reduce or avoid adverse outcomes. Current interventions focus on acute illnesses such as acute myocardial infarction and stroke as a way to improve their intention to seek medical care and to reduce the incidence and duration of patient delay. In a study, researchers constructed a cognitive-narrative intervention program based on social cognitive theory to improve cognition, perception, and behavior in patients with acute myocardial infarction. The results showed that the program improved their attitudes and beliefs about the disease as

well as shortened prehospital delay time.⁴⁷ In another study, “text + visual” BCT-based intervention was used in patients. The results showed that the intervention has significant potential and is worthy of further testing.⁴⁸ These studies provide a more up-to-date perspective on the latest advances and innovations in delayed intervention for patients. In addition, we found that the subjects of these studies were people with diagnosed illnesses,⁴⁹ which could not change whether or not they experienced patient delay, only to improve the subjects’ intentions and attitudes toward seeking medical care. It is recommended that researchers increase public health education to improve the public’s intention to seek medical care and attitudes toward medical care. Interventions for those who do not experience patient delay can be effective in preventing the occurrence of delays in accessing care.

Strengths and Limitations

Bibliometrics can predict future trends in research development and illustrate the process by which research areas are formed and developed. Through the use of these bibliometric analysis tools, data can be extracted and analyzed comprehensively and systematically to reveal research directions and trends in the patient delay field. Nevertheless, the study’s limitations should not be ignored. Due to the limitations of the software, we only screened the literature from WOSCC, which may have led to the neglect of relevant literature. In addition, due to the timeliness of the literature, citations may be delayed, resulting in bias related to the number of citations. Further studies in this field could consider integrating multiple databases to gain a more comprehensive and in-depth understanding.

Conclusion

This study uses bibliometric tools to analyze articles on patient delays found in the WOSCC database from 2000 to 2023 to explore research directions and future research frontiers. This study provides useful information on research hotspots, frontiers, and other research details. Using the results of co-occurring keyword analyses, three hotspots in the field were explored: “Populations with high risk for Patient Delay”, “Influencing factors”, and “Adverse outcomes”. Recent keyword bursts indicate that “Patient delay criteria”, “Theoretical models of patient delay”, and “Management of patient delay” may be the research frontiers. This research can be used to determine the current status of research in this area and to point the way to future studies. In the future, researchers and administrators should focus on the management elements of patient delay and focus more attention on those at risk for patient delay. Moreover, public willingness to engage in healthcare behaviors and attitudes towards accessing healthcare should be improved as a means of reducing the incidence of patient delays. For example, the intention of the public or those at high risk of patient delay to seek medical care can be improved by exploring and adopting multidisciplinary collaboration and high-quality, high-level interventions or health education.

Data Sharing Statement

The original data associated with this study has not been deposited into any publicly available repository, as the data used to support the results of this study are provided by the Web of Science Core Collection with permission. Additional data will be made available on request to the corresponding authors.

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