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Reflection

Delayed Cancer Diagnosis: Bibliometric Analysis and its Relevance in Health Systems[*]

[English version]

Diagnóstico tardío del cáncer: análisis bibliométrico y su relevancia en sistemas de salud

Diagnóstico tardio do câncer: análise bibliométrica e sua relevância nos sistemas de saúde

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Abstract

Objective: To analyze scientific production and trends regarding the relationship between cancer, delayed diagnosis, and health systems from a comprehensive approach. **Methodology:** Bibliometric techniques were applied using the Scopus database, incorporating productivity indicators and bibliographic coupling network analysis. Temporal trends, distribution by authors, journals, countries, and fields of knowledge were examined. **Results:** Delayed diagnoses are explained by personal factors (age, education, and beliefs), social factors (economic, cultural, and geographical conditions), and structural factors (institutional fragmentation and weak coordination among stakeholders). Five research clusters were identified: determinants of delayed

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diagnosis, therapeutic options, socioeconomic factors, the impact of COVID-19, and life expectancy as a factor in treatment decisions. **Conclusions:** Reducing delayed diagnoses requires strategies at macro, meso, and micro levels, prioritizing health promotion, disease prevention, and guaranteeing the right to life and health.

Key words: cancer; delayed diagnosis; neoplasm staging; health care systems; health policy (obtained from the DeCS/MeSH thesaurus).

Clasification JEL: I18 - I19.

Resumen

Objetivo: analizar la producción científica y las tendencias sobre la relación entre cáncer, diagnóstico tardío y sistemas de salud desde un enfoque integral. **Metodología:** se aplicaron técnicas bibliométricas en la base de datos Scopus, con indicadores de productividad y análisis de redes de acoplamiento bibliográfico. Se examinaron tendencias temporales, distribución por autores, revistas, países y áreas de conocimiento. **Resultados:** los diagnósticos tardíos se explican por factores personales (edad, educación y creencias), sociales (condiciones económicas, culturales y geográficas) y estructurales (fragmentación institucional y baja articulación entre actores). Se identificaron cinco clústeres de investigación: determinantes del diagnóstico tardío, opciones terapéuticas, factores socioeconómicos, impacto de la COVID-19 y esperanza de vida como condicionante en decisiones de tratamiento. **Conclusiones:** reducir diagnósticos tardíos exige estrategias en los niveles macro, meso y micro, priorizando promoción de la salud, prevención de la enfermedad y garantía del derecho a la vida y a la salud.

Palabras clave: cáncer; diagnóstico tardío; estadificación de neoplasias; sistemas de atención de salud; política de salud (obtenidos del tesauro DeCS/MeSH).

Clasificación JEL: I18 - I19.

Resumo

Objetivo: analisar a produção científica e as tendências sobre a relação entre câncer, diagnóstico tardio e sistemas de saúde a partir de uma perspectiva integral. **Metodologia:** aplicaram-se técnicas bibliométricas na base de dados Scopus, com indicadores de produtividade e análise de redes de acoplamento bibliográfico. Examinaram-se as tendências temporais e a distribuição por autores, revistas, países e áreas de conhecimento. **Resultados:** os diagnósticos tardios são explicados por fatores pessoais (idade, escolaridade e crenças), sociais (condições econômicas, culturais e geográficas) e estruturais (fragmentação institucional e baixa articulação entre os atores). Identificaram-se cinco clusters de pesquisa: determinantes do diagnóstico tardio, opções terapêuticas, fatores socioeconômicos, impacto da COVID-19 e expectativa de vida como condicionante nas decisões de tratamento. **Conclusões:** reduzir os diagnósticos tardios exige estratégias nos níveis macro, meso e micro, priorizando a promoção da saúde, a prevenção da doença e a garantia do direito à vida e à saúde.

Palavras-chave: câncer; diagnóstico tardio; estadiamento de neoplasias; sistemas de atenção à saúde; política de saúde (obtidos do DeCS/MeSH).

Classificação JEL: I18 – I19.

Introduction

Cancer is one of the leading causes of death worldwide. It is defined as a group of non-communicable diseases characterized by the uncontrolled proliferation of abnormal cells that may remain localized or spread to other organs and tissues. According to the World Health Organization (PAHO, 2024), approximately 10 million people died from various types of cancer in 2021, primarily breast, lung, prostate, colon, and rectal cancers, and nearly 20 million new cases were reported. By 2040, a nearly 60% increase is projected, with over 30 million additional diagnoses.

Cancer may present as benign or malignant tumors, the latter being the most dangerous due to their rapid growth and invasive capacity. Classification is based on the cell type of origin, including solid tumors (carcinomas, sarcomas, lymphomas, brain and spinal cord tumors) or liquid tumors (leukemias) (UICC, 2024). Early identification of the disease stage is decisive in determining treatment, typically using the TNM system, which assesses tumor size (T), lymph node involvement (N), and the presence of metastasis (M), or specific classifications like FIGO for gynecological cancer and Lugano for lymphomas (American Cancer Society, 2024a, 2024b).

Globally, initiatives have been implemented to improve timely diagnosis and treatment. The WHO promotes the Global Cancer Strategy, while the Union for International Cancer Control leads the Cities Against Cancer program. Countries such as the United States, Peru, and Colombia have reference institutions such as the American Cancer Society, the National Institute of Neoplastic Diseases, and the National Cancer Institute, aimed at strengthening prevention and comprehensive care (CAC, 2015; NCI, 2024).

However, health systems face structural weaknesses and fragmented care, limiting a timely response to a high-cost, significant public health burden. This underscores the importance of analyzing, from a health systems perspective, the challenges of delayed diagnosis and the State's role in guaranteeing the right to health and cancer prevention (Shakarishvili *et al*., 2011).

Methodology

This study used bibliometric analysis as an evaluation technique for scientific output on health systems, cancer, and delayed diagnosis. The document search was conducted in the Scopus database, selected for its global coverage and for offering indicators that enable highly reliable descriptive and comparative analyses (Janik *et al.*, 2020; Shukla *et al.*, 2020).

The methodological procedure is presented below in Figure 1:

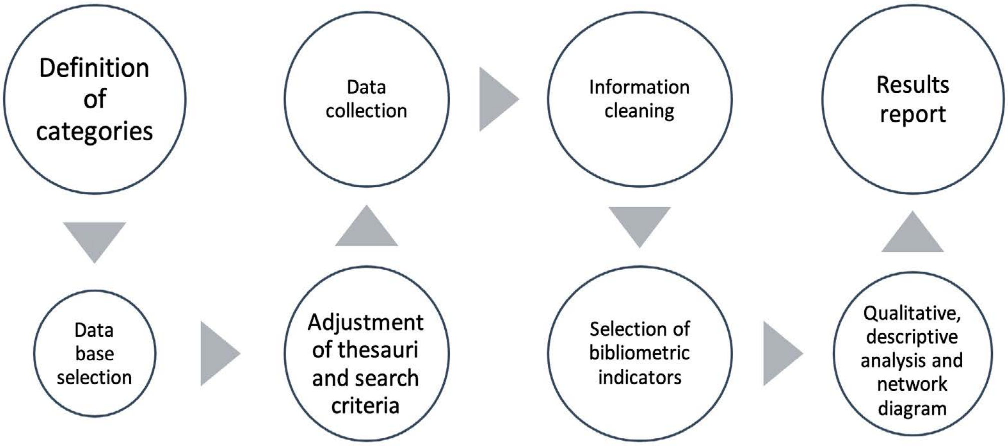

Figure 1. *Methodological Procedure.*

Source: Authors' own work based on Osorio-Andrade *et al.*, 2023..

Database Selection

Scopus was chosen as one of the most comprehensive sources of scientific literature and for its relevance in bibliometric studies related to public health (Shukla *et al.*, 2020).

Construction of Search Equation Using Thesaurus

The search equation was built using the UNESCO thesaurus and the DeCS/MeSH descriptors from Bireme: ((TITLE-ABS-KEY("cancer") OR TITLE-ABS-KEY("Carciogen") AND TITLE-ABS-KEY("Delayed Diagnosis") OR TITLE-ABS-KEY("Neoplasm Staging") AND TITLE-ABS-KEY("Health systems")) AND (LIMIT-TO (OA,"all")) AND (LIMIT-TO (DOCTYPE,"ar"))). The search was carried out up to March 2024.

Data Cleaning: Inclusion and Exclusion Criteria

No restrictions were set regarding language, country, author, or publication period, and an initial total of 350 records was obtained. After cleaning, documents other than scientific articles (e.g., in-progress reviews, errata, and session papers) and those without open access were excluded. The final sample consisted of 198 articles, processed using the *VOSviewer* software package (Waltman & van Eck, 2015). The criteria are outlined in Table 1.

Table 1. *Methodological Procedure.*

Criterion	Inclusion	Exclusion
Study period	All	None
Country/Territory	All	None
Authors	All	None
Subject area	All	None
Source type	All	None
Study population	All	None
Document type	Article	Under review, session paper, erratum.

Language	All	None
Open Access	All open access	Green, gold, bronze, hybrid gold

Source: Authors' own work based on Moreno & Urrego, 2022.

The selected documents were analyzed using bibliometric indicators, enabling descriptive, mathematical, and statistical analysis. Specifically, territorial indicators were used to identify the most representative countries; indicators for leading journals; indicators for the most prolific authors in the field and summaries of their most notable articles; indicators for the most-cited articles from various sources; areas of knowledge interested in the topic; affiliations or institutions with the highest global scientific output; term co-occurrence networks based on selected articles; bibliographic coupling for cluster generation; and finally, future research lines.

The combination of descriptive, statistical, and network analyses provided a comprehensive view of the field, consolidating evidence on scientific production related to cancer, delayed diagnoses, and health systems, as well as identifying gaps and future research directions.

Results

Temporal Trends and Volume of Publications

Figure 2 shows how scientific output on health systems and delayed cancer diagnoses began in 1999 with the article *Has the Use of Pap Smears Reduced the Risk of Invasive Cervical Cancer in Guadalajara, Mexico?* (Jiménez-Pérez & Thomas, 1999). This case-control study showed that women who underwent Papanicolaou smears had a significantly lower risk of cervical cancer (OR=0.3; 95% CI: 0.2–0.4), an effect that persisted for over five years.

Between 2000 and 2013, production was scarce, but from 2014 onward, there has been steady growth with intermittent behavior, reaching its peak in 2020 with 197 articles. The decline recorded in 2024 is due to the search cut-off conducted in April of that year, and therefore does not necessarily reflect a downward trend.

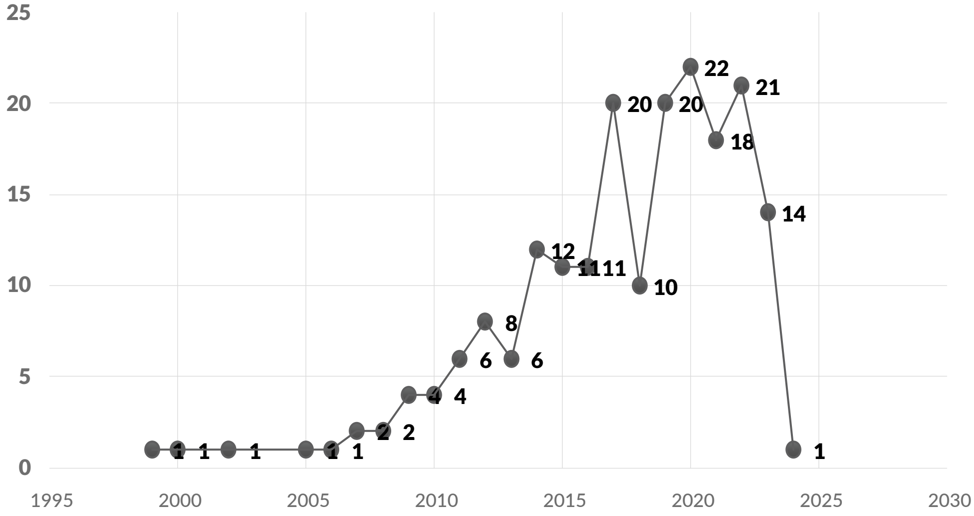

Figure 2. *Evolution of Scientific Production.*

Territorial Indicator

The United States accounts for the highest scientific output related to health system management and delayed cancer diagnoses, with 91 articles (27%), followed by Brazil (32; 10%), the United Kingdom (23; 7%), Spain (14; 4%), and Italy (13; 4%). In a second tier are Australia, Canada, and Germany with ten publications each (3%), France with nine (3%), and Uganda with seven (2%).

In Latin America, scientific production is low: Chile reports four articles (1%), Colombia three (1%), and Uruguay just one. Other countries, such as India and Pakistan, each contributed two documents. These data reveal a concentration in high-income countries and limited regional participation (Hershman *et al*., 2010).

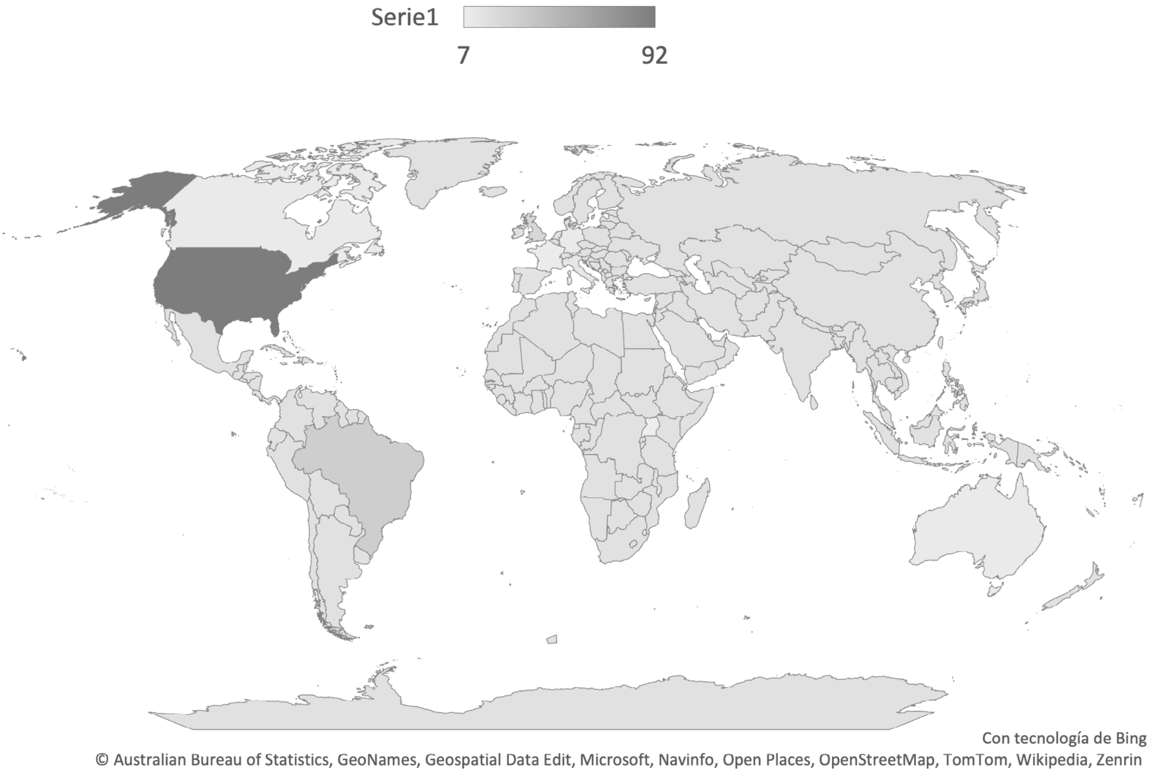

Figure 3. *Scientific Production by Country.*

Journal Indicator

The ranking of the ten journals with the highest scientific output in this field shows that 60% belong to the Q1 quartile of the SJR, 30% to Q2, and 10% to Q3. At the top of the list is *PLOS One* (USA) with ten articles, followed by *BMC Cancer* (UK) with eight, and *Breast Cancer Research and Treatment* (USA) with seven. These results highlight that journals with the greatest academic impact are the main channels for disseminating knowledge on cancer and delayed diagnoses.

Table 2. *Journals with the Highest Number of Publications.*

No.	Journal	No. of Documents	Country	SJR
1	Plos One	10	United States	Q1
2	BMC Cancer	8	United Kingdom	Q2
3	Breast Cancer Research and Treatment	7	United States	Q1
4	Journal of Clinical Oncology	7	United States	Q1
5	BMC Health Services Research	6	United Kingdom	Q1
6	Cancer	6	United States	Q1
7	International Journal of Cancer	6	United States	Q1
8	Annals of Surgical Oncology	4	United States	Q2
9	Asian Pacific Journal of Cancer Prevention	4	Thailand	Q3
10	Ciencia E Saude Coletiva	4	Brazil	Q2

Top-Contributing Authors Indicator

Table 3 presents the authors with the highest number of published scientific articles on health system management and delayed cancer diagnoses.

Zhu (F. Edward Hebert School of Medicine, USA) leads the list with 12 articles, highlighting his work on thyroid cancer incidence in the U.S. (1980–2005), cited 673 times (Enewold *et al.*, 2009). This author is followed by Shriver (Uniformed Services University of the Health Sciences, USA), with an h-index of 70 and his most cited article: *Comprehensive Molecular Portraits of Human Breast Tumours*, with over 8,900 citations (The Cancer Genome Atlas Network, 2012).

In third place is McGlynn (NCI, USA), recognized for her research on hepatocellular carcinoma and germ cell tumors. Her article on HCC incidence and mortality has more than 1,400 citations (Altekruse *et al.*, 2009).

Lin (HJF, Rockville, USA) ranks fourth for his contributions to lung cancer cohort studies and the role of metformin in survival (Lin *et al.*, 2017). Finally, Kantelhardt (University of Halle-Wittenberg, Germany) has contributed studies on early detection and therapies for breast cancer, including highly impactful clinical biomarker research (Schmitt *et al.*, 2019).

Together, these authors shape the leading lines of investigation and global academic influence networks in the field..

Table 3. *Most Prolific Authors.*

Author	Publications	Citations	h-index	Country
Zhu, K.	12	4160	35	United States
Shriver, C. D.	11	41.095	70	United States
McGlynn, K. A.	8	26.418	80	United States
Kantelhardt, E. J.	5	2217	28	Germany
Lin, J.	5	212	8	United States
Zahm, S. H.	5	13.463	66	United States
Jemal, A.	4	508.077	146	United States
Pawloski, P. A.	4	2.661	27	United States
Weller, D.	4	9.089	49	United Kingdom
Cherchiglia, M. L.	3	1314	19	Brazil

Most Cited Articles Indicator

The five most cited articles in this field, published between 2008 and 2020, address topics related to treatment adherence, early detection, and quality of oncology care.

The most cited study analyzes adherence to adjuvant hormonal therapy in stage I–III breast cancer, showing that sociodemographic factors decisively influence treatment continuity (Hershman *et al.*, 2010). The second most cited, *Characteristics of Missed or Interval Colorectal Cancer and Patient Survival*, highlights the importance of preventive colonoscopy in identifying polyps and reducing colorectal cancer incidence (Samadder *et al.*, 2014).

The third article, *American Society of Clinical Oncology/National Comprehensive Cancer Network Quality Measures*, established quality benchmarks for breast and colorectal cancers to support clinical management and decision-making (Desch *et al.*, 2008).

Fourth, a *Journal of Clinical Oncology* article highlighted poor adherence among older women with breast cancer, linked to advanced age and life expectancy (Soulos *et al.*, 2012). Finally, *Patient Beliefs that Chemotherapy May Be Curative and Care Received at the End of Life Among Patients with Metastatic Lung and Colorectal Cancer* (Mack *et al.*, 2015), with 104 citations, showed that patient beliefs about metastatic cancer influence the choice between chemotherapy and palliative care.

Table 4. *Most Cited Articles.*

Article	Authors	Journal	Year	No. of Citations
Early Discontinuation and Nonadherence to Adjuvant Hormonal Therapy in a Cohort of 8,769 Early-Stage Breast Cancer Patients	Hershman, D., Kushi, L., Shao, T *et al.*	*Journal of Clinical Oncology, 28*(27), pp. 4120-4128.	2010	632
Characteristics of Missed or Interval Colorectal Cancer and Patient Survival: A Population-Based Study	Samadder, N., Curtin, K., Tuohy, T *et al.*	*Gastroenterology, 146*(4), pp. 950-960.	2014	215
American Society of Clinical Oncology/ National Comprehensive Cancer Network Quality Measures	Desch, C., Mcniff, K., Schneider, E *et al.*	*Journal of Clinical Oncology, 26*(21), pp. 3631-3637.	2008	200
Assessing the Impact of a Cooperative Group Trial on Breast Cancer Care in the Medicare Population	Soulos, P., Yu, J., Roberts, K *et al.*	*Journal of Clinical Oncology, 30*(14), pp. 1601-1607.	2012	109
Patient Beliefs that Chemotherapy may be Curative and Care Received at the End of Life Among Patients with Metastatic Lung and Colorectal Cancer	Mack, J., Walling, A., Dy, S., Keating, N., Tisnado, D *et al.*	*Cancer, 121*(11), pp. 1891-1897.	2015	104

Fields of Knowledge

Scientific output on delayed diagnosis, cancer, and health systems primarily comes from the field of medicine, which accounts for 69% of the 183 articles. Biochemistry, genetics, and molecular biology rank second with 25% (66 articles), followed by multidisciplinary studies with 4% (10 articles).

Environmental sciences and nursing show lower participation, each accounting for 1% (4 publications). The remaining contributions come from diverse fields such as economics, pharmacology, social sciences, dentistry, neuroscience, decision sciences, and arts and humanities, each with one or two articles.

These data reflect the dominant presence of the biomedical field, with emerging contributions from social and economic disciplines.

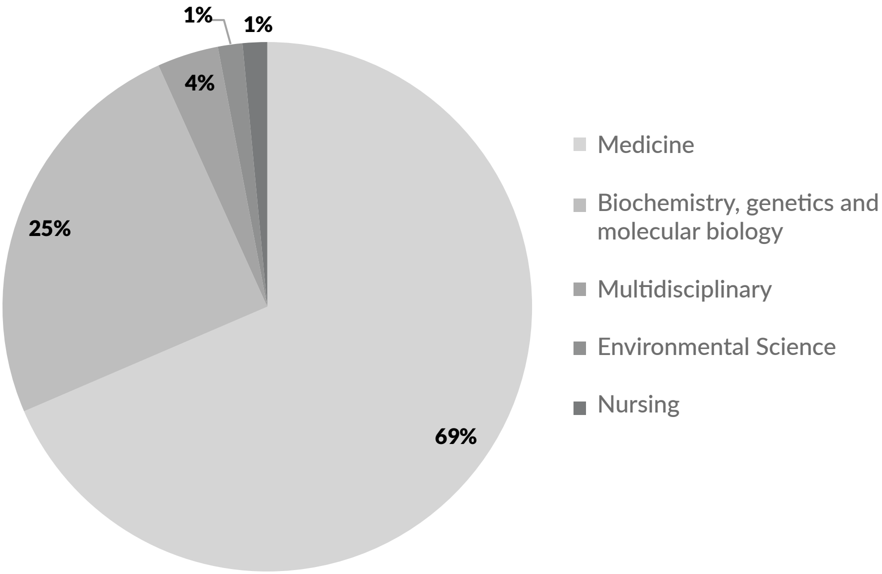

Figura 4. *Scientific Production by Field of Knowledge.*

Top-Contributing Affiliations

The institutions with the highest number of publications in this field are predominantly based in the United States. Leading the list is the *Uniformed Services University of the Health Sciences* with 12 articles, followed by the *Walter Reed National Military Medical Center* with 11. Three institutions each produced ten articles: *Harvard Medical School*, the *National Cancer Institute* (NCI), *and Brigham and Women's Hospital.*

In Latin America, the *Universidade de São Paulo* (Brazil) ranks sixth with nine publications. At similar levels are *Kaiser Permanente* (USA) with nine, the *F. Edward Hebert School of Medicine* with eight, the *Harvard T. H. Chan School of Public Health* with seven, and the *Duke University School of Medicine* with six.

These findings confirm the predominance of U.S.-based institutions in cancer research and diagnosis.

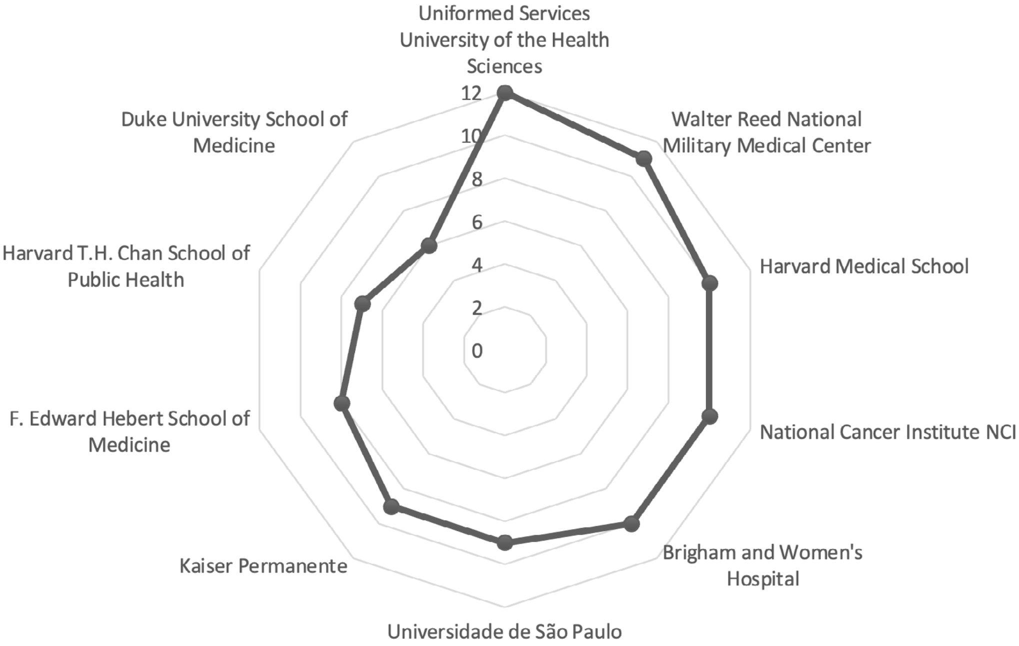

Figure 5. *Institutions with the Highest Scientific Output.*

Term Co-occurrence Network

The term co-occurrence network (figure 6) allowed the identification of the most frequently used keywords in the 198 selected articles (Donthu *et al.*, 2021). The analysis yielded a total of 304 terms, organized into five clusters that reflect the main research axes related to cancer, delayed diagnosis, and health systems. These clusters complement the findings from the bibliographic coupling and make it possible to visualize the conceptual structure of the field, as well as the connections between biomedical, epidemiological, and health management areas, thereby guiding potential future research lines.

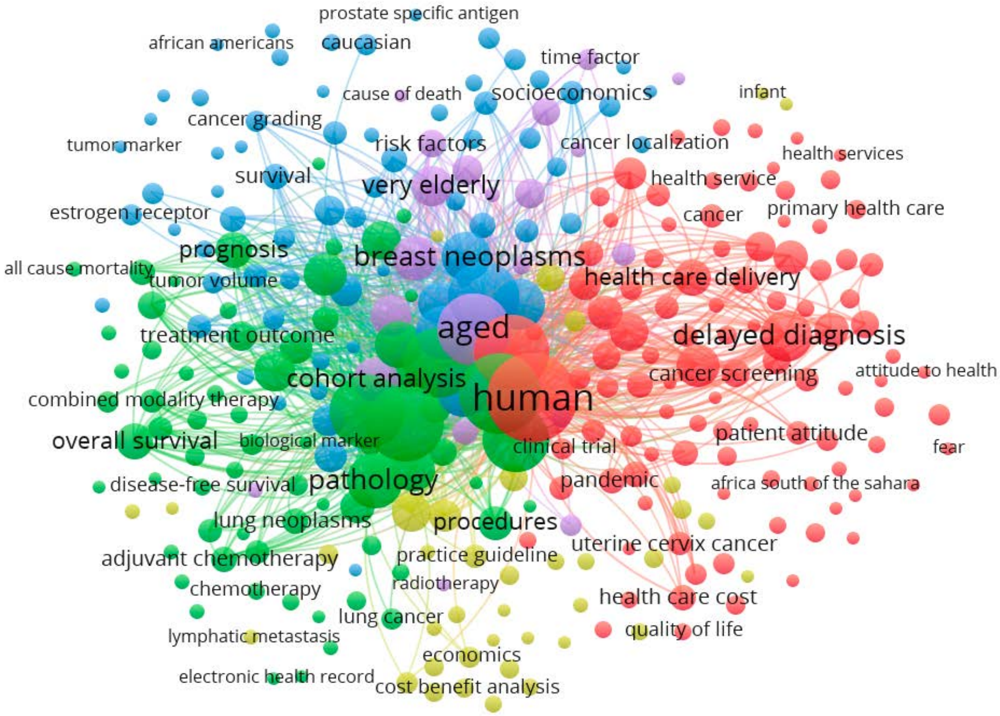

Figure 6. *Term Co-occurrence Network.*

Bibliographic Coupling

The bibliographic coupling analysis (figure 7) identified five clusters composed of 15 articles published between 2008 and 2021 (Waltman & van Eck, 2015). These clusters represent the main currents of international research on cancer, delayed diagnosis, and health systems, and provide a foundation for understanding prevailing trends and approaches in this field of study.

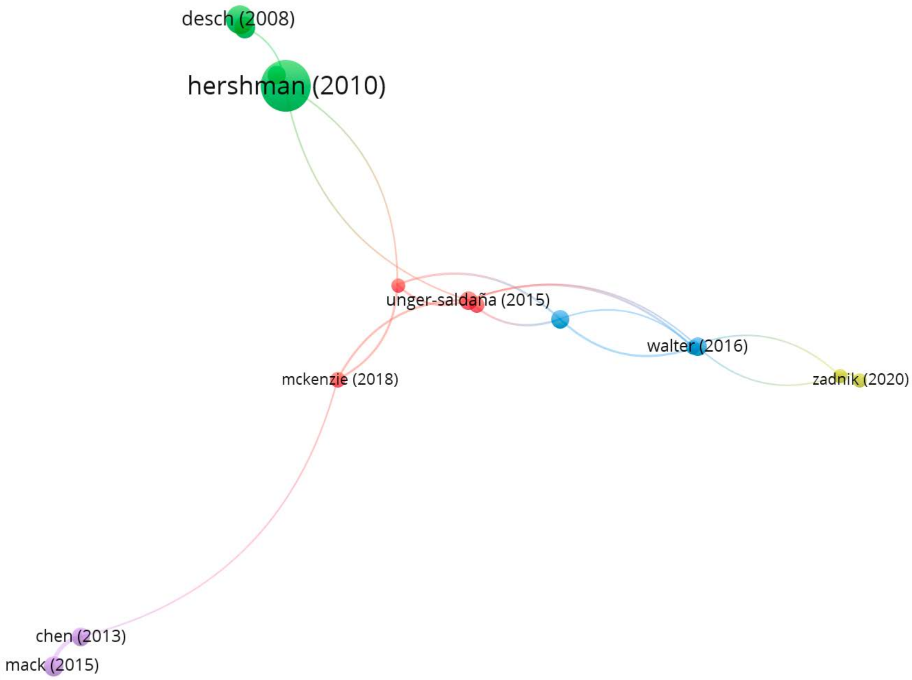

Figure 7. *Bibliographic Coupling.*

Clúster 1: Determinants of Delayed Diagnosis in Breast Cancer and Its Relationship with Personal and Clinical Factors.

This cluster comprises four studies analyzing the factors associated with delayed breast cancer diagnosis, complemented by evidence from other cancer types in developing countries.

The study *Health System Delay and Its Effect on the Clinical Stage of Breast Cancer* (Unger-Saldaña *et al*., 2015) found that 48% of Mexican patients were diagnosed at stages III and IV, with a median of seven months between symptom onset and treatment initiation. The main delays occurred between the first consultation and diagnostic confirmation, linked to both system-level delays and individual factors such as age and lack of breast care knowledge.

In Sub-Saharan Africa, a study in Malawi revealed that late care-seeking was influenced by personal, social, and systemic factors, including the use of traditional remedies and community norms. A multilevel approach involving education, improved access pathways, and institutional strengthening was recommended (Kohler *et al.*, 2017). Similarly, the multicenter ABC-DO study (McKenzie *et al.*, 2018) found that 61% of the 1,795 women were diagnosed at advanced stages, primarily due to modifiable factors such as low levels of education, limited disease awareness, and delays in referral.

In the article *Cancer Care Challenges in Developing Countries* (Price *et al.*, 2012), it was noted that over 60% of patients with breast cancer, Kaposi's sarcoma, or lymphoma experienced waits longer than six months for care, linked to geographic inequalities, oncologist shortages, and cultural beliefs.

Overall, the evidence shows that delayed breast cancer diagnosis results from an interplay of individual, social, and structural factors. Additional studies (Nila *et al.*, 2024; Ferreira *et al.*, 2023) confirm that these disparities affect survival and reinforce the urgency of strengthening early detection policies and timely access to care.

Cluster 2: **Cancer Treatment Based on Care Measures According to Pathology Type and Stage.**

This cluster includes studies on therapeutic interventions for different types of cancer and their impact on survival, adherence, and quality of life, highlighting the need for standardized protocols in health systems.

The article *Quality Measures of the American Society of Clinical Oncology/National Comprehensive Cancer Network* (Desch *et al.*, 2008) established three standards for breast cancer and four for colorectal cancer, developed by multidisciplinary panels to ensure quality and consistency in care.

In the case of melanoma, the study *Use of Sentinel Lymph Node Biopsy* (Bilimoria *et al.*, 2009) showed that its use in stages IB/II depended on clinical, hospital, and socioeconomic factors. This finding underscores the importance of adherence to clinical guidelines to ensure equity in access.

Two breast cancer studies complement these results. The first, *Early Discontinuation of Adjuvant Hormonal Therapy*, involving 8,769 patients, showed that age was a critical factor in non-adherence, highlighting the need for educational strategies targeting young women (Aiello *et al.*, 2012). The second, *Impact of a Cooperative Group Trial in Medicare Patients*, analyzed the use of radiotherapy and found that, despite differences related to age, comorbidities, and marital status, the application rate was high, confirming its role in reducing mortality (Soulos *et al.*, 2012).

Overall, this cluster demonstrates that the quality of cancer care depends on both strict adherence to clinical protocols and on socioeconomic and cultural factors, highlighting the need for policies that foster adherence and reduce inequities.

Cluster 3: Personal, Social, Health System, and Geographic Factors Determining Delayed Cancer Diagnosis.

This cluster analyzes how individual, clinical, administrative, and sociodemographic factors influence delayed cancer detection.

The study *How Might Healthcare Systems Influence the Speed of Cancer Diagnosis?* compared experiences in the United Kingdom, Canada, and Australia, showing that centralized services, provider connectivity, and reduced access barriers enhance diagnostic timeliness, highlighting the impact of health system context on outcomes (Brown *et al.*, 2014).

In the *SYMPTOM Pancreatic Study cohort*, conducted in seven hospitals, symptoms and factors associated with diagnostic intervals in pancreatic cancer were analyzed. The study concluded that health systems should recognize vague gastrointestinal symptoms, mental health comorbidities, and diabetes as warning signs to reduce critical delays in confirmation (Walter *et al.*, 2016).

Meanwhile, the study *Rural and Urban Disparities in Time to Diagnosis and Treatment of Colorectal and Breast Cancer* found that rural patients experience longer diagnostic intervals, averaging 6 to 95 days for colorectal cancer, due to socioeconomic and insurance-related factors. For breast cancer, the differences were less significant, although inequalities related to geographic location persisted (Bergin *et al.*, 2018).

Taken together, the findings reinforce that social and geographic determinants are as influential as clinical factors in diagnostic opportunity, making it essential to develop differentiated policies based on cancer type and territorial context.

Cluster 4: COVID-19 and Its Relationship with Delayed Cancer Diagnoses, a Long-Term Impact.

This cluster brings together studies that analyze how the pandemic affected cancer detection and treatment, generating both short- and long-term consequences.

In Central Europe, the article *Impact of COVID-19 on Cancer Diagnosis and Treatment In Slovenia* (Zadnik *et al.*, 2020) reported a 43% decrease in histological notifications, a 33% drop in referrals, and up to a 76% decline in mammograms compared to the pre-pandemic period. These decreases were attributed to both the reorganization of services and patient behavior, as well as the responsiveness of healthcare professionals.

In South America, the study *Impact of the Pandemic on Cancer Diagnosis and Survival in Chile, 2020–2030* (Ward *et al.*, 2021) used a microsimulation model and estimated that the interruption of screening programs will increase the number of late-stage diagnoses and significantly reduce survival rates for breast, cervical, colorectal, prostate, and stomach cancers.

Various studies (Casella *et al.*, 2021; Do Nascimento *et al.*, 2023) show how some health systems attempted to reorganize care pathways and introduce flexible processes to reduce infection risks among cancer patients. However, the suspension of screening programs, delays in resuming services, and disparities in healthcare infrastructure may result in a sustained increase in delayed diagnoses in the coming years.

In summary, the pandemic acted as an amplifier of structural and social barriers, forcing health systems to rethink resilient strategies to maintain continuity of oncology care during crises.

Cluster 5: **Life Expectancy and Its Relationship with Treatment Choices in Cases of Delayed Cancer Diagnosis.**

This cluster examines how patients' perceptions of life expectancy influence treatment decisions in advanced-stage cancer.

In the study *Expectations About the Effectiveness of Radiation Therapy Among Patients with Incurable Lung Cancer* (Chen *et al.*, 2013), 384 patients in stage IIIB or IV were evaluated. 78% believed radiation therapy would prolong their lives, and 64% did not understand that the treatment was not curative. Misconceptions were more common among older patients and those who relied on caregivers for information.

Complementarily, the study *Patient Beliefs that Chemotherapy May Be Curative in Metastatic Cancer* (Mack *et al.*, 2015) analyzed 722 patients with lung and colorectal cancer. Only 33% understood that chemotherapy was not curative; those who did were more likely to receive palliative care (OR 1.97; 95% CI: 1.37–2.82). This highlights the importance of education in decision-making.

Other studies (Elkin *et al.*, 2022; Eaglehouse *et al.*, 2019) further emphasize that clinical factors (such as tumor size and lymph node involvement) and contextual factors (like wait times and health system inequities) directly impact survival.

Altogether, this cluster shows that patients' perceptions of prognosis influence treatment decisions as much as clinical conditions do. It underscores the need for clear communication and comprehensive programs for palliative care and emotional support.

Future Research Lines

Five priority research lines have been identified to guide future studies on cancer, delayed diagnosis, and health systems.

Table 5. *Clusters for Future Research.*

Cluster	Topics
Evaluation of health system functions	Comparative analysis of public, private, and complementary models will help identify effective strategies and improvement opportunities in technical and administrative management, ensuring quality and timeliness at all levels of care.
Personal, social, and cultural patient factors related to delayed cancer diagnosis	It is necessary to investigate how patients' and caregivers' lack of knowledge about the disease contributes to diagnostic delays, in order to propose educational processes and support networks that incorporate contextual, social, and cultural variables.
Social determinants of health and their relationship with delayed cancer diagnosis	Research is needed on how the health sector coordinates with other state sectors to address the social determinants that influence detection and treatment, recognizing cancer as a high-cost disease that requires strategic intersectoral planning.
Life expectancy and treatment decision-making in delayed cancer diagnosis	Studying treatments and comprehensive approaches that include physical rehabilitation, mental health, and family support can help ensure that a late diagnosis is not perceived as a synonym for premature death, but rather as an opportunity to improve the quality and dignity of life.
Promotion and strengthening of robust research	Given the predominance of publications from high-income countries, it is necessary to build research capacity in Latin America and other regions to encourage innovative studies tailored to local contexts and contribute to the development of public policies aligned with the Sustainable Development Goals.

These lines provide a strategic framework to advance knowledge and improve health systems' response to cancer.

Discussion

The bibliometric review shows that delayed cancer diagnoses are explained by an interaction of individual, social, and structural factors. This confirms the need for interventions at macro, meso, and micro levels: international policies, community actions, and person-centered clinical practices. However, health systems have yet to effectively deploy comprehensive strategies that reduce inequalities (Bran *et al.*, 2020).

In this context, training frontline healthcare professionals is essential. Physicians and related professionals must be prepared to recognize early symptoms and guide patients through care pathways without causing critical delays. Training should be comprehensive and include comorbid conditions such as HIV or hepatitis, which alter prognosis and require tailored approaches (McMahon *et al.*, 2022).

Diagnostic timeliness is measured through time intervals: from symptom recognition to the initial consultation, from consultation to histological confirmation, and from diagnosis to treatment initiation. In low- and middle-income countries, these intervals are significantly longer, reflecting structural inequalities. Sociocultural factors such as education level, marital status, or beliefs influence delays in seeking care, while in rural areas, travel times and lack of infrastructure amplify delays (Unger-Saldaña *et al.*, 2015; Bergin *et al.*, 2018).

Administrative, economic, cultural, and geographic access barriers remain key determinants of treatment adherence. Overcoming them requires redesigning the structure of health systems to ensure continuity and quality throughout the care process. A comprehensive approach must recognize that these limitations are not exclusive to certain countries but represent a global reality requiring context-specific adjustments (Bran *et al.*, 2020).

Conclusions

The bibliometric review confirms that cancer and delayed diagnoses represent a global challenge for health systems. Delays are explained by individual factors (age, education, beliefs), social factors (economic, cultural, and geographic conditions), and structural factors (infrastructure, care networks, financing, and human resources). This is both a public health and governance issue with significant economic impact, as cancer is a high-cost disease.

The findings highlight the need to strengthen the training of frontline professionals, along with interdisciplinary teams capable of guiding patients from the initial consultation to diagnosis. Education and family support are essential to prevent access barriers or beliefs from unnecessarily extending waiting times.

Territorial inequalities also affect diagnostic timeliness: in rural areas, lack of infrastructure and long travel distances delay care; in urban zones, overcrowded services hinder responsiveness. This calls for structural adjustments to ensure equity.

Integrating educational programs, health navigation strategies, and early palliative care would help improve treatment adherence and support shared decision-making. At the same time, public policies must prioritize humanized care and continuity of treatment.

Addressing cancer and delayed diagnoses requires a comprehensive response that combines prevention, education, infrastructure, skilled human resources, and intersectoral policies. Only then will it be possible to reduce inequalities, ensure timely access, and improve the quality of life for people affected by this disease across all social and health care contexts.

Limitations

One of the main limitations of this bibliometric review is the limited representation of research from Latin America. Although countries like Colombia, Chile, Peru, and Venezuela face serious challenges regarding delayed diagnosis, their scientific output remains limited compared to high-income regions.

This gap hinders a deeper understanding of how each context's specific social, economic, cultural, and demographic factors influence the structure and responsiveness of health systems. Although Colombia has shown acceptable progress in academic production within the Ibero-American sphere, there is still a need to promote more local research that analyzes the causes of delayed diagnoses in low- and middle-income countries, to develop policies and strategies that are better aligned with local realities (Acuña & Ramírez, 2018; Martínez-Pérez *et al.*, 2020).

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