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BIBLIOMETRICS *DOI: 10.9789/2175-5361.rpcfo.v17.13733*

BIBLIOMETRIC ANALYSIS OF SCIENTIFIC PRODUCTION ON BLOOD TRANSFUSION IN THE ELDERLY IN LIGHT OF BRADFORD'S AND LOTKA'S LAWS

Análise bibliométrica da produção científica sobre transfusão sanguínea em idosos à luz das leis de Bradford e Lotka

Análisis bibliométrico de la producción científica sobre transfusiones de sangre en personas mayores a la luz de las leyes de Bradford y Lotka

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RESUMO

Objetivo: analisar a produção científica sobre transfusão sanguínea em idosos, utilizando as Leis de Bradford e Lotka como ferramentas bibliométricas. **Metodologia:** foram incluídos 55 artigos publicados entre 2020 e 2024, recuperados da base de dados Web of Science. A análise de Bradford identificou os periódicos mais relevantes para o tema, enquanto Lotka revelou a desigualdade na produtividade autoral, com poucos autores sendo responsáveis pela maioria das publicações. **Resultados:** os resultados destacaram que periódicos como Transfusion e BMC Musculoskeletal Disorders concentram grande parte das publicações, enquanto a colaboração internacional e o uso de palavras-chave específicas contribuíram para identificar redes de pesquisa. Constatou-se também uma taxa de crescimento anual de 9,91% na produção científica. **Considerações Finais:**

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embora haja avanços significativos na literatura, lacunas importantes permanecem, principalmente na aplicação de estratégias educacionais voltadas para a segurança transfusional em idosos. Este estudo oferece uma base para o desenvolvimento de práticas mais eficazes e equitativas.

DESCRITORES: Transfusão de sangue; Idoso; Bibliometria.

ABSTRACT

Objective: to analyze the scientific production on blood transfusion in the elderly using Bradford's and Lotka's Laws as bibliometric tools. **Methodology:** 55 articles published between 2020 and 2024 were included, retrieved from the Web of Science database. Bradford's analysis identified the most relevant journals on the topic, while Lotka's revealed inequality in author productivity, with a few authors responsible for the majority of publications. **Results:** the results highlighted that journals such as Transfusion and BMC Musculoskeletal Disorders concentrate a large portion of publications, while international collaboration and the use of specific keywords contributed to identifying research networks. An annual growth rate of 9.91% in scientific production was also observed. **Final Considerations:** although there have been significant advances in the literature, important gaps remain, mainly in the application of educational strategies aimed at transfusion safety in the elderly. This study provides a foundation for the development of more effective and equitable practices.

DESCRIPTORS: Blood transfusion; Aged; Bibliometrics.

RESUMEN

Objetivo: analizar la producción científica sobre transfusiones de sangre en personas mayores utilizando las Leyes de Bradford y Lotka como herramientas bibliométricas.**Metodología:** se incluyeron 55 artículos publicados entre 2020 y 2024, recuperados de la base de datos Web of Science. El análisis de Bradford identificó las revistas más relevantes sobre el tema, mientras que Lotka reveló la desigualdad en la productividad autoral, con pocos autores responsables de la mayoría de las publicaciones. **Resultados:** los resultados destacaron que revistas como Transfusion y BMC Musculoskeletal Disorders concentran gran parte de las publicaciones, mientras que la colaboración internacional y el uso de palabras clave específicas contribuyeron a identificar redes de investigación. También se observó una tasa de crecimiento anual del 9,91% en la producción científica. **Consideraciones Finales:** aunque ha habido avances significativos en la literatura, persisten importantes lagunas, principalmente en la aplicación de estrategias educativas dirigidas a la seguridad transfusional en personas mayores. Este estudio proporciona una base para el desarrollo de prácticas más efectivas y equitativas.

DESCRIPTORES: Transfusión de sangre; Anciano; Bibliometría.

INTRODUCTION

Population aging is a global phenomenon that poses growing challenges for health systems, requiring special attention to the needs of the elderly population. In this context, blood transfusions play an essential therapeutic role in promoting the survival and quality of life of elderly patients, who often face complex and debilitating clinical conditions.[1] According to the World Health Organization (WHO), blood transfusion is considered an essential and life-saving medical treatment, requiring rigorous control and safety processes to minimize risks and optimize benefits.[2]

However, the blood transfusion process presents specific challenges for elderly patients, who, due to physiological changes related to ageing, are more prone to complications and adverse reactions.[3] These reactions can be aggravated by comorbidities common in the elderly population, such as heart and kidney disease, which increase the risk of adverse outcomes.[4] In this scenario, health education plays a crucial role, ensuring that patients understand the risks, benefits and procedures involved, strengthening their autonomy and active participation in care.[5]

The nursing team is fundamental in this process, as it is directly involved in all stages of transfusion therapy, from sample collection for blood typing to post-procedure hemovigilance.[6] In addition, these professionals have a responsibility to provide clear and accurate information to patients and their families, reducing uncertainties and promoting greater confidence in the treatment.[7] However, studies show that gaps in knowledge about blood transfusion are frequent among the elderly, which can negatively impact their perception of the procedure and therapeutic outcomes.[8]

Educational materials, whether printed or digital, have proven to be effective tools in disseminating health information, especially in complex situations such as blood transfusion.[9] These resources, combined with nursing educational practice, contribute to more effective communication, helping to translate technical concepts into accessible and understandable information for the elderly.[10] Thus, the application of educational technologies in clinical practice can facilitate understanding of the risks and benefits of transfusion, promoting more humanized and patient-centred care.[11]

Blood transfusion is regulated in Brazil by Resolution No. 34 of the National Health Surveillance Agency (ANVISA), which establishes guidelines for the blood cycle, from donation to administration in patients.[2] Data from ANVISA's Hemovigilance Bulletin show that elderly patients are especially susceptible to transfusion complications, representing a significant proportion of the adverse reactions recorded.[12] This reinforces the need for educational strategies that address both the technical aspects and the emotional needs of this vulnerable population.[13]

Although the role of nursing in health education is widely recognized, few studies explore how the elderly understand the risks and benefits of blood transfusion.[14] This gap in scientific knowledge limits the development of more effective and personalized care strategies that can meet the specific needs of this population.[15] Thus, it is essential to investigate how educational practices impact the understanding of the elderly and safety in the transfusion process.[16]

The use of bibliometric methods, such as Bradford's and Lotka's Laws, offers a unique opportunity to explore the patterns of scientific production related to blood transfusion in the elderly.[17] These tools make it possible to identify the main sources and authors on the subject, as well as highlight gaps in knowledge that can guide new investigations.[18] In this sense, bibliometric studies are fundamental to consolidate existing knowledge and promote advances in the field of geriatric health.[19]

By analyzing scientific production on the subject, it is possible to understand how the literature approaches health education and care related to blood transfusions in the elderly.[20-23] In addition, these analyses can help identify emerging trends, as well as areas that need greater attention from the scientific community and health professionals.[21-24] In this way, bibliometrics is a powerful tool to support the construction of a more robust body of knowledge that is applicable to clinical practice.[22,25]

Therefore, this study aims to analyze scientific production on blood transfusion in the elderly in the light of Bradford's and Lotka's laws as analytical methods. By investigating the main publications and authors, the aim is to contribute to the development of more effective educational strategies, promoting the safety and well-being of elderly people undergoing this essential procedure.[23,26]

METHODOLOGY

This study was conducted as a bibliometric analysis, using Bradford's and Lotka's Laws to map scientific production on blood transfusion in the elderly. The analysis aimed to identify publication patterns, author productivity and the relevance of journals on the subject. This method is widely recognized for its effectiveness in examining trends and gaps in scientific production in health.[27]

The sample consisted of 55 documents retrieved from the Web of Science database during the month of December 2024. The documents selected included only research and review articles published in the last five years (2020-2024) that had the descriptors "Blood Transfusion" and "Aged" or "Elderly" in their titles. Documents such as conference abstracts, editorials, letters to the editor, etc. were excluded.

The variables analyzed included the title of the articles, authors' names, affiliated institutions, journals of publication, years of publication, number of citations and keywords of the documents. These variables were selected based on their relevance to the Bradford and Lotka analyses, which assess the dispersion of the literature and the productivity of the authors respectively.[28-29]

The tools used to collect and organize the data consisted of the Capes Journal Portal interface, the Web of Science database and electronic spreadsheets for tabulation. In addition, the VOSviewer and Bibliometrix software was used to analyze and visualize bibliometric data, enabling the construction of keyword co-occurrence maps, co-authorship networks and thematic clusters.[30]

Data analysis followed a quantitative and descriptive approach. Bradford's Law was applied to identify the most relevant journals and assess the dispersion of articles, classifying journals into productivity zones. Lotka's Law was used to examine the productivity of authors, identifying those who contributed most to the field.[31]

Bibliometric data was also used to generate collaboration networks between authors, institutions and countries. These networks were analyzed to understand how knowledge is distributed and shared in the scientific community. This analysis helps to identify the main research hubs and emerging trends.[32]

The sample was rigorously reviewed to ensure the quality and validity of the data. Incomplete or inconsistent records were eliminated. In addition, each article was manually reviewed to confirm that it met the previously established inclusion criteria.[33]

The temporal analysis of the documents makes it possible to identify trends in scientific production over the years. This time frame makes it possible to identify publication peaks and the factors that can influence variations.[34]

The results were presented in tables and graphs which highlighted the most influential journals and the most productive authors. In addition, visual maps generated by the software used enabled a more in-depth analysis of the relationships between the various elements of scientific production.[35]

This study respected ethical principles at all stages, using publicly available data and ensuring methodological transparency. The findings aim to contribute to the expansion of knowledge in the area and to the development of educational strategies and public policies aimed at the health of elderly people undergoing blood transfusions.[36]

RESULTS

The results provided reveal significant information about recent scientific production on the subject. The data indicates a growing attention to the impact of transfusions on this population, highlighting diversified sources (47 in total) and a considerable volume of publications. This scientific output reflects advances in knowledge about transfusion safety, adverse reactions and the integration of new technologies into clinical management. In addition, the initial analysis allows us to identify gaps in critical areas, such as strategies for preventing complications and optimizing transfusion protocols for the elderly. These results establish a solid basis for exploring emerging trends and directing future research. Table 1 below summarizes the main findings.

Table 1 - Detailed information on information retrieval in WOS

Description	Results
Sources (Journals)	47
Documents	56
Annual Growth Rate (%)	9,91
Average age of documents	10,3
Average number of citations per document	32,5
DOCUMENT CONTENT	
Keywords Plus (ID)	1309
Author's keywords (DE)	1027
AUTHORS	
Authors	291
Authors of Individual Documents	38
COLLABORATION BETWEEN AUTHORS	
Individually Authored Documents	41
Co-authors per Document	5,27
International collaborations	12,25
TYPES OF DOCUMENTS	
Research articles	53
Review articles	3

Source: Research authors, 2024.

The table based on the application of Bradford's Law shows the distribution of the most relevant journals on the topic analyzed. The classification of journals was divided into zones, where Zone 1 (Table 1) includes the journals with the greatest relevance and concentration of articles, such as Transfusion, Trials and BMC Musculoskeletal Disorders, which together account for the highest frequency of publications.

Zones 2 and 3 represent journals with a lower frequency of individual articles, but which together make a significant contribution to the body of knowledge. This pattern demonstrates the concentration of scientific production in specific high-impact journals and the dispersion of knowledge across a wide range of additional sources. The analysis makes it possible to identify central journals for consultation and secondary journals for expanding references, optimizing access to the most relevant information in the field.

Table 1 - Bradford Zone 1 journals

Journal	Ranking	Freq	Sum of Freq	Zone
Transfusion	1	3	3	Zone 1
Trials	2	3	6	Zone 1
Bmc musculoskeletal disorders	3	2	8	Zone 1
Cureus journal of medical science	4	2	10	Zone 1
Journal of korean medical science	5	2	12	Zone 1
Medicine	6	2	14	Zone 1
Acta anaesthesiologica scandinavica	7	1	15	Zone 1
Aging clinical and experimental research	8	1	16	Zone 1
American journal of emergency medicine	9	1	17	Zone 1
Annals of cardiac anaesthesia	10	1	18	Zone 1
Annals of hematology	11	1	19	Zone 1

Source: Research authors, 2024.

Analysis of the results based on the Bradford Multiplier (mB) (Table 2) shows the concentration of articles in different journal zones. Zone 1 brings together the central journals, with 11 sources responsible for 19 articles and mB equal to 1, representing the reference base. Zones 2 and 3 contain 18 journals each, both contributing 18 articles, and an mB of approximately 0.95, indicating a slight decrease in the concentration of articles compared to Zone 1. These results reflect the typical distribution expected by Bradford's Law, highlighting the central journals as priority sources for access to the most relevant information on the subject studied.

Table 2 - Bradford Multiplier

Zone	Number of Journals	Number of articles	Bradford multiplier (mB)
Zone 1	11	19	1
Zone 2	18	18	0,947368421
Zone 3	18	18	0,947368421

Source: Research authors, 2024.

Table 3 highlights the 10 most relevant authors, considering their productivity, and therefore the main contributors to the topic analyzed. Author Zhang Y leads the way with 3 published articles and a fractionalized index of 0.52, showing a significant contribution to scientific production. Other prominent authors include Ansaldi G, Chen I, and Deng X, each with 2 published articles, but with variations in the fractionalized indices, which reflect their proportional participation in the articles. This data makes it possible to identify the most influential and engaged researchers in the field of study, providing a basis for future collaborations and in-depth research.

Table 3 - The 10 most productive authors on the subject

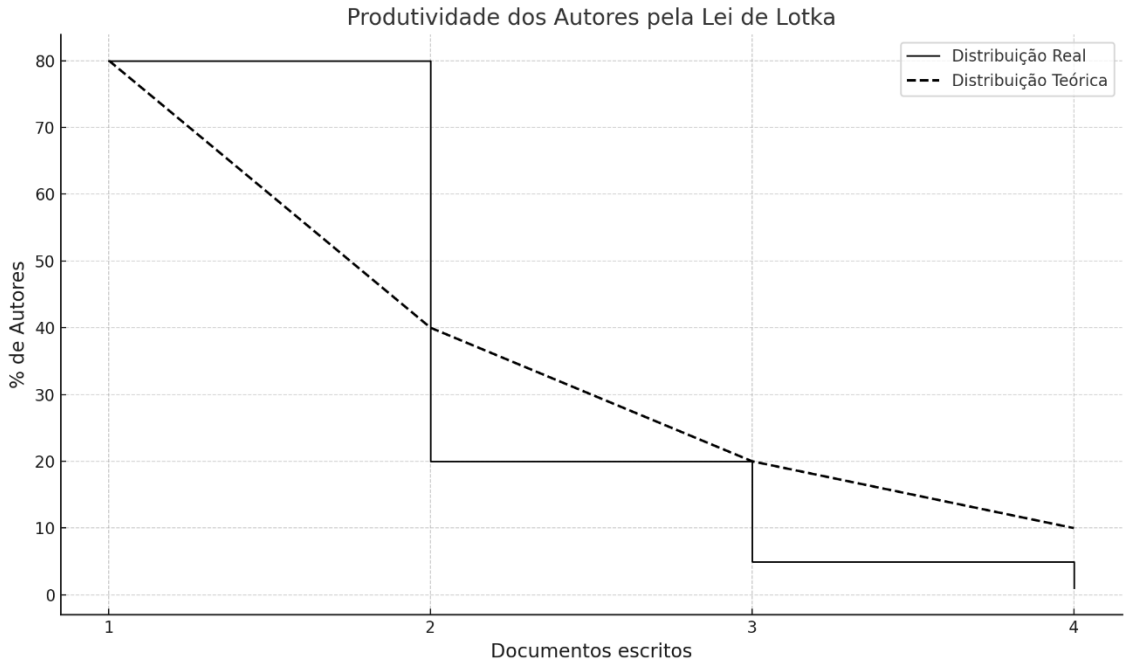
Authors	Number of articles	Fractionalized articles
Zhang Y	3	0,52
Ansaldi G	2	0,07
Chen I	2	0,35
Deng X	2	0,42
Feng F	2	0,23
Ghirardello S	2	0,14
Giannantonio C	2	0,07
Han SB	2	0,33
Kim JH	2	0,33
Mozzetta I	2	0,07

Source: Research authors, 2024.

Applying Lotka's Law to the data analyzed revealed a typical pattern of author productivity, showing the concentration of publications by a small number of the most productive authors. As shown in Graph 1, approximately 80% of the authors published just one article, while a significantly smaller proportion, around 20%, contributed two or more documents.

The solid line reflects the actual distribution observed, while the dotted line represents the expected theoretical distribution, indicating good adherence to Lotka's model. These results reinforce the importance of identifying and valuing the most productive authors, who play a central role in building scientific knowledge on the subject under investigation. In addition, the distribution observed offers insights into the dispersion and authorial collaboration in the field of study.

Graph 1 - Distribution of authors by Lotka's Law



Source: Research authors, 2024.

DISCUSSION

The bibliometric study explored scientific production on blood transfusions in the elderly, using Bradford's and Lotka's Laws as analytical tools. This mapping is essential for understanding publication patterns, authorial productivity and the relevance of sources, providing a comprehensive view of the scientific panorama in this field. The analysis of journals, categorized into zones of relevance by Bradford's Law, revealed that a small number of journals concentrate the majority of articles, indicating that journals such as Transfusion and BMC Musculoskeletal Disorders are key sources. This pattern reflects the typical concentration of knowledge in high-impact journals.[37]

Lotka's Law highlighted a significant inequality in authorial productivity, with few authors contributing extensively and the majority publishing only one article. This observation is consistent with previous bibliometric studies, which demonstrate the relevance of leading authors in consolidating knowledge in specific areas.[38] Authors such as Zhang Y and Ansaldi G emerge as protagonists in this field, reinforcing the need to foster collaborations with these experts in order to advance transfusion safety research in the elderly.

In addition, the analysis identified an average of 32.5 citations per document, indicating that the selected articles have a significant impact on the scientific community. This suggests a growing appreciation of issues related to the safety and efficacy of transfusions in geriatric populations. These findings highlight the importance of specific protocols and education aimed at clinical practice, issues which are still insufficiently addressed but which are crucial to improving outcomes in this population.[39]

Transfusion complications, often exacerbated by comorbidities such as heart and kidney failure, are a central aspect of the studies reviewed. Educational strategies have been shown to be effective in mitigating such complications, emphasizing the importance of assistive technologies and educational materials adapted for the elderly^[40]. These educational practices improve not only patients' understanding of risks and benefits, but also autonomy in decision-making, aligning with principles of patient-centered care.[5]

The international collaboration networks observed in the study are another striking feature. These networks are essential for the exchange of knowledge and the development of global guidelines for safe transfusions. The integration of institutions from different countries reflects the interdisciplinary and

global nature of this field of study.[41] However, gaps persist in harmonizing practices and adapting guidelines to local contexts, especially in countries with limited resources.[42]

The temporal analysis revealed a steady growth in scientific production, with an annual growth rate of 9.91%. This indicates a growing interest in exploring interventions and technologies that minimize transfusion risks and maximize therapeutic benefits for the elderly. This increase is possibly driven by technological advances and greater awareness of the vulnerability of this population.[43]

In terms of educational impact, the introduction of methodologies such as e-Health for disseminating information and training healthcare teams has been highlighted as a significant advance. These technologies not only facilitate continuous learning, but also promote safer and more effective practice in transfusion management.[44] The inclusion of gerontotechnological data also signals a transition towards more integrated and evidence-based approaches.[45]

Despite advances, challenges remain in implementing uniform strategies and mitigating cultural and linguistic barriers. The lack of consensus on ideal protocols for transfusions in the elderly reinforces the need for further research, especially longitudinal studies that assess long-term outcomes.[46] In addition, a focus on qualitative analyses can enrich the understanding of the elderly's perceptions of transfusions, contributing to the improvement of humanized care.[47]

The study reaffirms the need for public policies aimed at geriatric health, prioritizing health education as a transformative tool. Thus, the results provide a solid basis for the development of specific interventions, ensuring that scientific advances translate into tangible improvements in clinical practice and the quality of life of the elderly.[48]

The search used the Web of Science database exclusively and included only documents published in the last five years (2020-2024). This may have excluded relevant studies published in other databases or in previous years, limiting the scope of the analysis and the identification of broader historical patterns.

Although the analysis based on Bradford and Lotka's Laws offers important information on the dispersion of literature and authorial productivity, the study did not integrate a detailed qualitative assessment of the articles' contents. This restricts the understanding of how scientific evidence discusses practical issues related to the safety and efficacy of transfusions in the elderly. Therefore, these are two limitations worth highlighting in this study.

FINAL CONSIDERATIONS

The bibliometric analysis carried out on scientific production related to blood transfusions in the elderly, based on Bradford and Lotka's Laws, brought relevant contributions to understanding the dynamics of scientific knowledge in this field. There was a significant concentration of publications in high-impact journals, demonstrating that access to these journals is essential for building evidence-based practices. In addition, the identification of highly productive authors highlights the importance of fostering international collaborations to strengthen research and clinical practice.

The results highlighted not only the relevance of quantitative approaches to mapping the scientific landscape, but also the need to deepen qualitative understanding of the needs of older people and the challenges faced during transfusion processes. Transfusion complications, often associated with comorbidities common in the elderly population, reinforce the urgency of personalized protocols and educational strategies that promote both patient safety and autonomy.

Despite the growth observed in scientific production, important gaps remain. These include the limited integration of educational technologies into transfusion management and the need for greater uniformity in care protocols for the elderly. In addition, the under-representation of regional and cultural contexts in international literature points to the relevance of studies that capture the diversity of transfusion practices around the world, especially in countries with limited resources.

Therefore, this study has not only contributed to mapping the main trends and challenges in the field, but has also highlighted the need for future research that combines interdisciplinary and technological approaches. Such advances are crucial to ensure that transfusion practices evolve in an equitable and patient-centered manner, promoting better clinical outcomes and quality of life for the elderly population.

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