

CUIDADO É FUNDAMENTAL

Escola de Enfermagem Alfredo Pinto – UNIRIO

BIBLIOMETRY

DOI: 10.9789/2175-5361.rpcfo.v14.11915

VENOUS CATHETERIZATION COMPLICATIONS IN PEDIATRICS: BIBLIOMETRIC ASPECTS

*Complicações da cateterização venosa em pediatria: aspectos bibliométricos**Complicaciones del cateterismo venoso en pediatría: aspectos bibliométricos***Viviane reis Fontes da Silva**¹ **Luiz Carlos Santiago**² 

ABSTRACT

Objective: to analyze the intellectual production on the complications of pediatric venous catheterization available in the Scopus database. **Method:** bibliometric study that approached the production electronically registered in the base, from 1972 to 2022, with descriptive statistical analysis. **Results:** we retrieved 1077 articles published in 408 journals. The average authorship per article was 4.68. Nursing contributed with 19 (1.7%) documents from the Health area. **Conclusion:** the data presented demonstrate the low level of interest of the scientific community in the subject. It was not possible to identify an Elite group of Authors. The study shows that there is dispersion in the production of journals. Only the first Bradford zone obeys the Bradford Theory. The quantitative contribution of nursing is insignificant when compared to medicine.

DESCRIPTORS: Nursing; Bibliometrics; Venous Catheterization Complications; Pediatrics.

¹ Secretaria Municipal de saúde do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil

² Universidade Federal do estado do Rio de Janeiro, Rio de Janeiro, Rio de Janeiro, Brazil

Received: 05/26/2022; Accepted: 06/07/2022; Published online: 12/27/2022

Corresponding Author: Viviane reis Fontes da Silva, E-mail: vivianereisfontes@gmail.com

How cited: Silva VF, Santiago LC. Venous catheterization complications in pediatrics: bibliometric aspects. *R Pesq Cuid Fundam* [Internet]. 2022 [cited year month day];14:e11915. Available from: <https://doi.org/10.9789/2175-5361.rpcfo.v14.11915>



RESUMO

Objetivo: analisar a produção intelectual sobre as complicações da cateterização venosa pediátrica, disponibilizada na base Scopus. **Método:** estudo bibliométrico que abordou a produção registrada eletronicamente em base, de 1972 a 2022, com análise estatística descritiva. **Resultados:** recuperou-se 1077 artigos publicados em 408 periódicos. A média de autoria por artigo foi de 4,68. A Enfermagem contribuiu com 19 (1,7%) documentos da área de Saúde. **Conclusão:** os dados apresentados demonstram o baixo nível de interesse da comunidade científico pelo assunto. Não foi possível identificar um grupo de Elite de Autores. O estudo mostra que há dispersão na produção de periódicos. Apenas a primeira zona de Bradford obedece à Teoria de Bradford. A contribuição quantitativa da enfermagem é insignificante quando compara à medicina.

DESCRITORES: Enfermagem; Bibliometria; Complicações do cateterismo venoso; Pediatria.

RESUMEN

Objetivo: analizar la producción intelectual sobre complicaciones del cateterismo venoso en pediatría, disponible en la base de datos Scopus. **Método:** estudio bibliométrico que abordó la producción registrada electrónicamente en la base, desde 1972 hasta 2022, con análisis estadístico descriptivo. **Resultados:** se recuperaron 1077 artículos publicados en 408 revistas. La media de autoría por artículo fue de 4,68. La enfermería contribuyó con 19 (1,7%) documentos del área de Salud. **Conclusión:** los datos presentados demuestran el escaso interés de la comunidad científica por el tema. No fue posible identificar un grupo de autores de élite. El estudio muestra que hay dispersión en la producción de revistas. Sólo la primera zona de Bradford obedece a la teoría de Bradford. La contribución cuantitativa de la enfermería es insignificante en comparación con la de la medicina.

DESCRIPTORES: Enfermería; Bibliometría; Complicaciones del cateterismo venoso; Pediatria.

INTRODUCTION

Hospitalization is a condition that causes direct changes in the life of human beings, whether by the imminent fact that the reason is illness, but also by the fact of rupture with their social needs, especially the estrangement from their families, especially when it comes to pediatric hospitalization.¹

In the most diverse hospital admission units, health professionals assist their pediatric patients with diversified care, attention, orientations, physical evaluation, techniques and procedures that are performed according to the clinical condition and individual needs, with some frequency, invasive procedures that may cause pain, suffering and discomfort to the patient and companions, especially when accompanied by complications, such as those resulting from venous catheterization.¹

It is reasonable to admit that peripheral venous catheterization (PVC) is the most common procedure experienced by patients and nursing professionals in hospitals, and it could become a common need if two important aspects were not considered: the access route and the age of the patient who will be submitted to this procedure.

The use of venous catheters, particularly those for central access, started in 1930; however, in pediatrics, it has been more widespread since 1945. The Peripherally Inserted Central Catheter – PICC is an intravenous access device, with characteristics of biostability and biocompatibility, widely used in pediatric Intensive Care Units and neonatology. Having a safe and long lasting venous access is fundamental for the specific treatment given to pediatric patients who are at high risk of death, as it will permit infusion of antibiotics, hydration, blood and blood products etc., however, it may cause important complications for the child's clinical stability.² A prospective study from October

2003 to September 2004, involving patients from one month to 18 years of age, admitted to a pediatric intensive care unit, submitted to venous catheterization (VC), revealed that 120 catheters were inserted in 83 patients, two of which, seven (5.8%) puncture attempts were unsuccessful. The most frequent complications were: catheter malposition (17.6%), arterial puncture (10.9%) and pneumothorax (4.1%).² As for complications related to catheter maintenance, local infection was the main complication, with (68.2%). These complications may increase because of the length of hospital stay, and worsening of the child's clinical condition added to his cognitive and motor ability to prolong the venous access time, despite the fact that the presence at the bedside of a companion, which is usually his mother.²⁻³

For children, VC represents a moment of physical and psychological pain, suffering, and stress, situations that may directly impact the treatment, and notwithstanding, the relationship involving the triad – child/accompanions/nursing. One must also consider the lived environment⁴ that permeates this relationship, an environment often unknown to the child and the mother, or an environment remembered by both, as in the case of previous hospitalizations.⁴

As the intervening factors in the performance of VC are multidisciplinary, since it involves aspects of Psychology, Sociology, Biology, Physics, Anatomy, among others, it is possible that researchers from different areas of knowledge have directed their research to seek and propose ways to intervene in the practice of venous catheterization in children. Therefore, the state of the art of such research may benefit from bibliometric studies such as this.²⁻³

Bibliometric analysis, from the application of statistics to bibliography, has three worldwide recognized laws: Bradford's Law (law of scientific knowledge dispersion), Lotka's Law (law

of authors' productivity) and Zipf's Law (word frequency). The difference between bibliography and bibliometry is that the latter uses, among other methods, most of the time the quantitative, while discursive, to a lesser extent, which gives bibliometry greater objectivity in the evaluation of scientific production. However, bibliometrics is not concerned only with the quantitative aspect. It is also concerned with verifying the relevance and the impact of authors, journals, institutions, groups or countries in the most diverse areas of knowledge.⁴⁻⁶

Bibliometric analyses are based on a set of laws and empirical principles, whose origins are in information science. Their objective is to study the quantitative aspects of the production of knowledge, its dissemination and use of available and registered information, allowing researchers from the most diverse areas to evaluate the current state of the sciences, as well as to manage research.⁷⁻⁹

This study is justified by investigating the characteristics of the scientific/intellectual production on the theme venous catheterization from the perspective of its complications in pediatrics, which may contribute to other health researchers or from related areas, because it will demonstrate the distribution of production in time, by geographic and knowledge area, the impact of journals, the most productive authors, among other aspects.

Even with a large volume of books in the large health area that address VC in Pediatrics, there still seems to be little information on the current state of the art of academic research related to this topic, thus motivating the investigation of the following question: is the level of productivity of authors and journals on the complications of pediatric venous catheterization correlated to the laws and bibliometric principles of intellectual production of authorship and publication?

In order to answer this question through the use of bibliometric metrics, the objective is to analyze the scientific production available on the Scopus database on complications arising from venous catheterization in pediatrics.

METHOD

This is a bibliometric study that addressed the production/dissemination and use of electronically recorded information in an international database, published between 1972 and 2022. The principle of bibliometry comprises the use of reliable indicators, which may be defined as parameters used in evaluation processes.⁵⁻⁶ Information retrieval was carried out in the Scopus database in March 2022, using the descriptors contained in the string (TITLE-ABS-KEY (venous AND catheterization) AND TITLE-ABS-KEY (pediatric) AND TITLE-ABS-KEY (complications)).

Scopus was chosen because it is the largest database of abstracts and citations of peer-reviewed literature, with bibliometric tools to track, analyze and visualize research. Scopus contains more than 22,000 titles from over 5,000 publishers worldwide, covering the fields of science, technology, medicine, social sciences, and arts and humanities. In addition, it contains more than

55 million records dating back to 1823, two of which 84% have references dating back to 1996.

All statistical analyses were processed by the bibliometric 3.1 application, whose statistical basis is processed by the R® and R-Studio® programs.

RESULTS

The search returned 1077 documents, with an average of 12.2 published documents per year. The average annual citation per document was 1.501. Regarding authorship, 5,040 authors were identified, of which, 46(1.09%) published without co-authorship. The most productive author published 13(0.82%) documents, while 4504 authors (99.18%) published only 1(one). The average number of documents per author was 0.214 and, 4.68 authors per document, while the coauthorship per document reached 5.41. The collaboration index among authors was 4.84. The quantity of original articles was 922(85.6%), the other types of publication accounted for 155(14.4%). The geographical distribution of the retrieved publications shows the absolute leadership of the United States of America – USA with 348 documents (32.3%), followed by Italy with 66(6.1%). Brazil ranks 13th with 16(1.4%). The other 50 countries together published 647 papers, representing 60% of the world production.

The geographical analysis of collaboration between countries identified 19(35.8%) countries. Figure 1 represents the geographical distribution of this collaboration, considering the minimum of two published papers per country.

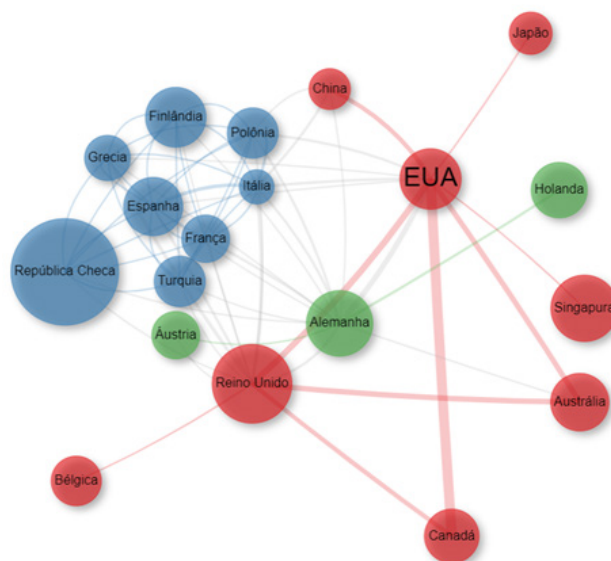
The retrieved documents were produced by 215 institutions, with 31 (14.4%). The institution that produced the most was the Hospital for Sick Children University of Toronto, with 35 documents (3.2%). Next was the Children's Hospital Boston with 31 (2.87%). Brazil contributed with 19 institutions (1.7%).

Thirteen distinct journal areas were identified. Nursing contributed with 54 (5%) of the published papers, second only to Medicine with 916 (85%). Regarding journal relevance, the one with the highest h-index was the Journal of Pediatric Surgery, h-index = 20 and SJR 2020 = 0.937. This journal is not stratified in the Qualis/CAPES (2013-2016) for Nursing, however, it is in Medicine I as B2.

Table 1 summarizes the Bradford Table with the distribution of the core journals, i.e., those contained in Bradford zone 1.

Table 2 presents the comparison of the theoretical calculation with the empirical findings. The output of the journals was divided into three Zones, each containing 1/3 of the total output, so 359 articles in each zone. "Y" represents the number of journals in the 1st Zone, no to 16.

Table 3 presents the production by authors, according to Lotka's Law. It can be seen that slightly more than 89% of the authors published only a single paper. The authors who produced more than one paper, could not approach the 50% of the total production, this group produced only 59 documents, approximately 11% of the total published documents, not being possible to admit an Elite Group of authors for the studied theme.

Figure 1 – Map of collaboration between countries with more than 2 published articles

Source: Survey data. Rio de Janeiro, 2022.

Table 1 – Bradford Table – Zone 1

Periodical	Rank	Frequency	Accumulated Frequency	Bradford Area
Journal of pediatric surgery	1	60	60	Zone 1
Pediatric critical care medicine	2	40	100	Zone 1
Journal of vascular access	3	33	133	Zone 1
Paediatric anaesthesia	4	30	163	Zone 1
Catheterization and cardiovascular interventions	5	28	191	Zone 1
Pediatric blood and cancer	6	24	215	Zone 1
Journal of pediatric hematology/oncology	7	18	233	Zone 1
Pediatric infectious disease journal	8	17	250	Zone 1
Pediatric radiology	9	16	266	Zone 1
Pediatrics	10	16	282	Zone 1
Critical care medicine	11	13	295	Zone 1
Journal of parenteral and enteral nutrition	12	13	308	Zone 1
Pediatric hematology and oncology	13	13	321	Zone 1
Pediatrics international	14	13	334	Zone 1
Journal of vascular and interventional radiology	15	12	346	Zone 1
Pediatric surgery international	16	12	358	Zone 1

Source: Survey data. Rio de Janeiro, 2022.

Table 2 – Theoretical calculation and empirical finding of the Bradford Zones.

Zones	Theoretical Calculation		Empirical Calculation		Online
	Total articles	N newspapers	Total number of articles	N newspapers	
1a	359	16	358	16	Yes
2a	359	160	364	82	No
3a	359	1600	355	310	No

Source: Survey data. Rio de Janeiro, 2022.

Table 3 – Proportion table of document production by complete authorship

Published documents	Number of authors	Proportion of production by authors
1	4504	89,36507937
2	393	7,797619048
3	89	1,765873016
4	33	0,654761905
5	11	0,218253968
6	2	0,03968254
7	2	0,03968254
8	3	0,05952381
11	2	0,03968254
13	1	0,01984127

Source: Survey data. Rio de Janeiro, 2022.

DISCUSSION

The analysis showed that the research corpus is consistent, because the search strategy and consequent construction of the data corpus allowed the recovery of documents from the main descriptors contained in the string, delimiting the subject matter of the research.

It was observed a progressive increase in publications from 1988 on, and the year 2020 had the highest number of publications. There was little dispersion in the productivity of the journals, unlike the 2019 study, which studied peripheral venous catheterization⁹, which showed low productivity and much dispersion, with an average of 4.953 articles per year, while this study reached 12.2 of average, therefore, almost three times more.

The productivity of the 5,040 authors was negligible. The most productive author, Dr. Rickard CM, published only 13 papers, which represents 0.82% of the total published papers, while 4504 authors (99.18%) published only 1(one). This result is quite compatible with the previously mentioned study. The same occurred with the coauthorship index, 5.45 in the 2019 study and, 5.41 in this study, both within the average admitted in most national and international journals, of a maximum of six authors per article.

It is quite reasonable to infer that the low rate of co-authorship is most likely due to the low relevance of the subject in scientific publications, and this finding is reinforced when the \sqrt{n} (square root) of the number of authors (n) was calculated, as recommended by Lotka and Price's Law to identify the Elite group in the production of articles on a given theme/subject.

The value found was approximately 71 authors. For an elite group to exist, the Law of Elitism (Lotka/Price)⁵⁻⁶ determines that the members belonging to this group should produce at least 60% of the publications; in this study, this was equivalent to approximately 646 articles. However, the empirical data showed that the first 71 authors, who should be part of the elite, published only 536 articles, which represents only 49.7% of the publications.

In this case, the non-determination of an Elite Group in the empirical data may be associated with the high number of

occasional authors, suggesting weak consolidation of the theme with the specific area of pediatrics or even a possible state of obsolescence of scientific literature, since the study considered 50 years of production – 1972-2022.

The analysis of co-authorship enables the verification of scientific collaboration, which is one of the most researched variables in Social Network Analysis (SNA), since it can provide the researcher with a broad view of the invisible colleges in which the vertices of the research are immersed, in addition to a series of other findings regarding the bonding relationships in the scientific field.⁸⁻⁹

In this case, when comparing the average number of co-authors with the institutions and countries of origin, it is possible to verify that ARS in the scientific sphere are limited among authors whose affiliation is the same for the most part, with the exception of the United States of America, Italy, the Czech Republic, the United Kingdom, Singapore, and Germany, which together formed the largest network of inter-country collaboration.

The language of the publications was dominated by English. This dominance can be easily explained, as English is a universal language for science. No Latin American country has networks with the countries represented in the collaboration map. This observation allows one to safely infer that the level of international interaction of Brazilian researchers, and those from the other countries that have not formed networks/links, even after 50, remains very fragile. There is strong collaboration between the USA, Canada, Australia, and the UK. However, there was no institution that stood out quantitatively.

Applying Bradford's Law to verify the behavior of the distribution/dispersion of the journals, whose statement is: by building a table in descending order of the production of journals on a given theme, it will be possible to distinguish a core of journals more devoted to the studied theme and several groups/zones with the same number of articles as the core, but with a greater number of journals in the proportion of: (Zone 1 = Y), (Zone 2 = 3Y) and (Zone 3 = 3Y²).⁶⁻⁹

From Tables 1 and 2, it was possible to identify that only in the first of the three Zones, the empirical data are compatible

with the theoretical model, and the others are not in line with the behavior of the Bradford theoretical model.⁶⁻⁹ It is possible to observe a low dispersion of production, which may indicate that the subject studied has little interest in research and/or scientific publication.

Nursing concentrates its production in A1 and A2, while Medicine, in B2 and B1, which can be explained by the differences between the two areas at the moment they establish their criteria for classifying their journals. Despite this fact, it cannot be denied that the production found in nursing is admittedly of high quality, which was confirmed in the stratification of the Qualis, SJR and h index of the journals.

Considering the time taken to register the theme in the Scopus database, it is possible to infer that the subject has already reached maturity and is in a state of production obsolescence, perhaps because it no longer holds the interest of the scientific community and/or the journals, despite the fact that some are extremely specific, but however, do not present production in a considerable quantity that could demonstrate the importance/relevance of the subject.

CONCLUSION

The study dealt with the analysis of 1077 documents retrieved from the scopus database and published in 408 journals in the period 1972-2022, in its absolute majority, international, with only nineteen Brazilian vehicles, which may indicate low productivity of Brazilian researchers about the complications of venous catheterization in pediatrics.

It was possible to demonstrate the evolution of the number of publications over 50 years, the origin of the articles, which journals published the most on the subject, the impact factor, and geographic location.

As to the authors, it was evident the inexpressive number of authors per article and, as to the most productive, the study highlighted the journal that published their research, the institution to which they are linked and their geographic location.

Although based on empirical facts, the laws of Bradford and Lotka, managed in this study, to confirm possible theoretical hypotheses that the core of journals is formed by the most devoted and therefore most productive, nevertheless, revealed that the more specific the subject/theme, the more limited the possibility of identifying elite groups of authors.

Another important aspect that needs to be considered refers to the cognitive institutionalization of the domain knowledge areas of the articles and journals retrieved, which could be identified by the string used, even using the grammatical standardization of descriptors through controlled vocabulary – DEC, even so the realization of unreliable inferences may configure a limitation of this study.

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