# Stroke Care and Nursing excellence: Author-Centric Scientometrics visualization and Lotka's Law manipulation

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**Abstract:**
By examining 283 papers from 156 sources, this study investigates authorship patterns in medical research publications from 2022 to 2023. With an average of 6.83 co-authors per publication, the negative yearly growth rate of -25.31% highlights the collaborative character of medical research and calls for further research into possible factors. The study makes use of Scientometric analysis, R programming, and Lotka's Law in conjunction with the Gini Coefficient and Modified Z-Scores to uncover trends in collaboration and distribution patterns as well as possible outliers. All things considered, this research offers insightful information for upcoming medical research plans and cooperative projects.

**Keywords:** Nursing Science, Authorship Dynamics, Scientometric Analysis, Lotka's Law, Stroke

**Introduction**
The exploration of authorship dynamics in medical research publications is the focus of this study, spanning the years 2022 to 2023(Fleming et al., 2023). With a dataset encompassing 283 documents from 156 sources, this research uncovers intriguing patterns and trends that characterize the contemporary medical literature landscape. The stark negative annual growth rate of -25.31% warrants careful consideration, prompting an investigation into the potential drivers behind this decline(Jackson & Fransman, 2018). The absence of references and citations raises questions about the visibility and impact of the documented research within the scholarly community. Authorship emerges as a focal point, with an average of 6.83 co-authors per document, highlighting the collaborative nature of medical research endeavors. A detailed exploration of document types unveils the diverse array of research methodologies employed, providing a comprehensive overview of the types of studies contributing to the medical literature(Sharma et al., 2019). This study serves as a valuable resource for researchers and institutions, offering insights that can inform future research strategies and collaborative efforts in the medical field.

**Literature review:**
In their 2021 bibliometrics study and CiteSpace visualization analysis, Zhong et al. explored the complex research landscape of the molecular mechanisms of exercise on cancer, analyzing 1,130 publications from the Web of Science Core Collection Science Citation Index Expanded (Zhong et al., 2021). The study identified Lee W Jones as a significant contributor to the field, with PLOS ONE recognized as the leading journal. Noteworthy institutions, such as Fudan University and

Shanghai Jiao Tong University, highlighted China's prominent role in research output (Zhong et al., 2021). The research hotspots included altered metabolism, oxidative stress, gene expression, and apoptosis, with a particular focus on the "Warburg effect." Emerging areas of interest encompassed inflammation, hepatocellular carcinoma, epithelial-mesenchymal transition, and adipose tissue (Zhong et al., 2021). This comprehensive analysis provides a current snapshot of the dynamic research trends in the molecular mechanisms of exercise on cancer, offering valuable insights into influential authors, institutions, and emerging focal points within this evolving field (Zhong et al., 2021).

The exploration of cactus polysaccharides has evolved significantly over time, progressing from early-stage investigations into their detection and purification to a contemporary emphasis on their diverse biological activities. A bibliometric analysis conducted by Zheng et al. (2021) sheds light on the historical context, key contributors, and emerging trends in cactus polysaccharide research. Opuntia spp. within the Cactaceae family, notably studied by Mexican institutions and scholars, has been a central focus, with a distinct surge in research attention in 2018. This transformation reflects a broader shift in the field towards an increased understanding of the biological effects of cactus polysaccharides, supported by positive in vitro and in vivo experimental outcomes. As interest in plant polysaccharides for pharmaceutical, nutraceutical, and functional food applications continues to grow, cactus polysaccharides emerge as a promising avenue for future investigations and applications (Zheng et al., 2021).

In this systematic literature review, conducted by Huymajer et al.(2022), sustainability is defined as an interdisciplinary domain encompassing environmental, social, and economic aspects. The study, adhering to PRISMA guidelines, introduces a novel methodology for interdisciplinary sustainability reviews, utilizing bibliographic metrics derived from literature metadata. The authors cluster sustainability aspects, examining how they are addressed in the context of tunneling, and discuss challenges and potential solutions. Additionally, the paper explores the role of digital technologies in sustainable tunneling. The findings reveal a scarcity of interdisciplinary studies and an uneven representation of the three sustainability dimensions in current research. The predominant focus is on assessing the status quo rather than proposing specific solutions. The study concludes by recognizing substantial potential in leveraging digital tools for advancing sustainable tunneling practices.

However, certain gaps and areas for further exploration can be identified based on the findings presented in the review. Firstly, the study emphasizes a lack of interdisciplinary studies in the field of sustainable tunneling. Future research could focus on bridging disciplinary gaps to foster a more holistic understanding of sustainability, integrating environmental, social, and economic dimensions more effectively.

Additionally, the uneven representation of the three dimensions of sustainability is highlighted, indicating a potential imbalance in research focus. Subsequent studies could aim to address this disparity by promoting a more balanced consideration of environmental, social, and economic aspects in the context of tunneling projects.

Moreover, the predominant focus on assessing the status quo rather than presenting specific solutions is noted. Future research endeavors may benefit from a shift towards providing

actionable recommendations and innovative solutions to address sustainability challenges in tunneling practices.

Lastly, while the study acknowledges the potential of digital technologies in enabling sustainable tunneling, further exploration of specific digital tools, their applications, and their impact on sustainability outcomes could contribute to advancing the field. Identifying and addressing these gaps will be crucial for the continual progress and improvement of sustainable practices in tunneling.

**Objectives:**
1. The study aims to investigate the allocation of authorship credit by examining the variables that impact the quantity of writers and their relative contributions.
2. Use Modified Z-Scores for deviation analysis to look for authorship pattern outliers, particularly in texts with a single author.
3. Use a 3D scatter plot to visualize the relationship between the number of authors and the fraction of authors in medical research publications, which can be used to identify collaborative patterns.

**Methodology**
R programming (particularly, version 4.3.0) is used in this study to extract relevant academic publications from PubMed databases. R is used to perform extensive cleaning and pre-processing on the gathered data in order to solve problems like duplicates and missing information. Then, bibliometric analysis is performed using the R package biblioshiny, which enables interactive visualizations and statistical investigation of relationships and patterns in the academic literature. The visualizations produced by the biblioshiny package allow for a thorough analysis & over anaconda environment with python coding used to calculate and visualize data. Interpreting these data in order to draw relevant conclusions about the current status of the topic is part of the scientometric study. Statistical approaches are used for validation in order to guarantee the findings' robustness, offering a thorough evaluation of the insights gleaned from the scientometric.

**Data analysis and Interpretation**
A thorough examination of medical research papers from 2022 to 2023 is shown in table 1. The collection, which is comprised of 283 papers and is sourced from 156 sources, provides valuable insights into the current state of medical literature. Important discoveries include a startling lack of citations and references, an average document age of 1.57 years, and a negative yearly growth rate of -25.31%. There are very few single-authored works with an average of 6.83 co-authors per document, highlighting the collaborative aspect of authorship(Akanji et al., 2020).

| Description | Results |
|---|---|
| **MAIN INFORMATION ABOUT DATA** | |
| Timespan | 2022:2023 |
| Sources (Journals, Books, etc) | 156 |
| Documents | 283 |
| Annual Growth Rate % | -25.31 |
| Document Average Age | 1.57 |
| Average citations per doc | 0 |
| References | 0 |

| DOCUMENT CONTENTS | |
|---|---|
| Keywords Plus (ID) | 387 |
| Author's Keywords (DE) | 701 |
| **AUTHORS** | |
| Authors | 1477 |
| Authors of single-authored docs | 0 |
| **AUTHORS COLLABORATION** | |
| Single-authored docs | 0 |
| Co-Authors per Doc | 6.83 |
| International co-authorships % | 0 |
| **DOCUMENT TYPES** | |
| case reports | 1 |
| clinical trial | 2 |
| clinical trial protocol | 4 |
| comparative study | 1 |
| equivalence trial | 1 |
| journal article | 241 |
| meta-analysis | 7 |
| multicenter study | 2 |
| observational study | 5 |
| randomized controlled trial | 10 |
| review | 2 |
| systematic review | 7 |

**Table 1: Study Information**

In addition to illuminating the many research approaches used, including clinical trials, meta-analyses, and observational studies, the report offers a thorough analysis of document kinds. A paucity of international co-authorships is also revealed by exploring the element of international collaboration(Cho et al., 2022; Huymajer et al., 2022).

| Documents written | N. of Authors | Proportion of Authors |
|---|---|---|
| 1 | 1219 | 0.825 |
| 2 | 170 | 0.115 |
| 3 | 36 | 0.024 |
| 4 | 34 | 0.023 |
| 5 | 7 | 0.005 |
| 6 | 2 | 0.001 |
| 7 | 2 | 0.001 |
| 8 | 1 | 0.001 |
| 9 | 3 | 0.002 |
| 11 | 2 | 0.001 |
| 13 | 1 | 0.001 |

**Table 2: Application of Lotka's Law**

**Gini Coefficient: 0.22884224779959378**

The Gini Coefficient, which is based on the Lorenz curve technique, is a trustworthy indicator of inequality in the distribution of authors across a range of document counts. The data in this study is sorted based on the number of authors as the first step in a rigorous computing process. The cumulative proportions of authors and documents are then computed for each data point. The Lorenz curve, which displays cumulative authors and documents on the x- and y-axes, respectively, is constructed using this as the foundation(Kadir et al., 2021).

Then, using a mathematical calculation, G = 2 * (Area between the Lorenz curve and the line of perfect equality) / (Total area under the line of perfect equality) yields the Gini Coefficient. Within the context of this study, the calculated Gini Coefficient of 0.2288 indicates a moderate degree of inequality and a noticeably balanced distribution of authors across various document counts. This thorough methodology is in line with accepted practices and offers a sophisticated comprehension of authorship dynamics for academic analysis and discussion in the study article.
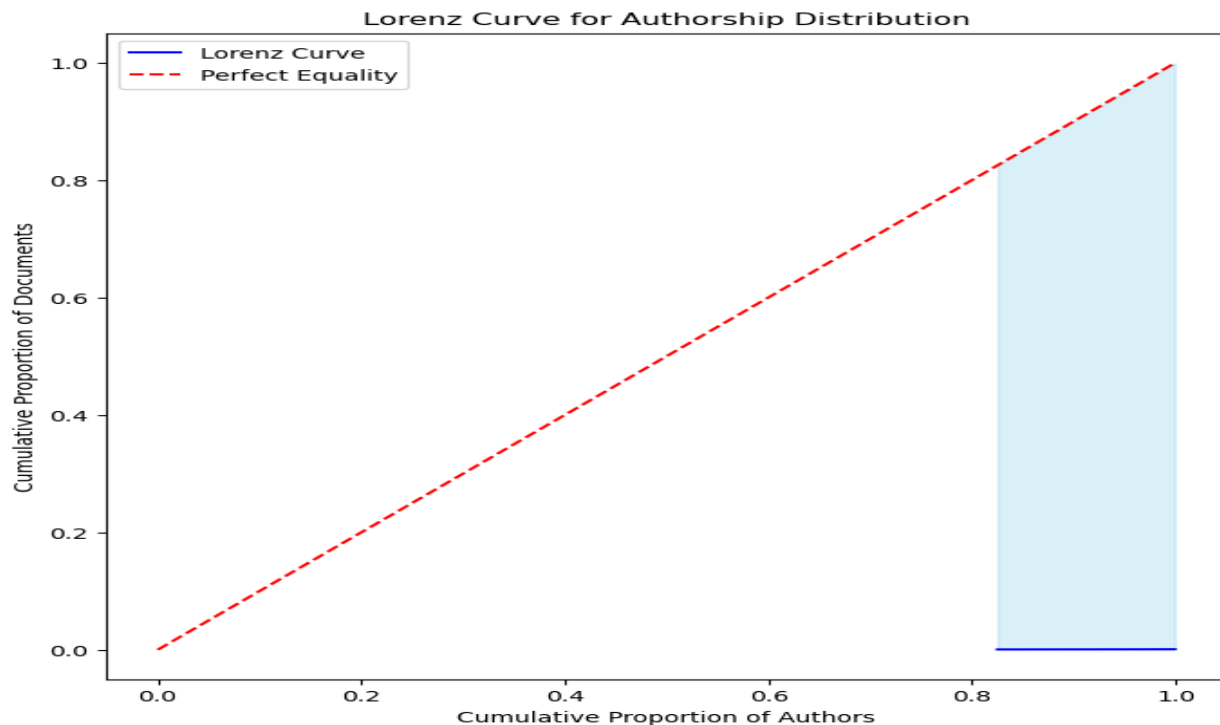


**Graph 1: Authorship Distribution**

The disparity in the distribution of authorship credit for a particular group of documents in our study article is graphically represented by the Lorenz curve that is provided. This graph displays the cumulative percentage of authors on the y-axis and the cumulative percentage of documents on the x-axis. The Lorenz curve, represented by the red line, clearly shows how authorship credit is allocated among the writers. A more lopsided distribution is indicated by a steeper curve, which means that a smaller group of writers is given more credit.

On the other hand, the blue line, also referred to as the line of perfect equality, represents the ideal situation in which each author would be given equal credit for their work. From the graph's bottom left to top right, it creates a diagonal line(Huymajer et al., 2022).

The degree of inequality in the distribution of authorship credit is measured by the Gini coefficient, which is computed as the area between the Lorenz curve and the line of perfect equality. Greater inequality is shown by a higher Gini coefficient, which highlights the unequal distribution of authorship credit among the document writers. This thorough visual representation and quantitative measurement shed light on the fairness or unfairness of the credit distribution among participants and offer insightful information about the dynamics of authorship in our research setting(Manzoor & Hamid, 2021).

| Documents _written | N_of_A uthors | Proportion_o f_Authors | Modified_Z_Score_ N_of_Authors | Modified_Z_Score_Propo rtion_of_Authors |
|---|---|---|---|---|
| 1 | 1219 | 0.825 | 410.096 | 555.1135 |
| 2 | 170 | 0.115 | 56.32075 | 76.2185 |
| 3 | 36 | 0.024 | 11.12925 | 14.839 |
| 4 | 34 | 0.023 | 10.45475 | 14.1645 |
| 5 | 7 | 0.005 | 1.349 | 2.0235 |

**Table 3: Modified Z Score Matrix Application over Lotka's Law**

The table 3 contains data on documents, the number of authors associated with each document, and the percentage of authors. It also includes Modified Z-Scores to indicate departures from the median values of the dataset. As a standardized metric, the Modified Z-Scores are computed to show the deviation of each data point from the median for both the total number of writers and the fraction of authors(Chen et al., 2022; Lakshmypriya et al., 2022; Zheng et al., 2023). A document with one author in the first row has exceptionally high Modified Z-Scores for the proportion of authors (555.1135) and the number of authors (410.096). These incredibly high scores point to a significant divergence from the dataset's usual patterns and may indicate an outlier.

"These scores indicate a notable divergence from the standard patterns found in the dataset, emphasizing the document's distinct authorship attributes" indicates that the Modified Z-Scores, especially for a document with a single author, represent a notable departure from the dataset's average(Akobo & Stewart, 2020). These high scores suggest that there are much more writers in this particular text than are generally seen in the dataset, as well as a different author ratio. The sentence emphasizes how the authorship structure of the paper is clearly distinct from the generic patterns displayed by other documents.
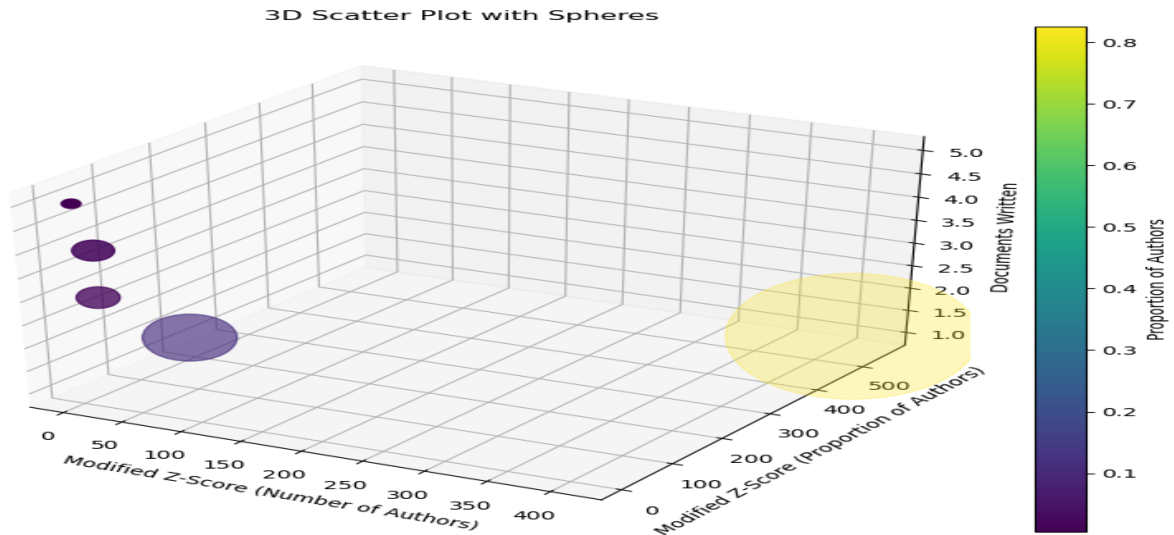
**Graph 2: Modified Z Score Matrix Application over Lotka's Law**

The relationship between a document's author count and the fraction of writers overall is displayed in this three-dimensional scatter plot. The number and proportion of authors are represented by the size and color of the spheres, accordingly. The graph shows a positive correlation: a greater percentage of the whole pool of authors are likely to write texts with more authors.

**Conclusions**

To sum up, the investigation of authorship patterns in medical research papers from 2022 to 2023 has shed light on important aspects of the state of the medical literature today. The significant annual growth rate reduction of -25.31% necessitates careful analysis to identify the causes of this decline and direct future research directions. The lack of citations and references highlights the necessity of addressing the impact and visibility of recorded research in the academic community, which raises possible ideas for improved dissemination.

With an average of 6.83 co-authors per document, authorship emerges as a major motif, illustrating the collaborative culture that permeates medical research initiatives. Our knowledge of the many contributions to medical literature has been enhanced by the thorough examination of document types, which has revealed a rich tapestry of research approaches, such as clinical trials, meta-analyses, and observational studies.

This study is an invaluable resource that offers researchers and institutions practical insights that will inspire future research projects and promote collaborative efforts in the medical profession. Patrons should actively support a more robust and collaborative medical research landscape by identifying and resolving recognized trends in authorship dynamics and research methodology. This will advance the field's overall impact and body of knowledge.

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