# Uncovering the Publication Trends and Pattern of Responsible Open Science Research: A Bibliometric Review

**Norizah Mustamil[1], Usama Najam[2], Muhamad Faizal Zulkifli[1], Zarina Zakaria[1]** and **Adida Md Amin[3]**

[1]Faculty of Business & Economics, Universiti Malaya, Kuala Lumpur, MALAYSIA

[2]Department of Business Administration, Air University, Multan, PAKISTAN

[3]Law Library, Universiti Malaya, Kuala Lumpur, MALAYSIA

e-mail: norizahmm@um.edu.my

**ABSTRACT**

*This research employs bibliometric analysis as a methodology to investigate the ethical ramifications associated with open access publications. The dataset employed in this study is sourced from the Scopus database, hence offering a comprehensive range for analysis. The primary aim of this research is to provide a thorough and comprehensive analysis of the complex ethical problems that are intertwined with the practice of open access publishing. To accomplish this task, a comprehensive literature and bibliometric analysis was conducted on a dataset including 210 documents. This study employs bibliometric techniques, such as bibliometric coupling, text mining, factorial analysis and thematic clustering to do a quantitative examination of various elements within the chosen materials. The aforementioned characteristics encompass authorship patterns, trends in citations, collaborations among co-authors, categorization of documents, and the creation of themed maps. The approach utilized in this study involves a comprehensive examination of bibliographic data, citation patterns, text mining, thematic mapping, cluster analysis, and co-authorship networks to elucidate the intricate network of ethical concerns linked to open access publications. This study seeks to utilize exploratory analysis and network visualization approaches to uncover emergent themes, ascertain key contributors, and assess the influence of research entities on the advancement of ethical discourse within this specific domain. The findings of this bibliometric analysis contribute to the scholarly understanding of ethical quandaries and discussions within the field of open access publication. The capacity to identify novel trends and established domains of emphasis enables scholars, professionals, and decision-makers to attain a holistic comprehension of the dynamic ethical landscape in the domain of open science. These observations hold relevance for enhancing ethical practices, fostering transparency, and cultivating responsible behavior within the broader framework of open access publication.*

**Keywords:** Open Science; Ethics; Responsible Publishing; Bibliometric; Text Mining

## INTRODUCTION

The concept of open science encompasses a movement that promotes the dissemination of scientific data, methodologies, and outcomes in an open and accessible manner (Amsen, 2015). In recent years, there has been an increasing recognition among researchers of the advantages associated with open science, including enhanced openness, reproducibility, and collaboration (Van Noorden, 2013). In the scientific community, the notion of "responsible open science research" is becoming more and more popular (Ramachandran et al., 2021). Although responsible or ethical open science research has many different definitions and interpretations, generally it refers to the concepts of promoting ethicality, transparency and collaboration in research along with providing open access to scientific knowledge (Ramachandran et al., 2021). Open access publishing, preregistration of studies, open data sharing, and the dissemination of research materials are all included in the concept of "responsible open science research" (Cook et al., 2021).

Open access publishing is widely regarded as a vital element of the open scientific paradigm. Open access publishing is a scientific publishing model that promotes unrestricted access to research articles, allowing users to freely read, download, and reuse them for diverse purposes. Tracz and Lawrence (2016) argue that this specific strategy has the potential to improve the availability of scientific knowledge to a wider audience, including researchers, policymakers, and the general public.

The incorporation of open science into responsible research and innovation has positioned it as a defining characteristic of ethical research across diverse settings, including higher education institutions and numerous governmental and non-governmental research groups. There is a noticeable trend among researchers, organizations, and professional bodies towards adopting the essential principles of this program. The core concepts of the program are being more widely acknowledged within the research community (Samuel & Lucivero, 2020).

Nevertheless, it is crucial to acknowledge that open access publication is not without its ethical considerations, as highlighted by Schöpfel et al. (2020). Certain researchers have expressed apprehensions on the possibility of predatory open access publishers exploiting scholars through exorbitant publication costs. Moreover, there was apprehension regarding the potential impact of open access publishing on the caliber of scientific research. In addition, an increasing number of research publications are embracing the Open Data policy, which involves the requirement or encouragement for researchers to share their data with the public. However, the dissemination of public data in the age of digital technology has the capacity to undermine the confidentiality of individuals, thereby discouraging them from voluntarily divulging information.

The present work utilizes bibliometric approaches, specifically bibliometric coupling, text mining, and factorial analysis, to conduct a quantitative analysis of different components within the selected materials. The elements comprise various aspects such as authorship patterns, citation trends, co-author collaborations, document classifications, and thematic

grouping and factorial analysis. The findings of this research provide valuable perspectives on the ethical implications linked to open access publishing. The data provided in this context has promise for its application in the development of policies and execution of protocols that promote the progression of accountable open science research.

**Objectives of the Study**

The main objective of this research is to provide a thorough and comprehensive analysis of the complex ethical problems that are closely linked to the practice of open access research. The present study will employ bibliometric analysis as a methodological approach to investigate the ethical considerations associated with open access articles. The dataset employed in this study is obtained from the Scopus database, offering a comprehensive range for analysis.

**Research Questions**

RQ1.How have Responsible Open Science Publication research trends evolved?
RQ2.What are the leading Journals, Publications, Countries and Authors in the field of Responsible Open Science research?
RQ3.What are the leading thematic research clusters and dimensions in the research domain?

## METHODOLOGY

We have applied bibliometrics technique to improve our understanding of our topic. In academic disciplines with a large volume of scholarly publications, bibliometric analysis is better than qualitative analysis, especially when examining structural relationships in the relevant literature. Our bibliometric analysis relies on data retrieved from a reliable database i.e. Scopus (Al-Khoury et al., 2022; Julius, 2021).

Two popular software programs, Biblioshiny and VOS-viewer, helped us with the inquiry. These applications help us to perform bibliometric analysis on scholarly publications, authors, journals, and keywords. The platform displays citation networks, co-authorship networks, keyword co-occurrence networks, network visualization, factorial analysis, text mining and thematic mapping (Cobo et al., 2011; Zhu et al., 2019).

**Search Strategy**

For this study, we put together our datasets using a Scopus database. This research included the articles published in English, Chinese, Croatian, Spanish. The research objective was to classify publication on ethical concerns related to open science publishing. We initially began by searching for the pertinent article by using keywords such as “Open access Publishing” AND “Ethics* OR “responsible” AND “Open Science”.

The process of gathering data to identify pertinent research papers associated with ethical/responsible open access publishing is shown in Figure 1

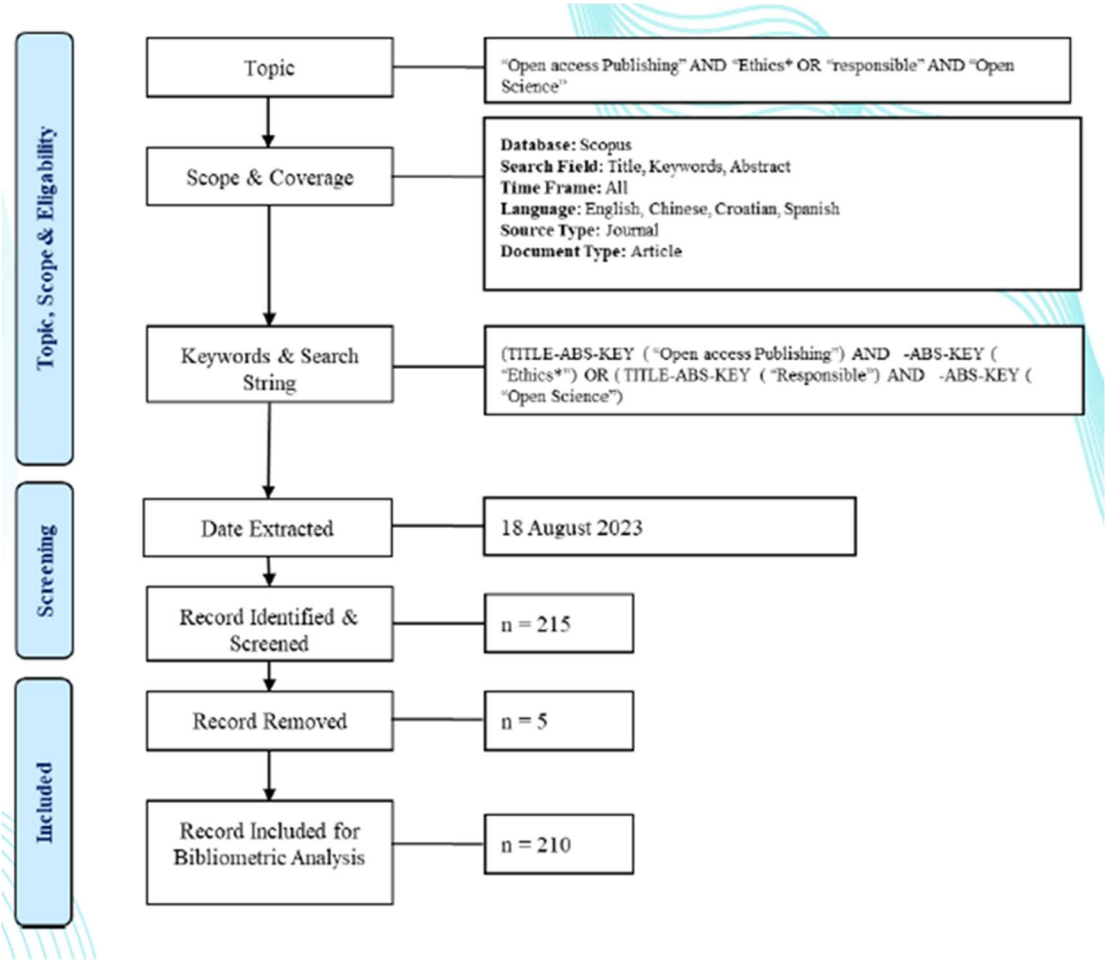


Figure 1: Search strategy

**FINDINGS AND DISCUSSION**

In order to address the RQ.1 we have used the Biblioshiney software and crafted the whole research canvas and publication trendline to uncover how the research has evolved in this field.


Figure 2: Research Canvas

Figure 2 visualizes the research done in the field of responsible open science publishing in Web of Science on a canvas. The research started in the field in 2004 and till now (2023) the trend still exists. There are a total of 157 journals that publish research on this topic. The annual growth is 14.45%, and average document age is 4.66 years and 11.33 citations. There are a total of 210 documents, and 748 authors contributed. 20% of the publications have international co-authorship, and there are 242 author's keywords.

**Publication Trend**

The Figure 3 presents the distribution of papers over different years, offering valuable insights into the evolving trajectory of research efforts within this topic.

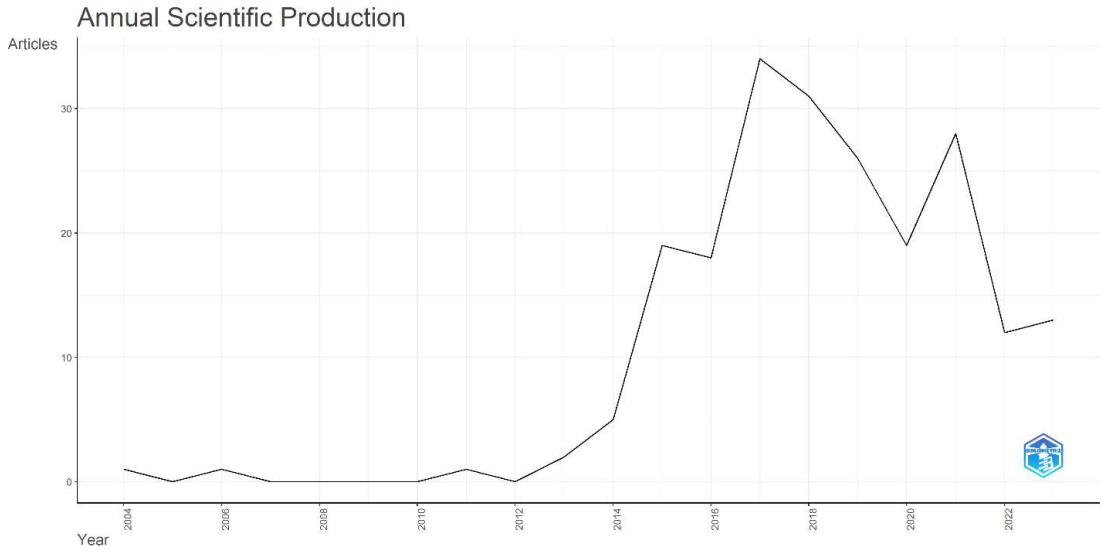


Figure 3: Publication Trend

Beginning in 2004 with just one paper, the investigation of an ethical and responsible open science framework rapidly gained momentum. The next years witnessed sporadic involvement up until 2013, when the trend experienced a notable acceleration following the publication of two works. A major increase in research activities followed, which was evidenced by a consistent rising trend in the number of academic articles published each year.

The number of articles significantly increased to five in 2014, demonstrating a growing understanding of the moral implications of releasing open research. The quantity of published works also expanded quickly in the years that followed, giving this phenomenon more momentum. With 19 articles published in 2015 and 18 articles published in 2016, there was a noticeable increase in the number of papers published between those two years.

The peak of this ascending trend occurred in 2017, when there were a total of 34 articles, a significant increase in the number of publications. This rise in scholarly production suggests more academic awareness of and interest in the moral issues surrounding open access to scientific publications. In the year 2018, there were a total of 31 articles, while the following year, 2019, there were 26 items. Furthermore, there has been a continuous interest in the subject matter in the years that followed, as seen by the continued publishing of pieces on a regular basis.

In spite of some variations, the year 2021 saw the publishing of 28 publications in the topic, therefore highlighting the enduring importance and durability of the nexus between open research publication and ethics. As of the present year, 2023, the prevailing pattern persists, with a total of 12 papers having been published so far. This signifies that the ongoing discussion pertaining to ethical issues in the realm of open research publishing continues to endure and undergo development.

To address the RQ.2 we have applied the bibliometric coupling technique to uncover the top publications, authors and countries in the field. And to understand the top journals we have applied Bradford's law.

**Top Publication**

The table 1 shows the top 10 publications in the field of ethical open science research, based on the norm citation score. The paper "The gender gap in science: How long until women are equally represented?" by Holman et al. (2018) has the highest number of total citations (372) and 16.84 norm citations. This study utilizes quantitative methodologies to forecast the temporal horizon at which women may attain parity in diverse scientific domains, drawing from prevailing patterns and trajectories. This study makes a valuable contribution to the continuing discourse surrounding gender equality, diversity, and inclusivity within the scientific community. It provides insights into the extent of development required to effectively tackle gender discrepancies in the field of science. The study utilized data obtained from the National Science Foundation's Survey of Doctorate Recipients to monitor the level of female representation within the fields of science, engineering, and medicine (STEM) for the period spanning from 1973 to 2015. The study revealed that there has been a notable increase in the proportion of women in STEM fields, rising from 28% to 40% throughout the

specified time frame. Nevertheless, there has been no significant change in the proportion of women occupying the most lucrative and prestigious positions within STEM fields. As an illustration, the proportion of women occupying tenure-track professor jobs in the fields of science and engineering has shown a modest rise from 23% to 28% throughout the specified timeframe.

Table 1: Top Publications

| **Title** | **Author, Year, Journal** | **Total Citations** | **Norm TC** |
|---|---|---|---|
| The gender gap in science: How long until women are equally represented? | (Holman et al., 2018), PLOS BIOL | 372 | 16.84 |
| Stop this waste of people, animals and money | (Moher et al., 2017), NATURE | 169 | 10.7 |
| Archiving Primary Data: Solutions for Long-Term Studies | (Mills et al., 2015), TRENDS ECOL EVOL | 88 | 7.67 |
| Problems and challenges of predatory journals | RICHTIG G, 2018, J EUR ACAD DERMATOL VENEREOL | 85 | 3.85 |
| Predatory Publishing, Questionable Peer Review, and Fraudulent Conferences | BOWMAN JD, 2014, AM J PHARM EDUC | 82 | 3.98 |
| How predatory journals leak into PubMed | MANCA A, 2018, CMAJ | 64 | 2.9 |
| The Post-Embargo Open Access Citation Advantage: It Exists (Probably), It's Modest (Usually), and the Rich Get Richer (of Course) | OTTAVIANI J, 2016, PLOS ONE | 48 | 2.72 |
| Knowledge sharing in global health research – the impact, uptake and cost of open access to scholarly literature | SMITH E, 2017, HEALTH RES POLICY SYST | 48 | 3.04 |
| Ethical issues in publishing in predatory journals | FERRIS LE, 2017, BIOCHEM MED | 45 | 2.85 |

The study also revealed that the disparity in representation between genders in STEM fields is not consistent across all academic areas. There exists a disparity in the representation of women throughout academic disciplines, with a higher likelihood of their presence in the biological and social sciences, and a lower likelihood of their representation in the physical sciences and engineering.

This paper is followed by "Stop this waste of people, animals and money" by Moher et al. (2017) (169 citations, 10.7 norm citation). This paper examines the prevalent problem of

research waste and inefficiency within the scientific community. The authors draw attention to the concerns surrounding the misallocation of resources, encompassing human labor, animal subjects, and financial investments. These concerns arise from a multitude of causes, including insufficient reporting, subpar study design, and the presence of publication bias. The issue of research waste is a substantial challenge within the scientific domain. The term "research waste" pertains to the superfluous or ineffective utilization of resources in the process of doing, reporting, and disseminating research. Waste can manifest in various forms, encompassing the utilization of incorrect procedures in research studies, the exclusion of crucial data, and the non-publication of unfavorable or inconclusive findings. Furthermore, the authors believe that Predatory journals are characterized by their susceptibility to manipulation. The acceptance of publications by these journals appears to be mostly independent of their quality, while their fees are significantly lower compared to those imposed by established open-access journals. The scholarly publishing firms in question are alleged to engage in opaque practices, generating revenue through fee collection without fulfilling their purported commitment to open access. Furthermore, these institutions are accused of neglecting essential functions such as peer review and archiving.

On the third position we have "Archiving Primary Data: Solutions for Long-Term Studies" by Mills et al. (2015) (88 citations, and 7.67 norm citation). The study examines the difficulties and resolutions associated with the preservation and dissemination of original data derived from extensive scientific inquiries. This work makes a valuable contribution to the ongoing discourse surrounding data management, reproducibility, and the responsible conduct of research. Its primary objective is to enhance the value and impact of long-term studies within the scientific community. Many biologists have welcomed the recent tendency in academic journals to mandate open access to source data that is included in articles. However, this development has raised concerns among researchers involved in long-term ecological and evolutionary studies. A global study conducted among 73 principal investigators (PIs) engaged in long-term research unveiled a prevailing inclination towards data sharing, particularly when the PI is involved or has given consent. Notably, an overwhelming majority of 93% of PIs have consistently engaged in the practice of data sharing in the past. A mere 8% of respondents voiced support for unregulated and unrestricted access to primary data, but a significant majority of 63% expressed substantial apprehension on this matter. In this discourse, Authors convey the perspective of the authors regarding a matter that holds significant scientific implications. Authors also examine the prospective expenses associated with the preservation of public data, while also presenting viable resolutions to effectively address the requirements of academic publications and researchers.

**Top Journals**

Bradford's Law is used to identify a discipline's top 10 sources in the table below. Bradford's Law divides scientific literature by topic into circular zones. Although these zones have fewer sources, they contribute to a large percentage of published articles. In this framework, zones are defined by the frequency of articles from each source (see Figure 4). The Table 2 below ranks the ten primary sources by field impact in decreasing order. It includes their rankings, frequencies, cumulative frequencies, and zones. First is "BMJ OPEN," with 16 articles in the field. The only source in Zone 1 is it. The next notable source is "NATURE," ranked 2. This

source has 13 articles, a cumulative frequency of 29. "NATURE" is also in Zone 1. Three and four articles from "PLOS ONE" contribute to Zone 1's 33 frequency.

Table 2: Top Journals

| Journal | Rank | Freq | cumFreq | Zone |
|---|---|---|---|---|
| BMJ OPEN | 1 | 16 | 16 | Zone 1 |
| NATURE | 2 | 13 | 29 | Zone 1 |
| PLOS ONE | 3 | 4 | 33 | Zone 1 |
| BIOCHEMIA MEDICA | 4 | 3 | 36 | Zone 1 |
| JOURNAL OF KOREAN MEDICAL SCIENCE | 5 | 3 | 39 | Zone 1 |
| JOURNAL OF THE EUROPEAN ACADEMY OF DERMATOLOGY AND VENEREOLOGY | 6 | 3 | 42 | Zone 1 |
| TRENDS IN ECOLOGY AND EVOLUTION | 7 | 3 | 45 | Zone 1 |
| AMERICAN JOURNAL OF MEDICINE | 8 | 2 | 47 | Zone 1 |
| CLINICAL AND EXPERIMENTAL DERMATOLOGY | 9 | 2 | 49 | Zone 1 |
| CURRENT MEDICAL RESEARCH AND OPINION | 10 | 2 | 51 | Zone 1 |

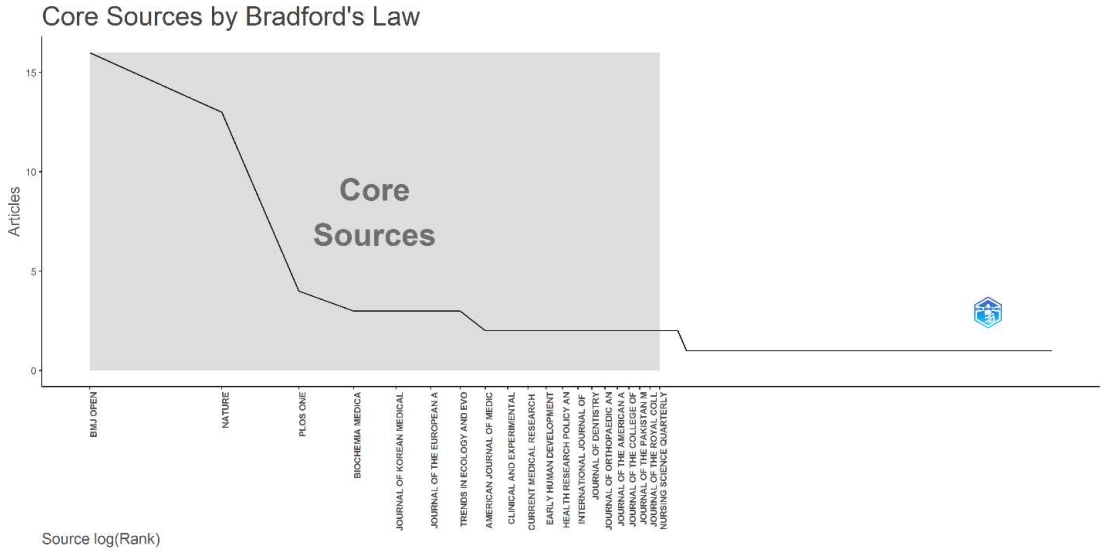


Figure 4: Top Sources Based on Bradford's Law

**Corresponding Author Countries**

The data (see Figure 5) offers valuable insights into the collaborative patterns observed in corresponding authorship across many nations, showing the widespread global engagement and collaboration in research pertaining to ethical considerations in the realm of open access publishing.

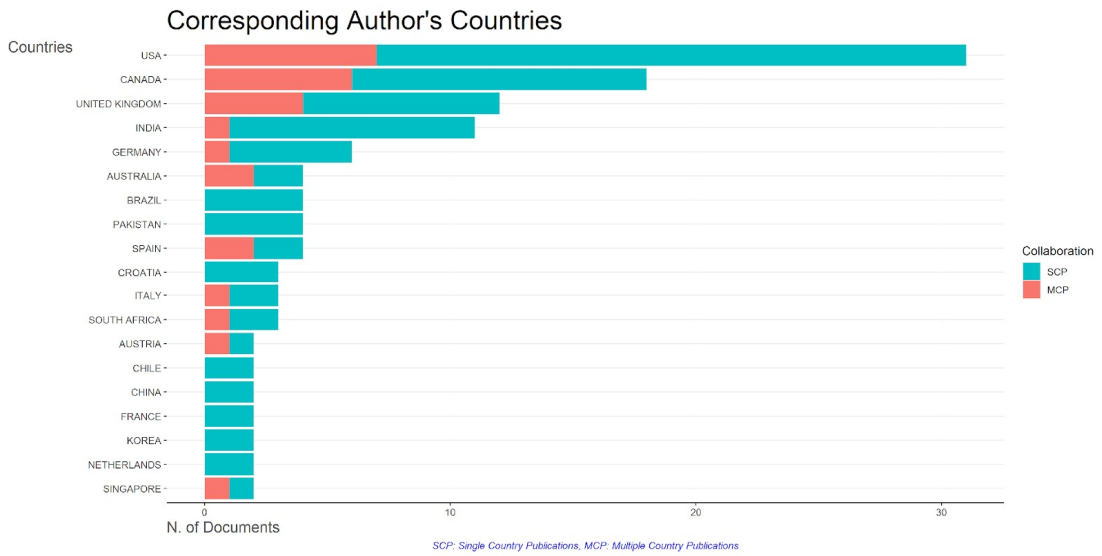


Figure 5: Corresponding Author's Countries

The United States of America (USA) has the biggest quantity of papers, totaling 31, encompassing a combination of single-authored articles (24) as well as works with multiple corresponding authors (7). The MCP ratio, with a value of 0.226, suggests that a significant proportion of papers originating from the United States involve collaborative efforts among many corresponding authors. Canada has a total of 18 articles, of which 12 are attributed to a single corresponding author, while the remaining 6 pieces have multiple corresponding authors. The MCP ratio exhibits a rather high value of 0.333.

To address or RQ.3 we have applied thematic mapping and factorial analysis using Vos, Viewer and Biblioshiny to uncover the leading thematic research clusters and dimensions in the research domain.

**Thematic Clusters**

We have applied text mining techniques, utilizing VosViewer and Biblioshiny (R studios) software to drive the network visualization (see Figure 6) clusters and thematic mapping.

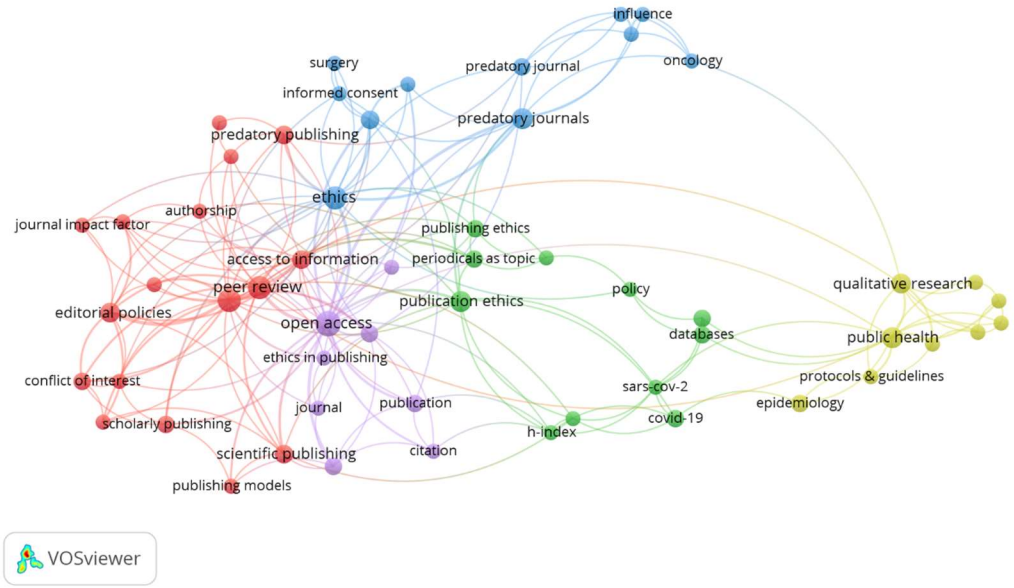


Figure 6: Network Visualization based on Text Data

Using VosViewer text mining to extract publication titles, abstracts, and author keywords, the following clusters were formed (Figure 6).

*Cluster 1 Publishing and Ethics:*
Ethical issues in open access publishing are central to Cluster 1. The publication process involves authorship, conflict of interest, peer review, publication ethics, and scientific misconduct. The presence of "open access journals" and "open access publishing" suggests a commitment to ethical research and transparency. This cluster emphasizes ethical standards for responsible and reliable open access articles.

*Cluster 2 Emerging Research and COVID-19:*
While not directly related to open science ethics, this cluster includes growing research domains like the pandemic. Ethical considerations are crucial for rapid scientific progress during crises. "COVID-19," "policy," and "SARS-CoV-2" may involve ethical issues related to research prioritization, data exchange, and information transmission. Transparent and influential research is morally required to address global issues, according to this cluster.

*Cluster 3 Health and Research:*
This cluster includes ethical considerations for open access publication, focusing on health-related topics. Medical research, especially community child health, epidemiology, and public health, emphasizes ethical conduct and dissemination. The ethics of careful study design and data collection are stressed in "research" and "qualitative research". This cluster emphasizes

the ethical obligations of ensuring the precision and ethical reliability of open-access health research.

*Cluster 4 Impact and Communication:*
This cluster emphasizes the ethical responsibility of writers and publishers to communicate research findings and effects openly. "Citation," "journal impact factor," and "predatory" are related to ethical research evaluation and avoiding unethical behavior. Thus, "scholarly communication" emphasizes the need for ethical communication protocols in open access materials, which fosters research community collaboration and responsibility.

*Cluster 5 Ethics and Research Integrity:*
Despite its diversity, Cluster 5 is ethically significant in responsible open access publishing. The terms "informed consent," "knowledge," "ethics," and "research management" emphasize the importance of ethical research, informed participant consent, and responsible data management. This cluster addresses the central issue of ethical considerations in open access publishing by strengthening research ethics regardless of focus.

**Factorial Analysis**
Factorial analysis output with two dimensions is interpreted in Figure 7 and Table 3. Open access and predatory publishing conflict in the first dimension. The left side of the axis includes "open access" and "publishing ethics"—terms closely related to open access publishing. This publishing model wants to make research articles freely available to everyone. The right-hand terms, "predatory journals" and "conflict of interest," refer to predatory publishing. Predatory publishing exploits researchers by charging them for article publication in low-quality journals.

Second dimension: Second, ethical considerations conflict with the potential consequences or influence of a given action or decision. The uppermost phrases on the axis, "ethics" and "publication ethics", represent publishing ethics. The lower end of the axis, "impact factor" and "h-index", measure research influence.

The two dimensions represent the different open science publishing perspectives. One ethical issue in scholarly publishing is the risk of predatory practices and the need to maintain research integrity. Advantages include improved research accessibility and quality. Open science publishing perspectives can be understood using factorial analysis. It can also help develop ethical strategies for open science publishing and promote its benefits.

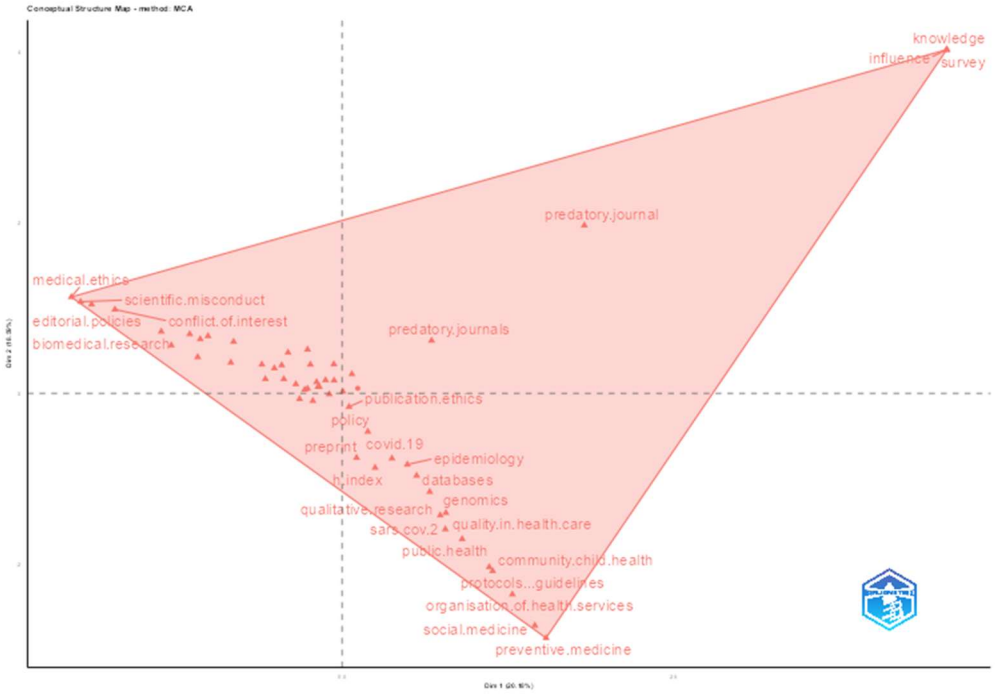


Figure 7: Factorial analysis

**CONCLUSION AND RESEARCH IMPLICATIONS**

The bibliometric analysis of the ethical implications of open science publications is a valuable first step in understanding this important topic. The findings of this study can be used to inform the development of future research in this area and to help ensure that open science is conducted in a responsible and transparent manner.

The bibliometric analysis undertaken on the ethical ramifications of open science publications has provided valuable insights into various noteworthy trends. The noticeable rise in the quantity of scholarly articles pertaining to this topic highlights a growing acknowledgment of the ethical intricacies inherent in the practice of open science. The inclusion of prominent journals such as BMJ Open, Nature, and PLOS ONE, along with notable authors (top publications) signifies the significant influence that these stakeholders exert in shaping discourse surrounding ethical considerations in the realm of open science.

The discourse has identified several focal points, including thematic clusters centered on ethics in publishing, the influence of emerging research and COVID-19, health-related research, impact and communication, and the ethical foundations that underpin research integrity. Factorial analysis has revealed two prominent dimensions in the field under study. The first dimension pertains to the conflict between open access and predatory publishing, while the second dimension focuses on the intricate interplay between ethical considerations and the potential consequences resulting from decision-making processes. Moving forward, the results emphasize the importance of developing thorough ethical principles that

guarantee the diligent and transparent implementation of open science. The establishment of responsible and ethically sound open science practices is of utmost importance within the scholarly community. This collaborative effort is necessary to cultivate a research environment that promotes both innovation and integrity.

The bibliometric analysis pertaining to the ethical ramifications of open science publications carries significant consequences for academics, professional librarians, and other relevant stakeholders. The study underscores the significance of ethical considerations in the context of open science publishing for researchers. It is imperative for researchers to possess a comprehensive understanding of the potential ethical dilemmas associated with open science publication, including the inherent risks of predatory publishing and the imperative to uphold research integrity. Researchers should possess knowledge of ethical norms pertaining to open scientific publication and should make efforts to adhere to these guidelines while disseminating their research findings.

For individuals working in the field of librarianship who possess the necessary qualifications and experience: Librarians possess the capacity to actively engage in the dissemination of knowledge pertaining to the ethical dimensions associated with open science publication, thereby contributing to the education of researchers in this domain. The authors have the capacity to furnish comprehensive insights regarding the diverse ethical quandaries implicated, encompassing the likelihood of predatory publishing and the paramount significance of sustaining study integrity. In addition, these platforms can assist researchers in locating and implementing ethical rules pertaining to the publication of open science.

**REFERENCES**

Al-Khoury, A., Hussein, S. A., Abdulwhab, M., Aljuboori, Z. M., Haddad, H., Ali, M. A., Abed,. A., & Flayyih, H. H. 2022. Intellectual Capital History and Trends: A Bibliometric Analysis Using Scopus Database. *Sustainability (Switzerland)*. https://doi.org/10.3390/su141811615

Amsen, E. 2015. Guide to open science publishing. *Guide to Open Science Publishing*.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field. *Journal of Informetrics*, *5*(1), 146–166. https://doi.org/10.1016/j.joi.2010.10.002

Cook, B. G., Fleming, J. I., Hart, S. A., Lane, K. L., Therrien, W. J., Dijk, W. v., … & Wilson, S. J. 2021. A how-to guide for open-science practices in special education research. Remedial and Special Education, 43(4), 270-280. https://doi.org/10.1177/07419325211019100

Holman, L., Stuart-Fox, D., & Hauser, C. E. 2018. The gender gap in science: How long until women are equally represented? *PLoS Biology*. https://doi.org/10.1371/journal.pbio.2004956

Julius, R., Halim, M. S. A., Hadi, N. A., Alias, A. N., Khalid, M. H. M., Mahfodz, Z., & Ramli, F. F. 2021. Bibliometric Analysis of Research in Mathematics Education using Scopus Database. In *Eurasia Journal of Mathematics, Science and Technology Education*.

https://doi.org/10.29333/EJMSTE/11329

Mills, J. A., Teplitsky, C., Arroyo, B., Charmantier, A., Becker, P. H., Birkhead, T. R., Bize, P., Blumstein, D. T., Bonenfant, C., Boutin, S., Bushuev, A., Cam, E., Cockburn, A., Côté, S. D., Coulson, J. C., Daunt, F., Dingemanse, N. J., Doligez, B., Drummond, H., … Zedrosser, A. 2015. Archiving Primary Data: Solutions for Long-Term Studies. In *Trends in Ecology and Evolution*. https://doi.org/10.1016/j.tree.2015.07.006

Moher, D., Shamseer, L., Cobey, K., Lalu, M. M., Galipeau, J., Avey, M. T., Ahmadzai, N., Alabousi, M., Barbeau, P., Beck, A., Daniel, R., Frank, R., Ghannad, M., Hamel, C., Hersi, M., Hutton, B., Isupov, I., McGrath, T. A., McInnes, M. D. F., … Ziai, H. 2017. Stop this waste of people, animals and money. In *Nature*. https://doi.org/10.1038/549023a

Ramachandran, R., Bugbee, K., & Murphy, K. 2021. From open data to open science. Earth and Space Science, 8(5). https://doi.org/10.1029/2020ea001562

Samuel, G., & Lucivero, F. 2020. Responsible open science: moving towards an ethics of environmental sustainability. *Publications*. https://doi.org/10.3390/publications8040054

Schöpfel, J., Azeroual, O., & Jungbauer-Gans, M. 2020. Research ethics, open science and cris. *Publications*. https://doi.org/10.3390/publications8040051

Tracz, V., & Lawrence, R. 2016. Towards an open science publishing platform. *F1000Research*. https://doi.org/10.12688/f1000research.7968.1

Van Eck, N. J., & Waltman, L. 2009. VOSviewer: A computer program for bibliometric mapping. *12th International Conference on Scientometrics and Informetrics, ISSI 2009*.

Van Noorden, R. 2013. Open access: The true cost of science publishing. In *Nature*. https://doi.org/10.1038/495426a

Yahaya, C. A. C., Firdaus, A., Ernawan, F., & Din, W. I. S. W. 2022. The Relevance of Bibliometric Analysis to Discover the Area's Research Efforts: Root Exploit Evolution. *International Journal on Informatics Visualization*. https://doi.org/10.30630/joiv.6.2-2.1095

Zhu, J., Song, L. J., Zhu, L., & Johnson, R. E. 2019. Visualizing the landscape and evolution of leadership research. Leadership Quarterly, 30(2), 215–232. https://doi.org/10.1016/j.leaqua.2018.06.003