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Analyzing The Evolution Of Cancer Research: A Scientometric Review Of Four Premier Oncology Journals

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ABSTRACT

The study aims to evaluate and visualize key scientometric indicators from the four most prolific journals in cancer research. Data retrieved from Scopus on December 6, 2024, were filtered to include publications from these journals. The analysis focused on growth metrics such as annual productivity trends, relative growth rate (RGR), annual growth rate, doubling rate, and growth ratios. Findings indicate an increase in doubling time from 0.82 to 9.90, alongside a decline in RGR from 0.84 to 0.07, reflecting the field's maturation. A comparative analysis revealed that the USA leads global contributions, followed by the UK, Germany, France, and Canada. This study provides quantitative insights into the performance of top cancer research journals and highlights the application of bibliometric tools to explore the intellectual structures within the discipline.

Keywords: Cancer research, Scientometrics, Bibliometric Analysis, The Lancet Oncology, Journal of Clinical Oncology.

1. INTRODUCTION

Cancer is characterized by the unchecked growth and spread of abnormal cells. These cells may form tumors, which can be benign (non-cancerous) or malignant (cancerous). Malignant tumors can invade surrounding tissues and metastasize, spreading to distant organs. Cancer can affect almost any part of the body, with types including carcinoma, sarcoma, leukemia, lymphoma, melanoma, and others involving the brain, spinal cord, or neuroendocrine cells. As the second leading cause of death worldwide, cancer was responsible for approximately 9.6 million deaths in 2018, demonstrating its significant global health burden. The study focuses on four active journals. The first Journal Cancer Cell launched in 2002, focuses on molecular mechanisms, tumor biology, and innovative treatments, with selected open-access content indexed in databases like PubMed and Scopus. The second journal The Lancet Oncology, established in 2000, covers diverse topics such as clinical trials and cancer policy, fostering international collaboration through partial open access. Similarly, the third one, the Journal of Clinical Oncology (JCO), founded in 1983, emphasizes clinical treatments and trials, advancing standards in oncology care. Lastly, Cancer Research, a biweekly

publication since 1941, provides insights into cancer biology and therapies, ensuring wide dissemination via significant indexing platforms.

2. REVIEW OF LITERATURE

Oskouie et.al (2024) The study examines the progression of Colorectal cancer (CRC) research over a decade. The study identified important contributors, partnerships, and research trends by analyzing 200, 385 CRC-related papers using data from Scopus. It emphasizes China's dominance in publications (46,674 articles), with notable input from organizations like the People's Republic of China's Ministry of Education. In terms of collaborative strength and citation effect, the US likewise performed quite well. To overcome global discrepancies in CRC research efforts, the study's conclusion highlights the necessity of increased financing and research focus, especially in developing nations.

Rezaee-Zavareh et al (2024) Research on the relationship between artificial intelligence (AI) and liver Cancer grew quickly between 2013 and 2022, and publications on the topic increased 12.7 times. 3950 publications in all comprising 2,695 articles and 366 reviews, were found, demonstrating the wide range of uses of AI in liver cancer. These include prognostic modeling, drug discovery, genomic analysis, and medical imaging for diagnosis and therapy planning. Notably, by 2022, papers about AI accounted for 4.03% of all liver cancer research, up from 0.55% in 2013, indicating that AI's use in oncology is growing.

Xu et.al (2024) The paper "Global Publication Productivity and Research Trends on Recurrent Ovarian Cancer: A Bibliometric Study" by Xu, Wang, and Xu (2024) examines global research trends and publication productivity in recurrent ovarian cancer. It employs bibliometric methods to analyze the number of publications, research impact, and emerging trends in this area. The study highlights significant research gaps, shifts in focus, and geographical variations in scientific output, offering valuable insights into the progression of ovarian cancer research.

Yang et.al (2024) have studied that one of the main causes of Gastric Cancer (GC), the fifth most frequent cancer worldwide, is Helicobacter pylori (HP). China and Japan dominate publishing production, while the University States lead in meaningful research, according to this analysis, which examines 1970 papers published between 2003 and 2022. Prominent contributions include the U.S. Department of Veterans Affairs and Vanderbilt University. Important subjects include autophagy, immunological regulation, and HP's function in carcinogenesis. As treatment approaches change, future research trends will concentrate on exosomes, immunotherapy, and gut microbiome.

3. OBJECTIVES OF THE STUDY

The study's primary goal is to examine the global output of cancer research from 2011 to 2024. The following are the study's major goals:

- To identify the annual publication trends in cancer research literature
- To assess the relative growth rate and doubling time of publications in leading cancer journals.
- To calculate metrics such as the Annual Growth Rate, Annual Ratio of Growth, and Compound Growth Rate.
- To examine the field's most prolific organizations, contributing countries, and key funding agencies

4. METHODOLOGY

This study utilized scientometric techniques to examine the progression of research in the field of cancer. Data spanning from 2011 to 2024 were systematically gathered from Scopus, focusing on four active journals: Cancer Cell, The Lancet Oncology, Journal of Clinical Oncology, and Cancer Research. The journals were identified based on their impact factor. Th e Unique ISSNs (International Standard Serial Numbers) of the selected journals were used as search parameters in Scopus. The records were extracted in

text file format for comprehensive evaluation. The analysis was conducted using Microsoft Excel, allowing for the organization and interpretation of the extensive dataset.

5. ANALYSIS AND RESULTS

The study thoroughly examines various components of cancer research by systematically organizing the findings into a series of comprehensive tables and illustrative figures. These visual aids are crafted to facilitate in-depth analysis and provide clarity to complex data.

5.1 Year-Wise Growth Analysis in Cancer Research

The dataset for this study was sourced from the Scopus database, renowned for its comprehensive coverage of subjects across science and technology. This analysis aimed to evaluate global contributions to prominent journals in the field of cancer research over a decade, spanning from 2014 to 2024. A total of 21675 articles were extracted for this purpose. These publications were analyzed to identify trends in journal productivity, with a focus on the top four scholarly journals in cancer research.

Table 1 Year-wise publications of the top four journals

Year	Total	%	Cancer Cell	%	The Lancet Oncology	%	Journal of Clinical Oncology	%	Cancer Research	%
2014	1743	8.04	193	9.25	534	8.62	841	10.70	175	3.16
2015	2268	10.46	188	9.01	639	10.31	893	11.36	548	9.91
2016	2510	11.58	217	10.40	646	10.43	910	11.58	737	13.32
2017	2283	10.53	172	8.24	655	10.57	765	9.73	691	12.49
2018	2173	10.03	192	9.20	659	10.64	665	8.46	657	11.88
2019	1940	8.95	157	7.52	618	9.97	573	7.29	592	10.70
2020	1796	8.29	198	9.49	535	8.63	594	7.56	469	8.48
2021	1887	8.71	208	9.97	524	8.46	557	7.09	598	10.81
2022	1699	7.84	196	9.39	514	8.30	587	7.47	402	7.27
2023	1757	8.11	180	8.62	423	6.83	809	10.29	345	6.24
2024	1619	7.47	186	8.91	449	7.25	666	8.47	318	5.75
Total	**21675**	**100**	**2087**	**100**	**6196**	**100**	**7860**	**100**	**5532**	**100**

Table 1 presents the distribution of cancer research publications across journals from 2014 to 2024, with percentages calculated using a specific formula. The yearly percentage contribution to total publications was computed as,

$$\text{Percentage} = \frac{\text{total publications for the year}}{\text{cumulative total publications}} * 100$$

These calculations provide insights into the relative contributions of each journal and yearly trends in cancer research publications. The findings indicate that 2016 marked the peak of research activity, with 2510 publications recorded, while 2024 experienced the lowest output at 1619 articles. Such trends highlight fluctuations in research productivity, reflecting potential influences such as funding, scientific focus, or external factors affecting the research landscape.

5.2 Relative Growth Rate and Doubling Time of Cancer Journals

The expansion of cancer research literature is quantitatively assessed through the computation of the Relative Growth Rate (RGR) and Doubling Time (DT) of publications. These metrics provide insights into the annual growth trends in the field. The analysis reveals a consistent year-over-year increase in the volume of literature, highlighting a sustained expansion in academic contributions to cancer research.

Table 2 Showing Relative Growth Rate (RGR) & Doubling Time (DT)

S. No	Year	Total	Cumulative	W1	W2	RGR	Doubling
1.	2014	1743	1743	0	7.46	0	0
2.	2015	2268	4011	7.46	8.30	0.84	0.82
3.	2016	2510	6521	8.30	8.78	0.48	1.44
4.	2017	2283	8804	8.78	9.08	0.3	2.31
5.	2018	2173	10977	9.08	9.30	0.22	3.15
6.	2019	1940	12917	9.30	9.47	0.17	4.08
7.	2020	1796	14713	9.47	9.60	0.13	5.33
8.	2021	1887	16600	9.60	9.72	0.12	5.77
9.	2022	1699	18299	9.72	9.81	0.09	7.70
10.	2023	1757	20056	9.81	9.91	0.1	6.93
11.	2024	1619	21675	9.91	9.98	0.07	9.90
Total		**21675**	**136316**	**91.43**	**101.41**	**2.52**	**47.44**

Table 2 presents the relative growth rate (RGR) and doubling time (Dt) of cancer research publications in selected journals from 2014 to 2014. The RGR, calculated as $RGR = \frac{W2-W1}{t2-t1}$, where W1 and W2 are the natural logarithms of the cumulative total at the beginning and end of the year, respectively, measure the proportional annual increase in publications. Here, t represents the time interval between the two observations. The Doubling time, derived as $Dt = \frac{\ln(2)}{RGR}$, represents the time required for the cumulative publications to double. The data reveals a declining RGR over time, indicating a slowdown in the proportional growth of publications, while the increasing Dt suggests that it takes progressively longer for the total output to double.

5.3 Annual Growth Rate, Annual Ratio of Growth, and Compound Annual Growth Rate

The annual growth rate quantifies the percentage change in a variable over one year, providing a measure of its increase or decrease. The Annual Growth Ratio (AGR) is determined by dividing the current value of the variable by its value in the previous year, offering a straightforward way to evaluate year-over-year performance

Table 3 Status of Annual Growth Rate and Annual Ratio of Growth of Cancer

Year	Total	ARoG	AGR	CAGR
2014	1743			-0.84
2015	2268	1.30	0.30	-0.64
2016	2510	1.11	0.11	-0.58
2017	2283	0.91	-0.09	-0.64
2018	2173	0.95	-0.05	-0.67
2019	1940	0.89	-0.11	-0.75
2020	1796	0.93	-0.07	-0.81
2021	1887	1.05	0.05	-0.77
2022	1699	0.90	-0.10	-0.86
2023	1757	1.03	0.03	-0.83
2024	1619	0.92	-0.08	-0.93
Total	**21675**	**9.99**	**-0.01**	**-8.32**

Abbreviations: ARoG = Annual Ratio of Growth, AGR = Annual Growth Rate, CAGR = Compound Annual Growth Rate

Table 3 analyzes the annual growth trends in cancer research publications from 2014 to 2024 using key metrics. The ARoG is calculated as the ratio of publications in a given year to the previous year, indicating proportional changes annually. The AGR, defined as $AGR = \frac{\text{publications in current year} - \text{publications in previous year}}{\text{publications in previous year}}$, measures the percentage increase or decrease in publications year over year. The data highlights a decline in the Annual Growth Rate, which dropped from 0.30 in 2015 to -0.08 in 2024. Similarly, the Annual Ratio of Growth decreased, starting at 1.30 in 2015 and falling to 0.92 by 2024. While the compound Annual Growth Rate remained negative, it slightly increased from -0.84 in 2014 to -0.93 in 2024.

5.4 Compound Annual Growth Rate (CAGR) of Cancer Journals

The Compound Annual Growth Rate is calculated as the number of publications in the present year divided by the number of publications in the previous year to the power of one divided by the period length and subtracted 1 from the subsequent result (Murphy, 2019). The average compound annual growth rate was found to be -0.89778 in cancer research.

Table 4 Description of Compound Annual Growth Rate of Cancer

CAGR	Cancer Cell	The Lancet Oncology	Journal of Clinical Oncology	Cancer Research
	-0.922341697	-1.0571641	-1.122455789	-0.48916841

Table 4 presents the CAGRs for four leading cancer research journals: Cancer Cell at -0.9223, The Lancet Oncology at -1.0571, the Journal of Clinical Oncology at -1.1225, and Cancer Research at -0.4891.

5.5 Top Most Productive Universities in Cancer

The most productive universities are listed in the table showing the most publishing 10 universities across the world.

Table 5 Details of Institutes that Enhanced Research Related to Cancer

S. No	Organisations	Records	%
1.	The University of Texas MD Anderson Cancer Centre	2211	18.56
2.	Dana-Farber Cancer Institute	2147	18.02
3.	Memorial Sloan-Kettering Cancer Centre	1914	16.06
4.	Harvard Medical School	1793	15.05
5.	National Cancer Institute NCI	1094	9.18
6.	Brigham and Women's Hospital	795	6.67
7.	University of California, San Francisco	547	4.59
8.	Mayo Clinic	544	4.57
9.	Massachusetts General Hospital	436	3.66
10.	Fred Hutchinson Cancer Centre	434	3.64

Figure 1 Top Most Productive Universities in Cancer

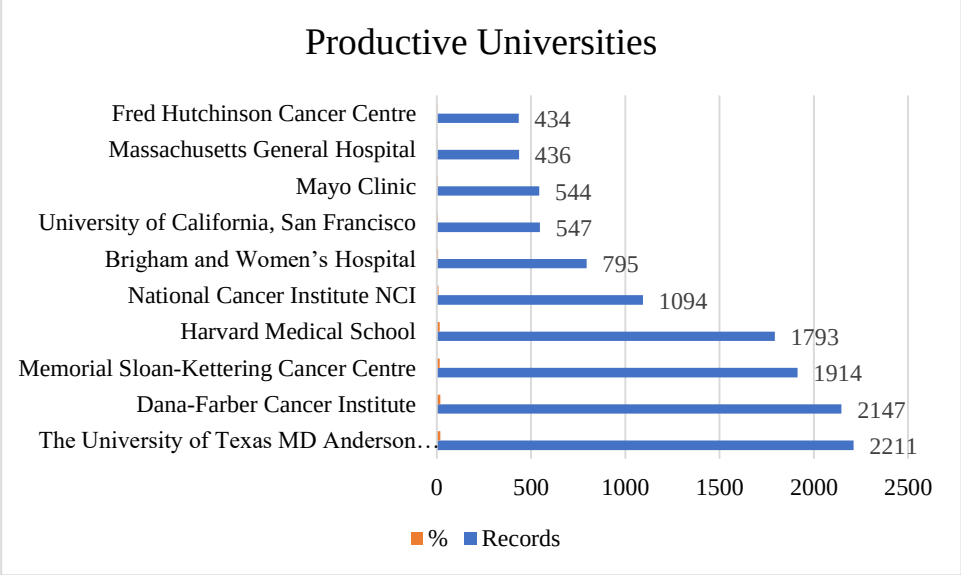


Table 5 lists the top 10 universities contributing to cancer research. The University of Texas MD Anderson Cancer Center leads with 2,211 publications, followed by Dana-Farber Cancer Institute with 2,147 and Memorial Sloan-Kettering Cancer Center with 1,914 publications.

5.6 Country-wise Distribution of Articles

The country-wise distribution of articles in cancer research is listed in the table showing the top 10 countries**.**

S. No	Country	Total
1.	United States	16434
2.	United Kingdom	3755
3.	Germany	2718
4.	France	2679
5.	Canada	2672
6.	Italy	2455
7.	Australia	1666
8.	Spain	1578
9.	China	1475
10.	Netherlands	1475

The collaboration of country-wise research output is displayed in Table 6. The unites states (16343) has the most publications, followed by the United Kingdom (3755) and Germany has 2718 publications.

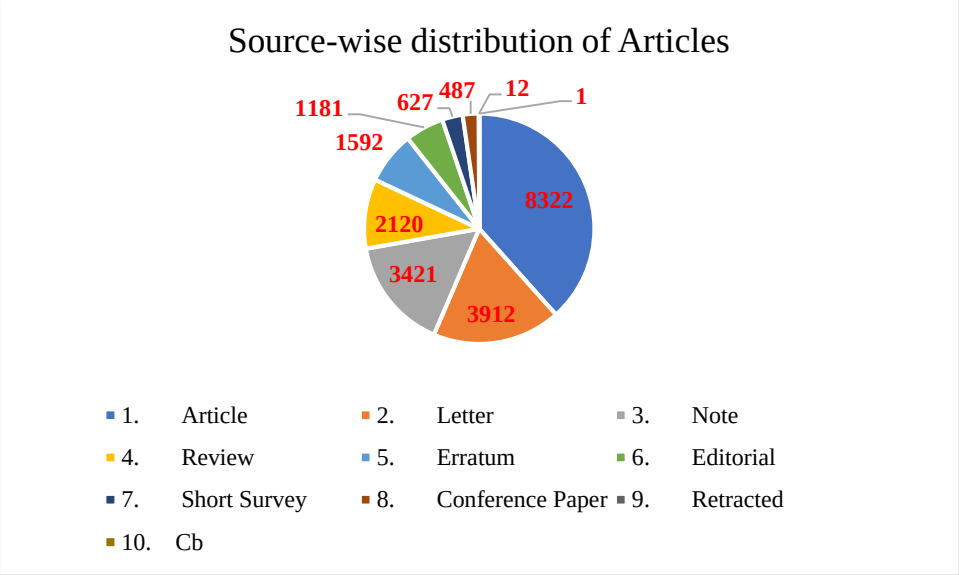
5.7 Source-wise Distribution of Articles

The purpose of the source-wise distribution of publications is to know the type of documents related to databases on cancer research from 2014 to 2024. Table 7 gives the details of major document types.

Table 7 Details of Major Document types related to cancer research

S. No	Documents	Total	Cumulative no. of articles
1.	Article	8322	8322
2.	Letter	3912	12234
3.	Note	3421	15655
4.	Review	2120	17775
5.	Erratum	1592	19367
6.	Editorial	1181	20548
7.	Short Survey	627	21175
8.	Conference Paper	487	21662
9.	Retracted	12	21674
10.	Cb	1	27733

Figure 2 Source-wise Distribution of Articles



From the study, it has been observed that a total of 21675 publications have come out on cancer research during the period of 2014 to 2024. It could be deduced from the analysis that out of the various sources of research on cancer literature, the journal articles occupy the first place, followed by letters.

5.8 Productivity of Funding Agencies

Table 8 shows the leading research institutes and the number of research papers they published.

Table 8 Details about Funding Agency for Research related to Cancer

S. No	Details of Funding Agency	Record	%
1.	National Cancer Institute	7373	34.34
2.	National Institute of Health	6157	28.67
3.	U.S. Department of Health and Human Services	4816	22.43
4.	National Natural Science Foundation of China	693	3.23
5.	European Commission	444	2.07
6.	AstraZeneca	437	2.04
7.	Ministry of Science and technology of the people's republic of China	437	2.04
8.	Cancer Research UK	404	1.88
9.	U.S Department of Défense	363	1.69
10.	Roche	348	1.62
	Total	**21472**	**100**

Figure 3 Productivity of Funding Agencies

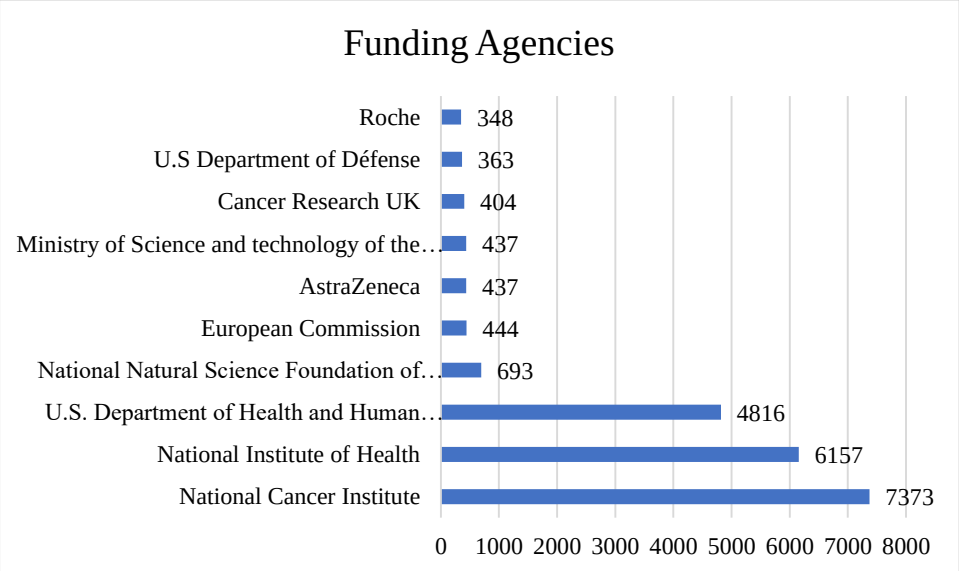


Table 8 gives the funding agencies in the maximum articles National Cancer Institute contributed 7373 papers, the National Institute of Health has 6157 papers, and The U.S. Department of Health and Human Services has 4816 papers.

5.9 Co-authorship of Authors

In the Co-authorship network of authors, 5630 authors with a minimum of 5 or more documents are considered among the total of 77044 authors.

Table 9 Co-authorship of Authors

Author	No. of Documents	Total Link Strength
Wang, Y	261	1379
Zhang, Y	206	1128
Wang, X	176	1036
Zhang, J	168	1043
Li, Y	177	946
Li, J	171	920
Chen, Y	153	888
Wang, J	179	837
Liu, Y	150	825
Zhang, L	144	808

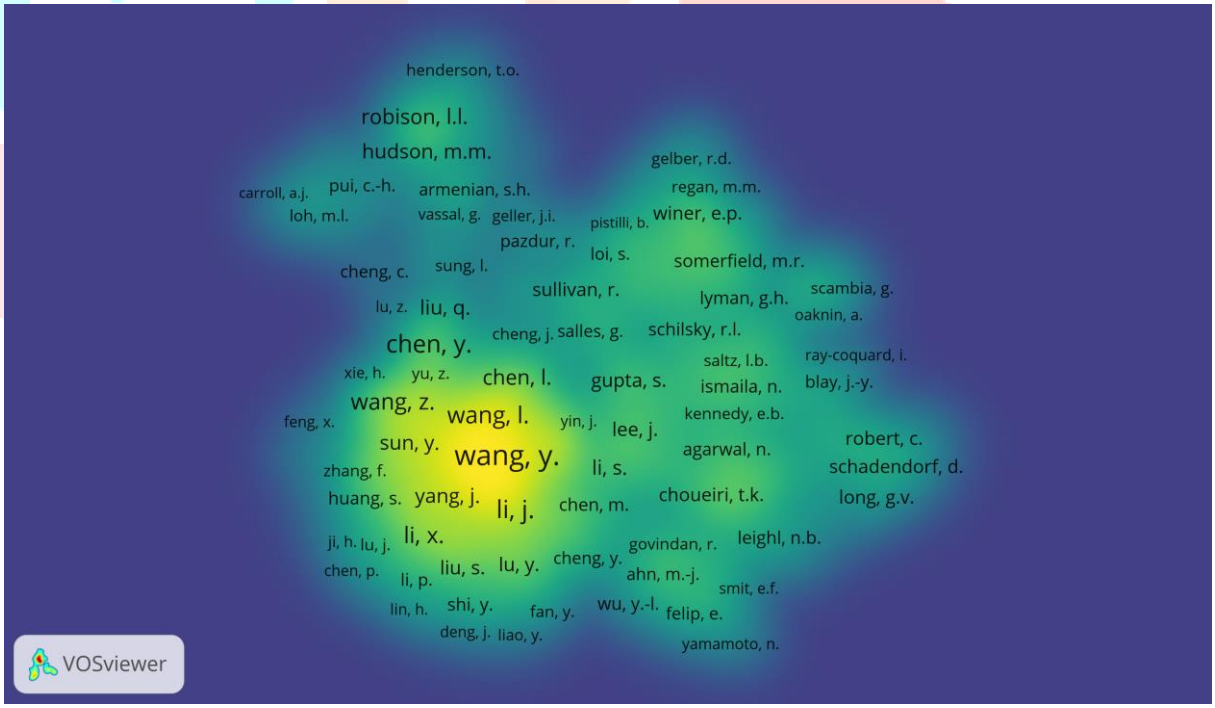


Figure 4 Density Visualization of Co-authorship Network of 5630 authors

6. CONCLUSION

The analysis of cancer research publications from 2014 to 2024 reveals significant insights into global research trends, highlighting fluctuations in productivity and growth. A declining relative growth rate and increased doubling time suggest a gradual slowdown in publication output, reflecting broader shifts in research focus or resource allocation. Key contributors, including leading journals, institutions, and funding agencies, demonstrate the collaborative and multi-disciplinary nature of cancer research. The findings emphasize the vital role of journals and institutional efforts in advancing knowledge and underscore the need for sustained investment to address challenges in the research landscape.

The insights derived from this study are critical for evaluating and enhancing the global landscape of cancer research. Shedding light on emerging trends and disparities empowers researchers and academicians to understand better and address the challenges in the field. The study emphasizes the need for strategic efforts to bridge gaps in research output and quality, particularly in underrepresented regions. Furthermore, it seeks to inspire meaningful dialogue among scientific and academic communities, fostering collaboration and innovation in cancer prevention, treatment, and control strategies.

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