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Geographic Distribution, Number, and Types of Papers Published in International Cytopathology Journals in the Last 5.5 Years: A Preliminary Study

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Keywords
Cytopathology-related articles · Peer-reviewed cytopathology journals · Geographical distribution of cytopathology papers

Abstract
Objective: The aim of this study was to explore the geographic distribution and number of papers published in international and Science Citation Index (SCI)-indexed cytology journals based on their country of origin. ***Materials and Methods:*** A country-based geographic analysis of studies published over a 5.5-year period from January 2016 to June 2021 in 5 cytopathology journals indexed as SCI and SCI-E with an impact factor higher than 1 (*Cancer Cytopathology*, *Cytopathology*, *Diagnostic Cytopathology*, *Acta Cytologica*, and *CytoJournal*) and papers categorized as "original" and "other" was performed. ***Results:*** A total of 3,063 papers were found, with 1,466 (47.8%) categorized as "original" papers and 1,597 (52.1%) designated as "other" papers. These papers were submitted from 62 different countries. The five countries with the greatest number of papers were the USA (38.4%), India (16.8%), Japan (7.4%), Italy (5.5%), and Brazil (3.1%). A general subgroup analysis was also performed on the original studies without a country breakdown. Cytomorphological, cytomorphological-immunohistochemical, and molecular assessments compose 38.5%, 45.7%, and 15% of the subgroups, respectively. ***Conclusion:*** The number of academic papers originating from developing countries in the field of cytopathology has increased in recent years. Although most scientific papers are produced in developed countries, the rate in these countries is much lower than that in some developing countries as the rate of academic growth in developed countries has stabilized. Despite the widespread and sophisticated implementation of cytology in daily practice in Western European countries outside the UK, such as Germany and the Netherlands, and in Scandinavian countries and other developed countries, such as Australia and Canada, these countries rank in the middle to lower end of countries producing cytology papers. Meanwhile, there has been an increase in the number of cytology papers published by authors from Southern European countries, such as Italy (ranked 4th) and Spain (ranked 6th), and Turkey (ranked 8th). There is a remarkable increase in cytology papers originating from Asia, particularly India, Japan, and China. ***Summary:*** We aimed to present a basic survey of the geographic distribution of manuscript submissions to high-impact cytopathology journals and to point out emerging trends in cytology utilization and basic research. However, our results show that the landscape of cytology is changing and suggest geographic regions that are ripe for the production of novel "points of view" and new research findings.

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Introduction

The importance, value, and prevalence of cytopathology in daily practice have gradually increased with the introduction of novel technologies, especially in the detection and treatment of cancer [1–3]. Concordantly, there has been an increase in the quantity and quality of cytology papers published by physicians and scientists. This is also positively reflected in the impact factor of cytology journals [4].

In this study, we investigated the geographic distribution of the papers published in international, Science Citation Index (SCI)-indexed cytopathology journals within the last 5.5 years. We aimed to show the number of publications per country of the institutions where these papers were produced.

Methods

This study analyzed the distribution per country of cytology papers published in five SCI-E and SCI-indexed international cytopathology journals with an impact factor higher than 1 within the past 5.5 years from January 2016 to June 2021. The analysis included *Cancer Cytopathology*, *Cytopathology*, *Diagnostic Cytopathology*, *Acta Cytologica*, and *CytoJournal* (online only). The papers were divided into two groups, "original papers" and "other contributions" (reviews, case presentations, brief reports, images in cytology, commentary, letters to the editor, and enigma portal). The papers' geographic origin was assumed to be that of the author's institution. In the case of multiple authors and countries, every country was added.

Table 1. List of countries in which papers are published*

	Countries		Countries
1	Argentina	32	Lebanon
2	Australia	33	Luxembourg
3	Austria	34	Malaysia
4	Bahrain	35	Mexico
5	Belgium	36	Mozambique
6	Brazil	37	The Netherlands
7	Canada	38	Nigeria
8	Chile	39	Norway
9	China	40	Pakistan
10	Colombia	41	Peru
11	Croatia	42	Philippines
12	Cyprus	43	Poland
13	Czech Republic	44	Portugal
14	Denmark	45	Romania
15	Dominic Republic	46	Russia
16	Egypt	47	S. Arabia
17	Finland	48	Singapore
18	France	49	Slovenia
19	French Guiana	50	South Africa
20	Germany	51	Korea
21	Greece	52	Spain
22	Hungary	53	Sudan
23	India	54	Sweden
24	Iran	55	Switzerland
25	Ireland	56	Taiwan
26	Israel	57	Thailand
27	Italy	58	Tunisia
28	Japan	59	Turkey
29	Jordan	60	The UAE
30	Qatar	61	The UK
31	Kuwait	62	The USA

* Countries are listed in an alphabetic order.

Results

The total number of papers published in the 5 journals within the study period was 3,063, with 1,466 (47.8%) grouped as "original papers" and 1,597 (52.1%) grouped as "other." The papers were submitted from 62 different countries (Table 1).

It was observed that the top 5 places in both the "original papers" and "other" categories were held by the USA (38.4%), India (16.8%), Japan (7.4%), Italy (5.5%), and Brazil (3.1%). A list of all 62 countries according to "original papers" and "other articles" published in the cytopathology journals included in our studies is shown in Table 2. The top 25 countries with original papers are presented in Table 3, while the top 25 countries with papers grouped as "other" are shown in Table 4. Distribution of the papers and types according to continent are presented in Table 5. Furthermore, the overall number and the relevant percentages of each category of papers are presented in a pie chart in Figure 1.

A general subgroup analysis was also performed on the original studies without a country breakdown. Cytomorphological, cytomorphological-immunohistochemical, and molecular assessments compose 38.5%, 45.7%, and 15% of the subgroups, respectively.

The papers classified as "others" varied according to the journals in which they were published. Each journal presented a different kind of study (such as a case report, image in cytology, correspondence, or review). Therefore, as described above, no statistical subgroup analysis was performed on the papers classified as "others."

Table 2. List of all 62 countries according to "original papers" and "other articles"

	Total number of countries publishing papers (*N* = 62)	Papers (*N* = 3,063), *N* (%)	Original papers (*N* = 1,466), *n* (%)	Others (*N* = 1,597), *n* (%)
1	The USA	1,176 (38.4)	547 (37.1)	629 (39.4)
2	India	516 (16.8)	191 (13.0)	325 (20.3)
3	Japan	228 (7.4)	114 (7.7)	114 (7.1)
4	Italy	169 (5.5)	89 (6.0)	80 (5.0)
5	Brazil	96 (3.1)	59 (4.0)	37 (2.3)
6	Spain	81 (2.64)	26 (1.7)	55 (3.4)
7	The UK	81 (2.64)	33 (2.2)	48 (2.9)
8	Turkey	79 (2.5)	52 (3.5)	27 (1.6)
9	China	66 (2.1)	47 (3.2)	19 (1.19)
10	Korea	49 (1.6)	31 (2.1)	18 (1.12)
11	France	48 (1.5)	21 (1.4)	27 (1.6)
12	Switzerland	44 (1.4)	13 (0.8)	31 (1.9)
13	Canada	44 (1.4)	22 (1.5)	22 (1.3)
14	Australia	39 (1.2)	21 (1.4)	18 (1.1)
15	Portugal	33 (1.0)	14 (0.9)	19 (1.1)
16	Greece	29 (0.9)	18 (1.2)	11 (0.6)
17	Iran	24 (0.7)	10 (0.6)	14 (0.8)
18	Taiwan	24 (0.7)	12 (6.9)	12 (0.7)
19	South Africa	16 (0.5)	9 (0.6)	7 (0.4)
20	Finland	13 (0.42)	9 (0.6)	4 (0.2)
21	Sweden	13 (0.42)	8 (0.5)	5 (0.31)
22	Germany	12 (0.39)	7 (0.47)	5 (0.31)
23	Kuwait	12 (0.39)	6 (0.40)	6 (0.37)
24	The UAE	11 (0.35)	5 (0.3)	6 (0.37)
25	Belgium	10 (0.32)	4 (0.2)	6 (0.37)
26	Czech Republic	9 (0.29)	8 (0.5)	1 (0.06)
27	Croatia	9 (0.29)	2 (0.13)	7 (0.4)
28	Holland	9 (0.29)	8 (0.5)	1 (0.06)
29	Norway	9 (0.29)	8 (0.5)	1 (0.06)
30	Slovenia	9 (0.29)	6 (0.40)	3 (0.18)
31	Thailand	7 (0.22)	2 (0.13)	5 (0.31)
32	Jordan	7 (0.22)	3 (0.2)	4 (0.2)
33	Ireland	6 (0.19)	6 (0.40)	0 (0)
34	Israel	6 (0.19)	4 (0.2)	2 (0.12)
35	Qatar	6 (0.19)	1 (0.06)	5 (0.31)
36	Singapore	6 (0.19)	3 (0.2)	3 (0.18)
37	Saudi Arabia	6 (0.19)	6 (0.40)	0 (0)
38	Denmark	5 (0.16)	5 (0.3)	0 (0)
39	Colombia	5 (0.16)	3 (0.2)	2 (0.12)
40	Austria	4 (0.13)	1 (0.06)	3 (0.18)
41	Egypt	4 (0.13)	3 (0.2)	1 (0.06)
42	Pakistan	4 (0.13)	3 (0.2)	1 (0.06)
43	Tunisia	4 (0.13)	3 (0.2)	1 (0.06)
44	Cyprus	3 (0.09)	1 (0.06)	2 (0.12)
45	Luxembourg	3 (0.09)	2 (0.13)	1 (0.06)
46	Malaysia	3 (0.09)	2 (0.13)	1 (0.06)
47	Mexico	3 (0.09)	3 (0.2)	0 (0)
48	Poland	3 (0.09)	1 (0.06)	2 (0.12)
49	Bahrain	3 (0.09)	3 (0.2)	0 (0)
50	Argentine	2 (0.06)	1 (0.06)	1 (0.06)
51	Nigeria	2 (0.06)	2 (0.13)	0 (0)
52	Peru	2 (0.06)	2 (0.13)	0 (0)
53	Russia	2 (0.06)	0 (0)	2 (0.12)
54	Dominic Republic	1 (0.03)	1 (0.06)	0 (0)
55	Philippines	1 (0.03)	0 (0)	1 (0.06)
56	French Guiana	1 (0.03)	0 (0)	1 (0.06)

Table 2 (continued)

	Total number of countries publishing papers (*N* = 62)	Papers (*N* = 3,063), *N* (%)	Original papers (*N* = 1,466), *n* (%)	Others (*N* = 1,597), *n* (%)
57	Lebanon	1 (0.03)	0 (0)	1 (0.06)
58	Hungary	1 (0.03)	1 (0.06)	0 (0)
59	Mozambique	1 (0.03)	1 (0.06)	0 (0)
60	Romania	1 (0.03)	1 (0.06)	0 (0)
61	Sudan	1 (0.03)	1 (0.06)	0 (0)
62	Chile	1 (0.03)	1 (0.06)	0 (0)

Table 3. List of top 25 countries according to "original papers"

	Countries	Original papers (1,466), *N* (%)
1	The USA	547 (37.3)
2	India	191 (13.1)
3	Japan	114 (7.7)
4	Italy	89 (6.1)
5	Brazil	59 (4.1)
6	Turkey	52 (3.5)
7	China	47 (3.2)
8	The UK	33 (2.2)
9	Korea	31 (2.1)
10	Spain	26 (1.7)
11	Canada	22 (1.5)
12	Australia	21 (1.4)
13	France	21 (1.4)
14	Greece	18 (1.2)
15	Portugal	14 (0.9)
16	Switzerland	13 (0.8)
17	Taiwan	12 (0.7)
18	Iran	10 (0.6)
19	Finland	9 (0.6)
20	South Africa	9 (0.6)
21	Czech Republic	8 (0.5)
22	The Netherlands	8 (0.5)
23	Sweden	8 (0.5)
24	Norway	8 (0.5)
25	Germany	7 (0.4)

Table 4. List of top 25 countries according to papers categorized as "others"

	Countries	Others (*N* = 1,595), *n* (%)
1	The USA	629 (39.4)
2	India	325 (20.3)
3	Italy	114 (7.1)
4	The UK	80 (5.0)
5	Brazil	55 (3.4)
6	Switzerland	47 (2.9)
7	Japan	37 (2.3)
8	Canada	31 (1.9)
9	Portugal	27 (1.6)
10	Spain	27 (1.6)
11	Turkey	22 (1.3)
12	France	19 (1.19)
13	Greece	19 (1.1)
14	Australia	18 (1.12)
15	Iran	18 (1.1)
16	Croatia	14 (0.8)
17	The UAE	12 (0.7)
18	Finland	11 (0.6)
19	Belgium	7 (0.4)
20	Korea	6 (0.37)
21	Jordan	6 (0.37)
22	Qatar	6 (0.37)
23	Israel	5 (0.31)
24	Sweden	5 (0.31)
25	South Africa	4 (0.2)

Countries with the same number of publications are listed in an alphabetic order.

Discussion

In this study, we analyzed the papers published in SCI-indexed international cytology journals by the number and type of paper and geographic distribution according to the country of origin. In parallel with advancements in science and technology, there has been development and change in the field of cytopathology in recent years [5–7]. This has also enhanced interest in cytology journals and led to an increase in their impact factors [8].

We noted that papers from 62 countries across the world were included in the five cytology journals analyzed in our study. In recent years, developing countries have been showing progress in science and technology. Growth has also been observed in academic publishing in developing countries. Although the majority of scientific

Table 5. Distribution of the papers and types according to the continents in cytopathology journals covered by our study

	Continents	Papers (*N* = 3,063), *N* (%)	Original papers (*N* = 1,466), *n* (%)	Others (*N* = 1,597), *n* (%)
1	North America	1,224 (39.96)	573 (39.08)	651 (40.76)
2	Asia	982 (32.06)	443 (30.21)	539 (33.75)
3	Europe	683 (22.29)	344 (23.46)	339 (21.22)
4	South America	107 (3.49)	66 (4.5)	41 (2.56)
5	Oceania	39 (1.27)	21 (1.43)	18 (1.12)
6	Africa	28 (0.91)	19 (1.29)	9 (0.56)

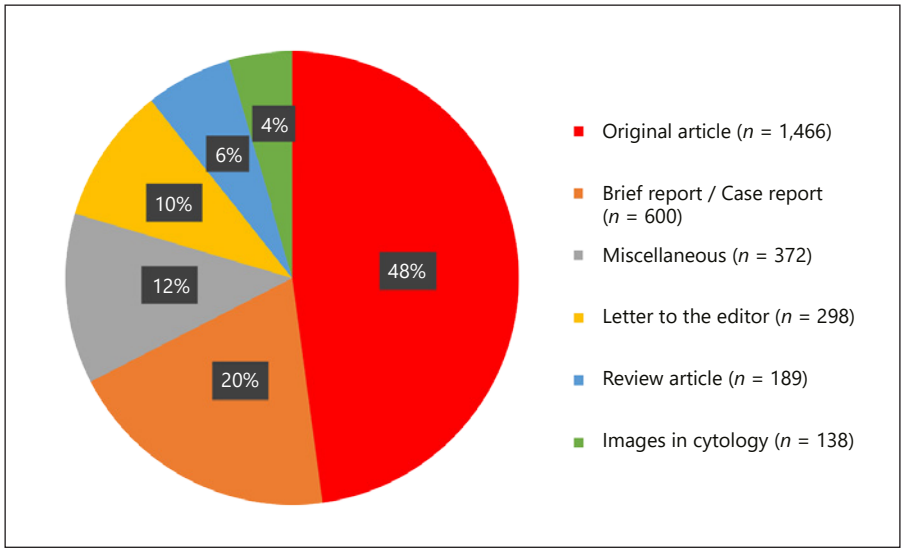


Fig. 1. Pie chart shows the overall number and the relevant percentages in each category of papers (the "Miscellaneous" category includes various papers in the "others" group which is not available in every cytopathology journal covered by our study; e.g., special contributions, enigma portals, commentaries, and educational forms).

studies are still produced in developed countries, some studies show that the growth rate in these countries has stabilized and is lower than the growth rate in some developing countries [8–10].

For instance, Brazil is the 5th country in terms of the number of papers, with a publication rate of 3.1% [11]. These studies reflect opinions on general academic publications. We do not have sufficient data to comment on cytopathology papers in this regard.

In our study, the USA produced 38.4% of all papers and is ranked at the top of the list. However, despite the widespread and sophisticated implementation of cytology in daily practice in Western European countries outside the UK (2.64% publication rate, ranked 7th), such as Germany, the Netherlands, and Scandinavian countries, they are ranked in the middle to lower end in terms of the cytology paper publication rate.

Meanwhile, a remarkable increase was observed in the number of cytology papers received from Southern European countries, such as Italy (ranked 4th; 5.5% publication rate) and Spain (ranked 6th; 2.6% publication rate), and Turkey (ranked 8th; 2.5% publication rate). This rate aligned with the study findings on general academic papers. A survey of the number of scientific publications listed in the Web of Science database shows that the growth rate in some Mediterranean countries, such as Spain, Italy, and Turkey, and Iran in the Middle East is faster than the world average [12].

The rate of growth in scientific production in the last 20 years was highest in Asia, led by India, Japan, China, and South Korea [10]. In our study, the overall geographic distribution was as follows: India was first, followed by the USA (16.8%), Japan in the 3rd place (7.4%), China in the 9th place (2.1%), and South Korea in the 10th place (1.6%). A comprehensive article published in 2003 reported that fine-needle aspiration cytology (FNAC) has been widely accepted and practiced all across India since the 1970s. The interest in cytology (especially FNAC) in India was also positively reflected in the number of publications. Of the 772 publications on FNAC from the developing world from 1987 to 2002, India alone contributed to 374 papers (48.4%) [13]. In our study, India is

ranked 2nd among all countries in terms of cytopathology publications.

Except for a few examples, no paper was produced in most of the Balkan countries (Bulgaria, Serbia, Bosnia-Herzegovina, and North Macedonia), Malta, Slovakia, Belarus, Ukraine, and the Baltic countries (Lithuania, Latvia, and Estonia). Cytopathology has become a globally accepted diagnostic method due to its speed, accuracy, and cost-effectiveness [13–15].

Increasing the diagnostic importance and value of cytology encourages the willingness and efforts of researchers in carrying out research and producing and publishing papers in this field. Putting their work into writing will help investigators clarify their investigative goals, contribute to the revision and interpretation of their data, and release their work for the benefit of the cytology community [16].

Cytopathology-related papers published on international platforms contribute to the dissemination of novel information and the implementation of cytology. A research project published in an accredited journal benefits both the investigator and his or her institution. The papers published in indexed journals also play a role in the appointment and academic upgrading of academicians. It should also be noted that cytopathology-related articles published in noncytopathology journals (e.g., *Thyroid*, *Endocrine Pathology*, etc.) were outside the scope of this study.

Conclusion

The rise in interest in cytology and its increased prevalence in medical practice have led to a broad geographic distribution of papers published in accredited cytology journals, as well as an increase in the number and quality of papers. For those devoted to cytology, it is highly satisfactory to see that the countries included in our study are located across a wide geographic spectrum and that there is an increase in the number of papers submitted by developing countries in addition to those coming from researchers in developed countries.

We have discussed our findings only based on our results in light of the literature. We acknowledge the shortcomings and limitations of our study. Our paper shows only the data acquired during the study period, and it should be regarded as a preliminary study on this particular topic.

In summary, we aimed to present a basic survey of the geographic distribution of manuscript submissions to high-impact cytopathology journals and use this analysis to point out emerging trends in cytology utilization and basic research. Our results offer an important insight into the changing landscape of cytology and suggest geographic regions that are ripe for the production of novel points of view and new research findings.

Acknowledgments

A part of this study was presented as a free paper at the 9th Turkish National Cytopathology Congress (virtual), March 26–28, 2021.

Statement of Ethics

This study was exempt from institutional Ethics Committee approval as it was a retrospective study based on a web search. No human material or patient data was used. This study was performed upon the corresponding author's initiative at his private cytopathology practice. However, permission was granted by the Provincial Health Department (October 12, 2021).

Conflict of Interest Statement

The authors declare no conflict of interest.

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Author Contributions

Büşra Y. Bayrak collected the data and drafted the manuscript. Nadir Paksoy designed the study, analyzed the data, and provided guidance in writing the manuscript. Both authors read and approved the final manuscript.

Data Availability Statement

Data are available from the authors upon request.

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