

A 25-year retrospective of Canadian plastic surgery research and its influence: a bibliometric study

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Background: Bibliometric analysis is a research tool for evaluating and analyzing scholarly output and impact within a specific domain. This study aimed to assess the quantity and quality of plastic surgery research conducted by Canadian-affiliated authors from 1999 to 2023.

Methods: We conducted a comprehensive bibliometric analysis using the Web of Science Core Collection to retrieve data from 60 leading plastic surgery journals, focusing on original articles and reviews published between 1999 and 2023. The InCites Benchmarking & Analytics platform evaluated the publications' quantity and quality. Quality assessment employed 2 key metrics: category-normalized citation impact (CNCI) and the percentage of publications in the top quartile of journals (%Q1) based on impact factors. We used VOSviewer to map collaborative relationships among universities over various periods.

Results: Canada ranked as the 11th leading contributor globally, with 4446 publications. Nationally, the University of Toronto accounted for more than 30% of Canadian contributions. In terms of quality, Canada led with a CNCI of 1.09 and 21% of publications in the %Q1. Within Canada, McMaster University had the highest CNCI at 1.33, while Dalhousie University ranked highest in %Q1 at 32.3%. Our VOSviewer map of institutional collaborations revealed increased cooperation between Canadian universities and international institutions over the last 25 years.

Conclusion: Over the last 25 years, the trajectory of Canadian plastic surgery literature has been characterized by continuous expansion while maintaining high quality. Efforts should be made to continue to increase the quality and quantity of Canadian research while sustaining international collaborations.

Contexte : L'analyse bibliométrique est un outil de recherche qui permet d'évaluer et d'analyser les productions savantes et leur impact dans un domaine spécifique. Cette étude visait à mesurer la quantité et la qualité des travaux de recherche menés en chirurgie plastique par des auteurs affiliés au Canada entre 1999 et 2023.

Méthodes : Nous avons procédé à une analyse bibliométrique complète à partir de la collection principale du Web of Science pour recenser les données provenant de 60 grandes revues de chirurgie plastique, en mettant l'accent sur les articles originaux et de synthèse publiés entre 1999 et 2023. La plateforme InCites Benchmarking & Analytics a permis d'évaluer la quantité et la qualité des publications. L'évaluation qualitative reposait sur 2 paramètres clés, soit l'impact normalisé des citations selon la discipline (INCD) et le pourcentage des publications se trouvant dans le quartile supérieur (Q1) pour les facteurs d'impact. Nous avons eu recours à VOSviewer pour cartographier les collaborations entre les universités au cours de diverses périodes.

Résultats : Le Canada s'est classé au 11^e rang des principaux contributeurs mondiaux, avec 4446 publications. À l'échelle du pays, l'Université de Toronto a représenté plus de 30 % des publications canadiennes. Au plan de la qualité, le Canada menait, avec un INCD de 1,09 et 21 % de ses publications se situant dans le Q1. Au Canada, McMaster University a obtenu l'INCD le plus élevé, 1,33, tandis que Dalhousie University s'est classée au premier rang pour le Q1, à 32,3 %. Notre carte VOSviewer des collaborations entre établissements a révélé une coopération plus grande entre les universités canadiennes et étrangères au cours des 25 dernières années.

Conclusion : Durant ces 25 dernières années, la trajectoire de la recherche canadienne publiée dans le domaine de la chirurgie plastique a connu une expansion continue tout en maintenant un degré de qualité élevé. Il faudra continuer d'augmenter la qualité et la quantité des travaux de recherche au Canada, tout en maintenant des collaborations internationales.

Plastic surgery encompasses a diverse array of surgical techniques aimed at restoring, reconstructing, or altering the form and function of the human body.¹ Over the past decades, the landscape of plastic surgery research has undergone notable shifts, marked by innovations like organ transplantation, microsurgery, and negative pressure wound therapy.² As the discipline continues to evolve, understanding the global and national impact of plastic surgery research and the dynamics of collaborative networks within the academic community becomes crucial for evaluating nationwide initiatives in plastic surgery and gauging the overall performance and advancements within the specialty nationally.

Bibliometric analysis is an essential methodological tool for evaluating scientific output. It facilitates the measurement of research activities within a specific domain by quantifying the volume of research produced by individual researchers, institutions, or regions. It also provides a means to assess the impact and influence of research contributions.³ Studies across diverse disciplines have been subjected to bibliometric analysis to evaluate the effects of research and to facilitate comparative analyses with other countries.⁴⁻⁷

We sought to conduct a comprehensive bibliometric analysis that explored the Canadian plastic surgery literature level over a quarter-century, from 1999 to 2023. Through an analysis of publication trends and citation metrics, our study aimed to elucidate the trajectory and impact of Canadian contributions to plastic surgery. Concurrently, through network visualizations and keyword analyses, we sought to unravel the intricate web of scholarly interactions, identifying key contributors and thematic focal points that have shaped the trajectory of Canadian plastic surgery literature. More specifically, we sought to evaluate the productivity of plastic surgery research, with a particular focus on Canadian institutions, and to visually depict the evolution of plastic surgery research over the past 25 years, offering valuable insights into its trajectory and development within Canada.

METHODS

Data source

We conducted the literature search on March 1, 2024, using the Web of Science (WOS) Core Collection. This prominent citation database encompasses more than 21 000 peer-reviewed scholarly journals from various disciplines worldwide. Journals that primarily focus on publishing content in the field of plastic and reconstructive surgery are referred to as “plastic surgery journals.” The journals were identified based on previous bibliometric studies highlighting the impact of plastic surgery across multidisciplinary perspectives (Appendix 1, available at www.canjsurg.ca/lookup/doi/10.1503/cjs.012024/tab-related-content).⁸⁻¹⁵ Only journals

indexed in the WOS database and written in English were considered for inclusion in this study as WOS predominantly includes peer-reviewed publications, ensuring a robust and reputable source of scholarly literature (Appendix 1). We restricted the search criteria to original articles and reviews published between 1999 and 2023 to capture a 25-year period. We excluded journals that did not have a primary focus on plastic surgery.

Appraisal of scientific publications

The InCites Benchmarking & Analytics platform, an integral WOS component, is a research evaluation tool used in previous bibliometric analyses.⁴ It facilitates the assessment and evaluation of research performance. In this study, we used the platform to evaluate the quantity and quality of the research performance of various countries.

The platform uses a point-based system to quantify publications attributed to individual countries, allowing each country to accrue a maximum of 1 point per article for authors affiliated with that country. For instance, if a single article was coauthored by 1 researcher affiliated with a Mexican institution and 2 researchers affiliated with Canadian institutions, Mexico would be allocated 1 point, and Canada would also be allocated 1 point. This study specifically targeted countries with a notable presence in the field, focusing on those with more than 2500 publications in plastic surgery.

We employed 2 bibliometric indices to gauge the quality of each country’s articles. We used the Category Normalized Citation Impact (CNCI) to measure a publication’s impact compared with documents of the same type, year, and subject area. For instance, an article with 40 citations would have a CNCI of 2 if the average citation for similar papers in the same year was 20, indicating its impact is twice the average. Additionally, the analysis includes publications published in journals ranked in the top quartile of their respective fields according to impact factor (%Q1).

We evaluated the contributions of Canadian academic institutions. We identified plastic surgery programs offered by Canadian universities through the Canadian Resident Matching Service (CaRMS) website.¹⁶ The same methodology was used to evaluate the quantity and quality of publications worldwide and in Canadian academic centres. Although no universally accepted criteria exist,¹⁷ we maintained methodological rigour by following established practices in bibliometric research.

We used VOSviewer version 1.6.20, developed by Nees Jan van Eck and Ludo Waltman, to visually map out keywords within the publications and collaborations among universities over various timeframes.¹⁸ In this analysis, the size of an item’s circle is directly proportional to its assigned occurrence or weight, resulting in larger circles for items with higher occurrences or weights. Thicker lines indicate a higher frequency of co-occurrence between the

Table 1. The quantity and quality of scientific output in plastic surgery from 1999 to 2023

Country	1999–2003			2004–2008			2009–2013			2014–2018			2019–2023			1999–2023		
	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1
World	13057	0.92	10.2	18344	0.87	16.2	29082	0.85	16.1	35904	0.81	14.0	43998	0.75	13.5	140385	0.82	14.2
United States	5625	1.06	13.9	6826	1.06	22.7	9989	1.08	24.5	12064	1.01	20.5	14936	0.87	20.5	49440	1.00	20.9
United Kingdom	1190	0.93	5.2	1684	0.85	9.3	2545	0.83	17.5	2486	0.92	10.7	2882	0.80	9.25	10787	0.86	11.1
China	211	0.75	5.2	561	0.76	9.6	1793	0.72	11.5	2819	0.70	9.5	5024	0.72	14.8	10408	0.72	12.0
Japan	1109	0.66	7.6	1279	0.66	13.4	1740	0.68	13.4	2102	0.54	12.6	2263	0.52	8.39	8493	0.60	11.3
Türkiye	605	0.57	4.8	1159	0.49	6.1	1533	0.46	4.3	1864	0.46	4.8	2181	0.58	4.96	7342	0.51	5.0
South Korea	304	0.75	6.3	812	0.49	17.6	1614	0.65	10.2	2268	0.63	10.4	2169	0.58	11	7167	0.61	10.9
Germany	653	1.08	15.1	943	1.04	17.0	1298	1.01	17.5	1623	0.98	14.7	1651	0.96	14.1	6168	1.00	15.6
India	125	0.71	7.3	329	0.47	9.6	1185	0.52	6.3	1652	0.50	8.1	2235	0.53	3.57	5526	0.52	6.1
Italy	333	0.77	7.6	745	0.84	10.3	1191	0.89	10.2	1503	1.02	14.2	1643	1.23	10.1	5415	1.01	11.1
Brazil	202	0.90	12.9	501	0.84	12.7	1147	0.79	8.2	1400	0.76	8.2	1557	0.77	9.34	4807	0.79	9.3
Canada	363	1.12	11.4	600	1.24	22.6	819	1.24	24.8	1144	1.15	21.3	1520	0.89	20.2	4446	1.09	21.0
Netherlands	308	1.00	10.9	464	1.10	14.2	751	1.06	16.6	952	1.14	19.8	1007	0.96	19.7	3482	1.05	17.3
Australia	228	1.17	6.2	413	1.05	16.6	693	1.00	11.7	905	1.07	14.5	1134	1.04	16.2	3373	1.05	14.0
France	270	0.92	10.8	316	1.04	19.9	512	1.05	19.0	888	0.76	12.2	1162	1.09	8.28	3148	0.97	12.7
Taiwan	276	1.08	5.8	375	0.86	21.9	501	0.90	20.3	626	0.84	16.3	780	0.74	16.6	2558	0.85	16.8

%Q1 = percentage of articles published in the top quartile of the most influential journals in plastic surgery according to impact factor; CNCI = Category Normalized Citation Impact.

2 words. The word analysis incorporated co-authorship and institutions. We examined 3 distinct time frames — 1999–2003, 2009–2013, and 2019–2023 — to compare the evolution of collaborations among institutions with more than 4 publications in the timeframe.

RESULTS

Research quantity in Canada

The global productivity of plastic surgery research was examined across 60 journals indexed in the WOS, resulting in a retrieval of 140385 publications. Only 15 countries surpassed the threshold of 2500 publications (Table 1). The United States emerged as the foremost contributor, accounting for 35.2% of all publications with 49440 articles. Canada contributed 4446 publications, positioning it as the eleventh leading contributor to plastic surgery research worldwide. Canada’s ranking experienced consistent growth over the 25-year study period, nearly tripling its output. Similarly, other countries also demonstrated increased research output, exhibiting various growth rates (Figure 1 and Figure 2). However, 2022 and 2023 witnessed a decline in productivity in Canada and almost all countries, with China being the exception. China elevated its global ranking, progressing from fourteenth in 1999 to second in 2023.

Research quantity across Canadian universities

Thirteen Canadian universities offer residency programs in plastic surgery. The University of Toronto, the University

of British Columbia, and McGill University were leading contributors to plastic surgery research during the study period, with 1416, 592, and 512 publications, respectively (Table 2). The University of Toronto alone accounted for more than 30% of all Canadian contributions to plastic surgery research. Among the universities examined, only Université de Sherbrooke did not contribute to plastic surgery research during the first decade of the study period because the program was launched later, in 2008. Canadian universities exhibited varied growth rates in plastic surgery research productivity, with McGill University and Dalhousie University demonstrating the most substantial increases in publication output over the study period.

Research quality in Canada

Over the past 25 years, the CNCI of plastic surgery research worldwide declined, decreasing from 0.92 (1999–2003) to 0.75 (2019–2023), with an overall average CNCI of 0.82 (Table 1). Similarly, plastic surgery research in Canada showed a decline over the same timeframe, ranking between first and second in the initial 20-year period and concluding in the fifth position in the most recent 5-year period. Despite this decline, Canadian research consistently maintained a high CNCI throughout the 25 years, surpassing countries with substantial research output like the US, the United Kingdom, and China. When assessing the Q1% of global plastic surgery publications, the percentages ranged from 10.2% to 16.2%. Initially, the Q1% showed rapid growth followed by a

gradual decline, resulting in an overall upward trend over time. Throughout this period, Canada, the US, and Germany consistently maintained Q1% values higher than the global average across all evaluated periods. Canada consistently ranked between first and second place in terms of Q1%. Canada achieved the highest average Q1% at 21%, followed closely by the US with a Q1% of 20.9%.

Research quality across Canadian universities

The CNCI of the 13 Canadian universities with residency programs in plastic surgery exhibited diverse fluctuations over the years, generally demonstrating a decreasing trend (Table 2). However, the average CNCI of 10 of the 13 universities was equal to or greater than 1.00. On average, McMaster University, the University of British Columbia, and Dalhousie University had the highest CNCI values, registering at 1.33, 1.30, and 1.27, respectively. About half of the universities showed an increase in publications within the Q1%, while the other half experienced a decrease. Over the studied period, Dalhousie University emerged with the highest number of publications within the Q1%, followed by the University of Alberta and the Université de Sherbrooke, with averages of 32.3%, 31.4%, and 29.4%, respectively.

Collaboration of Canadian institutions

We visualized the connections between institutions using VOSviewer software, which allowed for a comprehensive examination of collaboration dynamics. In comparisons of the 3 distinct time frames, there is a notable increase in the number of institutions in each cluster from 25 institutions in 1999–2003 (Figure 3), 76 institutions in 2009–2013 (Figure 4), and 182 institutions in 2019–2023 (Figure 5), corresponding with the increased productivity of Canada. The University of Toronto had the highest link strength, rising from a total link strength of 63 (1999–2003), to 219 total links (2009–2013), to 613 total links (2019–2023). Between 1999 and 2003, collaborative ties between institutions were scarce, with low link strength among universities. The substantial number of connections observed between the University of Toronto and the Hospital for Sick Children in this timeframe is likely attributable to the authors' affiliations with both institutions (Figure 3). From 2009 to 2013, collaboration increased, notably involving the University of Toronto, the University of British Columbia, and the University of California, Los Angeles (Figure 4). Between 2019 and 2023, there was a

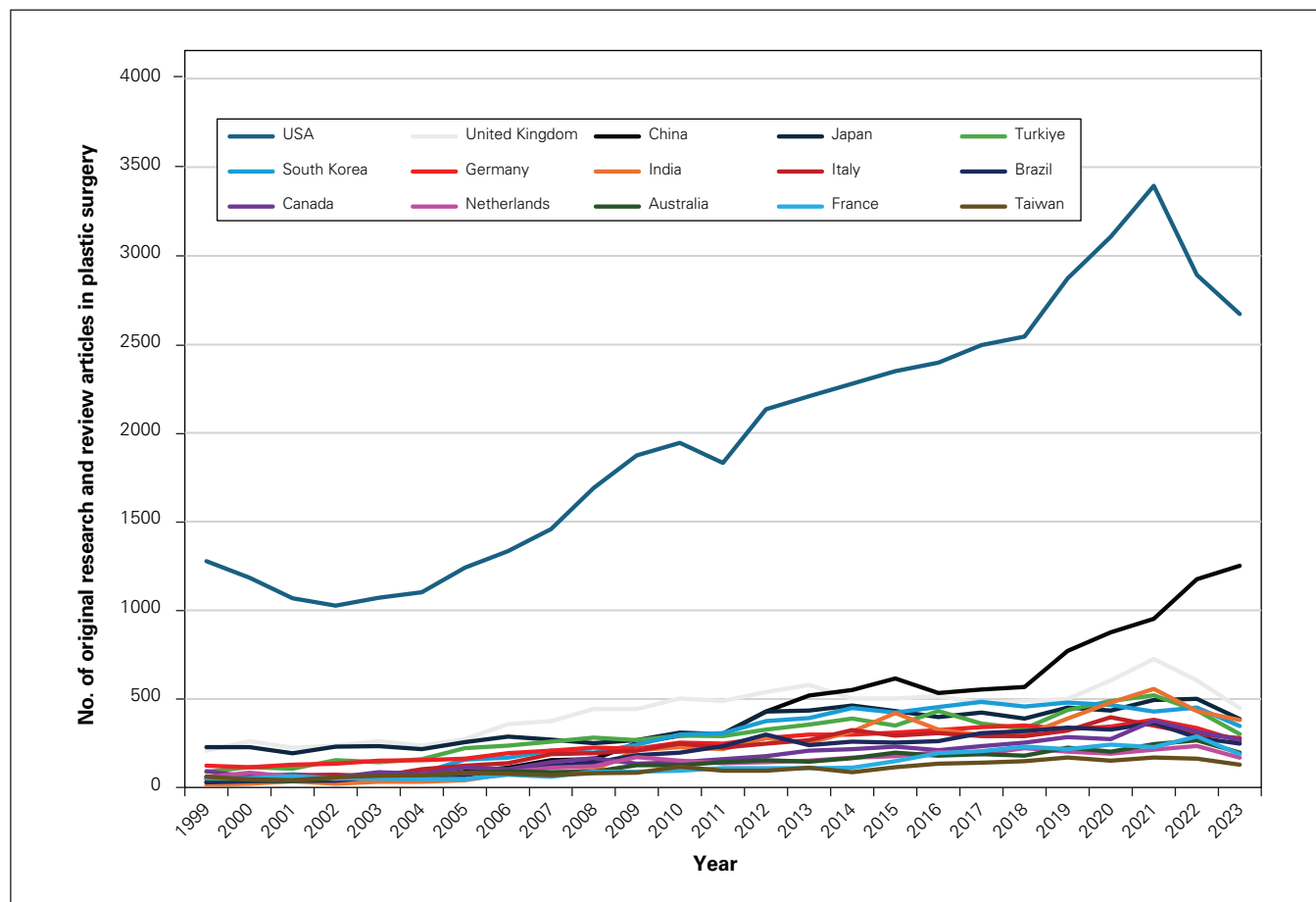


Fig. 1. Output of the 15 most prolific nations in terms of scientific publications in plastic surgery.

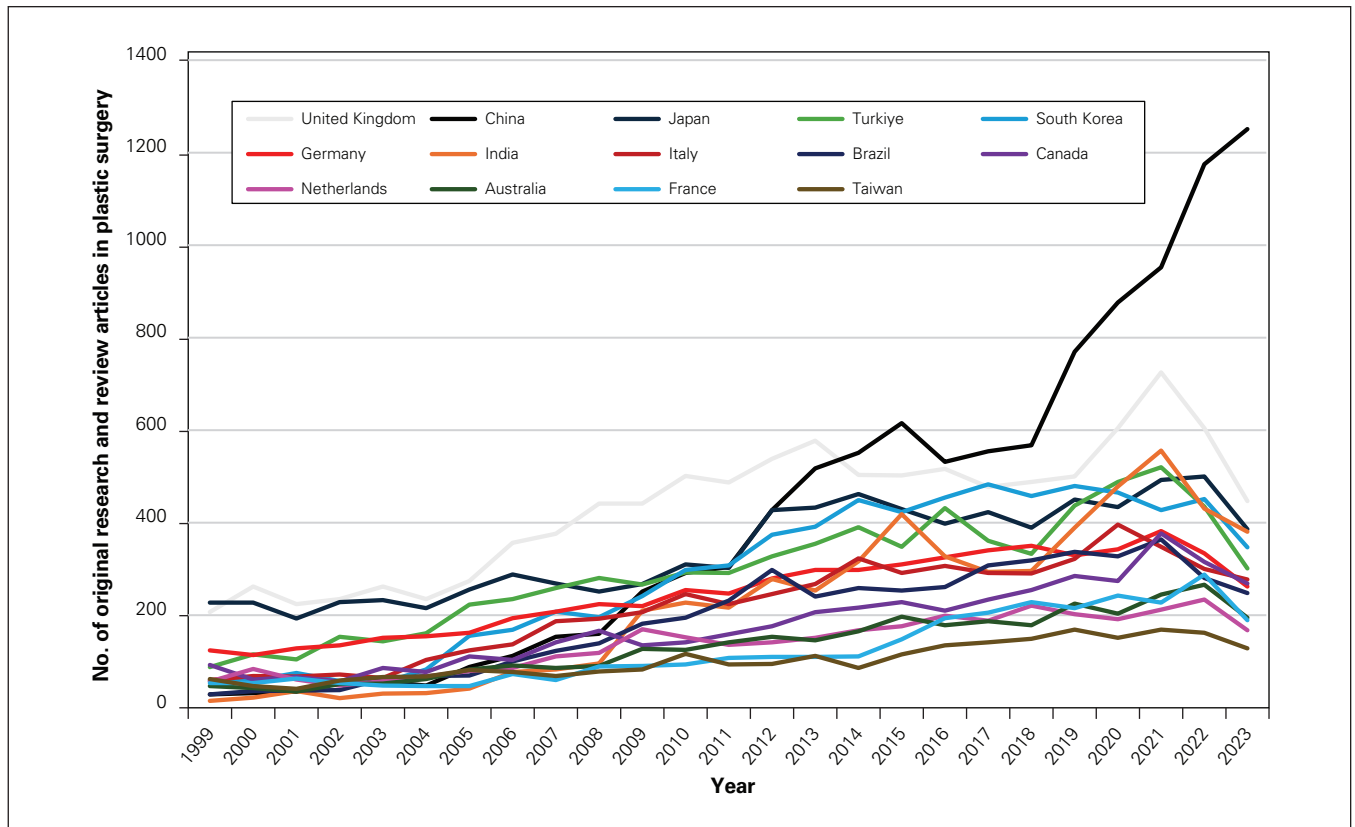


Fig. 2. Output of the most prolific nations in terms of scientific publications in plastic surgery, not including data for publications from the United States.

Table 2. Plastic surgery research output of Canadian institutions from 1999 to 2023

Institution	1999–2003			2004–2008			2009–2013			2014–2018			2019–2023			1999–2023		
	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1	No. of articles	CNCI	%Q1
Canada	363	1.122	11.4	600	1.24	22.6	819	1.244	24.8	1144	1.15	21.3	1520	0.89	20.2	4446	1.09	21.0
University of Toronto	129	1.206	5.5	206	1.06	20.6	264	1.163	18.3	364	1.12	21.9	453	0.80	18.2	1416	1.02	18.3
University of British Columbia	34	1.077	39.4	89	1.53	26.7	96	1.919	30.3	155	1.27	23.1	241	1.00	26.3	592	1.30	25.7
McGill University	22	0.978	0.0	48	0.89	17.8	80	1.036	25.0	121	1.04	17.4	218	0.99	22.2	512	1.00	21.4
Dalhousie University	16	1.174	0.0	37	0.90	22.2	70	1.396	43.8	109	1.62	20.2	156	0.81	26.9	382	1.27	32.3
McMaster University	16	1.346	6.3	33	1.72	42.4	68	2.455	40.3	105	1.32	41.1	105	0.90	20.6	333	1.33	27.4
Western University (University of Western Ontario)	39	1.022	10.3	50	0.95	16.0	71	0.845	11.1	71	0.92	18.8	92	0.74	9.7	323	0.87	13.3
Université de Montréal	17	0.717	13.3	27	0.80	14.8	52	0.822	16.3	63	0.77	17.2	114	0.82	21.9	273	0.80	17.8
University of Alberta	21	0.914	33.3	42	1.52	52.5	54	1.154	30.2	73	1.04	25.0	82	0.66	24.6	272	1.01	31.4
University of Ottawa	18	0.709	0.0	32	0.83	10.3	33	1.126	13.3	53	0.70	8.3	88	0.84	6.6	224	0.84	8.1
University of Manitoba	13	0.938	0.0	21	2.40	17.7	26	1.232	16.0	69	0.86	9.5	61	0.62	13.6	190	1.01	11.8
University of Calgary	11	1.533	36.4	22	1.41	28.6	23	1.427	35.0	54	1.08	21.3	74	0.78	13.2	184	1.07	23.4
Université Laval	6	0.969	33.3	7	5.22	14.3	15	0.626	16.7	17	0.55	0.0	21	0.86	7.7	66	1.20	11.3
Université de Sherbrooke	-	-	-	-	-	-	4	1.291	75.0	6	1.28	16.7	9	0.97	16.7	20	1.13	29.4

%Q1 = percentage of articles published in the top quartile of the most influential journals in plastic surgery according to impact factor; CNCI = Category Normalized Citation Impact.

surge in institutional collaborations. Prominent institutions with the highest link strength during this period included the University of Toronto, McMaster University, McGill University, and the University of British Columbia (Figure 5).

DISCUSSION

Our bibliometric analysis of data from more than 60 English-language journals showed that, over the past 25 years, research productivity in plastic surgery has

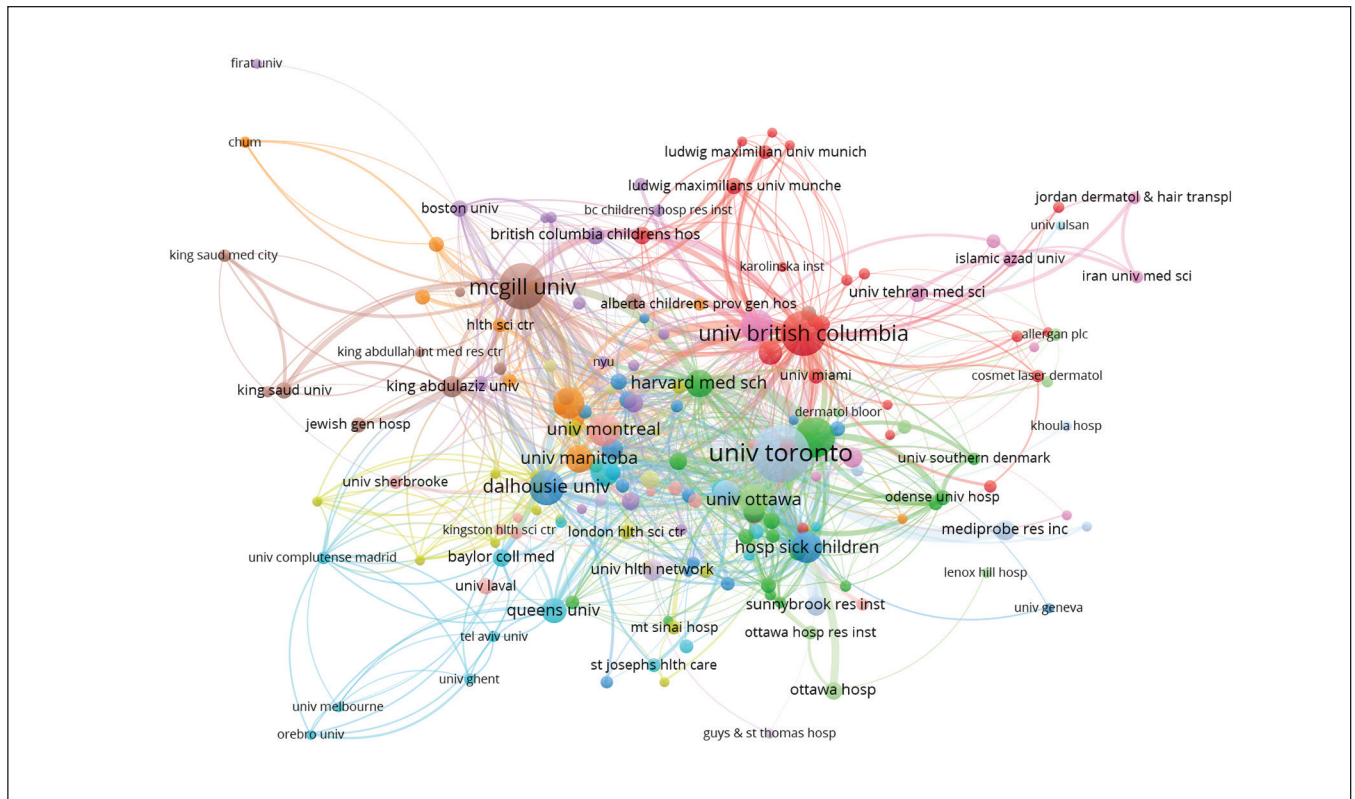


Fig. 5. Institutional collaborations in Canadian plastic surgery Research from 2019 to 2023. Image created with VOSviewer version 1.6.20.

research output over the analyzed period, primarily attributable to increased government investment and policy support, research infrastructure expansion, and research workforce growth.²⁰

Our study positioned Canada at the eleventh rank in productivity, whereas similar studies have ranked Canada slightly higher, placing it as the ninth most productive country.^{9,11,12} This slight discrepancy between our findings and those of prior studies may be attributed to differences in the timeframe and the selected journals analyzed. Unlike previous studies that focused on a limited number of journals, our research examined a broader spectrum of 60 journals, providing a more comprehensive analysis. Moreover, although previous studies relied solely on the first author to ascertain the country of the paper, our methodology considered all countries affiliated with each paper, which may have influenced the final rankings.

Among the Canadian institutions demonstrating the highest productivity, the University of Toronto, the University of British Columbia, and McGill University were at the forefront. This trend aligns with a study that evaluated the research productivity of Canadian ophthalmology departments and concluded that larger departments in Canada tended to produce a higher volume of research and secure more federal funding.²¹ With regard to orthopedic surgery research, the University of Toronto and the University of British Columbia were at the forefront, while McGill University ranked as the seventh most productive institution.⁴

Canadian plastic surgery research remains less prominent than research of other medical specialties despite Canada’s high ranking. Wang and colleague’s study revealed that, among surgical specialties, plastic surgery, vascular surgery, and general surgery researchers exhibited comparatively lower levels of productivity.²² Several other studies have consistently positioned Canada within the top 10 nations in terms of research in various medical disciplines. Specifically, Canada ranks fifth in otolaryngology, sixth in orthopedic and neurosurgery, eighth in vascular surgery, and tenth in minimally invasive general surgery and dermatology.^{4-7,23,24}

Several factors may contribute to the lower academic productivity of plastic surgeons compared with their counterparts. One potential explanation for this disparity could be constraints such as time limitations or inadequate infrastructure. A survey of Canadian plastic surgery residents unveiled that, although most respondents expressed interest in participating in research, time constraints emerged as the primary barrier hindering research pursuit. The lack of access to research supervisors or mentors and the research ethics approval process were also barriers to conducting research.²⁵ The optimization of infrastructure, team structure, and interpersonal dynamics could enhance the development of plastic surgery research. By focusing on these aspects, The Warren Alpert Medical School of Brown University experienced a notable increase in publications and presentations within a single year. This initiative

increased the research contributions of faculty, residents, and medical students.²⁶ Although financial support provides advantages in quantity, funding is not a necessity to produce high-quality plastic surgery research.¹³

The integration of artificial intelligence (AI) is revolutionizing research by assisting researchers in everyday tasks, enhancing publication efficiency, and identifying research gaps.^{27–29} Advanced algorithms and machine learning can be used to optimize research and analyze vast data sets to uncover underexplored topics.²⁹ Additionally, AI can automate labour-intensive aspects of systematic reviews, such as literature screening and data extraction, ensuring faster and more accurate results while enabling continuous updates.³⁰ However, these advancements necessitate human judgment to ensure reliability.³¹ Ethical considerations, such as algorithmic bias and accessibility disparities, must also be addressed to ensure equitable AI integration in academia.³²

With regard to research quality, Canada emerged as a leader in plastic surgery research quality, ranking first in CNCI and Q1%. Rymer and Choa observed that the impact factor of Canadian plastic surgery research increased substantially over their study period, ranking Canada second highest among countries.⁹ Studies involving several other specialties have also assessed Canadian research quality within their respective fields. Otorhinolaryngology ranked eighth in impact factor, and orthopedic surgery demonstrated higher CNCI and Q1% than prominent countries such as the US, Germany, the UK, and China.^{4,23}

Using the VOSviewer map, we observed a notable increase in the number of collaborations with Canadian institutions, from 25 to 182. From 1999 to 2003, collaborations were predominantly within Canada. In later years (2009–2013 and 2019–2023), there was a substantial increase in interactions with non-Canadian institutions, partly explained by federal support.³³ In addition, the interactions exhibited greater strength, as evidenced by increased link strength among institutions over time.

Limitations

One limitation of this study is the lack of classification of research type (e.g., observational study, randomized controlled trial), which is crucial for understanding research contributions. However, this was beyond the scope of our analysis. This limitation arises from challenges like inconsistent reporting and lack of standardized terminology. Future studies could leverage AI-driven text analysis to automate classification of study type, which would provide richer insights into research trends and quality. Such advancements would allow comparisons across study designs, enhancing the value of bibliometric analyses for stakeholders. We relied on journals indexed within the

WOS platform. Journals indexed in other databases, such as Google Scholar, were not included, which may have led to the exclusion of relevant literature. However, WOS is one of the longest-running platforms for bibliometric research and has a comprehensive index of plastic surgery-specific journals. It covers subject domains in sciences and arts and has a higher coverage of health and medical sciences than sources such as COCI (the Open-Citations Index of Crossref). Although it has lower coverage than Google Scholar and Microsoft Academic, it offers advanced search and filtering options, which is useful for evidence synthesis in systematic reviews.³⁴ Our search was restricted to plastic surgery journals, which may not uniformly cover all relevant articles in the field of plastic surgery. Additionally, our focus on English-language journals may have introduced a bias favouring English-speaking countries, potentially overlooking valuable contributions from non-English-speaking regions. Qualitative and quantitative bibliometric indicators may be less stable for recently published articles (i.e., 2019–2023), which would affect the last period evaluated. Finally, the quantitative analysis was based on overall production rather than a per capita research analysis, given the limitation posed by the lack of data on the number of faculty members and their full-time equivalent research commitments. Similarly, clinician–scientists may have influenced measures of research productivity in both quantity and quality. However, such data were not accessible for this analysis.

CONCLUSION

Our study demonstrated the evolution of Canadian plastic surgery research. This comparative analysis facilitated a nuanced examination of Canada alongside other nations renowned for high productivity. Our findings identified high-performing countries and provided an understanding of the Canadian plastic surgery research landscape, which could allow for strategic investments in underperforming institutions to strengthen their capabilities. The methodologies and strategies employed by highly productive universities with superior research quality should be analyzed so that similar programs can be implemented in other institutions. This approach will strengthen the overall research infrastructure across Canadian universities and foster a more robust and effective research environment in plastic surgery.

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Competing interests: None declared.

Contributors: Sophie Nguyen and Carlos Cordoba contributed to the conception and design of the work. Daniel Josué Guerra Ordaz, Antoine Lalonde, and Rocío Branes contributed to data acquisition. Daniel Josué Guerra Ordaz, Peter Tai, Magdalena Cordoba, Éolie Delisle, and Maryam Mozafarinia contributed to data analysis and interpretation. Daniel Josué Guerra Ordaz, Peter Tai, Antoine Lalonde, Magdalena Cordoba, and Éolie Delisle drafted the manuscript. All of the authors revised it critically for important intellectual content, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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