

Breast cancer recurrence and tumor size: A bibliometric analysis

Research Article

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Abstract:

Background Breast cancer (BC) is the most common malignancy diagnosed in females. Over the years, many factors have been studied to understand what causes BC to come back. One of them is the tumor size at the beginning of the treatment. Tumor size is an interesting parameter, and some classifications of cancer grade depend on it.

Methods This bibliometric analysis examined the pattern followed by publications on BC recurrence and tumor size. The Scopus database was used, and bibliometric analysis was utilized to identify the most prolific authors, the journals most involved in the field, and the countries, institutions, and keywords used. BC recurrence and tumor size have an exponential growth in the number of publications over the years.

Results For the last 11 years, from 2012 to 2022, the trend of annual publications concerning BC recurrence and tumor size increased dramatically, showing that the majority of publications were published in the United States (452 articles) by Morrow, M., who authored 13 articles; The University of Texas, Anderson Cancer Center had the most published articles (48 articles); and *Breast Cancer Research and Treatment* journal achieved the largest quantity of published articles (112 articles).

Conclusion Tumor size is an important risk factor for BC recurrence, and this bibliometric analysis focused on the high interest introduced by the research community.

Keywords: breast • cancer • recurrence • tumor • size

1. Introduction

Breast cancer (BC)^[1] is the most common diagnosed cancer in females and is the leading cause of cancer-related mortality among females. It may be a symptomatic or remarkable lump. Some symptoms may indicate possible BC, such as a change in breast size or shape, breast skin changes, nipple changes, unusual discharges, and an axillary lump. Early detection of BC is recommended, and it is achieved through breast self-examination, mammography, ultrasonography, and magnetic resonance imaging. A biopsy may be done to determine the type and severity of the tumor. Treatment is identified by a specialist. The patient may need surgery followed by radiation therapy, hormonal therapy, or chemotherapy. Radiation following surgery may reduce recurrence rates in some patients.

If cancer symptoms disappeared after treatment and disappearance continued for 5 years, it will be considered remission (no recurrence), but if the cancer symptoms come back during 5 years, that will be called recurrence. Over the years, many factors have been studied to understand what causes BC to come back. One of them is tumor size ^[2] at the beginning of the treatment. ^[3]

2. Methods

2.1. Study design

This research followed a descriptive bibliometric analysis design ^[4] to do a scientific mapping of scientific publications on tumor size and BC recurrence. This design was used in other research ^[5] and in many

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fields.^[6] It was applied using VOSviewer, which is one of the most common software programs in the area of bibliometric analysis.

2.2. Data collection

The Scopus database was used as a source of data. This database is mostly used to do bibliometric analyses due to the wide content of indexed journals and the adequate data supplied for this type of analysis.

The data were extracted from The Scopus database on October 14, 2023. The search was done as follows: TITLE-ABS-KEY (breast AND cancer AND recurrence AND tumor AND size) AND PUBYEAR > 2011 AND PUBYEAR < 2023 AND (LIMIT-TO (SUBJAREA , “MEDI”)) AND (LIMIT-TO (DOCTYPE , “ar”)) AND (LIMIT-TO (LANGUAGE , “English”)) AND (LIMIT-TO (EXACTKEYWORD , “Breast Cancer”)).

The search was restricted to publication years from 2012 to 2022, while excluding publications in 2023 and 2011. The search was limited to sub-area medicine. Additionally, only articles, English-language papers, and studies pertaining to “breast cancer” were included in the search parameters. The final dataset was downloaded and then analyzed.

2.3. Statistical analysis

A descriptive bibliometric analysis was performed from 2012 to 2022 to display the scientific mapping of BC recurrence and its relation to tumor size, the growing increase in the annual number of publications, the researchers authored in this field, many important journals that are interested in the topic, wide regions/countries, and co-authorship. All of them were analyzed by using the Scopus database and VOSviewer to ensure interest in that topic.

3. Results

3.1. Growing growth in annual publications

For the last 11 years from 2012 to 2022, the number of papers that were collected from the Scopus database talking about the relation between BC recurrence and tumor size was 1606 articles, as follows: in 2012 (n = 141), 2013 (n = 133), 2014 (n = 110), 2015 (n = 152), 2016 (n = 145), 2017 (n = 156), 2018 (n = 143), 2019 (n = 135), 2020 (n = 150), 2021 (n = 183), and 2022 (n = 158) (Figure 1, Table S1).

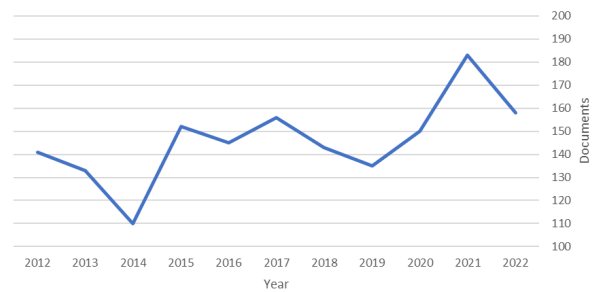


Figure 1: Number of studies on breast cancer recurrence and tumor size published annually.

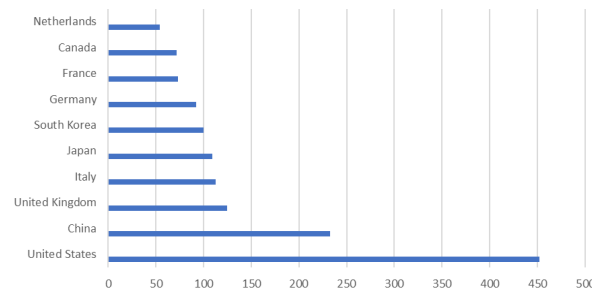


Figure 2: Top 10 countries shared publications on breast cancer recurrence and tumor size.

3.2. Countries/regions

The total number of countries that shared publications on BC recurrence and tumor size is 73 (Table S2). The United States had the most publications overall (452 articles, 28.1%), China (233 articles, 14.5%), the United Kingdom (125 articles, 7.8%), Italy (113 articles, 7%), Japan (109 articles, 6.8%), South Korea (100 articles, 6.2%), Germany (92 articles, 5.7%), France (73 articles, 4.5%), Canada (72 articles, 4.48%), and the Netherlands (54 articles, 3.36%) (Figure 2). Figure 3 shows the countries in co-authorship density map; the number of publications is correlated with the intensity of the yellow color.

3.3. Country co-authorship

Figure 4 shows a VOSviewer network visualization map of country co-authorship or what is known as international collaboration. There are 43 items (countries) involved in co-authorship in 8 clusters. Cluster 1 consists of 10 items (Australia, Austria, Belgium, Denmark, Germany, Hungary, Ireland, New Zealand, Sweden, and Switzerland). Cluster 2 consists of 9 items (China, Greece, Italy, Japan, Poland, South Korea, Spain, Thailand, and Turkey). Cluster 3 consists of 7 items (Hong Kong, Malaysia, the Netherlands,

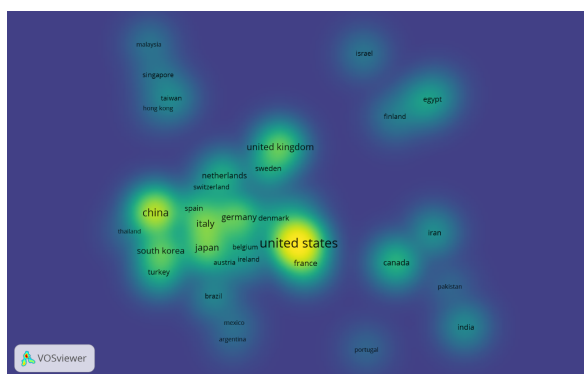


Figure 3: Density map of countries in co-authorship.

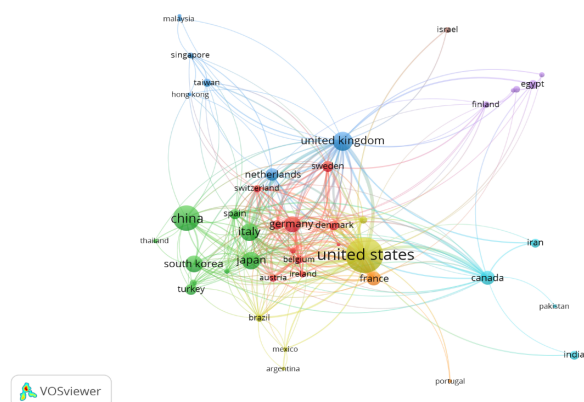


Figure 4: Country co-authorship mapping.

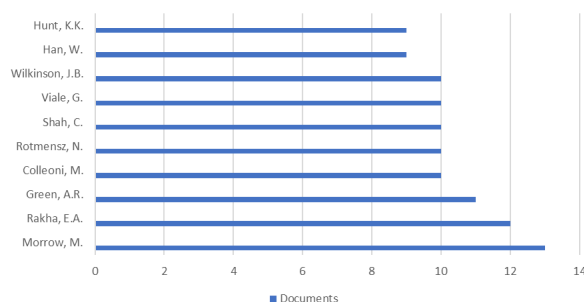


Figure 5: Top 10 authors published on breast cancer recurrence and tumor size.

Nigeria, Singapore, Taiwan, and the United Kingdom). Cluster 4 consists of 5 items (Argentina, Brazil, Mexico, Norway, and the United States). Cluster 5 consists of 5 items (Egypt, Finland, Iraq, Saudi Arabia, and Tunisia). Cluster 6 consists of 4 items (Canada, India, Iran, and Pakistan). Cluster 7 consists of 2 items (France and Portugal). Cluster 8 consists of 1 item (Israel). Items in each cluster shared the same color in the map, and the most co-authorship of each item happened in its cluster, but this does not prevent the presence of co-authorship with items in other clusters.

This co-authorship is very interesting. As the collaboration in the research community goes beyond boundaries, it is healthy and good. I did a small search for the most-cited published article in the top 10 countries to demonstrate the educational institution of the first author and I was surprised. The highest-cited article is common in both the United States and Germany, while the educational institution of the first author in that article was the University of Oxford! Also, the highest-cited article is common in both France and the Netherlands, while the educational institution of the first author was The Netherlands Cancer Institute. The educational institution of the first author of the highest-cited article in Japan was Institut Curie, France. The educational institution of the first author of the highest-cited article in South Korea was NRG Oncology, the United States. The educational institution of the first author of the highest-cited article in Canada was Montefiore Medical Center, Albert Einstein College of Medicine, the United States. (Table S3)

3.4. Authors

The total number of authors who shared publications related to BC recurrence and tumor size is 159 (Table S4). The author of the most publications was Morrow, M. (13 articles); followed by Rakha, E.A. (12 articles); Green, A.R. (11 articles); Colleoni, M., Rotmensz, N., Shah, C., Viale, G., and Wilkinson, J.B. (10 articles); and Han, W., and Hunt, K.K. (9 articles) (Figure 5).

3.5. Affiliation

The total number of affiliations that shared publications on BC recurrence and tumor size is 160 (Table S5). The University of Texas, Anderson Cancer Center had the most published articles (48 articles), followed by Memorial Sloan-Kettering Cancer Center (43 articles), Dana-Farber Cancer Institute (33 articles), and the Institute Europeo di Oncologia (23 articles). Harvard Medical School and the University of Toronto had 22 articles. The Ministry of Education of the People Republic of China, Yonsei University College of Medicine, Massachusetts General Hospital, and Università degli Studi di Milano had 21 articles (Figure 6).

3.6. Journals

The total number of journals that shared publications on BC recurrence and tumor size is 159 (Table S6).

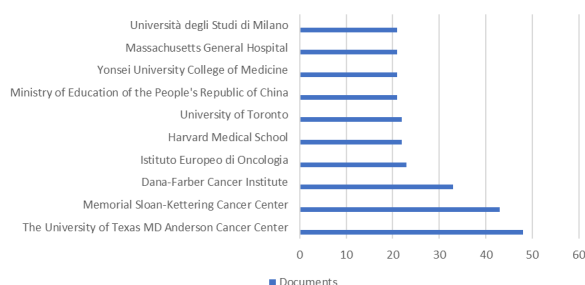


Figure 6: Top 10 affiliations shared publications on breast cancer recurrence and tumor size.

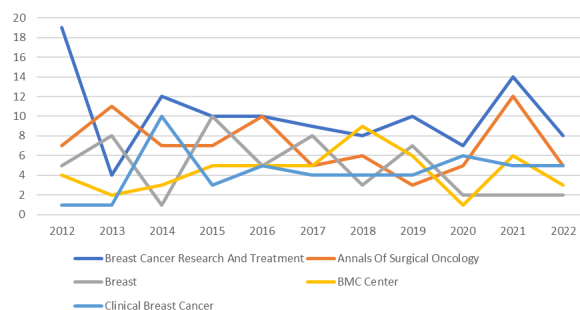


Figure 7: top 5 journals shared publications on breast cancer and tumor size.

The most publications were found in 5 journals: *Breast Cancer Research and Treatment* (112 articles), *Annals of Surgical Oncology* (78 articles), *Breast* (53 articles), *BMC Center* (49 articles), and *Clinical Breast Cancer* (48 articles) (Figure 7).

Table S7 gives brief details about the top 10 journals concerning the BC recurrence and tumor size topic, the total publications for each, the total number of citations, the cite score, the title of the most-cited article, the times it was cited, and the publisher. The top publisher here is Springer Nature (publisher of 4 of the top 10 journals); Elsevier is publisher of 3 journals and then Wiley-Blackwell, Impact Journals, and Frontiers Media S.A. Although *Breast Cancer Research and Treatment* journal had the highest cite score, the most-cited article was cited only 26 times, while for other journals like *Breast*, the most-cited article was cited 262 times; for *Frontiers in Oncology*, the most-cited article was cited 97 times, for *Annals of Surgical Oncology* journal, the most-cited article was cited 72 times, for *International Journal of Radiation Oncology Biology Physics* journal, the most-cited article was cited 64 times, and *BMC Cancer* journal, the most-cited article was cited 38 times.

3.7. Most-used keywords in published papers

Figure 8 shows the most-used keywords. Terms like breast cancer (occurrence 1606 times), tumor volume (occurrence 786 times), and cancer grading (occurrence 434 times) were the most used in the papers.

The next table shows the most related keywords and the number of their occurrences. The most related keywords are breast cancer (1606 times), breast neoplasm (1160 times), cancer recurrence (873 times), tumor volume (786 times), breast tumor (690 times), neoplasm recurrence (639 times), cancer staging (604 times), prognosis (586 times), tumor recurrence (559 times), cancer size (501 times), and cancer grading (434 times).

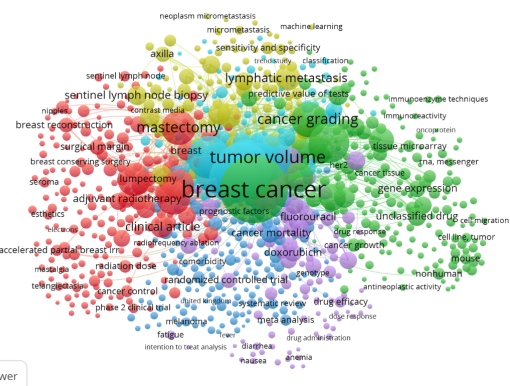


Figure 8: Most related keywords.

Table 1: Most keywords used and number of its occurrence.

No	Keyword	Occurrence
1	Breast cancer	1606
2	Breast neoplasms	1160
3	Cancer recurrence	873
4	Tumor volume	786
5	Breast tumor	690
6	Neoplasm recurrence, local	639
7	Cancer staging	604
8	Prognosis	586
9	Tumor recurrence	559
10	Cancer size	501
11	Cancer grading	434

4. Discussions

The initial search reviewed 6354 papers. When the search was restricted to the last 11 years, from 2012 to 2022, it included 3303 papers. This search covered only the medicine field in 2930 papers and was restricted to an article type in 2527 papers. English-language papers were 2381. The final article number limited to breast cancer is 1606 (Figure S1).

In the current study, there have been 159 authors from 73 countries/regions who have published on this

topic, and in this time range, the most prolific regions are the United States, China, and the United Kingdom. An exponential growth in the number of publications was observed, and in the years 2015 and 2021, the increasing pace of the number of publications accelerated, showing special peaks.

The current study examined a total of 159 journals. *Breast Cancer Research and Treatment* journal published the most articles on this subject, followed by *Annals of Surgical Oncology*, *Breast*, *BMC Center*, and *Clinical Breast Cancer*. The largest number of publications was by Morrow, M., followed by Rakha. The analysis of the most frequently mentioned keywords used in BC recurrence and tumor size research and the number of their occurrence are as follows: breast cancer (1606 times), breast neoplasm (1160 times), cancer recurrence (873 times), tumor volume (786 times), breast tumor (690 times), neoplasm recurrence (639 times), cancer staging (604 times), prognosis (586 times), tumor recurrence (559 times), cancer size (501 times), and cancer grading (434 times).

Tumor size is a significant factor, especially in BC, to investigate cancer grade, efficacy of some treatments, and recurrence. One of the studies of the *Scopus* library of this bibliometric analysis used tumor size as a parameter to show that tiny invasive breast cancers with tumor diameters ≤ 5 mm are linked to an excellent prognosis without a systemic therapy.^[7] Another study demonstrated the use of magnetic resonance imaging to evaluate BC grades depending on the tumor size.^[8] Another study looked at the incidence of late BC recurrence and found that women with high lymph node burden, large tumor size, and estrogen receptor–positive tumors had an increased risk of late recurrence.^[9] A study used parameters like age, primary tumor size, nodal and progesterone receptor status, and disease-free survival to test the efficacy of adjuvant endocrine therapy.^[10] A comparative study used the tumor grade, the presence of necrosis inside the tumor, and the estrogen receptor status to detect if there was a relation of positive expression of Ki67 and these factors.^[11]

5. Conclusions

This bibliometric analysis presents an overview of the findings of BC recurrence and tumor size research worldwide. There has been an exponential increased growth in research on BC recurrence and tumor size from 2012 to 2022. The largest number of publications

was achieved in the United States (452 papers, 28.1%), the most relevant author being Morrow, M., and *Breast Cancer Research and Treatment* journal published the most articles on this subject.

Abbreviations

BC	Breast cancer
TP	Total publications
TC	Total citations

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Not applicable

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Availability of data and materials

This published article contains all of the data that were analyzed for this investigation.

Ethics approval and consent to participate

Not applicable

Consent for publication

Nil

Competing interests

Nothing

References

- [1] Pavani Chalasani, M., MPH Professor of Medicine, Director, Division of Hematology and Oncology, Leader, Breast Cancer Clinical Research Team, Co-Program Leader, Clinical and Translational Oncology Program, George Washington Cancer Center, George Washington University School of Medicine and Health Sciences. *Breast Cancer*. 2023 Oct 09, 2023]; Available from: <https://emedicine.medscape.com/article/1947145-overview>.
- [2] Alexandre Lafourcade, M.H., Laura Baglietto, Marie-Christine Boutron-Ruault, Laure Dossus, Virginie Rondeau, *Factors associated with breast cancer recurrences or mortality and dynamic prediction of death using history of cancer recurrences: the French E3N cohort*. *BMC Cancer*, 2018; 18: 171.
- [3] Donald Courtney, M.G.D., Brian M. Moloney, Michael K. Barry, Karl Sweeney, Ray P. McLaughlin, Carmel M. Malone, Aoife J. Lowery, and Michael J. Kerin, *Breast cancer recurrence: factors impacting occurrence and survival*. *Ir J Med Sci.*, 2022; 191(6): 2501–2510.
- [4] Naveen Donthu, S.K., Debmalya Mukherjee, Nitesh Pandey, Weng Marc Lim, *How to conduct a bibliometric analysis: An overview and guidelines*. *Journal of Business Research*, 2021. Volume 133.
- [5] Ramon Handerson Gomes Teles, H.F.M., Márcia Regina Cominetti, *Global trends in nanomedicine research on triple negative breast cancer: a bibliometric analysis*. *International Journal of Nanomedicine*, 2023: p. 2321-2336.
- [6] Hassan Abuhassna, F.A., Kawthar Bayoumi, Diaya Uddeen Alzitawi, Ahmed H Alsharif, Noraffandy Yahaya, *Understanding Online Learning Readiness among University Students: A Bibliometric Analysis*. *iJIM*, 2022. 16.
- [7] Cao, L., Towe, C.W., Shenk, R., Stabellini, N., Amin, A.L., Montero, A.J. , *A comparison of local therapy alone with local plus systemic therapy for stage I pT1aN0M0 HER2+ breast cancer: A National Cancer Database analysis(Article)*. *Cancer*, 2022. 128(13): p. 2433-2440.
- [8] Mao, Y., Xiong, Z., Wu, S., Huang, Z., Zhang, R., He, Y., Peng, Y., Ye, Y., Dong, T., Mai, H., *The Predictive Value of Magnetic Resonance Imaging-based Texture Analysis in Evaluating Histopathological Grades of Breast Phyllodes Tumor(Article)*. *Journal of Breast Cancer*, 2022. 25(2): p. 117-130.
- [9] Rikke Nørgaard Pedersen, B.Ö.E., Lene Mellekjær, Peer Christiansen, Bent Ejlersen, Timothy Lee Lash, Mette Nørgaard, Deirdre Cronin-Fenton, *The Incidence of Breast Cancer Recurrence 10-32 Years After Primary Diagnosis*. *Journal of the National Cancer Institute*, 2022. 114(3).
- [10] Leone, J.P., Cole, B.F., Regan, M.M., Thürlimann, B., Coates, A.S., Rabaglio, M., Giobbie-Hurder, A., Gelber, R.D., Ejlersen, B., Harvey, V.J., Neven, P., Láng, I., Bonnefoi, H., Wardley, A., Goldhirsch, A., Di Leo, A., Colleoni, M., Vaz-Luis, I., Lin, N.U., *Clinical behavior of recurrent hormone receptor-positive breast cancer by adjuvant endocrine therapy within the Breast International Group 1-98 clinical trial*. *Cancer*, 2021. 127(5).
- [11] Bahaddin, M.M., *A comparative study between Ki67 positive versus Ki67 negative females with breast cancer: Cross sectional study*. *Annals of Medicine and Surgery*, 2020. 60.