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Review Article

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An Overview of Oncology Researches in Iran: A Scientometric Approach (1974 – February 2019)

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Abstract

Background: With the growing rate of tumors, cancer has become one of the most important health concerns in Iran. The urgency with which Iranian researchers and health professionals address this challenge leads to a load of scientific materials.

Methods: To reveal gaps in produced knowledge and suggest future research directions, applying well-validated scientometric tools, we assessed the trends of Iranian published scientific articles and citations in the field of oncology. The inclusion criteria consisted of all oncology-related articles that were data-based, and peer-reviewed; with at least an abstract published in English; and authored by at least one researcher affiliated with Iranian institutions.

Results: Amongst 5 063 525 oncology research records indexed in at least one of PubMed, Scopus, or Web of Science Core Collection (WoS) from the start to February 2019, Iranian researches accounted for about 24 867 (0.49%). Published articles on all cancers by Iranian researchers had a sharp continuously ascending trend, with the same pattern for citations received. Some important topics such as complementary and alternative medicine (CAM) therapies have been missing and some such as diagnostic and pharmaceutical innovations have been less investigated. The most collaborative country was the United States, while no close collaboration was observed with China that was introduced as the most productive country in the field of oncology over the past decades.

Conclusion: Despite the progressive trend in most oncology fields, some significant practical topics are still missing. Systematic reviews of produced theoretical innovations and translating them to functional knowledge can be of importance to fulfill the mentioned gaps.

Keywords: Cancer research, Co-citation analysis, Data visualization, Social network analysis

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Introduction

Neoplasms are still amongst the top 10 causes of death in the World Health Organization's fact sheet and a major public health problem worldwide.[1] They are considered the third leading cause of mortality and disability-adjusted life years in the Iranian population.[2] Nowadays, smoking and inappropriate diet which exacerbate the disease status have increased dramatically in urban areas of Iran, along with additional cancer risk factors including household air pollution from solid fuels, urban air pollution caused by fossil fuels, exposure to occupational pollutants, and drug use.[3] Therefore, cancer has become a more important health concern and a major burden of non-communicable diseases (NCDs) in Iran, and effective interventions need to be taken in all aspects of the oncology field.

Scientific reliable evidence, which is provided by researchers, is the primary need for designing effective interventions. The urgency with which Iranian researchers have addressed cancers, as a great and continuous threat to the population, has led to the enormous growth of publications in the oncology subject. Although knowledge production in the oncology field is rapidly developing in Iran, several questions are still unanswered and several points are still missing.

Periodic review of research progress in the oncology field is of significance to both researchers and policymakers in order to make proper evidence-based policy and develop national cancer control plans.[4] Scientometric studies are reliable approaches to analyze and justify previously produced knowledge and reveal gaps in current knowledge and suggest future research directions.[5] A notable publication has recently quantified and analyzed

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the trend of scientific publications on four main NCDs, including cancer, in a 17-year period.[6] Furthermore, several scientometric studies in oncology were published, focusing on one cancer in particular.[7,8] Nonetheless, a detailed scientific analysis of Iranian researches related to most main cancer sites listed in GLOBOCAN–IARC database has yet to be undertaken, while some countries have already carried out deep researches on the subject.[9-11]

Considering the mentioned background, in the present scientometric analysis, applying well-validated scientometric tools, we assessed the trends of Iranian published scientific articles and citations in the field of oncology research, focusing on main cancer sites listed in GLOBOCAN–IARC database, from the start to February 2019, in an attempt to offer an overview of the considered research status. Although, through the obtained results, the main topics being researched in the oncology field in Iran can be identified, along with the publication trends, the main research institutions, and international and national collaboration networks, the main aim of this study was to reveal gaps in produced knowledge and suggest future research directions.

Materials and Methods

Data Source

A longitudinal analysis of Iranian research publications in cancer (1974-2019) was performed. PubMed (https://www.ncbi.nlm.nih.gov/pubmed/), Scopus (https://www.scopus.com/) and Web of Science Core Collection (WoS) (http://apps.webofknowledge.com/) were searched for data during February 2019, using search strategies shown in Supplementary file 1. WoS and Scopus are online bibliographical multidisciplinary publication and citation databases, available through subscription and were accessed from the Iranian Ministry of Health and Medical Education (MOHME). PubMed is the largest database of biomedical science literature that comprises about 29 million citations from MEDLINE and PubMed Central databases.

In order to balance the sensitivity and specificity of the data, a list of 17 cancers with the highest incidence rates in the country was selected from the GLOBOCAN database. Top cancers with the highest age-adjusted incidence rates were selected for analysis. The selected cancers included: breast, colorectal, lung, prostate, lymphoma, leukemia, stomach, esophageal, bladder, cervix, ovary, uterine, thyroid, liver, pancreas, central nervous system, and skin (including melanoma) cancers. Furthermore, sensitive search strategies were developed for any cancer and any database by an expert librarian. Major MeSH headings, as well as text words, were searched for each cancer site. Data were extracted in a plain text or comma-separated (CSV) formats and then imported to EndNote version X8 for duplication removal and relevance assessment. The retrieved records were also assessed to identify the most relevant records. Articles published in 2019 were not included in the analysis, as the indexing procedure was not completed in WoS and Scopus at the time of downloading.

Bibliometric Indicators

In order to assess the overall productivity and growth of cancer research, total publications and average annual growth rate (AAGR) were calculated. The AAGR was used to provide a better overview of changes in productivity. The AAGR measures the average growth of productivity across a series of equally spaced time periods.

Statistical Analysis

Descriptive statistics including frequencies were used for data summarization. Spearman correlation coefficient was used to investigate statistical associations among total publications and a range of socioeconomic indicators. Level of 0.05 was considered significant for two-sided tests. VOSviewer version 1.6.4 was used to illustrate co-occurrence and co-authorship networks for each cancer.

Results

By the February of 2019, Iranian researchers have published 24 867 articles in oncology and cancer-related fields. The temporal changes of Iranian cancer-related publications over the past two decades are illustrated in Figure 1. According to this figure, the overall annual rate of cancer-related publications indicated a rising pattern during the study period. Additionally, the overall contribution of Iranian publications to the world's cancer research also increased from 0.04% in 2000 to 1.68% in 2018. According to cancer site, breast cancer (n = 1128, 4.5%), leukemia and hematopoietic cancers (n = 422, 1.7%) and colorectal cancer (n = 400, 1.6%) were the most dominant topics of Iranian cancer research during this period. Figure 2 illustrates the AAGR of Iranian publications according to cancer site. According to this figure, the liver (AAGR = 4.23), cervix (AAGR = 3.82) and thyroid cancer (AAGR = 3.28) indicated the highest rates of publication growth rate during the study period. In contrast, esophageal cancer (AAGR = 1.41) and leukemia (AAGR = 1.55) represented the least annual growth rate among cancer sites.

Further inspection of available citation data highlighted the rising pattern of Iranian scientific impact in cancer-related fields. The temporal changes of total publications as well as citations per publication are illustrated in Figure 3.

A comparison of Iranian cancer-related scientific output, age-standardized incidence rates for the most common cancers, and cancer death incidence in Iran is illustrated in Figure 4. According to this figure, the distribution of research publications and respective incidence rates for each cancer indicated almost significant gaps between research priorities and incidence rates of cancers of prostate, bladder, skin (including melanoma) and leukemia. However, considering cancer death incidence in Iran versus the produced research topics, it has become

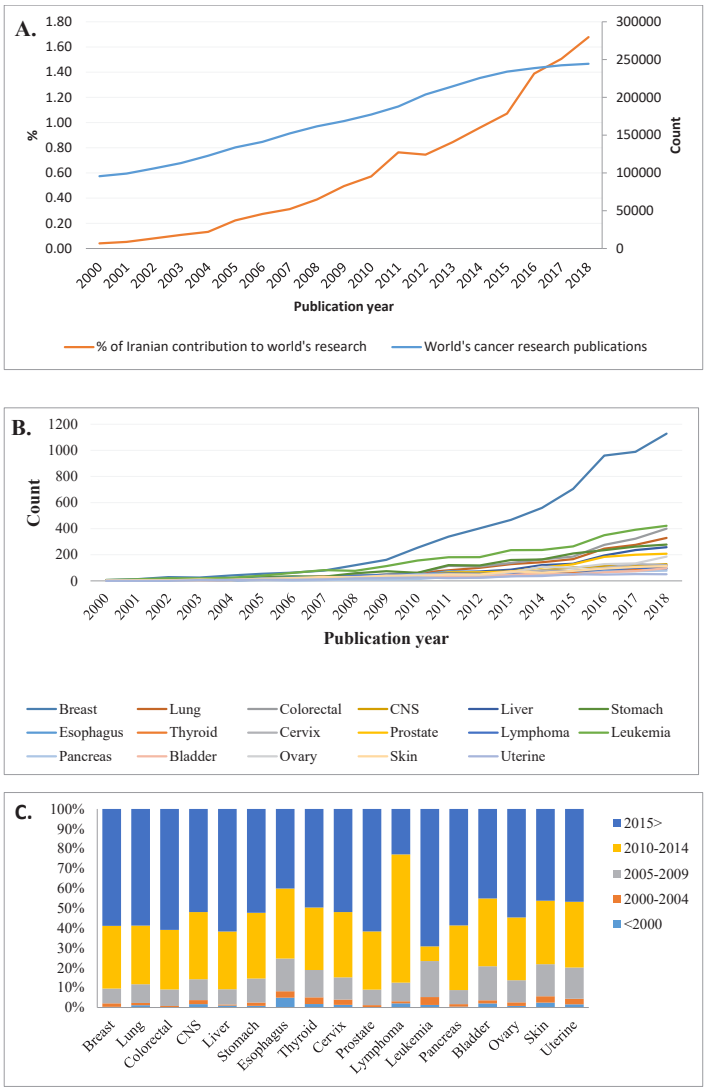

Figure 1. Publication Patterns of Iranian Researches on Oncology Indexed in Scopus, PubMed, and WoS from the start to February of 2019. (A) The trend of year-wise publications on the oncology field and the percentage of publications contributed by Iranian researchers. (B) The trend of publications on oncology, according to cancer sites. (C) Year-wise analysis of Iranian research production by cancer site.

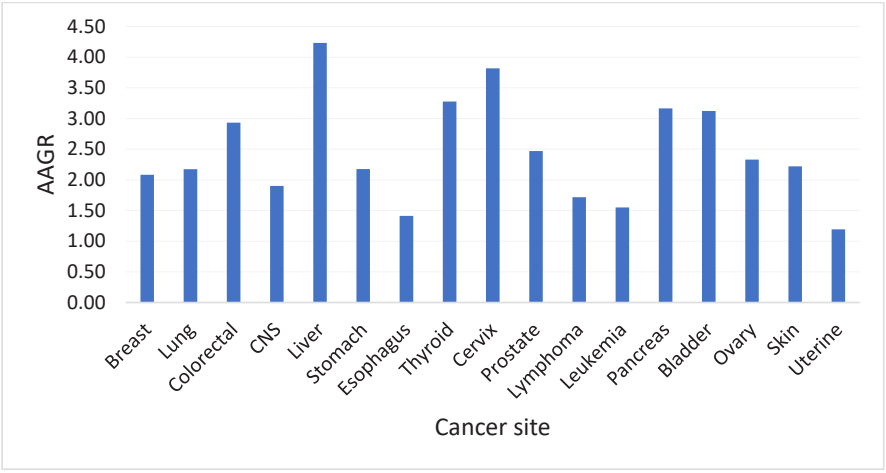

Figure 2. Average Annual Growth Rates (AAGR) of Iranian Cancer Research Publications Indexed in Scopus, PubMed, and WoS by Cancer Site from the Start to February of 2019.

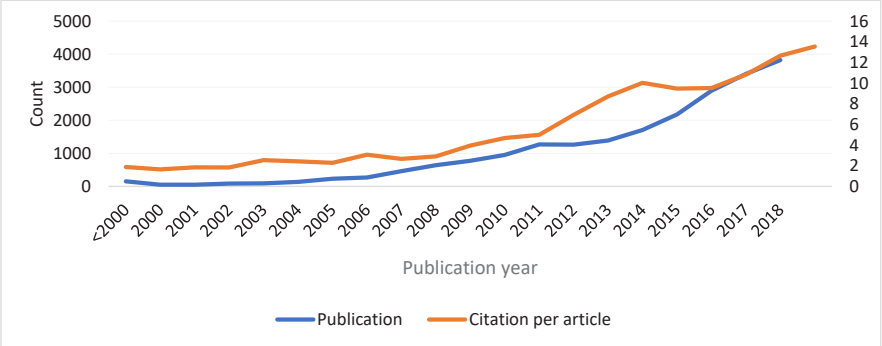

Figure 3. Publication Patterns of Iranian Researches on Oncology Indexed in WoS from the Start to February of 2019 Versus the Received Citations.

apparent that some most common lethal cancers including lung, brain, and nervous system have not been studied enough.

Article Type, Sources, and Major Subjects

Original articles indicated the greatest share of publications in almost all cancers with 92.4% of all published articles related to oncology research, while 4.7% were review articles and the remaining were letters, and conference proceedings (Figure 5A; Supplementary file 2, Table S2). Among all publication sources, the Asian Pacific Journal of Cancer Prevention has published most of the concluded publications followed by the Archives of Iranian Medicine and Journal of Isfahan Medical School (Supplementary file 2, Table S3).

Based on major research subjects, all research publications were categorized as four classes of basic, clinical, epidemiological or therapeutic research. This approach also allowed us to explore whether the research production in the cancer site level is more or less associated with the major capacities and research domains in the country. Our findings indicated that basic sciences had the largest contribution to the national cancer research production followed by epidemiological and clinical sciences (Figure 5B, Supplementary file 2, Table S2). The frequent terms network in Iranian oncology publications is also in concordance with these findings, while revealing some research gaps such as complementary and alternative medicine (CAM) therapies along with weak focus on pharmaceutical researches and diagnostic inventions (Figure 6 and Supplementary file 3). According to this figure, basic science keywords comprised the

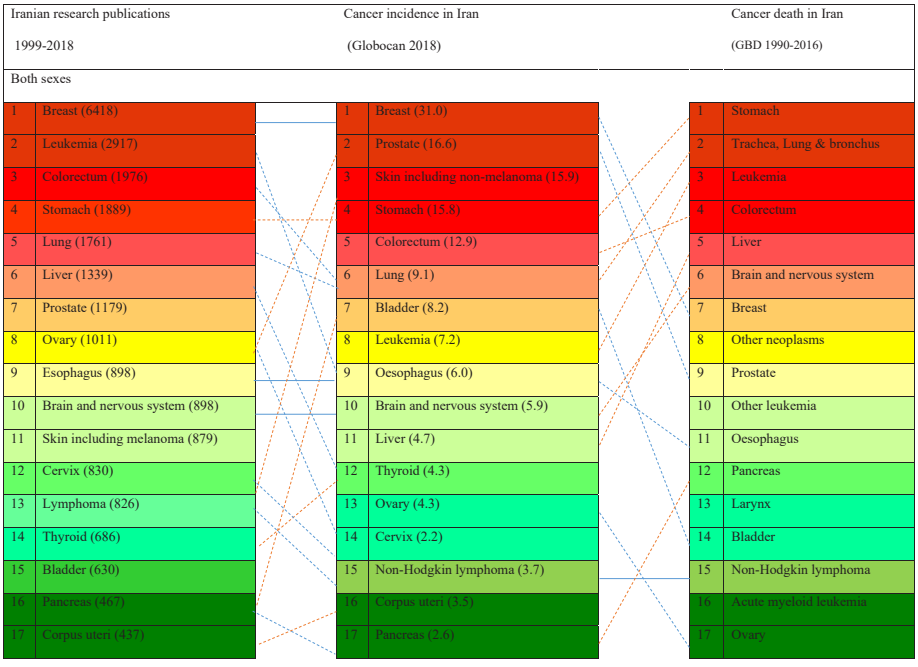

Figure 4. A Comparison of Iranian Cancer Research Publications Indexed in Scopus, PubMed, and WoS Versus Age-Standardized Incidence Rates of Cancers in Iran According to the Globocan 2018 Database and Cancer Death in Iran According to the Global Burden of Disease 1990-2016 (GBD).

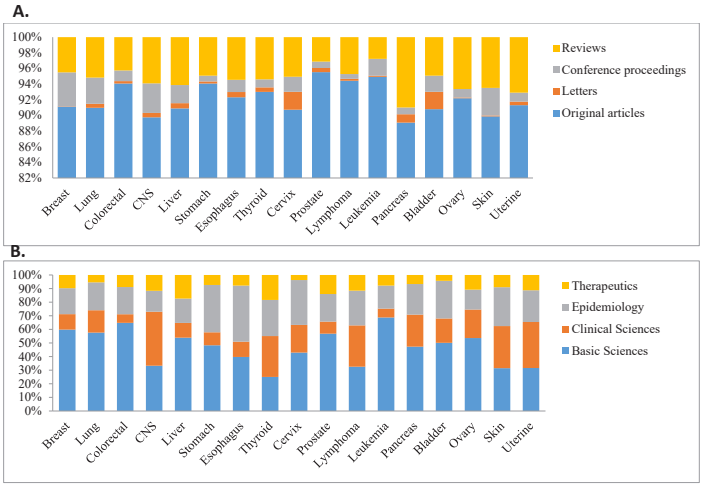

Figure 5. Publication Pattern of Iranian Oncology Researches Indexed in Scopus, PubMed, and WoS Based on (A) Articles Type and (B) Major Research Subjects.

largest proportion of highly cited articles followed by epidemiology and clinical sciences.

Authorship, Co-authorship, and International Collaboration

According to Scopus data, up to February 2019, most of the publications were authored by academics of the Tehran University of Medical Sciences followed by Shahid Beheshti University of Medical Sciences (Supplementary file 2, Table S4). Co-authorship and co-occurrence networks for all included cancers are illustrated in Supplementary file 3. These networks help identify the most productive research areas and individual authors for each cancer site. Based on Scopus results up to February 2019, Iranian researchers active in the oncology field have had the most collaboration with the United States, followed by the United Kingdom and Canada (Figure 7 and Supplementary file 2, Table S5).

Discussion

This study provides interesting insights into the Iranian cancer research landscape. It provides a comprehensive view of the quantity, quality and knowledge gaps of Iranian cancer-related scientific output by analyzing thousands of publications in major scientific datasets. Our findings confirmed the sharp rising pattern of research production in cancer-related fields by Iranian scholars over the past two decades. Additionally, the growing pattern of citations per publication, as well as the overall citation rate, indicated the rising pattern of the quality of publications. Breast cancer, leukemia, and colorectal cancer were the most prominent research topics among cancer sites.

The overall rising pattern of Iranian scientific output in cancer-related fields indicated the growing interest of Iranian scholars and academics in the field of oncology over the past two decades. This pattern was similar to the overall scientific output of Iran in other scientific areas including basic sciences and engineering. Current evidence suggests that the overall annual rate of scientific output in Iran outpaced the global trends in scientific publications.[12-14] According to a published report by the "Science-Matrix", the overall scientific output of Iran

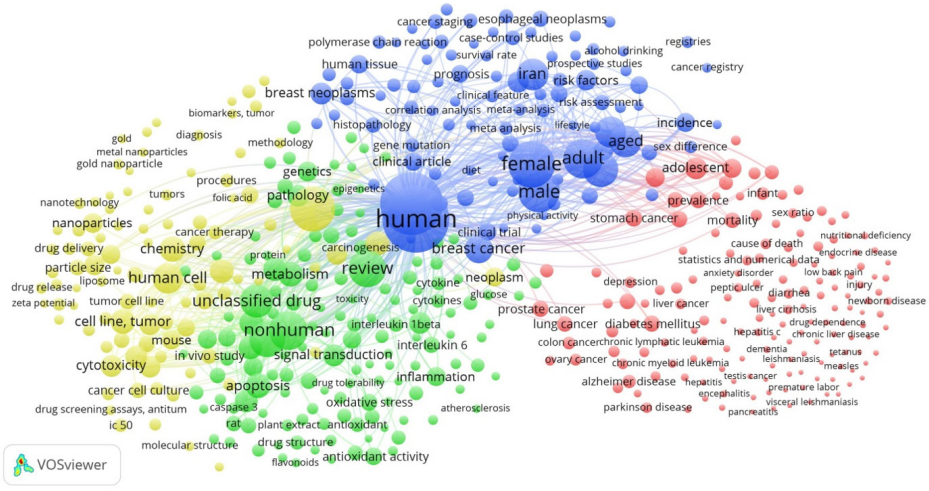

Figure 6. Map of Frequent Terms in the Iranian First 1000 Highly Cited Articles Indexed in Scopus. The size of the nodes is related to the number of documents, and the color reflects clusters of subject terms according to co-occurrence data.

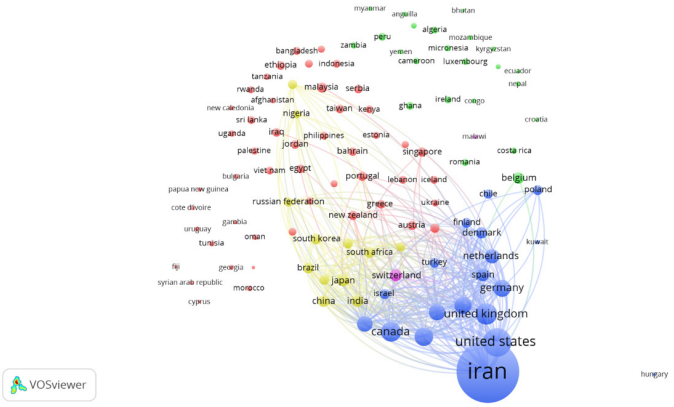

Figure 7. International Collaborations in the Oncology Research Field Based on Iranian Oncology Articles Indexed in Scopus. The size of the nodes is related to the number of documents, and the color reflects clusters of international collaborations according to co-occurrence data.

during 1996-2008 was 18 times higher than the world publication pattern.[12,15] Since then, the rapid growth of scientific output by Iranian scholars was further confirmed by several international reports that confirmed Iran as an emerging regional leader in science. Changes in demographic structure, increased average years of schooling, expansion of university capacities as well as government policies on higher education and research have been well documented as the major factors that affected the Iranian's academic landscape significantly.[14,16,17] However, the role of government policies on faculty promotion and student graduation heavily contingent upon scientific output and publication in peer-reviewed journals has been identified as the key driver contributing to this process.

Besides the quantity of scientific output, citation indicators including citations per publication have been proposed as another aspect of scientific output worldwide. Our findings confirmed the rising pattern of Iranian's scientific impact according to citations per publication indicator over the past two years. However, the available evidence suggested that the quality of Iranian publications (in terms of aggregate citations received) underperformed its global rank in scientific publications. Medicine and health were also presented as areas that received lower rates of citations among other academic disciplines over recent years.[14,16] This process may be justified by a great increase of graduate students over the recent years despite a plausible reduction of new faculty recruitments. Lack of qualified research experts, training on research ethics and lack of strict measures and regulations regarding punishment for plagiarism have resulted in a considerable volume of retracted articles and low-quality publications in a way that manifested Iran as the country with the highest plagiarism and retraction rate among others.[16]

Breast cancer was the dominant topic of Iranian publications over the past two decades. Breast cancer is the most common cancer among women in Iran and the world. According to the GLOBOCAN data, the age-standardized incidence rate of breast cancer was estimated at 28.1 per 100 000 population for Iranian women. However, the age-standardized mortality rate of breast cancer was estimated at 9.9 per 100 000 population. Compared with previous data, the incidence and mortality of breast cancer indicated substantial growth over the recent years and this trend would increase by 2.17-fold by 2035.[18] Colorectal and leukemia are the next common cancers in Iran, indicating a similar growth over the recent years. These striking patterns of incident cancers among the Iranian population call for further resources for the cancer surveillance system and evidence-based cancer control programs. High-quality cancer research is the key driver to produce robust evidence and assist policymakers to establish cost-effective interventions according to national health priorities.

As mentioned previously by several scientometric studies on other subjects, Iranian researches in cancer-related studies are also more concentrated on basic sciences and theoretical innovations rather than systematic reviews of produced theoretical innovations and translating them to functional knowledge.[6,19-21] Both article type analysis and frequent terms networks prove this fact (Figures 5 and 6). Considering the value of systematic review studies in evidence-based decision-making, and even for future research planning, encouraging researchers towards systematic review studies appears to be of high importance.

The strategic diagram on the frequent terms networks of Iranian oncology publications (Figure 6 and Supplementary file 3) revealed that the terms of CAM therapies are missing in the research literature, related to all considered cancers. However, with the rapid clinical development in the oncology field, over the past two decades, the mortality rate among some cancers reduced and the growing survivor group are now dealing with the quality of life challenges caused by treatment-associated side effects.[22,23] Addressing this challenge, CAM therapies are being developed for the treatment of cancer-related comorbidities, and are now being used by approximately one-third of cancer patients in the developed countries.[24] This might be a new research direction that must be

further addressed by Iranian oncology researchers.

While China is the most productive country in the field of oncology research,[10] as represented in the collaboration map (Figure 7), the first notable Iranian collaboration was with the United States, followed by the United Kingdom and Canada. However, it is notable that the United States received more citations than China with approximately 1000 fewer documents and reduced percentage of documents in Q1 proportionally, and is consequently considered a proper candidate for collaboration.[10] According to the results, Iranian researchers have close collaboration with India, as well. A previous study showed that India has greater than 60% of documents published in Q1.[10] Despite this, more effective collaboration with Chinese oncology researchers might be also beneficial.

Further methodological considerations for this study should be noted. First, our findings were limited to searches in the PubMed, WoS and Scopus databases. Searching each database required a special search strategy according to the database's search tips that may lead to different results. For example, MeSH headings are only available through the MEDLINE and PubMed interfaces. Database variations could affect the sensitivity and specificity of retrieved results. However, merging retrieved results from different databases could increase the overall coverage and provide a better overview of the topic of interest. Next, access to citation reports from WoS and Scopus is rather different due to database structures and strategies. Therefore, citation data are not routinely merged as for documents. This could lead to underestimation of citation patterns in this study. We used the age-standardized incidence rate of cancers for comparing current research priorities with the epidemiology of cancers in the country. However, incidence data may have limited implication for priority setting in this area and we need further tools such as the burden of the disease in the country. Unfortunately, comprehensive data about the burden (disability-adjusted life years) was not available for all cancer sites in Iran and therefore, this data was removed from the study. Additionally, our study focused on the quantitative analysis of Iranian publications in cancer science over recent years. So, we failed to compare this process with other countries such as Turkey, Brazil, and China as emerging scientific leaders in the world. But recent evidence[25] demonstrated the global landscape of cancer science by bibliometric and network analysis methods. Findings from this report suggested the contribution of the aforementioned countries to the world's cancer research. Additionally, our study failed to demonstrate the impact of the Iranian cancer-related publications on policymaking, improving the quality of health services provided to patients or even improving the health system. However, the available evidence suggested that a small proportion of scientific publications have been used in policymaking or clinical guidelines. This may be explained by the fact that most research studies are not compatible with national needs and priorities.[26]

In conclusion, this study provides a scientometric analysis of oncology research in Iran from the start up to the February of 2019. Using the three most reliable databases, by the most coverage in health and biomedical publications, this article is a rare study of this kind. While the overall research trend has shown acceptable clear progress, there are still weaknesses, especially in term of systematic reviews of produced theoretical innovations and translating them to functional knowledge. No significant measure was implemented in the field of diagnostic and pharmaceutical innovations, as well. It is necessary to encourage researchers to shift the focus from basic sciences to producing more translational knowledge and providing required evidence and innovations for national evidence-based decision-making and cancer control program. Improving and expanding knowledge exchange networks and encouraging national and international collaboration could be of great value for developing advanced and functional research direction by sharing experience gained over many years of professional work and achievement. It can also encourage researchers to shift the focus from basic sciences to producing more actionable knowledge and providing required evidence and innovations for national evidence-based decision-making and cancer control.

Authors' Contribution

MRM, MAM and AMJ conceived and designed the study and contributed to data analysis, interpretation and manuscript preparation. AB collected the data, performed the main analysis, and contributed to manuscript preparation. AA, HA, and RO contributed to data analysis, interpretation and manuscript preparation. MA wrote the paper and contributed to data gathering, analysis, and interpretation.

Conflict of Interest Disclosures

The authors declare that there is no conflict of interest.

Ethical Statement

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been totally considered by all authors.

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Supplementary Materials

Supplementary file 1 shows literature search strategies. Supplementary file 2 contains Tables S1-S5. Supplementary file 3 contains co-occurrence and co-authorship networks of research domains according to cancer sites.

References

1. WHO. The 10 leading causes of death in the world, 2000 and 2012. Available from: https://www.who.int/en/news-room/fact-sheets/detail/the-top-10-causes-of-death/. Accessed

March 2019.
2. Saadat S, Yousefifard M, Asady H, Jafari AM, Fayaz M, Hosseini M. The most important causes of death in Iranian population; a Retrospective Cohort Study. Emergency. 2015;3(1):16–21.
3. Forouzanfar MH, Sepanlou SG, Shahraz S, BESc PN, Pourmalek F, Lozano R, et al. Evaluating causes of death and morbidity in Iran, global burden of diseases, injuries, and risk factors study 2010. Arch Iran Med. 2014;17(5):304-20.
4. Barua SK, Raghunathan V, Varma JR. Research on the Indian capital market: a review. Vikalpa. 1994;19(1):15-32. doi: 10.1177/0256090919940102.
5. Davarpanah MR. A scientometric model for the assessment of strength and weakness of scientific disciplines: A domain-based analysis. Libr Rev. 2010;59(8):596-605. doi: 10.1108/00242531011073128.
6. Peykari N, Hashemi H, Asghari G, Ayazi M, Janbabaei G, Malekzadeh R, et al. Scientometric study on non-communicable diseases in Iran: A review article. Iran J Public Health. 2018;47(7):936-43.
7. Zarei M, Bagheri-Saweh MI, Rasolabadi M, Vakili R, Seidi J, Kalhor MM, et al. Breast cancer research in Iran: a scientometric analysis of publications output from 1991 to 2015 in Scopus. Electron Physician. 2017;9(2):3816-22. doi: 10.19082/3816.
8. Ghojazadeh M, Naghavi-Behzad M, Nasrolah-Zadeh R, Bayat-Khajeh P, Piri R, Mirnia K, et al. Knowledge production status of Iranian researchers in the gastric cancer area: based on the medline database. Asian Pac J Cancer Prev. 2014;15(12):5083-8. doi: 10.7314/apjcp.2014.15.12.5083.
9. Shao H, Yu Q, Bo X, Duan Z. Analysis of oncology research from 2001 to 2010: a scientometric perspective. Oncol Rep. 2013;29(4):1441-52. doi: 10.3892/or.2013.2239.
10. Moral-Munoz JA, Carballo-Costa L, Herrera-Viedma E, Cobo MJ. Production Trends, collaboration, and main topics of the integrative and complementary oncology research area: a bibliometric analysis. Integr Cancer Ther. 2019;18:1534735419846401. doi: 10.1177/1534735419846401.
11. Begum M, Lewison G, Jassem J, Mixich V, Cufer T, Nurgozhin T, et al. Mapping cancer research across Central and Eastern Europe, the Russian Federation and Central Asia: Implications for future national cancer control planning. Eur J Cancer. 2018;104:127-36. doi: 10.1016/j.ejca.2018.08.024.
12. Wilsdon J. Knowledge, networks and nations: Global scientific collaboration in the 21st century. Available from: http://sro.sussex.ac.uk/id/eprint/45410/. Accessed March 2019.
13. Hosseini Nasab E, Hosseini Nasab E. Inducements to scientific outputgrowth: the experience of Iran. Am J Soc Mgmt Sci. 2011;2(4):384-91.
14. Kharabaf S, Abdollahi M. Science growth in Iran over the past 35 years. J Res Med Sci. 2012;17(3):275-9.
15. Science-Metrix. 30 Years in science. Secular movements in knowledge creation. 2010. Available from: http://www.science-metrix.com/?q=en/30years-Paper.pdf.
16. Sadeh S, Mirramezani M, Mesgaran MB, Feizpour A, Azadi P. The Scientific Output of Iran: Quantity, Quality, and Corruption, Working Paper 7, Stanford Iran 2040 Project. Stanford University; February 2019.
17. Habibzadeh F. A bird's eye view of science publishing and editing in Iran. Eur Sci Edit. 2006;32(4):98-100.
18. Mohebbi E, Nahvijou A, Hadji M, Rashidian H, Seyyedsalehi MS, Nemati S, et al. Iran cancer statistics in 2012 and projection of cancer incidence by 2035. BCCR. 2017;9(3):3-22.
19. Foroughi Z, Siamian H, Alizadeh-Navaei R, Davodi A. The relation between iranian medical science research in PubMed and burden of disease. Acta Inform Med. 2016;24(4):271-6. doi: 10.5455/aim.2016.24.271-276.
20. Ghanei M, Eftekhari MB. Health research system evaluation in IR of Iran. Arch Iran Med. 2012;15(7):394-99.
21. Habibi E, Mesgarpour B, Vasei M. Research assessment of Iranian medical universities, an experience from a developing country. Iranian J Publ Health. 2009;38(1):47-9.
22. Caro-Moran E, Fernandez-Lao C, Galiano-Castillo N, Cantarero-Villanueva I, Arroyo-Morales M, Díaz-Rodríguez L. Heart rate variability in breast cancer survivors after the first year of treatments: a case-controlled study. Biol Res Nurs. 2016;18(1):43-9. doi: 10.1177/1099800414568100.
23. Cho H, Mariotto AB, Mann BS, Klabunde CN, Feuer EJ. Assessing non–cancer-related health status of US cancer patients: other-cause survival and comorbidity prevalence. Am J Epidemiol. 2013;178(3):339-49. doi: 10.1093/aje/kws580.
24. Wyatt G, Sikorskii A, You M. Self-reported use of complementary and alternative medicine therapies in a reflexology randomized clinical trial. Altern Ther Health Med. 2013;19(5):31-7.
25. Cabral BP, Fonseca MdGD, Mota FB. The recent landscape of cancer research worldwide: a bibliometric and network analysis. Oncotarget. 2018;9(55):30474-84. doi: 10.18632/oncotarget.25730.
26. Yazdizadeh B, Majdzadeh R, Janani L, Mohtasham F, Nikooee S, Mousavi A, et al. An assessment of health research impact in Iran. Health Res Policy Syst. 2016;14(1):56. doi:10.1186/s12961-016-0129-9.