

# Forty-seven years of Iranian cardiovascular disease scientific publication: A bibliometric and altmetric analysis

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## Original Article

### Abstract

**BACKGROUND:** The present study was conducted to investigate the scientific contributions of Iranians in the field of cardiovascular research, as indexed in the Scopus database, using bibliometric and altmetric methods.

**METHODS:** This applied study was conducted with a scientometric approach, utilizing bibliometric and altmetric indicators. The research population consisted of the scientific works of Iranian researchers in the field of cardiovascular diseases, indexed in the Scopus database over a period of 47 years. For bibliometric analysis and the generation of co-citation, co-occurrence, and co-authorship maps, the authors employed VOS Viewer software and the bibliometrix package in the R programming language. In the final stage, articles mentioned on social media were analyzed and evaluated using an altmetric approach.

**RESULTS:** The results indicated that the commencement point for the publication of documents was 1975, and there has been a steep increase in recent years. Moreover, the documents were primarily research articles out of 6853 retrieved documents, and a limited number of documents were single-authored. Other findings also revealed the co-authorship map of authors and the co-occurrence of words, highly cited authors and institutions, and highly frequent keywords, signifying the scientific collaboration of Iranian researchers with the United States and England. Altmetric analysis also demonstrated that 43.41% of documents were shared at least once on social media and had an Altmetric Attention score. Furthermore, the analysis of altmetric indices showed that Mendeley, Twitter, and News had the highest share of document mentions on social media, respectively.

**CONCLUSION:** The findings of the study can offer valuable information to researchers, managers, and policy makers to become aware of the current state of research in the field of cardiovascular diseases and implement the necessary policies to inform society and enhance public health status.

**Keywords:** Cardiovascular Diseases; Publications; Altmetric; Social Media; Scientometrics; Bibliometrics

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## Introduction

Cardiovascular diseases are among the most prevalent non-communicable diseases globally<sup>1</sup>, necessitating substantial costs for healthcare systems<sup>2,3</sup>. These diseases are also one of the primary causes of death worldwide<sup>4,6</sup>, and the number of deaths attributed to these diseases is increasing annually. While the number of deaths related to cardiovascular diseases was 17.5 million in 2012, this figure rose to 17.9 million in 2016, and it is projected to reach 22.2 million by 2030<sup>1</sup>. Such diseases cause families to suffer by reducing their quality of life at the micro level, but at the macro level, they impose a significant financial burden on countries' health budgets<sup>7</sup>. The adverse effects of cardiovascular diseases are particularly noticeable in low- and middle-income countries, where mortality rates from cardiovascular diseases are higher.

In this context, it is crucial to address the scientific productions of some health topics, including cardiovascular diseases, which are one of the main causes of death worldwide<sup>4,6</sup>, as they impose a double financial burden on countries' health budgets at the macro level<sup>7</sup>.

Nowadays, academic institutions and public and private funding sectors primarily consider the evaluation of the quality and productivity of scientific works as a parameter to measure academic excellence for resource prioritization, using various techniques such as bibliometrics, altmetrics, etc. The bibliometric technique is deemed a powerful tool in conducting citation analysis and assessing a scientist's scientific influence in the scientific community. In fact, bibliometric analysis is widely used to understand the structure of knowledge and discover development trends using quantitative and qualitative analyses<sup>8,9</sup>. This method provides the possibility to quantitatively measure the distribution of the domain outline and the relationship and clustering of research. It also addresses issues such as the historical trend of the subject, the contribution of authors, institutions, countries, leading journals, frequently used keywords, highly cited articles, etc., in addition to describing and predicting the future development of a specific research field<sup>10-12</sup>. This analytical approach plays a vital role in formulating scientific guidelines, understanding research centers, and evaluating research trends<sup>13</sup>. Many health

fields, including gastrointestinal diseases<sup>14</sup>, cancer diseases<sup>15,16</sup>, rheumatic system diseases<sup>17</sup>, nervous system diseases<sup>18</sup>, orthopedics<sup>19</sup>, neurosciences<sup>20</sup>, ophthalmology<sup>12,21</sup>, and otolaryngology<sup>22</sup>, have been investigated using this method.

On one hand, the value of the citation rate in the bibliometric approach has always been a topic of discussion. Researchers in altmetrics have begun using alternative metrics (altmetrics) for the evaluation of scientific outputs, highlighting the limitations of bibliometrics and emphasizing the importance of social media in establishing scientific communications, disseminating research findings, and the speed of altmetrics. However, altmetric indices can be used alongside citation indices to evaluate the effectiveness of scientific outputs as a complement, not a substitute<sup>23-26</sup>. In this regard, many studies in the field of health have measured scientific productions using altmetric indices, such as those of diabetes mellitus<sup>27</sup>, pediatric surgery<sup>28</sup>, emergency medicine<sup>29</sup>, stroke<sup>24</sup>, radiology<sup>30</sup>, neuroimaging<sup>31</sup>, and cardiology<sup>32,33</sup>.

In recent years, researchers have shown a strong inclination to use bibliometric and altmetric indices to evaluate research outputs. Altmetrics researchers have demonstrated that altmetric indices may be used as a complement, not a substitute, along with reference indices to evaluate the effectiveness of scientific outputs. They mention the limitations of bibliometrics (high dependence on time, the need to access expensive databases, and the lack of indexing of all information items in citation databases) and express the importance of social media in establishing scientific communications, disseminating research findings, and the speed of alternative measures in the evaluation of scientific outputs.

On the other hand, some studies have uncovered and extracted the hidden issues of various subject areas using topic modeling. However, none of the studies employing both approaches (bibliometrics and altmetrics) have investigated scientific productions in the field of cardiovascular diseases. Therefore, the current research aimed to examine the scientific productions in this field using such an approach to provide an important parameter for prioritizing the research budget, with an emphasis on cost-effectiveness available to experts, researchers, and policymakers in this field.

It is necessary to pay attention to the evaluation of scientific products related to cardiovascular diseases,

which directly deal with societal health, to formulate policies and clinical guidelines. This can assist researchers in developing new ideas, providing a clear view of authors, countries, institutions, top journals, and influential researchers about emerging hot issues. Thus, the present study evaluated the scientific productions of researchers regarding cardiovascular diseases using bibliometric and altmetric indices and assessed articles on social networks, in addition to monitoring the number of citations.

Since cardiovascular diseases have a high disease burden, the results of this research can lead to the correct allocation of funds for various categories in the field of cardiovascular diseases. Policymakers and cardiology specialists can use the results of this research to plan for the future of scientific productions in this field. By following the elites of this field, the top journals, as well as the top countries, and also identifying the authors who have the most impact as core authors on the products, they have tried to modify some processes and bring theory and practice closer together.

The main objective of this study is to investigate the scientific productions made by Iranians in the field of cardiovascular diseases indexed in the Scopus database using bibliometric and altmetric methods. The sub-questions of the research are as follows:

1. To determine the publication trend and received citations of scientific productions in the field of cardiovascular diseases.
2. To determine top sources in scientific productions in the field of cardiovascular diseases.
3. To determine the influential authors and most cited articles in scientific productions related to cardiovascular diseases.
4. To determine productive countries and institutions participating in scientific productions of cardiovascular diseases.
5. To determine keywords with the highest frequency in scientific productions of cardiovascular diseases made by Iranian researchers.
6. To determine the co-authorship map of authors of scientific productions in the field of cardiovascular diseases.
7. To determine the co-occurrence map of scientific productions' keywords on cardiovascular diseases.
8. To determine altmetric analysis of scientific productions of cardiovascular diseases.

These objectives will guide the research process

and help to structure the final report of the study.

## Materials and Methods

This research was conducted using a scientometric approach and employing bibliometric and altmetric indicators. The research population consisted of all scientific productions by Iranians in the field of cardiovascular diseases, indexed in Scopus over a period of 47 years (January 1, 1975, to October 25, 2022), which includes 6853 records. This database is multidisciplinary with comprehensive and complete search capabilities, and due to its criteria for selecting journals, it has a wider inclusion than other citation databases.

In the first stage, all articles from the Scopus database were included in the study without sampling, using the following search strategy: (TITLE-ABS-KEY (“cardiovascular disease”) OR TITLE-ABS-KEY (“cardiovascular diseases”) OR TITLE-ABS-KEY (“Disease, Cardiovascular”) OR TITLE-ABS-KEY (“Diseases, Cardiovascular”) AND AFFIL (IRAN)).

All types of scientific productions with an organizational affiliation to Iran were considered for inclusion in the study. In the second stage, VOS Viewer software and the bibliometrix package in the R programming language were used for bibliometric analysis and the creation of co-citation, co-occurrence, and co-authorship maps. In the final stage, Altmetrics Explorer was used to extract Altmetrics indices, and the top articles were evaluated in terms of Altmetrics Attention Score (AAS), the number of citations from Scopus, Web of Science, and Dimensions, and presence on various social media platforms such as Twitter, Facebook, Blogs, News, Wikipedia, and Mendeley.

## Results

Table 1 presents data from 6853 publications by Iranian researchers in the Scopus database, spanning from 1975 to 2022. These publications were contributed to by 27,627 authors. Of these documents, 139 were authored by a single individual. On average, each article had contributions from eight authors, and the average citation per document was 23.52. The most common types of sources were research articles, with 4940 records, followed by review articles, which had 1475 records.

*Determining the publication trend and received citations of Iranians' scientific productions in the field of cardiovascular diseases*

Figure 1 illustrates the trends in publication and citation of scientific works in the field of cardiovascular diseases. This study spans a 47-year period, with the most significant increase in published articles occurring in recent years. The first article dates back to 1975, while the years 2022 and 2021 saw the most articles, with 983 and 929 articles respectively. Additionally, the highest average total citations per article was recorded for 105 articles in 2000, and the highest average of citations per year (6.52) was observed for articles published in 2017.

*Determining top producing sources in Iranians' scientific productions in the field of cardiovascular diseases*

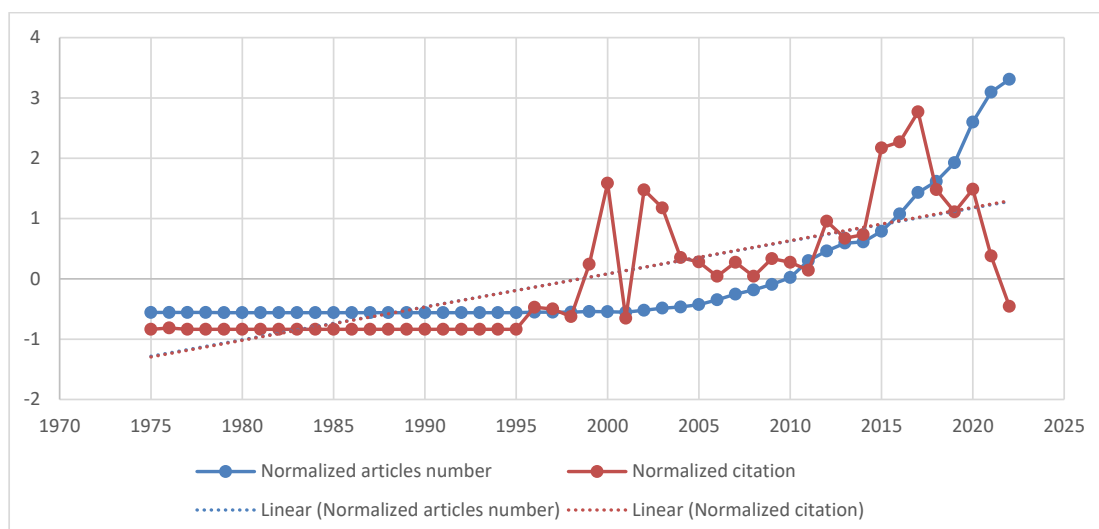
An analysis of documents published in the field of cardiovascular diseases by Iranian researchers indicates that three publications have the largest number of scientific contributions in this field. "Arya Atherosclerosis" leads with 141 documents, followed by the Journal of Isfahan Medical School with 96 documents, and the Archives of Iranian Medicine with 91 documents (Figure 2).

*Determining the Iranian influential authors and the most cited articles in scientific productions related to cardiovascular diseases*

Azizi and Sahebkar are the most prolific authors

**Table 1.** Iranian cardiovascular diseases' documents bibliometric characteristics

Main information about data		Document types	
Timespan	1975:2022	Article	4940
Documents	6853	Review	1475
Sources (Journals, Books, etc.)	1859	Letter	153
Average citations per doc	23.52	Book chapter	125
Annual Growth Rate %	5.65	Conference paper	65
Document Average Age	4.81	Editorial	41
<b>Authors</b>		Note	25
Authors	27627	Short survey	20
Authors of single-authored docs	139	Erratum	5
<b>Authors collaboration</b>		Book	2
International co-authorships %	28.28	Article in press	1
Co-authors per doc	8.72	Data paper	1



**Figure 1.** Distribution of publications and citations in Iranians' cardiovascular diseases documents by year from 1975 to 2022.

in the field of cardiovascular diseases, with 338 and 291 articles respectively (Figure 3). Sahebkar tops the citation index with 14,056 citations. The document titled “Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden

of Disease Study 2010,” published in The Lancet in 2012, has the highest citation frequency in this field with 5,496 citations (Table 2). A significant proportion of the top 10 most frequently cited articles on cardiovascular diseases have been published in The Lancet.

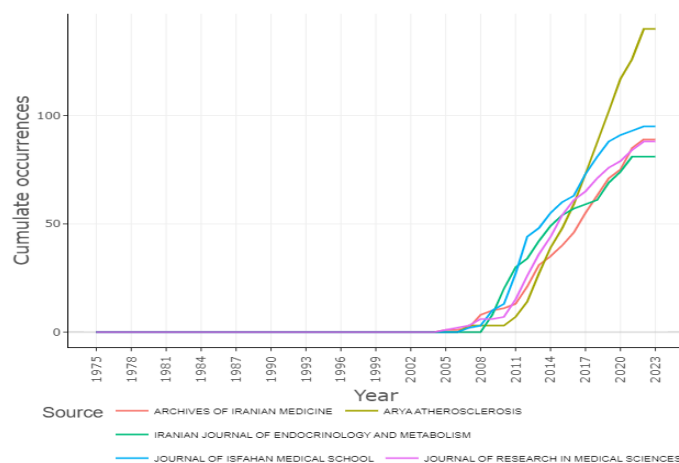


Figure 2. Determining the most active sources in Iranian cardiovascular diseases documents

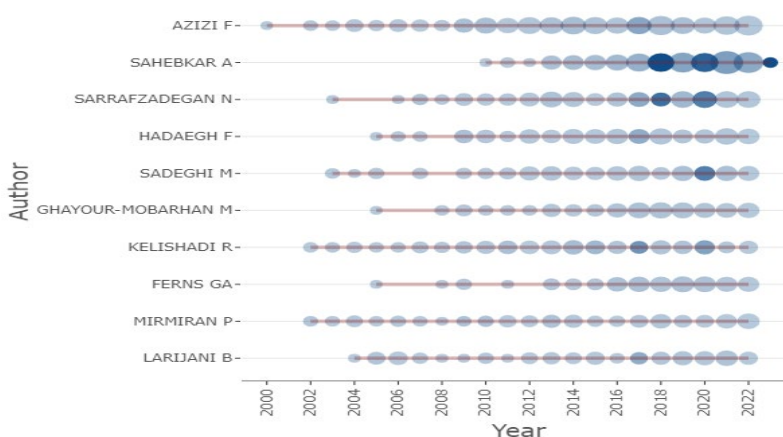


Figure 3. Determining the Iranian influential authors of cardiovascular diseases documents

Table 2. Determining the most cited cardiovascular documents authored by Iranians

Rank	DOI of Paper	Journal	Total Citations	TC per Year	Normalized TC
1	10.1016/S0140-6736(12)61729-2	THE LANCET	5496	499.64	141.41
2	10.1016/S0140-6736(14)61682-2	THE LANCET	5329	666.13	108.76
3	10.1016/S0140-6736(16)31678-6	THE LANCET	4419	631.29	98.23
4	10.1016/S0140-6736(17)32154-2	THE LANCET	4053	675.50	75.69
5	10.1016/S0140-6736(16)31012-1	THE LANCET	4013	573.29	89.20
6	10.1056/NEJMoa1614362	NEW ENGL J MED	3544	590.67	66.19
7	10.1016/S0140-6736(18)32203-7	THE LANCET	3369	673.80	134.12
8	10.1016/S0140-6736(17)32152-9	THE LANCET	2871	478.50	53.62
9	10.1016/j.jacc.2017.04.052	J AM COLL CARDIOL	2032	338.67	37.95
10	10.1016/S0140-6736(15)00128-2	THE LANCET	1898	237.25	38.74

*Determining productive countries and institutions participating in Iranians' scientific productions of cardiovascular diseases*

As per Figure 4 and Table 3, the greatest scientific collaboration in the field of cardiovascular diseases by Iranian researchers has been with the United States and England, with 676 and 514 articles respectively. Furthermore, Tehran University of Medical Sciences and Mashhad University of Medical Sciences are the most active and prominent institutions participating in Iranian scientific output in the field of cardiovascular diseases, with 2782 and 2245 scientific contributions respectively.

*Determining keywords with the highest frequencies in Iranians' scientific productions of cardiovascular diseases*

The tree map in Figure 2 displays that the keyword Metabolic Syndrome had the highest frequency of 348, followed by Obesity with frequency of 320, and then Hypertension with frequency of 291 in documents.

*Determining the co-authorship map of Iranian authors of scientific productions in the field of cardiovascular diseases*

Figure 7 illustrates the co-authorship map of Iranian authors in the field of cardiovascular diseases.

Authors with more scientific connections are closer together, while those with fewer connections are further apart. The study reveals that there are 27,570 authors in the field of cardiovascular diseases who have contributed to all the research in the Scopus database affiliated with Iran.

Of these, 17,665 authors with at least five university degrees were selected, and 1,308 of these authors were considered for the co-authorship network. This network comprises 16 clusters, 9,698 links, and a total link strength of 24,006. The largest cluster includes 144 authors.

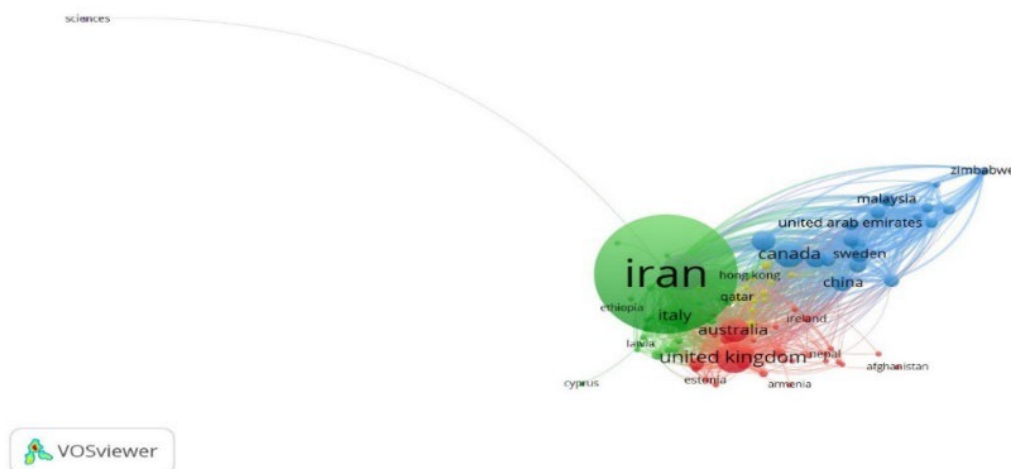
Further findings show that Azizi, F ranks highest in terms of research collaboration, with 330 documents, 146 links, and a total link strength of 1,138. Sahebkar, A, with 8,129 citations, a total link strength of 833, and 160 links, holds the highest rank.

*Determining the keyword co-occurrence map of Iranians' scientific productions in cardiovascular diseases*

The keyword co-occurrence map of Iranian documents on cardiovascular diseases is instrumental in identifying significant, trending, and widely used areas. This map aids researchers in staying informed

**Table 3.** Determining most productive countries participating in Iranians' cardiovascular documents

From	To	Frequency	From	To	Frequency
IRAN	USA	676	IRAN	POLAND	215
IRAN	UNITED KINGDOM	514	IRAN	INDIA	196
IRAN	AUSTRALIA	324	IRAN	CHINA	188
IRAN	CANADA	324	IRAN	SWEDEN	153
IRAN	ITALY	278	IRAN	GERMANY	137



**Figure 4.** Visualization map of most productive countries participating Iranian cardiovascular diseases documents



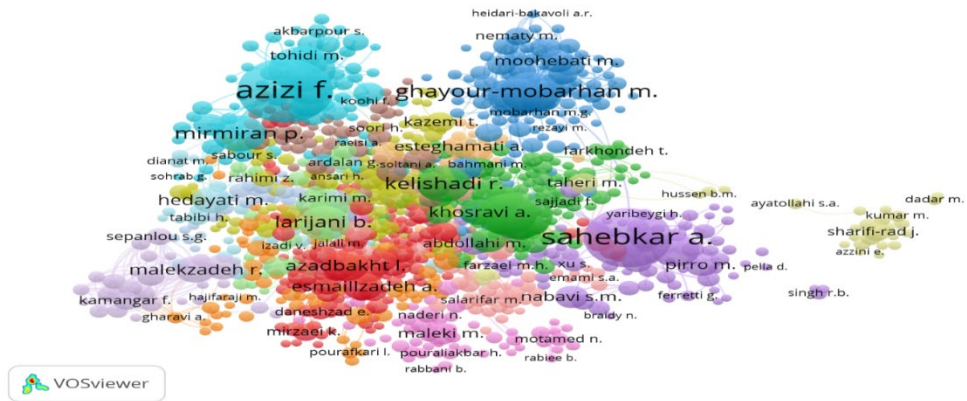


Figure 7. Co-authorship map of Iranian researchers contributing to cardiovascular diseases documents

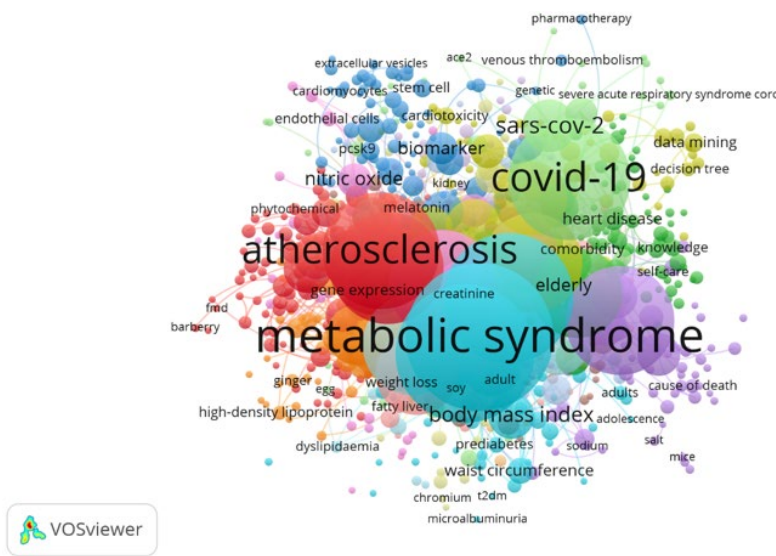


Figure 8. Keyword co-occurrence of keywords in documents related to cardiovascular diseases published by Iranian researchers

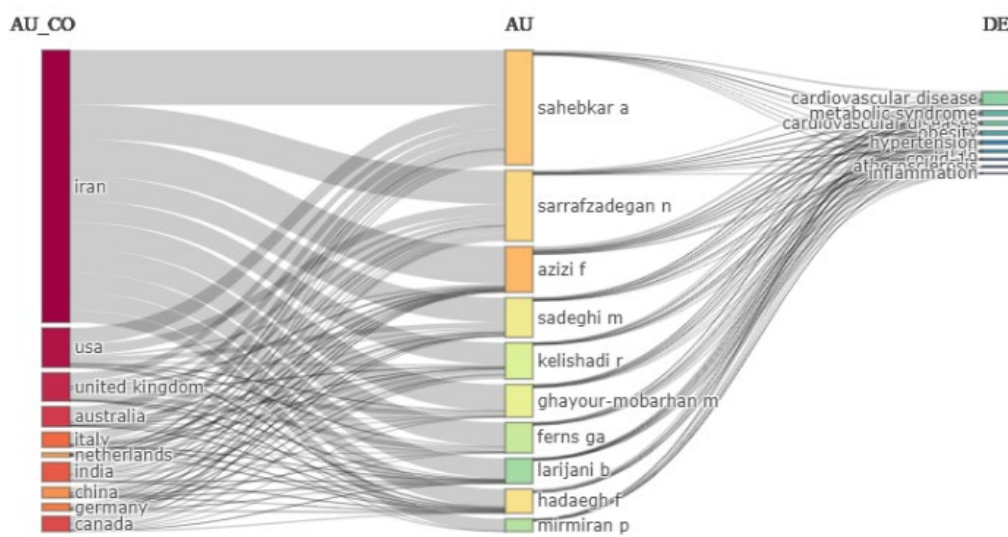


Figure 9. Sankey-diagram of Iranian researchers' cardiovascular disease documents



**Table 4.** The Altmetrics score of top 10 highly-mentioned publications

Rank	First Author, Year, Title	Journal	AAS	NC	BC	PC	TC	FBC	WC	MC	Dimensions Citation	Scopus Citation	WOS Citation
1	Dehghan M. (2017). Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study	The Lancet	7748	340	36	5	11913	526	13	2135	736	698	617
2	Afishin, A. (2017). Health Effects of Overweight and Obesity in 195 Countries over 25 Years	New England journal of medicine	3586	350	26	32	2845	179	14	4579	4312	3922	2786
3	Barber, RM. (2017). Healthcare Access and Quality Index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990–2015: a novel analysis from the Global Burden of Disease Study 2015	The lancet	2715	214	6	7	1904	58	1	1746	415	390	328
4	Lear, SA. (2017). The effect of physical activity on mortality and cardiovascular disease in 130 000 people from 17 high-income, middle-income, and low-income countries: the PURE study.	The lancet	2647	187	8	1	3623	57	1	1176	722	646	604
5	Dehghan M. (2018). Association of dairy intake with cardiovascular disease and mortality in 21 countries from five continents (PURE): a prospective cohort study	The lancet	2618	232	18	1	1801	52	1	684	261	243	225
6	Dehghan M. (2020). Association of egg intake with blood lipids, cardiovascular disease, and mortality in 177,000 people in 50 countries	The American Journal of Clinical Nutrition	2449	133	11	0	2532	27	0	205	58	52	51
7	Miller, V. (2017). Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study	The lancet	1942	185	10	11	1407	80	0	1230	379	369	331
8	Roshandel, G. (2019). Effectiveness of polypill for primary and secondary prevention of cardiovascular diseases (PolyIran): a pragmatic, cluster-randomised trial	The lancet	1700	206	8	1	565	9	0	427	157	153	142
9	Ge, L. (2020). Comparison of dietary macronutrient patterns of 14 popular named dietary programmes for weight and cardiovascular risk factor reduction in adults: systematic review and network meta-analysis of randomised trials	BMJ	1578	266	17	0	694	9	2	548	170	158	142
10	Mente, A. (2018). Urinary sodium excretion, blood pressure, cardiovascular disease, and mortality: a community-level prospective epidemiological cohort study	The lancet	1508	178	13	1	804	27	1	390	207	195	183

AAS: Altmetric Attention Score; NC: news count; BC: blog count; ; PC: Policy Source TC: twitter count; FBC: Facebook count; WC: Wikipedia count; MC: Mendeley count

least once on social media and had an Altmetrics Attention score; 3010 documents (56.58%) were not mentioned on any social media.

Analysis of Altmetric indices indicates that these documents have been mentioned 354034 times through online social media, with Mendeley having the largest share with 266224 readers, followed by Twitter in second place with 71706 mentions, and News in third place with 8292 readers. [Table 4](#) provides the most important altmetric indices of the 10 articles with the highest Altmetric Attention score.

The findings show that Mahshid Dehghan *et al.*'s article entitled "Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study" had the highest Altmetric score (7747) and the first rank. This article was published in November 2017 in *The Lancet* and has so far managed to get 617 citations in Web of Science and 698 citations in Scopus. It has been mentioned in news stories 340 times through different news outlets. Moreover, it has been shared 36 times through blogs, five times through policies, 11913 times through Twitter, 526 times through Facebook, and 13 times through Wikipedia. This article has 2135 readers in Mendeley and 736 in Dimensions. After that, Afshin, A *et al.*'s (2017) article is ranked second with a score of 3586, and Barber, RM's (2017) article is ranked third with a score of 2715. The Altmetric indices of the other top 10 articles are presented in [Table 3](#).

Also, the results revealed that seven articles with high altmetric indices were published in *The Lancet*, and the first author of three articles was Mahshid Dehghan, showing that this author has a special focus on sharing articles on social media.

## Discussion

This study was conducted to review scientific productions on cardiovascular diseases indexed in Scopus using bibliometric and altmetric methods. The bibliometric analysis showed that the starting point for the publication of documents was 1975 and has increased with a steep slope in recent years; this trend is expected to continue with a positive slope for the upcoming years. The results are consistent with many scientific research studies in different study subjects in terms of an ascending trend<sup>34</sup>. The increasing trend indicates researchers' increasing

attention to this group of diseases. Many studies have reported the increasing trend of scientific production in various subjects, especially in the field of medicine and health, which is in line with the results of the present study<sup>21,35-37</sup>. It is notable that the number of scientific products for cardiovascular diseases as the first burden of disease in the world have increased over the years<sup>38</sup>. Also, the results manifested that out of 6853 retrieved documents, research articles were the most frequent, and a limited number of documents were single authored. Senthil Kumar also concluded that articles are a common type of documents<sup>39</sup>.

Azizi and Sahebkar are the most prolific authors with 338 and 291 articles, respectively, and Sahebkar is among the most cited authors in the field of cardiovascular studies with 14056 citations based on citation indices. Also, the three publications "Arya Atherosclerosis", "Journal of Isfahan Medical School", and "Archives of Iranian Medicine" had the largest number of articles in this field. Among the universities and institutes, Tehran University of Medical Sciences and Mashhad University of Medical Sciences are the most prolific and prominent participating. The most scientific cooperation of Iranian researchers in the field of cardiovascular diseases has been with America and England with 676 and 514 articles respectively. Sahebkar is the main contributor with Iran, America, England, Australia, Italy, and Holland. These findings confirm the results of other studies that Iranian writers usually have the most cooperation with countries such as America and England<sup>40,41</sup>.

The visualization maps, created using the co-occurrence of keywords, provide a snapshot of the topics related to cardiovascular diseases and the relationships between these concepts. The most frequent keywords in the documents were Metabolic Syndrome, Nitric Oxide, Body Mass Index, COVID-19, and Atherosclerosis. Additionally, the keywords Metabolic Syndrome and Hypertension were the most technologically advanced in documents related to cardiovascular diseases. Such analyses are crucial for determining the trend of studies and identifying gaps in cardiovascular diseases.

The co-authorship map of Iranian authors in the field of cardiovascular diseases reveals that the co-authorship network includes 16 clusters, 9698 links, and a total link strength of 24006. The largest cluster

consists of 144 authors. Kuzhabekova's research demonstrated that co-authorship strategies have varying effects on productivity, and researchers who act as intermediaries between other researchers are often the most productive authors in the field under investigation<sup>42</sup>.

Research related to the field of cardiology often involves many specialties working together as a team, resulting in numerous networks of scientific productions among researchers with different specialties from different countries. This represents the ability of teams to effectively collaborate and integrate knowledge from diverse perspectives<sup>43</sup>, and to answer solution-oriented research questions<sup>44</sup>.

Other results regarding altmetric analysis indicate that articles on cardiovascular diseases by Iranian researchers have been reported on various social media platforms such as Twitter, Facebook, Blogs, News, Wikipedia, and Mendeley. According to the database of the Altmetrics Institute, 43.41% of documents have been shared at least once on social media and possess an Altmetrics Attention Score. This suggests a relatively high focus on these articles by researchers and social network users. Social media platforms have the potential to display and measure the amount of attention each article garners. While it may take years for an article to receive citations, the number of downloads, views, and mentions on social media can be reported in days or even hours<sup>45</sup>.

The assessment of altmetric indices reveals that these documents have been mentioned 354034 times through online social media. Mendeley had the largest share of sharing with 266224 readers, followed by Twitter in second place with 71706 mentions, and News in third place with 8292 readers. The superiority of Mendeley over other social networks could perhaps be attributed to its ease of use, user-friendliness, and free access. Robinson, Goltaj, and Jokar also concluded that social media, especially Twitter and Mendeley, are potent tools in terms of possessing altmetric data<sup>46,47</sup>. Furthermore, Twitter has garnered more attention than other media following Mendeley's social network. This is also in line with the results of Costas et al., who reported that medical researchers tend to share their findings through Twitter due to the short half-life of publications in this field. In fact, the highest level of social media usage belongs to medical science researchers<sup>48</sup>.

The findings reveal that seven out of the top 10 articles, based on Altmetric indices, have been published in *The Lancet*. This aligns with the study of Batoli and Sayah regarding the significance of the journal<sup>49</sup>. Conversely, Mahshid Dehghan was the first author of three articles, demonstrating her particular emphasis on sharing articles on social media. An article with the DOI: 10.1016/S0140-6736(17)32252-3 has been featured in news stories 340 times across various news outlets. In addition, it has been shared 36 times through blogs, five times through policies, 11913 times on Twitter, 526 times on Facebook, and 13 times on Wikipedia. It has had 2135 readers on Mendeley and 736 on Dimensions. Since scientific productions in any format are viewed as one of the products derived from research activities, it is feasible to identify the beneficiaries and audiences in any subject area, akin to any other products, and then market the products using existing channels. With the advancement of information and communication technology and various platforms based on artificial intelligence, they can serve as a platform for marketing scientific products. Social networks and their analysis offer greater visibility of scientific products and their accessibility for policy makers and physicians in the scientific areas.

## Conclusion

One of the most effective methods in the evaluation of evidence-based studies is the use of bibliometric and altmetrics approaches in assessing scientific outputs covered by global citation databases. The current results, based on the bibliometric and altmetrics approach, demonstrate that altmetrics indices can serve as a supplement to traditional citation-based indices in the review of scientific productions. This allows researchers to contribute to greater visibility of their works and receive more citations by sharing their works via social networks. On the other hand, the degree of scientific cooperation at the national and international level is one of the factors in enhancing the quality of articles, receiving more citations, and being more influential in scientific fields. Therefore, the more the researchers move towards the publication of collaborative outputs, the more productive they will be; as a result, they will receive more citations. Given the importance of co-authorship in scientific productions, policy makers

should strategize to foster such collaborations at the national and international levels and provide the necessary budget and facilities for future researchers. Accordingly, providing a satisfactory analysis of the current state of scientific issues and the relationship between them, important keywords, and terms regarding cardiovascular diseases is feasible as the study revealed that Iranian researchers performed well with the main contributions in different information sources through assessing the scientific productions on cardiovascular diseases from various perspectives and participating in international collaborations.

The visualization of scientific fields' categories does not inherently provide specific policy options or suggestions, but it can be instrumental in understanding the state of existing knowledge and the direction of scientific policies. Indeed, the quantitative evaluation of science can assist policy makers and planners in maximizing the use of financial and human resources at a lower cost and effectively optimizing the socio-economic structure. Thus, science and technology policy makers can utilize the new Altmetrics indices as a criterion for the scientific-research evaluation of researchers and academics, alongside traditional research evaluation indices such as citation analyses. In the current situation, despite the complexities of the health system for developing and empowering techniques to address diseases and their societal and economic burden, analyzing scientific products is a suitable and effective solution to solve problems and challenges in the field of health in general, and cardiovascular diseases specifically.

It is important to note that this study has analyzed all Iranian documents on cardiovascular diseases indexed in Scopus without imposing any language restrictions. Further comparative studies are recommended to analyze scientific productions from other databases and assess the relationship between the number of citations received by the articles and the altmetrics score. The present study may inform Iranian research institutes, universities, and authors about topics that have the potential for in-depth study of cardiovascular diseases or plan for collaborations with other researchers globally. This study also attempted to bridge the gap between theory and practice. By using the results, policy makers can plan for research with economic and commercial impact, identify the causes of research

with more attention that can be designed in teaching, approaches to influencing public policy, in research, contributing to the body of knowledge.

### Conflict of interest

The authors declare that they have no conflict of interests.

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### Author's Contributions

Study design was done by the corresponding author and the second author, and data collection was done by the first author. All authors contributed to data interpretation, analysis and statistical interpretation of data. The manuscript was drafted by the corresponding author and the first author. All authors read and approved the final manuscript.

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