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Scientometric Analysis of Iranian Scientific Productions in the Field of Ophthalmology

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ABSTRACT

Background and objectives: Evaluation of scientific productions in different fields using scientometric methods is indispensable for determining scientific trends. The purpose of this study was to perform a scientometric evaluation of Iran's scientific productions in the field of ophthalmology.

Methods: We investigated all scientific papers in the field of ophthalmology that have been indexed in the Web of Science from 2000 to the end of 2018. The VOSviewer software (version 1.6.9) was used to draw bibliometric maps considering a threshold of 20 times for the keywords used in this field of medicine.

Results: Iran ranked 19th in the world in terms of scientific production on ophthalmology. H-Index of documents written by Iranian authors was 38, with an average citation per item of 7.13. Overall, the documents had received 7262 citations, 6.2% of which were self-citation. We observed that the rate of scientific production has grown dramatically since 2014. Tehran University of Medical Sciences (37.19%) was the most prolific organization in Iran and Seyyed Hassan Ghazizadeh Hashemi (8.63%) was the most prolific Iranian author in this field. All keywords retrieved from the documents on ophthalmology were analyzed, and an ophthalmologist separated the keywords into five clusters. The most frequently used keywords in ophthalmology-related papers belonged to the clusters of Treatment of Retinal Diseases and Glaucoma with 49 appearances.

Conclusion: Our results show that the growth of scientific productions in the field of ophthalmology in Iran and its contribution to the global science production is favorable. However, Iranian authors are recommended to pay more attention to selection of appropriate journals for publishing their scientific papers since publishing in prestigious journals with a high impact factor subsequently increases visibility and citation rates.

KEYWORDS: Scientometric, Ophthalmology, Citation Analysis, Scientific Production

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INTRODUCTION

In recent years, there has been much interest in the use of bibliographic information for evaluation of research activities, which is an important tool for achieving the standards of research performance (1). In this regard, the evaluation of scientific productions in various fields have been emphasized for numerous reasons (2) including the possibility of knowing the status quo and comparing different subject areas (3). Amount of scientific production is an indicator of a country's development. In addition, evaluating the status of scientific productions and the progress made in a subject area gives us a comprehensive picture of scientific activities along with their weaknesses and strengths (4). Studying scientific networks is one of the most important aspects of science assessment studies. Not only education and research in the field of medicine is costly, but they also directly affect the health of humans; thus, design and direction of research activities in this field of science requires special planning. Such planning is not possible without a complete understanding of the framework of this field or previous research. In this regard, scientometric studies, particularly science mapping can provide an overview of the status of published papers and reveal the relationship between medical subfields and the most influential subject areas (5). Assessing various aspects of medical research can be effective in directing future research, planning for balanced development in different medical subfields, allocating optimal budget and facilities, and ultimately improving the quantity and quality of medical scientific productions. Although ophthalmology is one of the most important areas of medicine, no study has yet assessed scientific production in this field at the international level. In this study, we conducted a scientometric analysis of Iran's scientific productions in the field of ophthalmology between 2000 and 2018.

MATERIAL AND METHODS

This scientometric study investigated Iran's scientific productions in the field of ophthalmology from 2000 to the end of 2018, based on the data available on the Web of Science database. The search query was made on December 24, 2018. All five databases of Web of Science comprising Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Conference Proceedings Citation Index-Science (CPCI-S), Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH) and Emerging Sources Citation Index (ESCI) were included. To retrieve all relevant documents, the following search strategy was used:

TOPIC: (Eye Diseases OR Ophthalmolog* OR Orthoptics).

The VOSviewer software (version 1.6.9), developed by the Leiden University, was used to draw bibliometric maps, considering a threshold of 20 times for each keyword.

RESULTS

We found 76661 documents related to ophthalmology on the Web of Science, 1019 (1.32%) of which were written by Iranian authors. Iran ranked 19th in the world in terms of scientific production in the field of ophthalmology (Table 1). H-Index of the documents written by Iranian authors was 38, with an average citation per item of 7.13. Overall, the documents had received 7262 citations, 6.2% of which were self-citation.

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Table 1. Ranking of countries based on the number of documents in the field of ophthalmology on the Web of Science between 2000 and 2018

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Country	USA	Germany	England	China	Japan	Italy	Australia	France	India	Canada	Turkey	Brazil	Spain	South Korea	Netherland	Switzerland	Singapore	Austria	Iran
Number of	25,120	6,468	6,189	4,538	4,502	3,725	3,472	3,383	3,207	2,878	2,640	2,218	2,204	1,995	1,759	1,648	1,488	1,144	1,019
% of total	32.768 %	8.437 %	8.073 %	5.920 %	5.873 %	4.859 %	4.529 %	4.413 %	4.183 %	3.754 %	3.444 %	2.893 %	2.875 %	2.602 %	2.295 %	2.150 %	1.941 %	1.492 %	1.329 %

As shown in figure 1, Iran's scientific production in the field of ophthalmology has been rising dramatically since 2014.

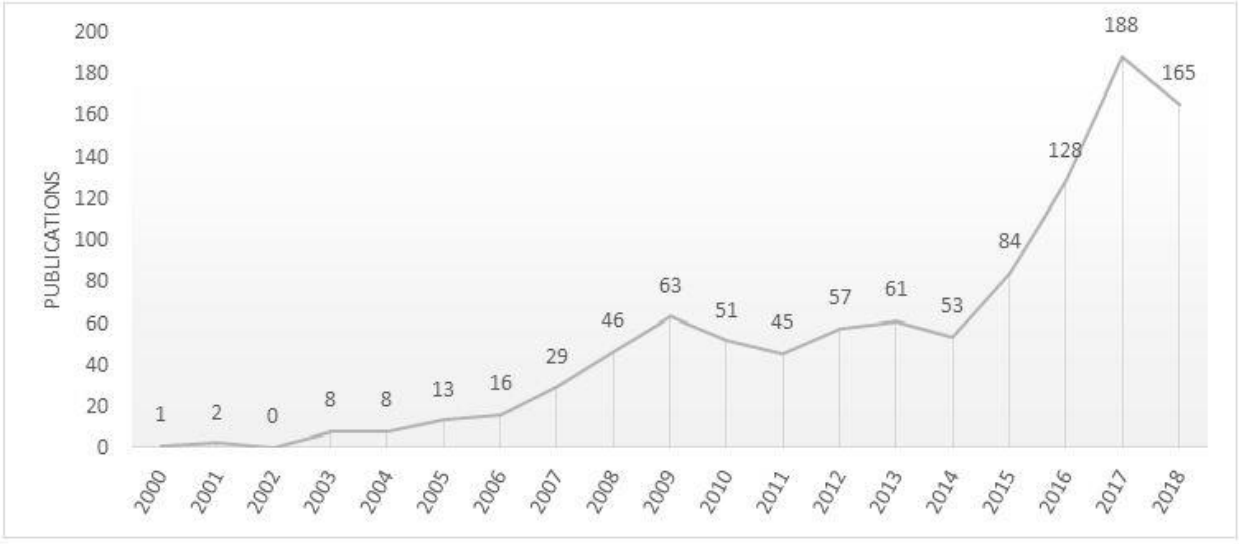

Figure 1. Trend of science production in the field of ophthalmology by Iranian researchers based on the number of documents indexed in the Web of Science between 2000 and 2018

The University of California was the most prolific organization in the world by publishing 3.59% of the total publications on ophthalmology. In Iran, Tehran University of Medical Sciences was the most prolific organization by publishing 37.19% of the total Iranian publications on ophthalmology (Table 2).

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Table 2. Top 10 countries based on the number of publications on the Web of Science between 2000 and 2018

	International			Iran		
	Organizations	**Record Count**	**% of 76,661**	**Organizations**	**Record Count**	**% of % of 1,019**
1	University of California System	2,752	3.590 %	Tehran University of Medical Sciences	379	37.193 %
2	University of London	2,606	3.399 %	Shahid Beheshti University of Medical Sciences	200	19.627 %
3	Harvard University	2,150	2.805 %	Mashhad University of Medical Science	113	11.089 %
4	University College London	2,031	2.649 %	Iran University of Medical Sciences	111	10.893 %
5	Johns Hopkins University	1,783	2.326 %	Noor Eye Hospital	88	8.636 %
6	National Institutes Of Health (NIH) USA	1,356	1.769 %	Shiraz University of Medical Science	78	7.655 %
7	VA Boston Healthcare System	1,294	1.688 %	Isfahan University Medical Science	65	6.379 %
8	Moorfields Eye Hospital NHS Foundation Trust	1,269	1.655 %	Islamic Azad University	63	6.183 %
9	National University of Singapore	1,173	1.530 %	University of Tehran	45	4.416 %
10	University of Melbourne	1,100	1.435 %	Baqiyatallah University of Medical Sciences (BMSU)	39	3.827 %

On the global scale, Wong TY was the most prolific author in the field of ophthalmology. Moreover, the most prolific author in Iran was Seyyed Hassan Ghazizadeh Hashemi who ranked 64th in the world based on the number of publications (Table 3).

Table 3. Top 10 most prolific authors based on the number of publications on the Web of Science between 2000 and 2018

	International			Iran		
	Authors	**Record Count**	**% of 76,661**	**Authors**	**Record Count**	**% of 1,019**
1	Wong TY	589	0.768 %	Hashemi H	88	8.636 %

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2	Mitchell P	410	0.535 %	Khabazkhoob M	50	4.907 %
3	Klein R	299	0.390 %	Fotouhi A	36	3.533 %
4	Wang JJ	291	0.380 %	Yekta A	31	3.042 %
5	Tsubota K	269	0.351 %	Falavarjani KG	26	2.552 %
6	Jonas JB	194	0.253 %	Moghimi S	24	2.355 %
7	Aung T	192	0.250 %	Yaseri M	24	2.355 %
8	Klein BEK	192	0.250 %	Ahmadieh H	23	2.257 %
9	Holz FG	181	0.236 %	Jabbarvand M	23	2.257 %
10	Baudouin C	172	0.224 %	Yazdani S	23	2.257 %

The papers published in Ophthalmology journal and Investigative Ophthalmology Visual Science were cited the most by Iranian authors (Table 4).

use were previous prescription notes (53.2%), previous experience with the condition (31%), family members and relatives (28.6%), and pharmacy personnel (28.6%).

Table 4. Top 10 ophthalmology journals based on the number of publications on Web of Science between 2000 and 2018

	International			**Iran**		
	Source Titles	**Record Count**	**% of 76,661**	**Source Titles**	**Record Count**	**% of 1,019**
1	Ophthalmology [impact factor (IF)=7.48, Q=1]	5,332	6.955 %	Journal of Current Ophthalmology (ESCI[1])	130	12.758 %
2	Investigative Ophthalmology Visual Science (IF=3.38, Q=1)	3,627	4.731 %	Iranian Journal of Ophthalmology (IF=0.08, Q=4)	39	3.827 %
3	Journal of Cataract and Refractive Surgery (IF= 2.68, Q=2)	1,701	2.219 %	Ophthalmology (IF=7.48, Q=1)	28	2.748 %

[1] Emerging Sources Citation Index

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4	American Journal of Ophthalmology (IF=4.79, Q=1)	1,530	1.996 %	Cornea (IF=2.46, Q=2)	24	2.355 %
5	British Journal of Ophthalmology (IF=3.38, Q=1)	1,402	1.829 %	Journal of Cataract and Refractive Surgery (IF= 2.68, Q=2)	22	2.159 %
6	Plos One (IF=2.76, Q=1)	1,137	1.483 %	European Journal of Ophthalmology (IF=1.89, Q=3)	14	1.374 %
7	Eye (IF= 2.47, Q=2)	1,133	1.478 %	International Ophthalmology (IF= 1.33, Q=4)	13	1.276 %
8	Cornea (IF=2.46, Q=2)	1,009	1.316 %	Eye (IF= 2.47, Q=2)	12	1.178 %
9	Klinische Monatsblatter Fur Augenheilkunde (IF= 0.88, Q=4)	942	1.229 %	Iranian Red Crescent Medical Journal (IF=0.78, Q=4)	12	1.178 %
10	Graefes Archive for Clinical and Experimental Ophthalmology (IF= 2.24, Q=2)	893	1.165 %	Archives of Iranian Medicine (IF= 1.25, Q=3)	11	1.079 %

The purpose of keyword analysis is to discover trends and topics of interest. We used the VOSviewer software (version 1.6.9) to analyze all keywords retrieved from the documents related to the field of ophthalmology. An ophthalmologist separated the keywords used in thepapers into five clusters (Table 5 and Figure 2). The placement of keywords in each cluster and the distance of the nodes were based on their co-occurrence (an occasion when two or more similar keywords are used at the same time). The size of the circle in each cluster represents the volume of productions in that subject. The most frequently used keywords in ophthalmology-related papers belonged to the Treatment of Retinal Diseases and Glaucoma clusters with 49 appearances.

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Table 5. The five clusters created based on the analysis of keywords used in ophthalmology documents on the Web of Science between 2000 and 2018

Clusters									
Treatment of Retinal Diseases		**Corneal Diseases**		**Diagnostic Evaluation of Keratoconus**		**Types of Refractive Eye Defects**		**Cataract Management**	
Keyword	**Frequency**	**Keyword**	**Frequency**	**Keyword**	**Frequency**	**Keyword**	**Frequency**	**Keyword**	**Frequency**
Avastin	18	Cornea	17	Central corneal thickness	12	Amblyopia	12	Cataract	18
Bevacizumab	10	Dry eye	30	Glaucoma	49	Astigmatism	10	Cataract surgery	20
Choroidal neovascularization	10	In-situ keratomileusis	21	Intraocular pressure	37	Blindness	23	Management	39
Diabetes	27	Inflamation	17	Keratoconous	41	Lens	10	Ophthalmology	20
Diabetic petinollathy	32	Keratitis	12	Open angel glaucoma	18	Myopia	20	Phacoemulsification	18
Endothelial growth-fact	24	Ocular surface	16	Optical coherence tomography	36	Vision	10	Uveitis	31
Hypertention	10	Penetrating keratoplasty	12	Oxidative stress	19			Vitrectomy	10
Intravitreal injection	11	Photorefractive keratectomy	18	Pentacam	14				
Macular edema	16			Thickness	15				
Retina	19			Topography	15				
Retinopathy	28								
Retinopathy of prematurity	12								

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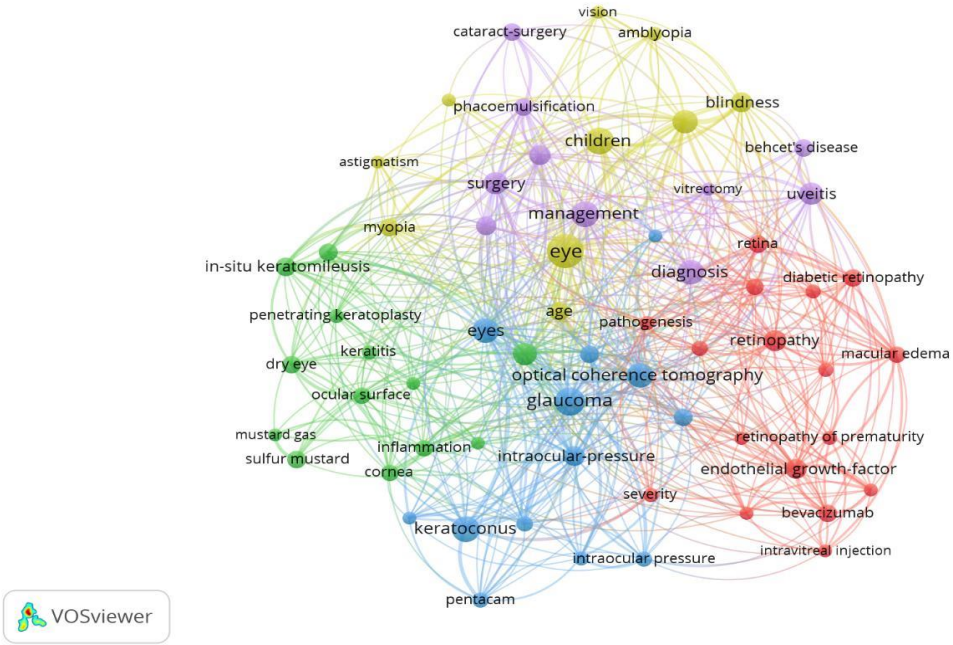

Figure 2. Visualization of the five clusters created based on the analysis of keywords used in ophthalmology-related documents indexed in the Web of Science between 2000 and 2018

Figure 3 shows the appearance of the keywords used in ophthalmology documents over time. The map illustrates the subject trend and thematic tendencies of Iranian researchers in the field of ophthalmology.

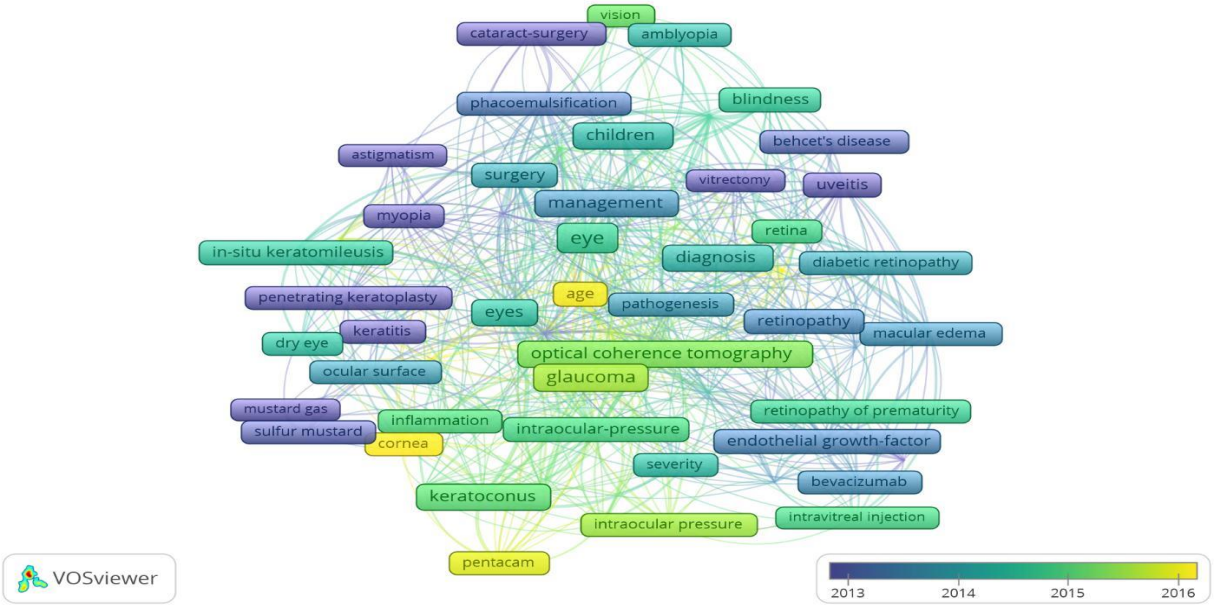

Figure 3. Appearance of keywords in the five clusters formed based on analysis of keywords used in ophthalmology documents indexed in the Web of Science. Keywords in blue are used in older documents, while those in yellow appeared more recently. A greater distance between two keywords means less co-occurrence between the two keywords.

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DISCUSSION

By producing 1,019 scientific documents, Iran currently ranks 19th in the world and sixth in Asia in terms of scientific production in the field of ophthalmology. Another study reported Iran as the 26th largest producer of scientific papers in the field of traditional medicine in the world (3). In the field of medical ethics, papers written by Iranian authors accounted for only 1% of the total scientific productions in the world (6). According to another study, in the field of orthopedics, Iran ranked 34th in the world and 8th in Asia after Japan, South Korea, Taiwan, China, India, Hong Kong and Singapore (7).

Our results also demonstrated that the United States, Germany and the United Kingdom are the largest producers of scientific papers in the field of ophthalmology. Similarly, in the field of medical ethics, the United States, England, Canada and Germany are the top producers of scientific papers (6). Some of these countries are also amongst the largest producers of scientific papers on patient rights (4) and orthopedics (7).

The growing trend of publishing scientific papers on ophthalmology first started in 2006 and continued to rise more significantly since 2014. Similar trends have been observed in studies on other subfields of medicine (1, 3, 4, 6, 7).

In Iran, the Tehran University of Medical Science contributed the most to production of scientific papers in the field of ophthalmology (37% of total publications). In Iran, this university is also leading in production of scientific papers in other subfields of medicine (1, 3, 7).

We found that 12.75% of articles written by Iranian authors have been published in the Journal of Current Ophthalmology, which is indexed in ESCI and has no IF. Given the direct association between publishing in journals with a high IF and citation rates, these statistics indicate the undesirable quality of research papers written by Iranian authors in the field of ophthalmology. On contrary, we found that most of the world's publications have been published in journals with a high IF.

Our results showed that during the study period, H-Index of documents authored by Iranian scientists was 38, with an average citation rate of 7.13. In another study, H-index of the Iranian scientific productions on orthopedics was 17 (7). Furthermore, the H-Index of research papers on cardiovascular disease, cancer, diabetes, chronic respiratory disease and exosome research is reported to be 77, 150, 87, 36 and 74, respectively (8, 9).

Overall, the documents had received 7262 citations, 6.2% of which were self-citation. Considering that the average level of self-citation is up to 20% (10), the rate of self-citation in the field of ophthalmology is favorable.

CONCLUSION

The scientometric analysis showed that the growth of scientific productions in the field of ophthalmology in Iran and its contribution to the global science production is favorable. However, Iranian authors are recommended to pay more attention to selection of appropriate journals for publishing their scientific papers since publishing in prestigious journals with a high IF subsequently increases visibility and citation rates. In this regard, we provided a list of top prolific journals in the field of ophthalmology, which could be beneficial for Iranian researchers. The analysis of the keywords used in the relevant documents could also provide valuable information for researchers when designing future research.

DECLARATIONS

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Not applicable.

Ethics approvals and consent to participate

Not applicable.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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