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Effects of Scientific Collaboration between Domestic and Foreign Authors on Quality Indices of Journals

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Abstract

The aim of the study was to determine the effect of scientific collaboration between domestic (Iranian) and foreign authors on their quality indices in articles published in Iranian medical journals, indexed in the Web of Science citation database. The present scientometric study was conducted on the 22 Iranian medical journals that indexed in Web of Science from 2010 to 2016. Using stratified systematic random sampling method and Cochran formula, the sample size was determined 1230 articles. The data analysis was performed by Microsoft Excel and descriptive methods. The qualitative indices were determined using the Klimogrof-Smirnov test, Kruskal-Wallis test and correlation coefficient. The results revealed that 4.66 percent of the articles were compiled by Iranian authors, 29 percent written by foreign authors and 6.4 percent was written by scientific collaboration between Iranian and foreign authors. The average number of authors for each article was 4.9. The journals that have articles which have Iranian authors have a lower Impact Factor (0.69%) than the journal's articles which is the product of the collaboration of Iranian and foreign authors (0.82%). In conclusion, international collaboration in the writing of articles has a direct effect on qualitative indexes of articles, including Impact Factor, 5-years Impact Factor, Immediacy index and journal's Impact Factor.

Keywords

Scientific collaboration; Citation; Scientometrics; Medical journals; Iran

Introduction

Scientific collaboration, which is defined as the joint work of researchers to the production of science and knowledge, is one of the main characteristics of each society's scientific development and has become one of the major issue in science policy (Barabasi & al., 2002; Leydesdorff, Wagner, Park, & Adams, 2013). In fact, in today's world and in the age of information and communication, governments, organizations, scientists, and specialists in various fields of science, in the field of research and production of scientific findings are more dependent on teamwork than ever (Wang et al., 2013) and there is a close relationship between scientific findings, outputs, and research collaboration (Abramo, D'Angelo, & Murgia, 2013).

Communication and collaboration between authors, in the same or different disciplines, is an important factor in the increasing influence of scientific works in the scientific community and increases the applicability of science. Also, scientific collaboration creates scientific synergy (Lee et al., 2010). More recent evidence shows that there is a relationship between the amount of teamwork and the quality of the articles; that is, the more scientific collaboration, the better the quality of the articles and this method should be expanded (Afshar, Abdulmajid, & Danesh, 2009).

In Nodelman and Lander's opinion, the importance and credit that the scientific community gives to articles with more authors are higher than articles with fewer authors (Ahn, Oh, & Lee, 2014). Katz and Martin (1997) also believed that the amount of co-authorship of an article was strongly linked to the impact of that article. Ding, Foo, and Chowdhury (1998) stated that most of the published articles in the core journals of the library and information science were articles that had numerous authors and published with scientific collaboration (Ding, Foo, Chowdhury, & Review, 1998). The amount of scientific collaboration is different in various fields (Katz & Martin, 1997). Generally, in the technical and medical fields; scientific collaboration is strong whereas in the humanities is weak. In total, worldwide amount of scientific collaboration in published works is increased and there are no longer many articles that have a single author (Subramanyam, 1983). On the other hand, Citation rates are used as a criterion for the quality of the scientific publication. The amount of referrals to scientific works is a measure of the extent of its influence in the field of science. By counting the number of citations to scientific works, one can judge their quality. Therefore, the citation is the focal point of citation analysis and bibliometric studies, and citation indicators are a symbol of the quality and impact of scientific productions (Hasanzadeh & Hochghan, 2009).

Journals in the field of medical sciences and their articles are the most important tools for knowledge transfer and scientific collaboration among researchers in Iran. Considering that so many material and spiritual costs are spent on the publication of these articles, it is necessary to pay attention to the effectiveness of these scientific products (Mohammadi et al., 2015). Therefore, considering need to pay attention to various dimensions affecting the quality of journals and importance of international scientific collaboration and experimental and laboratory nature of the field of basic sciences and medicine, which requires more group collaboration, this study investigated the international scientific collaboration between native (Iranian) and foreign authors and the impact of this on quality indices, in Iranian medical journals indexed in Web of Science (2010-2016).

Materials and Methods

A scientometric study was conducted on the Web of Science database. Required data was extracted by visiting and viewing directly to the database and searching the titles of the journals and reviewing all the published articles in each of the journals. The research population was 15569 articles of 22 Iranian medical journals, indexed in Web of Science from 2010 to 2016 (Table 1).

Table 1. Titles of examined journals and the abbreviation used on them by the author

Symbol	Name of the journal
J1	DARU Journal of Pharmaceutical Sciences
J2	Urology Journal
J3	Journal of Research in Medical Sciences
J4	Archives of Iranian Medicine
J5	Cell Journal
J6	Iranian Red Crescent Medical Journal
J7	Iranian Journal of Public Health
J8	Iranian Journal of Basic Medical Sciences
J9	Iranian Journal of Allergy, Asthma and Immunology
J10	Iranian Journal of Pharmaceutical Research
J11	Iranian Journal of Radiation Research
J12	Iranian Journal of Radiology
J13	Iranian Journal of Pediatrics
J14	Iranian Journal of Immunology
J15	Iranian Journal of Reproductive Medicine
J16	Journal of Environmental Health Science and Engineering
J17	Hepatitis Monthly
J18	Iranian Journal of Parasitology
J19	Iranian Journal of Kidney Diseases
J20	International Journal of Fertility & Sterility
J21	Iranian Journal of Arthropod-Borne Diseases
J22	Jundishapur Journal of Microbiology

The sampling method was systematic classified random sampling relying on the percentage of articles at each year for each magazine. The sample size was based on the Cochran formula, considering the ratio of the number of articles of each journal each year, divided by all papers examined by all the journals in the same year, which was calculated based on the following formula, 1230 articles were recruited for this study.

$$n = \frac{N z^2 p (1 - p)}{d^2(N - 1) + z^2 p(1 - p)}$$

Data collection technique was organized viewing. The data gathering tool was a pre-made checked listed and used by Mohammadi et al. (2015). According to the research objectives, the data that were viewed and recorded in a checklist includes the following:

The number of authors in each article, the number of Iranian authors in each article, and the number of foreign authors in each article, with their nationality.

The citation indices in this study were the Impact Factor (IF), 5-year Impact Factor, Immediacy Index, and Eigenfactor Score. This information was extracted from the JCR database for each journal. To retrieve journals in the Web of Science database, we used the field of "Publication Name" in the advanced search, entering the title of each journal in the search box and then, the journal articles were limited to the time period. For each article, the number of authors, the number of Iranian authors, the number of foreign authors, and the nationality of the foreign authors were extracted and entered into the checklist prepared in the Excel 2010. To analyze the data and to investigate the relationship between the status of internationality of authors and the citation indices, we used SPSS21, Excel 2010, analytical statistics and correlation analysis. We tested the Kolmogorov-Smirnov to decide whether the use of the parametric or nonparametric test and since the results of the Kolmogorov-Smirnov test for all quantitative variables showed their abnormal distribution, we used nonparametric tests for analyses. To investigate the correlation between the number of authors and the indices of journals, we used the Pearson correlation test. The relationship between the number of authors and journal coefficients was analyzed based on the Kruskal-Wallis test. Table 1, shows the specifications of the examined journals by mentioning the acronyms specified by the researcher to display the information of the journals.

Findings

The findings of this study showed that from 2010 to 2016, 15569 articles have been published in 22 Iranian journals indexed in Web of Science. According to the explanations provided in the research method and the determination of the statistical ratio for each journal, *Iranian Journal of Public Health* had the highest sample abundance (178 articles) and *Iranian Journal of Arthropod-Borne Diseases* had the lowest sample abundance (2 articles). The total number of authors of the examined articles was 6009. The statistical results indicated that the average number of authors in the articles of the examined journals was 4.89. The findings also showed that journal of *Hepatitis Monthly* had the highest mean Impact Factor (1.73), 5-year Impact Factor (1.20) and Immediacy index (0.40); whereas *Iranian Journal of Reproductive Medicine* had the lowest mean Impact Factor (0.13), 5-year Impact Factor (0.09) and Immediacy index (0.01), among examined journals (Table 2).

Table 2. The average quality indices of the Iranian medical, indexed in Web of Science from 2010 to 2016

Name of the journal	Impact Factor	5-year Impact Factor	Immediacy index	Eigenfactor score
DARU Journal of Pharmaceutical Sciences	1.07	1.04	0.24	0.00
Urology Journal	0.59	0.43	0.07	0.00
Journal of Research in Medical Sciences	0.69	0.48	0.08	0.00
Archives of Iranian Medicine	1.09	1.02	0.27	0.00
Cell Journal	1.03	1.00	0.19	0.00
Iranian Red Crescent Medical Journal	0.58	0.50	0.07	0.00
Iranian Journal of Public Health	0.57	0.65	0.07	0.00
Iranian Journal of Basic Medical Sciences	0.91	0.70	0.10	0.00
Iranian Journal of Allergy, Asthma and Immunology	0.89	0.83	0.11	0.00
Iranian Journal of Pharmaceutical Research	0.92	0.86	0.12	0.00
Iranian Journal of Radiation Research	0.28	0.21	0.04	0.00
Iranian Journal of Radiology	0.33	0.31	0.02	0.00
Iranian Journal of Pediatrics	0.41	0.40	0.09	0.00
Iranian Journal of Immunology	0.40	0.29	0.02	0.00
Iranian Journal of Reproductive Medicine	0.13	0.09	0.01	0.00
Journal of Environmental Health Science and Engineering	0.29	0.29	0.06	0.00
Hepatitis Monthly	1.73	1.20	0.40	0.00
Iranian Journal of Parasitology	0.68	0.64	0.05	0.00
Iranian Journal of Kidney Diseases	0.86	0.42	0.31	0.00
International Journal of Fertility & Sterility	0.21	0.21	0.03	0.00
Iranian Journal of Arthropod-Borne Diseases	0.59	0.60	0.12	0.00
Jundishapur Journal of Microbiology	0.65	0.63	0.07	0.00

The findings showed that the frequency of articles written exclusively by Iranian authors in the examined journals was 817 articles, which had 4127 authors that were equal to 66.4 percent of all authors. Also, the results showed that out of the total number of articles, 357 articles (26%) written by 1897 exclusively foreign author. Fifty-six articles, equal to 4.6 percent of all articles, were the result of scientific collaboration between Iranian and foreign authors, which was produced with the collaboration of 56 authors (Figure 1).

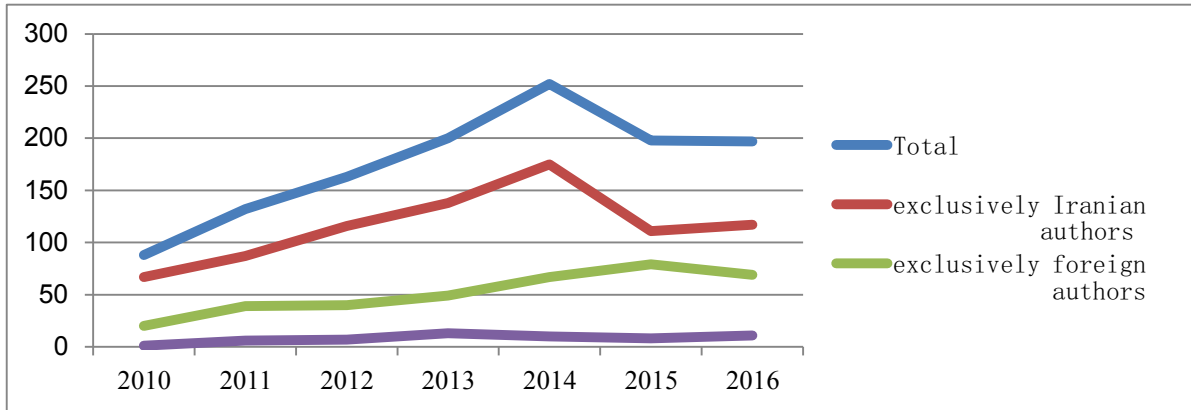


Figure 1. How Authors Contribute in Writing Articles Based on their Nationality

The average number of authors in the examined articles was 4.89 and articles with four authors (232 articles equal to 18.9%) had the most frequency. In the next ranks, there were five authors (202 articles, 16.4%), three authors (199 articles equal to 16.2%), six authors (169 articles, 13.7%), two authors (130 articles, 10.6%) and seven authors (108 papers equal to 8.8%) (Figure 2).

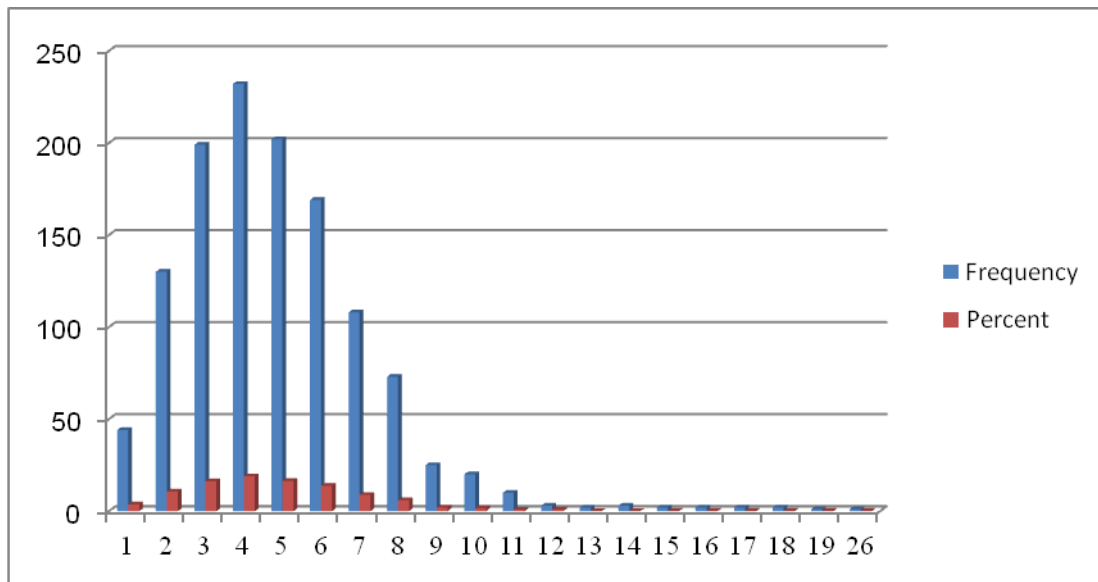


Figure 2. Abundance distribution and percentage of authors per article in the Iranian medical journals indexed in Web of Science from 2010 to 2016

Distribution of nationality of authors of articles indicates that the authors of the papers were from 50 countries. Iranian authors (66.29%), China (6.1%), Turkey (5.9%), and India (3.2%), had the highest rate in producing these articles (Table 3).

Table 3. Distribution and percentage of abundance of the authors of the articles of Iranian medical journals indexed in Web of Science in from 2010 to 2016 by nationality

Country	Abundance	%
Iran	871	66.29
China	77	5.86
Turkey	72	5.48
India	42	3.20
USA	30	2.28
Malaysia	18	1.37
Australia	14	1.07
Italy	13	0.99
Canada	12	0.91
South Korea	11	0.84
England	11	0.84
Pakistan	11	0.84
Egypt	11	0.84
Nigeria	9	0.68
Poland	8	0.61
Romania	7	0.53
Spain	6	0.46
Tunisia	6	0.46
Germany	6	0.46
Serbia	6	0.46
Saudi Arabia	6	0.46
Japan	6	0.46
Brazil	6	0.38
Greece	6	0.38
Taiwan	6	0.38
Others	46	3.50

Statistical analysis showed that the number of authors had a significant positive correlation with the Impact Factor ($P = .000$), 5-year Impact Factor ($P = .000$) and Eigenfactor score ($P = 0.006$), But did not show such a correlation with the Immediacy index ($P = .368$) (Table 4).

Table 4. Pearson Correlation Test: The connection between the Number of authors and Qualitative Indicators

		author	Impact Factor	5-year Impact Factor	Immediacy index	Eigenfactor score
Author	Pearson correlation	1				
	Sig. (2-tailed)					
	N	1230				
Impact Factor	Pearson correlation	0.136*	1			
	Sig. (2-tailed)	0.000				
	N	1230	1230			
5-year Impact Factor	Pearson correlation	0.141*	0.700**	1		
	Sig. (2-tailed)	0.000	0.000			
	N	1230	1230	1230		
Immediacy index	Pearson correlation	0.026	0.618**	0.225**	1	
	Sig. (2-tailed)	0.368	0.000	0.000		
	N	1230	1230	1230	1230	
Eigenfactor score	Pearson correlation	0.079**	0.562**	**0.666	**0.154	1
	Sig. (2-tailed)	0.006	0.000	0.000	0.000	
	N	1229	1229	1229	1229	1229

** . Correlation is significant at the 0.01 level (2-tailed).

The results showed the meaningful relationship between the impact factor and the national combination of the authors (purely Iranian, Iranian-foreign and only foreign) ($P < 0.001$). The average Impact Factor of journals containing articles with exclusively Iranian authors was 0.69, journals having articles with Iranian and foreign authors was 0.82, and journals with exclusive articles was 0.85. Considering that the obtained level of significance was equal to 0.001 and less than 0.05, we can say that with 95 percent confidence there is a significant relationship between the authors' contributing combination and the Impact Factor (Table 5).

Table 5. Kruskalwalis test - the relationship between the Impact Factor and the collaborative composition of the authors

the collaborative composition of the authors	N	average
Just Iranian	817	0.6870636
Iranian and foreign	56	0.8163036
only foreign	357	0.8461541
sum	1230	
Test results		
Kai Scorp	30.937	
DegreeS of freedom	2	
Asymp. Sig.	0.000	

The findings indicated that the average 5-year Impact Factor of journals containing articles with exclusively Iranian authors was 60 percent, journals containing articles with Iranian and foreign authors was 71 percent, and journals with exclusively foreign articles was 71 percent. Considering that the obtained level of significance was equal to 0.001 and less than 0.05, we can say that with 95 percent confidence there is a significant relationship between the authors' contributing combination and the 5-year Impact Factor (Table 6).

Table 6. Kruskal Wallis test - The relationship between the five-year Impact Factor and the contributory composition of the authors

the collaborative composition of the authors	N	average
Just Iranian	817	0.5999168
Iranian and foreign	56	0.7080893
only foreign	357	0.7099132
sum	1230	
Test results		
Kai Scorp	13.761	
DegreeS of freedom	2	
Asymp. Sig.	0.001	

The results showed that the average Immediacy Index of the journals containing articles with exclusively Iranian authors was 0.109, the journals containing articles with Iranian and foreign authors was 0.164 and the journals with exclusive foreign articles was 0.149. Considering that the obtained level of significance was equal to 0.001 and less than 0.05, we can say that with 95 percent confidence, there is a significant relationship between the authors' contributing combination and the Immediacy Index of the journal ($P < 0.001$) (Table 8).

Table 8. Kruskal Wallis test - The relationship between the Immediacy index and the contributory composition of the authors

the collaborative composition of the authors	N	average
Just Iranian	817	0.1090673
Iranian and foreign	56	0.1645714
only foreign	357	0.1489356
sum	1230	
Test results		
Kai Scorp	20.369	
DegreeS of freedom	2	
Asymp. Sig.	0.000	

Results showed that the average Eigenfactor score of the journals which had articles with exclusively Iranian authors was 0.0010, journals which had articles with Iranian and foreign collaborators was 0.0013 and journals with exclusively foreign articles was 0.0012. Considering that the obtained level of significance is equal to 0.001 and less than 0.05, with 95 percent confidence, there is a significant relationship between the author's contributory combination and the Eigenfactor score (Table 9).

Table 9. Kruskalvalis test - The relationship between the Eigenfactor score and collaborative composition of authors

the collaborative composition of the authors	N	average
Just Iranian	817	0.00106612
Iranian and foreign	56	0.00132875
only foreign	356	0.00123626
sum	1229	
Test results		
Kai Scorp	14.480	
DegreeS of freedom	2	
Asymp. Sig.	0.001	

Discussion

According to the findings, 66.4 percent of authors of Iranian journals are Iranian authors. The abundance of foreign authors in articles is only 29 percent. This finding indicates that the cooperation of foreign authors in these journals is very low. Hariri and Riahi (2013) achieved similar results; So that 4.6 percent of articles are the result of co-authorship between Iranian and foreign authors. This finding indicates that international collaboration in the Iranian articles is very low. Rasoul Abadi, Heydari, Zarei, Khezri and Gharibi (2014) also achieved similar results.

The average number of authors in the Iranian medical journals indexed in Web of Science is 4.89. Most published articles have four authors (18.9%). In other words, 84.6% of articles have 3 or more authors. These statistics reflect the desirable status of scientific collaboration in the field of medicine. Mohammadi and others (2014) achieved similar results in their study in 2014.

Iran, China, and Turkey have the most scientific publications in the published articles of journals. Osareh, Shirazi, and Khademi (2014) showed that the most international collaboration in the field of Pharmacy and Pharmacology was with the researchers of England, America, and Canada.

The analysis of the results showed that there is a positive and significant correlation between the number of authors of the articles and the statistical significance. That is, with the increase in the number of authors, the Impact Factor, 5-year Impact Factor, and the Eigenfactor score increase. But the Immediacy Index has no positive and significant relation. The results of Mohammadi and others (2014) showed that there is a positive and significant correlation between the number of authors and the number of citations to each of them. In addition, the results of Tavakoli Zadeh Ravari, Makizadeh, Abedi Khorasgani and Soheili (2015) showed a significant relationship between the authors and the Impact Factor. In the study of Ibnz, Bils, and Leranga (2013), there was a significant difference in the number of citations to articles and the number of authors.

Based on the obtained results, journals with only Iranian authors have a lower Impact Factor (0.69%) than those with external or joint authors (0.82). in other words, the more authors and the more international authors, the higher Impact Factor of the journals will be. In similar studies, Santin and Venezuela Cagento (2016) showed that international collaboration increased the audience and visibility of Brazilian publications.(Santin, de Souza Vanz, & Caregnato, 2016)

In the other part, there is a positive and significant relationship between the 5-year Impact Factor index and the collaboration rate of foreign authors. Therefore, journals containing articles with foreign authors or a combination of authors from different countries have a higher 5-year Impact Factor than journals whose articles have been written only by Iranian authors. Khor and Yu (2016) achieved similar results.

According to the findings, journals that have more articles with foreign authors have a higher Immediacy Index than journals whose articles are written only by Iranian authors. In similar studies of Mohammadi and others (2014), Tavakoli Zadeh Ravari et al. (2015) and Ibnz, Biles, and Lranga (2013), similar results have been achieved. Findings also show that the collaboration of foreign authors in the writing of articles has led to an increase in the Eigenfactor score. In similar studies of Osareh, Shirazi and Khademi (2014), and Tavakoli Zadeh Ravari et al. (2015) similar results were obtained.

Conclusions

The findings of this study indicate the direct impact of international collaboration in the writing of articles on the quality indices of the journals, including Impact Factor, 5-year Impact Factor, Immediacy Index, and Eigenfactor score. Given that, currently, only 4.6 percent of the articles written by Iranian researchers are as a result of international collaborations, this status denotes the basic weakness in this area and the need to change the scientific paradigm for increasing research collaboration with other countries. Undoubtedly, scientific exchanges and the expansion of scientific collaboration is not the only responsibility of authors, and the journal's policymakers and research institutes of the country should take into account the issue of accepting and receiving articles and obtaining incentives to promote this collaboration as essential factors. Future studies should concentrate on preserving good trends such as the number of authors and obviating weaknesses such as the low international scientific collaboration in the writing of articles.

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