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Original article

The Features of Cardiovascular Papers and Impact on Citations

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Abstract

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Keywords:
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Introduction: The number of citations is a factor in evaluating the quality of scientific articles. The present study aims to examine the factors affecting the citation rate of cardiovascular articles.

Methods: In this scientometrics study, the research population is all cardiovascular articles in 2014 in Web of Science (WoS), including a sample of 381 articles studied. Pearson correlation coefficient, Mann–Whitney, Kruskal–Wallis, and Bonferroni tests were used to examine the impact of article features on citations.

Results: The results indicated that all quantitative variables (title length, number of authors, author's H-index, journal IF, number of pages, number of author's keywords, number of keywords-plus, number of references) had a significant relationship with the number of citations (P-value<0.001), except for the number of article keywords. All of the qualitative variables (title length, number of authors, author's H-index, journal IF, number of pages, number of author's keywords, number of keywords-plus, number of references) also affect the number of citations (p-value<0.001). Open access articles, articles with the first author from Australia and North America, articles with international collaboration, and meta-analysis articles have received a more citation rate.

Conclusion: Paying attention to the factors affecting the citation rate of cardiovascular articles can be of help to cardiovascular centers for policy-making and researchers in determining the research approach. In this way, they can improve the citation of their works.

Introduction

Large numbers of articles are published annually, few of which receive a significant number of citations. Most of these articles are not even cited so that 20% of articles receive 80% of the total citation (1). In addition to publishing the research output, citation by others can be a fundamental goal of researchers and authors (2–4). Research articles are evaluated from different perspectives, of which citation is one (5–8). The most cited articles have a higher ranking compared to articles in similar fields regarding the impact on scientific progress (9–13). Besides, scientific evaluation of researchers and

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scientific centers and allocating funds are usually based on citation indices. Therefore, objectively examining why particular articles are frequently cited and some are not is the center of debate and is vital for researchers and journals. Numerous studies have investigated drastic factors affecting the number of citations of different subjects (5,12,14–20). It seems certain factors such as journal IF, a number of authors, accessibility, and international collaboration are likely to be more effective in article citation (21). The factors influencing citation can be classified into three groups of Article features, Journal-related factors and Author-related factors. The most important factors, including qualitative and quantitative variables, are discussed in this section.

Quantitative Variables: Title length as a quantitative variable was considered, while prepositions were excluded. Some studies indicated that the title length affects citations (9,22), the number of authors in another quantitative variable. Many researchers believe that it has a positive relationship with citation (2,9,16,20,23–27). However, some studies could not find a relationship between these factors while working on chemistry and science and technology articles, respectively (5,28). A study investigating the factors affecting the citation of chemistry showed highly-cited authors received more citations than others (5). Nevertheless, Yu and Yu did not report a strong relationship between the H-index and citation (23). The other quantitative variable is the Impact Factor (IF) of the journal registered in the Journal Citation Reports (JCR). Many studies reported a positive relationship between the IF and citation (2,9,10,27,29). However, Finardi did not find a relationship between these two factors (29). The findings of some studies showed that most cited articles have more pages (9,26); however, a study on science and technology articles showed that the number of pages had a negative relationship with citation (28). Also, research on science and technology articles indicated that a positive relationship was found between author keywords and citation (28). Moreover, some keywords assigned to the article in the WoS, known as keywords plus. No study has been conducted on the relationship between the number of keywords-plus and citations. Since the number of keywords-plus is one of the methods for retrieving and content introduction in the WoS (30), we decided to examine the relationship between the number of keywords-plus and citation. Numerous studies also reported a positive relationship between the cited references and citation (9,27,28).

Qualitative variables: Some features of the articles studied in the present study include qualitative variables, which accessibility of paper (being open access or non-open access) is one of them. Davis (2008) studied the relationship between open access and citation in different fields and concluded that it is not effective in the citation (31); however, some studies on the citation of other areas found that this variable had a direct relationship with the citation (32,33). Previous studies indicated that the author's country is also influential in the citation (25), and articles from North American countries (34), especially from the USA, are cited more than others (23,26). Another variable is National/International collaboration. If an article is written by more than one author from different countries, considered to be an international collaboration; otherwise, it is a national one. Studies by other researchers showed that national and international collaboration was influential in the citation (2,16,25,27,28). Studies by various researchers revealed that the study design was productive in the citation (12,18,25). However, the outcomes of researches in this area are dissimilar. Some studies pointed out that RCTs received more citations (12,14). A study on the orthopedic literature showed that the most cited articles were retrospective observational studies (17). Another study on Brazilian articles in ophthalmology journals revealed that the most cited articles were cross-sectional (35). A study in 2012 on the effect of study design in the citation of health science articles demonstrated that the most cited articles were meta-analysis (15). In general, the backgrounds show that the rate of citations is affected by different variables. Still, no comprehensive research has been done so far to examine these variables in cardiovascular articles.

Cardiovascular diseases have been the leading cause of death worldwide in the last 15 years. As the most crucial cause of death, cardiovascular diseases lead to the death of 17.3 million people annually. According to studies, if the trend continues, the number is expected to reach 23.6 million in 2030 (36–38). For this reason, there is a lot of research going on around the world each year that publishing them can improve evidence-based medicine, treatment, and patient's quality of life. Interestingly, the number of webs of science's (WoS) published cardiovascular

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articles have noticeably increased in recent years (39). Apart from an increasing number of articles, the quality of researches is of great importance. In this regard, the number of citations is a factor in evaluating the quality of scientific articles. If an article has no citation, it means that the study has not been effective in the scientific circle, and time and budget have been wasted. However, the factors that influence the rate of citations of cardiovascular articles have not been identified so far. Therefore, the present study aimed at identifying the most critical factors affecting the citation of cardiovascular articles. Findings can help authorities, researchers, and cardiovascular research centers in policymaking and guide the research approach. By considering the mentioned factors, it is possible to make appropriate decisions to develop and increase the effectiveness of cardiovascular articles scientifically.

Methods

In this scientometrics study, the research population is all cardiovascular publications in WoS in 2014 (17034 articles). The data were extracted from Science Citation Index-Expanded, having in mind the year publication of 2014, as well as limiting the subject category to "CARDIAC CARDIOVASCULAR SYSTEMS". The search was limited to article type and English language and carried out on May 28th 2018.

Krejcie and Morgan Table were used to determine the sample size (40) of 381 articles selected as samples using the random sampling method. As this research aims to assess the impact of article features on citations, the full text of the articles was downloaded, and the qualitative and quantitative variables mentioned in the related works section were extracted in the checklist. To ensure that the extracted factors were interpreted correctly, 20% of the articles were randomly selected as samples and re-reviewed by a second person. As the adaptation of the results, the accuracy of the analyses confirmed. The number of citations, H-index of the authors, and IF of the journals were extracted from WoS.

Data analysis was performed using SPSS 23 and descriptive statistics such as mean, median, and standard deviation. The impact of quantitative variables on citations measured by Pearson's correlation coefficient, as well as some qualitative variables (OA/non-OA; and national/international co-authorship) on citations examined by the Mann–Whitney test. Moreover, Kruskal–Wallis and Multiple comparison Bonferroni tests were performed to compare the citations in the articles from different countries or study designs as some other qualitative variables.

Results

The total English cardiovascular articles in 2014 are 17034, of which a sample of 381 is studied through the present research. Table 1 shows the mean citation number in the articles 19.53. The mean number of title words is 12.1, and the H-Index of the first author is 14.2. Also, the mean of keywords in articles is 3.9, while the mean of keywords plus is 8.

Table 1. Descriptive statistics of quantitative variables of cardiovascular articles

variables	Minimum	Maximum	Mean	Median	St. deviation
Citations	0	332	19.53	9.00	30.425
Title length	3	30	12.1	11	4.4
Number of authors	1	43	8.7	8	5
H-index (first author)	1	127	14.2	9.5	17
H-index (second author)	1	184	16.1	11	20
IF	0.343	17.759	5.4	3.5	5.1
Number of pages	2	32	7.9	8	2.9
Author keywords	0	12	3.9	4	2
Keywords plus	0	10	8	10	3
Number of references	2	283	32	29	24.5

Pearson's correlation coefficient shows that all quantitative variables have a significant relationship with the number of citations (p-value <0.01), except for the number of author keywords. The intensity of the relationship is higher in the IF of journals, H-index of the first author, and the number of authors than other variables. (Table 2)

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Table 2. Correlation between quantitative variables and the number of citations in cardiovascular articles

Variables	Pearson correlation	P-value*
Title length/citations	0.138	0.007
Number of authors/citations	0.357	0.000
H-index first author/citations	0.384	0.000
H-index second author/citations	0.156	0.002
IF/citations	0.564	0.000
Number of pages/citations	0.281	0.000
Author keywords/citations	0.087	0.090
Keywords plus/citations	0.131	0.009
Number of references/citations	0.177	0.001

- The significance level is less than 0.01

Table 3 shows that the mean citations in OA articles are 27.21. This value is 10.68 in non-OA articles. Also, Mann–Whitney test indicated that the mean number of citations in OA articles is significantly higher than others (p-value <0.001).

The articles that the first author's country is from Europe, and North America, have the most frequency (172 and 137 articles, respectively). The Kruskal–Wallis test has proven that the average citations in articles with the first author's countries from Australia and North America (16 and 23.55, respectively) were significantly greater than other countries (p-value <0.001). (Table 3)

The most analyzed articles relate to national articles (72.4%). The figure for international articles is 27.6 %. Mann–Whitney test presented that the average citations of articles with international collaboration were significantly higher than articles with national articles (P-value <0.001). (Table 3)

Utmost articles were cohort articles (34.6%), and the average citations received in meta-analysis articles were higher than others. (Table 3). It should be noted that four articles had an unspecified design master, which did not include in this table.

The Kruskal–Wallis test showed that the average citations are different in articles with various study designs (P-value <0.001).

The multiple comparison Bonferroni tests stand out that the average citations in meta-analysis articles were significantly higher than in other articles (p-value<0.001) (except for articles by in vitro study design with p-value=0.052). Also, the mean of citations in case reports is significantly lower than other varieties of research designs (p-value <0.001).

Table 3. The comparison of the citations in qualitative variables in the cardiovascular articles

Variables		Frequency		Citations			P-value*
		Number	Percent	Mean	Median	St. Deviation	
OA or Non-OA	Non-OA	177	46.5	10.68	6.00	14.510	<0.001
	OA	204	53.5	27.21	13.00	37.719	
Country	Europe	172	45.1	20.13	9.50	34.158	<0.001
	North America	137	36	23.55	12.00	29.964	
	Asia	56	14.7	8.52	4.00	9.680	
	South America	6	1.6	10.67	3.50	13.471	
	Australia	7	1.8	26.00	3.50	13.471	
	Africa	3	0.8	9.67	3.00	13.317	
Collaboration	National	276	72.4%	14.30	8.00	20.219	<0.001
	International	105	27.6	33.28	14.00	45.143	
Study design	Clinical trial	90	23.6	26.89	12.00	33.998	<0.001
	Cohort	132	34.6	15.45	9.00	18.797	
	Meta-analysis	14	3.7	57.57	11.00	90.884	
	Cross-sectional	14	3.7	14.00	7.00	21.119	

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Table 3. The comparison of the ... (continued)

Variables	Frequency		Citations			P-value*
	Number	Percent	Mean	Median	St. Deviation	
IN Vitro	13	3.4	21.62	12.00	22.640	
Animal research	40	10.5	16.63	13.00	14.113	
Case-control	24	6.3	15.08	9.00	15.128	
Case report	28	7.3	1.96	2.00	1.688	
Review	22	5.8	14.41	9.50	13.599	

• The significance level is less than 0.01

Discussion

The article title is the foremost tool to communicate with the readers and potential citations in the future (41). The results confirmed that title length was influential in the citation of cardiovascular articles, as reported by other studies (9,19,22). This finding contrasts to Fox and Burns (42,43) and Falahati Qadimi Fumani et al. but is in line with the Guo et al., which showed the relation between title length and citations is positive after 2000 (44). It seems, selecting short titles for cardiovascular articles might lead to the inappropriate introduction of an article to the scientific community.

Forming a research team and collaborating on the cardiovascular topic can significantly improve citation in the future. According to Uddin and Khan's research results, the number of authors of a research paper in almost all subject areas affects the number of citations, which is more in the field of social sciences and Art and Humanities than others (45). The present study indicated a significant relationship between the number of authors and the number of citations of cardiovascular articles, consistent with previous studies (2,9,20,46). It proves that scientific and research cooperation can improve the quality of research papers. Besides, the number of citations received from articles with international collaboration is significantly higher than articles with national collaboration, which is in line with Sin's study (16). Research institutes and centers try to publish high-quality research in collaboration with other international scientific centers, leading to an increase in the number of citations to articles (47).

Fewer pages may mean the insufficiency of information essential for a research paper (48). We found that number of pages is associated with citations. It is in line with some previous studies that indicated the articles with more pages are likely to have more citations (26,49,50); nevertheless, another study revealed that the number of pages had a negative relationship with its citation. (28)

Although some previous studies did not find a strong relationship between the journal IF or the author's H-index with citation (24,51), the findings of the present study are in agreement with some other previous studies indicating that author's H-index and journal IF correlate with citation (5,10). It means that cardiovascular papers in journals with higher IF and authors with higher h-index receive more citations. Most people prefer to cite articles published by authors with higher H-index. Given that the H-index and the IF are directly affected by the number of citations, these findings seem rational.

Keywords are considered as an essential factor in retrieving articles and play a key role in introducing the article to the academic community (52). Linder (2015) points out that searching for health articles with a keyword is just a quick way to find some articles (53). However, Uddin and Khan noted that the number of authors' keywords is an essential factor in retrieving articles and increasing citation count (54). Similarly, the findings of the present study confirmed that the number of author keywords is not related to the number of citations in cardiovascular articles. Still, the number of keywords-plus is related to the number of citations. This difference is probably due to the lower number of author keywords compared to the number of additional keywords.

The present research findings revealed that the number of references is considerably related to the number of citations, which is in line with Falagas et al. (9). This is associated with the fact that Research with more reference numbers provides more and more diverse data so that the ideas presented in the paper are more effective than similar works. Also, articles with more pages will naturally have more references and more impact on the scientific community. These results confirm Fox and Paine's research, which found

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that three factors, the number of pages of an article, the number of authors, and the number of references, were required factors in increasing citations (48).

The findings demonstrated that the citations received from OA cardiovascular articles were higher than those from non-OA articles. This supports previous studies (32,33,55,56) and revealed that open access plays a key role in cardiovascular article citations. In this regard, Wang et al. concluded that articles with free access have more visibility and downloadability than articles without free access. OA articles are continuously downloaded over time, while articles with non-OA only are downloaded in a specific period after publishing (55).

The first author's country is also efficient in the citation. A study on the factors affected citation conceded that articles written by USA and UK authors received more citation than those of other countries (26). The present study results showed that cardiovascular articles written by the first author from Australia and North America received more citations. It should be noted that these countries are among the developed countries in the field of medical sciences with a trustworthy scientific background, which makes them conduct higher quality research and thus receive more citations.

Meta-analysis studies can be considered as the highest level of evidence pyramid and play a crucial role in clinical decisions (57,58). As in previous studies (15,59), we found that study design is remarkably effective in the citation. Also, case reports have received fewer citations than other types of study designs, which is similar to the results of other researchers who have stated that in the field of medicine, case reports receive the lowest number of citations compared to other researches (15,35).

Conclusion

Qualitative assessment of papers is a very problematic task; however, the citation is considered the essential indicator of quality. Therefore, identifying the most crucial factors affecting citation is of great importance. The results showed that all mentioned variables are related to citation, apart from the number of the author's keywords. Paying attention to these factors such as OA publishing, collaborating especially with the authors with higher H-index or from North America, or Australia, paying attention to the levels of evidence and study design can help cardiovascular centers and researchers to improve the citation impact of their works. It is also suggested that the authors consider other variables such as an appropriate number of references, more pages and keywords, a higher number of authors, and publishing in the journals with a higher IF. It may affect and improve the citations number of cardiovascular articles. As the present article indicated the factors affecting the citations, it is suggested that more in-depth studies need to be conducted to examine the predictor variables of citations in the cardiovascular articles and other fields by using regression analysis.

Declarations

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Conflicts of interest

The authors declared no conflict of interest

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