Impact of ResearchGate on Increasing Citations and Usage Counts of Hot Papers in Clinical Medicine Indexed in Web of Science

Elmira Janavi

Assistant Professor, Scientometrics Department, National Research Institute for Science Policy, Tehran, Iran, ORCID: 0000-0003-2550-4021. E-mail: janavi@nrisp.ac.ir

Somayyeh Nadi-Ravandi*

*Corresponding Author, Assistant Professor, Health Information Management, Kashan University of Medical Sciences, Kashan, Iran.
Center for Medical Education Development and Studies, Kashan University of Medical Sciences, Kashan, Iran. ORCID: 0000-0002-6257-2325. E-mail: snadi2006@gmail.com

Zahra Batooli

PhD in Information Sciences, Assistant Professor, Department of Health, Safety and Environment Management, Faculty of Health, Kashan University of Medical Sciences, Kashan, Iran. ORCID: 0000-0002-1212-9835. E-mail: batooli91@gmail.com

Abstract

The purpose of this research was to conduct a comparative study of the impact of ResearchGate indicators on increasing citation and usage counts of hot papers in clinical medicine indexed in the Web of Science (WoS) database. This is an applied research and has been performed using scientometric methods. Article titles, the number of citations, "Usage count last 180 days", "Usage count since 2013", publication year, and authors of 583 hot papers in clinical medicine were extracted from the WoS database. Then, the readership and citation counts of articles were extracted from ResearchGate social network. The data were analyzed by descriptive and analytical statistics using Microsoft Excel and SPSS 21. The results showed that there was a significant relationship between the number of received citations, both usage counts in WoS and ResearchGate indicators (P value $\leq$ 0.01). Self-archiving in scientific social networking sites such as ResearchGate may be effective on visibility of articles that may also be related to their received citations.

Introduction

As research performance has increasingly become important for academic institutes to compete in rankings, absorb students and receive enough budgets, many scientific indicators have been developed for measuring different aspects of research performance and scientific output (Yu et al. 2016). Recently, in the field of scientific production, the quality of published items has been emphasized by scientific institutions as well as their attempts to increase their scientific output, especially scientific articles. However, the qualitative aspect of scientific production is measured by quantitative indicators, including the number of received citations, the impact factor of publishing journals, and so on. In addition, new indicators such as h-index and SciVal have been considered to measure the quality of a scientific article. In all of these indicators, the number of citations received by an article is the main measure to improve the quality of the article. However, "publishing a paper in the journal which has a high impact factor is not guaranteed by analyzing citation rate" (Ale Ebrahim et al., 2014).

Apart from the received citations, several approaches can be effective in increasing the number of citations that an article receives such as increasing visibility (Ale Ebrahim et al., 2014) and researchers' scientific collaboration (Yu et al., 2016). Using the indicators of ResearchGate is one of these ways that combines bibliometrics with altmetrics for creating a comprehensive indicator to measure the research output (Yu et al., 2016). ResearchGate or any other social medium with the capability of bookmarking (RG score) can determine the degree to which a scientific article is used. In other words, the RG scores of an article indicate the number of times it has been read used (Batooli, 2017), which means that this social network can increase the citation frequency of an article by increasing its visibility (Priem et al., 2012). However, these social networks can also have negative effects. For example, a study by Ebrahimy et al. (2016) revealed that "social networks discussing scientific findings have a negative effect on the future citation of articles through visibility metrics".

In many countries, issues such as increased h-index of authors, high citation rates of articles, increase in hot papers and highly cited ones are considered influential by the academic community. The Essential Science Indicators (ESI) database considers those articles included in the list of One percent of highly referenced papers during the past ten years as highly cited ones. For example, nearly 9000000 articles have been published in 10000 famous international journals from 2000 to 2010, receiving about 85000000 citations in total. One percent of these articles (i.e., 9000 papers) had the highest citation rates during this period. Out of these highly cited articles, 1800 papers received the highest rate of international citations in the last two years and are conceived as "Hot Papers". These articles are the best ones that are included among the first 0.1 percent of the highly cited items (Batooli, 2017).

In this study, possible effects of ResearchGate performance indicators (such as reading and citing) on three WoS indicators including citations (from ESI), "Usage count last 180 days" and "Usage count since 2013" of hot papers in clinical medicine were investigated. "Usage count last 180 days" and "Usage count since 2013" are two indicators that are counted for every article in WoS. Due to the large number of these articles, clinical medicine as one of the main scientific fields was selected in this study. As one field among 22 research areas of ESI, clinical medicine receives the highest citation rate among the categories. The purposes of this research were as follows:

1. Identifying the frequencies of hot papers in clinical medicine authored by researchers and indexed in ESI by affiliated country, publication year, and publishing journal.
2. Identifying the frequencies of citations received by hot papers including the received citations in ESI, "Usage count last 180 days" and "Usage count since 2013" in WoS in clinical medicine authored by researchers
3. Determining the status of hot papers in clinical medicine authored by researchers indexed in WoS and shared in ResearchGate by the frequency of reading and citing.
4. Investigating the possible relationship between citations, "Usage count since 2013", and "Usage count last 180 days" in WoS and reading and citing frequency of them in ResearchGate.

Materials and Methods

This research is an applied study conducted by scientometric approach. Required data were collected via Essential Science Indicators (ESI), the Web of Science (WoS) Database and ResearchGate. At first, the hot papers in clinical medicine were extracted from ESI and the output in Excel was prepared by author names, article and journal titles, and the number of citations. Then, the titles of articles were searched on the Web of Science (WoS) Database and indicators including "Usage count last 180 days" and "Usage count since 2013" were extracted manually. In the next step, the titles of articles were searched in ResearchGate and the reading and citing frequency of each article was imported in the Excel software. Finally, SPSS 16 was used to analyze the data and clarify the statistical results. Table 1 shows the description of citation and altmetric indicators.

Table 1. Metrics, sources, and definitions of the five indicators used in this study

Citation and Altmetric indicators	Indicators	Description
WOS	Citation	The number of times the item has been cited.
	Usage count Last 180 days	The number of times the full text of a record has been accessed or a record has been saved in the last 180 days.
	Usage count Since 2013	The number of times the full text of a record has been accessed or a record has been saved since February 1, 2013.
ResearchGate	Citation	The number of times the item has been cited.
	RG Read	The number of times the item has been read.

Results

Considering the frequency of hot papers in the field of clinical medicine, findings showed that a total of 583 articles were considered as the hot ones. Table 1 shows the frequency distribution of articles by the journal titles.

Table 2. Journals publishing 60 percent of hot papers authored by journal

Year	Number	Percentage	Percentage of cumulative frequency
New England Journal of Medicine	119	20.4	20.4
Lancet	65	11.1.	31.5
JAMA-Journal of the American Medical Association	22	3.8	35.3
Circulation	19	3.3	38.6
Lancet Oncology	19	3.3	41.8
Journal of Clinical Oncology	16	2.7	44.6
Nature Reviews Clinical Oncology	14	2.4	47
Diabetes Care	13	2.2	49.2
Science	13	2.2	51.4
Nature	12	2.1	53.5
European Heart Journal	11	1.9	55.4
JAMA Oncology	11	1.9	57.3
Journal of the American College of Cardiology	10	1.7	59
Nature Reviews Cancer	10	1.7	60.7

The results also showed that about just over 60 percent of the hot papers (354 articles) were published in 14 journals (10.3 percent). As Table 2 shows *New England Journal of Medicine* published a majority of articles with 119 papers. 72 Journals in which only one article was published had the least published articles.

The frequency distribution of articles by publication year (Table 3) revealed that all articles were published after 2017. The publication year 2019 was ranked first with 204 (35 percent) published articles.

Table 3. Distribution of articles by publication year

Year	Number	Percentage	Percentage of cumulative frequency
2019	204	35	35
2018	292	50	85
2017	87	15	100
Total	583	100	

Table 4 depicts the frequency distribution of citations received by articles in the field of clinical medicine and indexed in Web of Science (WoS). As the table shows, these 583 articles received 66823 citations (M= 114.62) in total with 3756 and 4 citations as the highest and least received citations, respectively. Furthermore, Table 3 indicates that 583 articles

were used 13885 times in the last 180 days and 39039 times since 2013. While the highest and the least number of usage counts in 180 days have been 870 and 0, the maximum and minimum of which have been 852 and 0 in turn since 2013.

Table 4. Descriptive statistical of WoS indicators

Database	No. of Articles	Citations and Usage counts	Number of non-zero occurrences	Average number of non-zero occurrences	Mean	Mode	Min.	Max.
WoS	583	Citations: 66823	583 (100%)	114.6	114.62	71	4	3756
		Usage count last 180 days: 13885	576 (98.7%)	24.1	23.82	13	0	870
		Usage count since 2013:39039	581 (99.6%)	67.1	66.96	35	0	852

Table 5 shows the status of these hot papers were shared in ResearchGate based on the number of times they were read or cited. Findings revealed that all articles were shared in ResearchGate, more than 98 percent of which were cited and read.

Table 5. Descriptive statistical of ResearchGate indicators

Database	Number of indexed documents	Total occurrences	Number of non-zero occurrences	Average number of non-zero occurrences	Mode	Min	Max
RG	583 (100%)	Citation: 90567	577 (98.9%)	157	120	0	983
		Read: 135255	577 (98.9%)	234	164	1	1068

It is clear from Table 5 that 98.9 percent of the articles were cited at least once in ResearchGate. What is more, 98.9 percent of them were cited and read in ResearchGate 90567 and 135255 times, respectively. As mentioned before, the least and the most cited articles were cited 4 and 3756 times on WoS, in turn. In ResearchGate, the highest numbers of reading and citing were 1068 and 983, respectively. Any bookmarked article in ResearchGate was read and cited 234 and 157 times. Furthermore, 25 articles received about 20 percent of citations and about 20 percent of the total number of readings belonged to only 30 articles.

Table 6 shows a correlation between the rate of received citations, "Usage count last 180 days", "Usage count since 2013" in WoS and reading and citation rates in ResearchGate. Results of Spearman's correlation test indicated that there were significant relationships between the study variables (P value < 0. 01).

Table 6. The results of the correlation test between the study variables

Metrics		WOS			ResearchGate	
		Citation	Usage count last 180 days	Usage count since 2013	Citation	Read
WOS	Citation	1				
	Usage count last 180 days	0.304[*]	1			
	Usage count since 2013	0.599[*]	0.884[*]	1		
RG	Citation	0.821[*]	0.323[*]	0.555[*]	1	
	Read	0.089[*]	0.110[*]	0.178[*]	0.164[*]	1
[*]Correlation is significant with p<0.01.						

Discussion

Keramatfar et al. (2015) argue that ResearchGate database has a good place amongst researchers. Bar-Ilan et al. (2012) and Zahedi et al. (2014) confirmed that the articles published in medical fields have the highest rate of shared items in academic social networks. Studies showed that social networks have increasingly been taken into account in recent years. For example, Haustein et al. (2014) revealed that the Altmetric coverage of biomedical articles increased from 2.4 percent in 2010 to 20.4 percent in 2012. Castas et al. (2015) found that the received Altmetric attention scores of publications increased from 11 percent in 2011 to 25 percent in 2013. In a study in Singapore, Erdt et al. (2016) found that the coverage of publications in social networks increased from 7 percent in 2009 to 28 percent in 2013. Likewise, Togia et al. (2017) confirmed such an increase in Greece up to 17 percent in recent years. Other studies by Batooli (2017) and Batooli et al. (2016) supported these findings.

It was also found that about 99 percent of hot papers authored researchers in ResearchGate were read and cited at least once. Batooli (2017) and Batooli et al. (2016) found a high ResearchGate reading rate of articles that were indexed in WoS and Scopus. Thelwall and Wilson (2016) found that out of 332,975 medical articles, 78 percent were read at least once in Mendeley. Some researchers argue that beginners should not try to publish their works in high impact journals but to share them in social networks such as ResearchGate and consequently increase their reading rates because reading is more important than citing (de Leon, 2018).

Maflahi and Thelwall argued that the number of article readings in Mendeley is theoretically important as an initial tool of impact. Reading prior to publication has recently become prevalent, which can be manifested in different sharing approaches authors take in distributing their works prior to publication. This can be a basic change in formal publication of an issue of a journal (Maflahi & Thelwall, 2018). It could be claimed that the number of reads in Mendeley is more powerful than citing in Scopus and can be consistent among different fields (Thelwall, 2017).

Our findings also showed a significant relationship between the number of received citations in ESI and that of ResearchGate. This result is in line with those by Batooli (2017) and Batooli et al. (2016). The study of Ebrahimy et al. (2016) showed that social networks such

as Mendeley, which provide the possibility of article storage, have a positive effect on the citation rate of an article in WoS.

Mohammadi and Thelwall (2014) indicated that there is a significant relationship between the frequency of article bookmark in Mendeley and its citation. Besides, our findings showed a significant correlation between the reading of articles in ResearchGate and their citing in WoS. Batooli (2017) and Batooli et al. (2016), Bar-Ilan et al. (2012) and Mohammadi and Thelwall (2014) reported similar results. As there was no option as "reading" in ResearchGate and there were options of "observing" and "uploading" instead when conducting previous researches, Batooli (2017) and Batooli et al. (2016) conceived these two indicators as an indicator for reading an article. Investigating a large number of published articles in 45 fields of medicine in Scopus in 2009, Thelwall and Wilson (2016) found that the number of citations heavily depends on the number of readings in Mendeley.

ResearchGate performance indicators can increase researchers' performance. Yu et al. (2016) confirmed that this effect may be more powerful than that of SciVal indicators. However, studying this field, Togia et al. (2017) claimed that in investigating the possible correlation between altmetric and the number of citations, many researchers have found controversial results. For example, Thelwall et al. (2013) stated that out of eleven altmetric indicators, six indicators including Twitter, Facebook wall posts, Research Highlights, blog mentions, mainstream media mentions and forum posts had a relationship with citation number, but the extent of the correlation was not exactly measurable. Among social networks, it appears that citations have a powerful correlation with Mendeley (Priem et al., 2012). This is confirmed in studies by Zahedi et al. (2014), Erdt et al. (2016), and Groth and Gurney (2010). In a study by Eysenbach (2011), a strong correlation was observed between citations in Google Scholar and Twitter. Shuia, Pepe and Bollen (2012) showed a correlation between Tweet mentions, arXiv downloads and article citations. Some studies (Haustein et al., 2015; Bar-Ilan, et al., 2012) found a weak correlation between altmetric indicators and the number of citations. In an investigation by Costas et al. (2015), a low correlation rate was found between the number of citations and the number of tweets per article.

In a study, Liang et al. (2017) compared "usage counts" with "times cited" provided by WoS in detecting research fronts of the regenerative medicine and concluded that usage count is more dynamic than "times cited" indicator that can greatly shorten the time log in research fronts detection. Muhammad and Cargo (2018) studied the relationship between article usage count and citations for articles in trade liberalization field. They showed that the first top 50 cited articles mentioned the highest number of usage counts.

Conclusion

The qualitative aspect of scientific production is measured by some quantitative indicators, including the number of received citations, and the impact factor of publishing journals and so on. Some ways can be effective in increasing the number of citations an article receives. In

this study, the possible effects of ResearchGate's performance indicators (such as reading and citing) on the rate of received citations, counts(last 180 days and since 2013) for hot clinical medicine articles indexed in Web of Science (WoS) was investigated and compared in this respect.

The results showed that there was a significant relationship between the number of received citations in ESI, "Usage count in last 180" days and "Usage count since 2013" in WoS and "read" and "citation" indicators in ResearchGate. Therefore, researchers, according to the results of this study, are suggested to use the functional indicators in order to correctly increase the number of citations of their articles; and their research will be read and used by more people. Policy makers are also recommended to emphasize the importance of social networks and to consider it as an indicator in the scientific evaluation of scholars.

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