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Impact of country self citation on the ranking of the top 50 countries in clinical neurology

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ABSTRACT

Objectives: To examine the factors that influence country self-citation rate (SCR) in clinical neurology and to assess the impact of self-citation on the ranking of the top 50 countries.
Methods: SCImago Journal & Country Rank was used to collect data for the 50 most cited countries in clinical neurology during 1996–2019. Country SCR was correlated with several productivity parameters and examined statistically. Countries that dropped in their ranking after the exclusion of self-citations were identified.
Results: The median (range) country SCR for the 50 most cited countries was 11.3%.
(5.3%- 47%). Country SCR correlated significantly with total citable documents and total cites numbers and rankings. The exclusion of self-citations led to a drop in the ranking of 8(16%) countries only. No significant difference between the total and net total cites rankings was observed.
Conclusions: Self-citation can be appropriate and reflect an expansion on earlier research. Highly cited productive countries tend to have high country SCR. Excluding self-citations had minimal impact on the ranking of the top 50 countries. Our findings indicate that self-citation is unlikely to influence country standing amongst the top 50 and does not support the argument for eliminating self-citations from citation-based metrics. A more globalization through international collaboration in research is encouraged.

1. Introduction

Citation rates are used for calculating journal impact factor and for evaluating researchers' productivity which can affect careers and funding. They can also influence the academic standing of scholars, institutions, journals, and countries [1,2]. Citation-based bibliometrics could be prone to manipulation by practices that make them appear imperfect [3].

Self-citation in all its forms may be considered one of these tactics and consequently it has become a matter of interest in recent years [2]. Self-citation may well be appropriate and may be even necessary. In fact, the non-use of proper self-citation could be considered an attempt to conceal that the new work is not as novel as it is claimed [1,4]. Self-citation can function as a promoting tool giving more visibility to the researcher's work and leads to more citations by others. It is regarded inappropriate when it is misleading as it can propagate erroneous theories. Furthermore, excessive, and improper self-citation can distort the scientific literature and may impact the citation metrics [3,4]. The literature on self-citation has been evolving in the last few years. Self-citation rate (SCR) can be quantified at the level of the author, journal, and country. Some of the publications that calculated self-citations reported an author SCR ranging from 2.2% [5] to 18% [6], a journal SCR ranging from 6.35% to 11.85% [7] and a country SCR ranging from 17.8% to 54.9% [8]. Country SCR has been increasing consistently during 1996–2008 in most countries particularly China, USA, and Iran [9].

The impact of country self-citation on bibliometric indicators utilizing publications from the Scopus database was examined in a recent publication [8]. However, the study was restricted to the 10 most productive countries, was specialty indiscriminate and did not included data beyond 2015 [8]. The lack of an up-to-date data concerning the factors that influence country SCR in clinical neurology and information relating to the impact of self-citations on country worldwide ranking prompted us to do this study.

SCImago Journal & Country rank (SJR) [10] is a portal that updated annually and uses Scopus database and provides free information relating to the performance of countries and journals in a variety of scientific disciplines. The purpose of the study is to to assess the factors

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that influence country SCR by calculating the SCR for the 50 most highly cited countries in clinical neurology during 1996–2019 and correlating it with several productivity indices. The study also aimed to assess the impact of country SCR on the total cites ranking of the top 50 countries in clinical neurology by examining the effect of the exclusion of self-citations on the countries' world ranking.

2. Methods

2.1. Search and data source

This study was carried out at King Khalid National Guards Hospital, Jeddah, Saudi Arabia. No ethical approval was necessary as the study was based on data obtained from open access sources. The SJR [10] was searched on 1st November 2020 using the items: subject area (medicine), subject category (clinical neurology), country (all regions) and year (1996–2019). The 50 countries with the highest total cites in clinical neurology during the period were selected and ranked based on their total cites. The following productivity indices were collected for each of the top 50 countries: total citable documents, total cites, total self cites, total citable documents world ranking, and total cites world ranking. The country self-citation rate (SCR) was calculated by dividing the total self cites by the total cites and expressed as a percentage. The net total cites number was calculated by subtracting the total self cites from the total cites. The net total cites scores for the 50 countries was used to make a new ranking. The total cites and net total cites rankings were compared and changes in rankings were documents. A country was considered to have been impacted by self-citation if it dropped a rank or

Table 1
Productivity parameters for the 50 most cited countries in clinical neurology during 1996–2019 showing total documents, total cites, total self cites, self-citation rate, net total cites, worldwide ranking based on total documents, total cites, and net total cites as well as the net change in total cites ranking following the exclusion of self cites.

Country	Citable Doc.	Total cites (a)	Self cites (b)	SCR (b/a) (%)	Net total cites (a-b)	Citable Doc. World Rank	Total cites world rank	Net cites world rank	Net cites rank change
United States	225,408	8,096,325	3,801,699	47%	4,294,626	1	1	1	0
United Kingdom	52,408	2,224,365	455,569	20.5%	1,768,796	4	2	2	0
Germany	62,194	1,890,698	420,611	22.3%	1,470,087	2	3	3	0
Canada	35,185	1,368,065	210,415	15.4%	1,157,650	6	4	4	0
Italy	43,459	1,230,868	247,119	20.1%	983,749	5	5	5	0
Japan	61,098	1,113,461	242,114	21.7%	871,347	3	6	7	+1
France	32,544	1,050,659	166,991	15.9%	883,668	7	7	6	−1
Netherlands	21,810	947,653	128,101	13.5%	819,552	10	8	8	0
Australia	21,251	740,036	120,018	16.2%	620,018	11	9	9	0
Sweden	12,520	560,631	70,161	12.5%	490,470	16	10	10	0
Spain	23,124	558,037	92,649	16.6%	465,388	9	11	11	0
Switzerland	15,290	502,302	53,903	10.7%	448,399	13	12	12	0
China	32,297	381,069	135,441	35.5%	245,628	8	13	17	+4
Austria	8262	332,422	28,601	8.6%	303,821	19	14	13	−1
Belgium	9049	327,414	34,436	10.5%	292,978	18	15	14	-1
Denmark	7650	296,381	38,718	13.1%	257,663	20	16	15	-1
South Korea	15,690	272,436	40,743	15%	231,693	12	17	18	+1
Finland	5876	272,192	25,287	9.3%	246,905	24	18	16	−2
Brazil	15,281	244,292	53,839	22%	190,453	14	19	20	+1
Israel	6989	242,718	21,891	9%	220,827	23	20	19	−1
Norway	5175	207,928	21,396	10.3%	186,532	25	21	21	0
Turkey	15,144	193,755	26,478	13.7%	167,277	15	22	22	0
India	12,299	162,538	35,100	21.6%	127,438	17	23	24	+1
Taiwan	7449	148,581	19,253	13%	129,328	21	24	23	−1
Portugal	3452	107,551	8537	7.9%	99,014	31	25	25	0
Poland	7151	102,220	15,087	14.8%	87,133	22	26	26	0
Ireland	2737	89,920	6409	7.1%	83,511	34	27	27	0
Greece	3801	87,130	7238	8.3%	79,892	29	28	28	0
New Zealand	2539	84,768	6454	7.6%	78,314	35	29	29	0
Argentina	3118	75,976	5995	7.9%	69,981	33	30	30	0
Czech Republic	5010	71,062	10,891	15.3%	60,171	27	31	33	+2
Hong Kong	2510	70,543	7349	10.4%	63,194	36	32	31	−1
Hungary	3378	70,125	7771	11.1%	62,354	32	33	32	−1
Singapore	2294	53,146	4893	9.2%	48,253	37	34	34	0
Mexico	3569	47,833	6233	13%	41,600	30	35	35	0
Iran	4427	44,718	11,447	25.6%	33,271	28	36	38	+2
Russia	5049	40,834	6357	15.6%	34,477	26	37	36	−1
South Africa	1554	37,532	4122	11%	33,410	41	38	37	−1
Chile	1707	27,237	3429	12.6%	23,808	40	39	39	0
Saudi Arabia	2122	25,225	2061	8.2%	23,164	38	40	40	0
Egypt	2055	22,579	1748	7.7%	20,831	39	41	41	0
Thailand	1400	22,465	1929	8.6%	20,536	42	42	42	0
Serbia	920	18,756	1209	6.5%	17,547	46	43	43	0
Slovenia	747	16,858	1440	8.5%	15,418	48	44	44	0
Croatia	1120	15,841	1612	10.2%	14,229	43	45	45	0
Colombia	1059	15,786	1810	11.5%	13,976	44	46	46	0
Malaysia	872	13,108	1302	9.9%	11,806	47	47	47	0
Slovakia	929	12,904	1424	11%	11,480	45	48	50	+2
Bulgaria	525	12,400	782	6.3%	11,618	50	49	48	−1
Lebanon	618	12,230	642	5.3%	11,588	49	50	49	−1

Abbreviations: SCR: Self-Citation Rate, Doc: documents.

more after the exclusion of its self-citations.

2.2. Data analysis

The country SCR results in clinical neurology during 1996–2019 was correlated with the findings from the four bibliometric factors which were total citable documents number and ranking as well as total cites number and ranking. The correlations were done using the Pearson correlation coefficient. Furthermore, the extent of the variation between the total cite and net total cite country rankings was ascertained by correlating the two variables using Wilcoxon Signed –Rank Test. The correlation analyses were done using Social Sciences Statistics [11] with significance being reached when $P < 0.05$.

3. Results

The productivity parameters in clinical neurology during 1996–2019 for the selected 50 highly cited countries are summarized in Table 1. The median (range) values for total citable documents, total cites, total self cites, net total cites, SCR, total citable documents and total cites worldwide rankings for the 50 and the 10 most cited countries are summarized in.

Table 2. The country SCR in clinical neurology during 1996–2019 correlated significantly positively with total citable documents ($R = 0.8005$) ($P < 0.0001$) and total cites ($R = 0.7335$) ($P < 0.0001$). It also correlated significantly negatively with total citable documents ranking ($R = -0.6509$) ($P < 0.0001$) and with total cites ranking ($R = -0.5395$) ($P = 0.0005$). However, there was no significant difference between the total cite and the net total cite rankings for the 50 most cited countries ($Z = -0.1738$) ($P = 0.865$).

The impact of excluding self-cites on the total cites ranking amongst the 50 most highly cited countries in clinical neurology during 1996–2019 is demonstrated in Table 1. The median [range] net cites ran change was 0 [(−2)- (+4)]. Table 1 shows that eliminating the self-citations had no effect on the total cites ranking for 29(58%) countries and led to an improvement in the ranking of 13(26%) countries by one-rank gain (12 countries) and a two-rank gain (1 country). However, it led to a drop in the ranking of 8(16%) countries by a one-rank drop (4 countries), a two-rank drop (2 countries) and a four-rank drop (one country). These 8 countries were considered to have been impacted by self-citation. They (and their SCR) were Japan (21.7%), China (35.5%), South Korea (15%), Brazil (22%), India (21.6%), Czech Republic (15%), Iran (25.6%) and Slovakia (11%). The median (range) productivity parameters result for the 8 countries whose total cites ranking was impacted by self cites is also summarized in Table 2.

Table 2
The median (range) values for the productivity parameters for the 50 and the10 most cited countries as well as the 8 countries whose total cites ranking was impacted by the exclusion of self cites.

Productivity parameter	The 50 most cited countries Median (Range)	The 10 most cited countries Median (Range)	The 8 countries impacted by self cites Median (Range)
Total citable documents	5112 (525–225408)	39322 (12520–225408)	13790 (929–61098)
Total cites	104,886 (12230–8096325)	1172165 (560631–8096325)	203,415 (12904–1113461)
Total self cites	13,267 (642–3801699)	226265 (70161–3801699)	37922 (1424–242114)
Net total cites	93074 (11480–4294626)	933709 (490470–4294626)	158946 (11480–871347)
Self-citation rate	11.3% (5.3%–47%)	18.2% (12.5%–47%)	21.7% (11%–35.5%)
Total citable documents ranking amongst top 50	25.5 1–50	5.5 (1–16)	15.5 (3–45)
Total cites ranking amongst top 50	25.5 1–50	5.5 (1–10)	21 (6–48)

4. Discussion

4.1. Country self-citation rate

There are several legitimate reasons to self-cite especially for scholars working over a long-time frame on the same topic, building on their previous research. Self-citation is a phenomenon that could boost the impact of the author, journal, and country. Self-citation was found to significantly impact the *h*-index of researchers [5]. It is also more frequent in specialty compared to general journals [7]. Self-citation is believed to correlate significantly with the total number of citations [1,12], number of publications [5,13] and number of authors [1,3,12]. The median country SCR in clinical neurology during 1996–2019 for the 50 and 10 most cited countries was 11.3% and 18.2% respectively. The latter is slightly lower than the median country SCR of 22.9% that was reported for the 10 most productive countries during 1996–2015 [8]. There is a slight variation in the top tier countries according to whether the ranking was based on total citable documents or total cites as in Table 1. It is recognized that countries with a bigger a share of world publications self-cite more [6,9]. The estimated country SCR here was higher than most reported author and journal SCR.

[5,7]. This is not surprising as country SCR reflects the summation of self-citations by single and groups of authors as well as institutions from the same country. High country SCR may come from local collaboration networks, meetings and people knowing about each other work locally and choosing to cite it. However, a significant part of country SCR can be attributed to authors citing their previous work [14].

In this study, the 10 countries that had the highest country SCR in clinical neurology during 1996–2019 (and their SCR) were: USA (47%), China (35.5%), Iran (25.6%), Germany (22.3%), Brazil (22%), Japan (21.7%), India (21.6%), Italy (20.1%) and UK (20.5%).

This result differs slightly from another publication [15] that also utilized SJR and found the countries with the highest SCR during 1996–2017 to be: China (55.6%), USA (45.6%), Iran (36.6%), India (34.3%), Brazil (33.1%), Russia (31.7%), Ukraine (27%), Japan (26.7%), Malaysia (26.1%) and Pakistan (25.8%). One more study [8] reported country SCR for the 10 most productive countries during 1996–2015 to be as follows: China (54.9%), USA (46.5%), Japan (26.7%), Germany (24.6%), Spain (23%), UK (22.8%), Italy (22.8%), France (21.3%), Australia (20.8%) and Canada (17.8%). The variation between the various reports could be accounted for by the duration of the study period, the specialty/field covered, the data source and the country inclusion criteria. Nevertheless, all the reports share the common observation that USA and China have the highest country SCR in the world.

4.2. Correlation between country SCR and productivity indices

We have observed a significant correlation between country SCR and total citable documents and total cites which is consistent with other reports [1,8,9]. The median country SCR for the 10 most cited countries was considerably higher than the median for the 50 countries (18.2% vs. 11.3%). As expected, the 10 most cited countries had a considerably higher median total citable documents (39,322 vs. 5112) and total cites (1,172,165 vs. 104,886).

A significant negative correlation between country SCR and the total citable documents rankings and total cites rankings was also seen. The 10 most cited counties that had higher median country SCR (18.2%) had lower median total cites rankings (5.5) while the 50 most cited countries that had lower median country SCR (11.3%) had higher median total

cites rankings (25.5). The association between country SCR and the number of cites per documents was not examined in this study. It has been observed that country SCR correlated negatively with the average net-citation per paper and the publications per capita [8]. Furthermore, the influence of international collaboration on country SCR was also not addressed in this study. It has been documented that broadening the network through international collaboration could influence country SCR significantly [8,9].

4.3. The impact of self-cites on the total cites ranking of the top 50 countries

We found no significant difference between the total cites rankings and the net total cites rankings for the top 50 countries in clinical neurology. The exclusion of self-citations had no impact on the country total cites ranking in 58% and led to an improvement in the ranking in 26%. It impacted the ranking negatively in 16% only. The 8 affected countries were Japan, China, South Korea, Brazil, India, Czech Republic, Iran, and Slovakia. They had median SCR that was considerably higher than that for the 50 most cited countries (21.7% vs. 11.3%) and slightly higher than the median for the 10 most cited countries (21.7% vs. 18.2%).

Compared to the 10 most cited countries, these countries had a considerably lower medians for total citable documents (13,790 vs. 39,322), total cites 203,415 vs. 1,172,165), total citable documents ranking (15.5 vs. 5.5) and total cites ranking (21 vs. 5.5). Each of the 8 countries has its language and many of them have a large population. It is recognized that country SCR is more likely to be high in countries with large population and those facing language barrier [9]. Our findings indicate that self-citation is unlikely to influence a country's scientific standing amongst the top 50 countries in clinical neurology. Hence, the results do not support the argument that was suggested by some authors [3,7,8] to exclude or modify the use of self-citations in citation-based metrics.

4.4. Study limitation

There are several limitations to the study. The study was heavily reliant on the precision of the search engine SJR. It is possible that there were inaccuracies particularly with multi-national publications. The selection of the top 50 countries based on their total cites could have influenced the inclusion of a few of the lower performing countries. Also, with the study being restricted to the top 50 countries it was not possible to make observations about the global, continental, or regional trends in country SCR. Furthermore, even though many international clinical neuroscience journals are categorized under clinical neurology in SJR, the site does not provide data about different topics in clinical neurology such as stroke and multiple sclerosis which may have allowed for a more in-depth analysis. The association between country SCR and the number of cites per documents and *h*-index as well as the influence of international collaboration on country SCR were not addressed.

5. Conclusions

Self-citation can be appropriate and may reflect an expansion on earlier research.

In this study the median country SCR in clinical neurology during 1996–2019 was found to be 11.3% for the 50 most highly cited countries. Country SCR correlated significantly with total citable documents, total cites, total citable documents ranking, and total cites world ranking. No significant difference between the total cites rankings and net total cites rankings was observed. Our results indicate that country self-citation is unlikely to significantly influence its scientific standing amongst the top 50 countries and nothing objectionable about country self-citation was observed. The findings therefore do not support the argument for the exclusion or modification in the utilization of self-citations in citation-based metrics. Nevertheless, a more globalization through international collaboration in scientific research is encouraged.

Conflict of interest statement

The authors declare that they have no competing interests, and no funding was received.

Authors' contribution

AMB: Data collection, literature, and manuscript review
AABJ: Methodology, data analysis and manuscript writing
MAS: Data collection, literature, and manuscript review
ABJ: Study design, methodology, data analysis and manuscript writing

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