eNeurologicalSci 4 (2016) 1–3

Contents lists available at ScienceDirect

eNeurologicalSci

journal homepage: http://ees.elsevier.com/ensci/

Impact of country-specific characteristics on scientific productivity in clinical neurology research

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ARTICLE INFO

Article history:
Received 27 January 2016
Received in revised form 9 March 2016
Accepted 11 March 2016
Available online 12 March 2016

Keywords:
Clinical neurology research
Bibliometrics
Scientific productivity
Worldwide ranking

ABSTRACT

Objectives: The objective of this study was to identify the top 50 countries in the world in clinical neurology research and to use their data to assess the impact of a number of country-specific characteristics on scientific productivity in clinical neurology.

Methods: The SCImago Journal & Country Rank (SCR) web site was used to identify the top 50 countries in the world based on their total documents in clinical neurology. Using their data 5 country-specific characteristics and 6 productivity indicators (total documents, total cites, *h*-index, citable documents, self-cites and citations per document) were correlated and examined statistically.

Results: The number of universities in the world top 500 and the number of clinical neurology journals enlisted in SCR correlated significantly with each of the 6 indicators. The gross domestic product (GDP) per capita and the percentage of GDP spent on research and development (R & D) correlated significantly with 3 and 4 out of the 6 indicators respectively. The population size did not correlate significantly with any of the 6 indicators.

Conclusions: The number of universities in the world top 500 and the number of clinical neurology journals enlisted in SCR appear to have a strong impact on scientific productivity. GDP per capita and spending on R & D appear to have a moderate impact on productivity that is influenced by the indicator used. Furthermore, population size appears to have no significant impact on productivity in clinical neurology research.

1. Introduction

The use of measures such as journal's impact factor (IF) and *h*-index to quantify the scientific creditability of research and researchers had been gaining worldwide acceptability. Increasingly these metrics are being used to assess the scientific output of different countries to a particular specialty [1–4]. The worldwide ranking of universities had drawn substantial attention and it is expected that the global ranking of medical specialty research will generate more interest. The objective of this study was to identify the top 50 countries in the world in clinical neurology research and to use their data to assess the impact of a number of country-specific characteristics on scientific productivity in clinical neurology.

2. Methods

SCImago Journal & Country Rank (SCR) [5] is a portal that integrates journal and country scientific statistics developed from Scopus database. The site provides lists of worldwide ranking based on 6 productivity indicators which are: total documents, total cites, *h*-index, citable documents, self-cites and citations per document. The findings vary according to the searched subject area, category, region and year. The SCR site [5] was searched on 1st November 2015 using the parameters “medicine” for subject area, “clinical neurology” for subject category, “1996–2014” for year and “all” for region. The site was also searched for “clinical neurology journals” and found to include 335 international journals that covered the range of clinical neuroscience specialties. Using the site we obtained a list of the top 50 countries in the world based on their total documents in clinical neurology. Information connected to 5 country-specific characteristics were gathered. These were: population size from the worldometer web site [6], gross domestic product at purchasing power parity (GDP) per capita from the International Monetary Fund database [7], percentage of GDP spent on research and development (R & D) from the World Bank web site [8], number of universities in the world top 500 from the Shanghai ranking web site [9] and the number of clinical neurology journals enlisted in SCR [5]. Furthermore, figures pertaining to the 6 productivity indicators provided in SCR were collected for each country. The data for the 5 country-specific characteristics and the 6 productivity indicators were correlated by calculating Pearson correlation coefficient (r) using Social Sciences Statistics [10] with significance being reached when P was less than 0.05.

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http://dx.doi.org/10.1016/j.ensci.2016.03.002

3. Results

The range (median) for each of the 5 country-specific characteristics was; population size: 2,069,000–1,347,000,000 (27,409,500), GDP per capita: $5808–$83,066 ($31,592), percentage of GDP spent on R & D: 0.16%–4.36% (1.4%), number of universities in the world top 500: 0–146 (3) and the number of clinical neurology journals enlisted in SCR: 0–94 (1). The ranges (median) for each of the 6 productivity indicators were; total documents: 462–176,187 (3687), total cites: 2904–4,406,449 (46,448), *h*-index: 23–410 (86), citable documents: 415–153,609 (3419), self-cites: 239–2,113,059 (6867) and citations per document: 5.87–36.07 (17.09).

Table 1 shows the top 50 countries in clinical neurology research ranked by their total documents with data for 4 country-specific characteristics (GDP per capita, percentage of GDP spent on R & D, number of universities in the world top 500 and the number of clinical neurology journals enlisted in SCR [5]) and 3 productivity indices (total documents, *h*-index and citations per document). Table 2 summarizes the correlation results between the 5 country-specific characteristics and the 6 productivity indicators.

4. Discussion

Bibliometric indicators are established tools used in the assessment of research performance in various disciplines. The data pool in this study was large compared to other published studies (335 journals over a 19-year period) [1–4]. Furthermore, the number of country-specific characteristics (5) and scientific productivity indicators (6) assessed in this study was higher than in other studies in the literature [1–4]. We observed that population size did not correlate significantly with any of the 6 productivity indicators. This indicates that population size has no significant impact on clinical neurology research output, which is contrary to reports from foot and ankle research [1], arthroscopy [2] and rheumatology [3].

The impact of high GDP on productivity had been reported as significant in a number of publications [1–3]. Conversely the impact of GDP per

Table 1
List of the top 50 countries in clinical neurology research ranked by their total documents with data of 4 of country-specific features and 3 productivity indices.

Country	GDP/capita ($)	Universities in top 500	Journals in SCR	% GDP in R & D	Total documents	*h*-index	Citations per document
United States	54,370	146	94	2.70	174,187	410	29.19
Japan	37,519	19	11	3.67	49,642	182	13.46
Germany	46,216	39	29	2.30	49,291	253	22.42
United Kingdom	39,826	38	67	1.70	41,522	297	31.79
Italy	35,131	21	13	1.10	35,023	208	19.44
France	40,538	21	13	1.90	25,770	223	24.15
Canada	44,967	21	1	1.80	25,464	243	32.59
Spain	33,835	12	4	1.30	18,908	161	15.18
China	13,224	44	4	2.08	15,969	104	13.84
Netherlands	47,960	13	30	1.60	15,904	218	34.86
Australia	46,550	19	1	1.70	14,565	184	29.11
Brazil	16,155	6	5	0.90	11,396	100	11.88
Turkey	19,698	1	7	1.01	11,363	91	10.55
Switzerland	58,149	7	12	2.30	10,805	170	26.70
South Korea	35,379	10	4	4.36	10,128	99	19.12
India	5808	1	5	0.90	9703	76	9.81
Sweden	46,219	11	1	3.30	9077	180	35.14
Belgium	43,139	7	0	1.70	6641	144	27.27
Austria	46,640	6	3	2.50	6507	148	29.75
Taiwan	46,036	0	1	2.30	5825	87	15.14
Israel	33,136	6	0	4.20	5473	131	25.60
Denmark	44,625	5	0	2.40	5044	147	33.22
Poland	25,247	2	5	0.90	4944	80	11.93
Finland	40,661	5	0	3.10	4538	151	36.07
Norway	67,166	3	0	1.60	3724	127	33.95
Czech Republic	30,047	1	3	1.40	3650	69	9.43
Greece	25,954	2	0	1.70	2942	74	16.20
Mexico	17,950	1	3	0.40	2602	63	12.41
Argentina	22,302	1	0	2.70	2412	82	16.26
Iran	17,443	1	2	0.70	2355	44	12.61
Portugal	27,069	3	1	2.80	2270	90	24.89
Hungary	25,019	2	2	0.90	2220	77	20.14
Ireland	51,284	3	1	1.40	1851	86	25.28
New Zealand	35,305	4	0	1.20	1818	86	26.63
Hong Kong	55,097	0	0	0.76	1724	72	20.17
Singapore	83,066	2	0	2.20	1577	64	18.69
Saudi Arabia	52,311	4	2	0.25	1189	40	9.10
Russian Federation	24,449	2	2	1.00	1133	56	17.92
Egypt	10,918	1	4	0.23	1124	40	13.20
Chile	23,057	2	1	0.53	1094	48	10.36
South Africa	13,094	4	0	0.70	1020	52	18.39
Croatia	20,947	0	1	0.81	915	42	9.99
Thailand	15,579	0	0	0.25	905	46	14.77
Cuba	18,796	0	0	0.42	892	31	5.87
Slovakia	28,279	0	0	0.40	639	35	10.95
Morocco	7813	0	0	0.60	571	23	7.29
Slovenia	29,867	1	0	1.40	571	40	14.13
Colombia	13,480	0	0	0.16	552	36	13.43
Serbia	13,378	0	0	0.35	480	28	13.04
Malaysia	25,145	2	1	0.63	462	32	14.20

Abbreviations: GDP: gross domestic product, R & D: research and development, SCR: SCImago Journal & Country Rank.

Table 2
Summary of the correlation between 5 country-specific features and 6 productivity indicators.

Country-specific characteristic	Productivity indicator	R-value	P value (significance)
Population size	Documents	0.1705	0.2365 (NS)
	Cites	0.1080	0.4553 (NS)
	h-index	0.0414	0.7753 (NS)
	Citable documents	0.1693	0.2399 (NS)
	Self-cites	0.1303	0.3671 (NS)
	Citation per document	−0.1969	0.1725 (NS)
GDP per capita	Documents	0.2638	0.0642 (NS)
	Cites	0.2957	0.0371 (Sig)
	h-index	0.4987	0.0002 (Sig)
	Citable documents	0.2659	0.0620 (NS)
	Self-cites	0.2281	0.1111 (NS)
	Citation per document	0.6300	<0.0001 (Sig)
GDP spending on R & D	Documents	0.3034	0.0322 (Sig)
	Cites	0.2755	0.0528 (NS)
	h-index	0.5136	0.0001 (Sig)
	Citable documents	0.3113	0.0278 (Sig)
	Self-cites	0.2077	0.1478 (NS)
	Citation per document	0.5476	3.9E-0.5 (Sig)
Universities in world top 500	Documents	0.9620	<0.0001 (Sig)
	Cites	0.9639	<0.0001 (Sig)
	h-index	0.7753	<0.0001 (Sig)
	Citable documents	0.9604	<0.0001 (Sig)
	Self-cites	0.9413	<0.0001 (Sig)
	Citation per document	0.3050	0.0313 (Sig)
Clinical Neurology journals in SCR	Documents	0.8781	<0.0001 (Sig)
	Cites	0.9024	<0.0001 (Sig)
	h-index	0.7700	<0.0001 (Sig)
	Citable documents	0.8742	<0.0001 (Sig)
	Self-cites	0.8411	<0.0001 (Sig)
	Citation per document	0.3033	0.0323 (Sig)

Abbreviations: R: Pearson correlation coefficient, GDP: gross domestic product, R & D: research and development, NS: not significant, Sig: Significant, SCR: SCImago Journal & Country Rank.

capita on research outcomes had been described as non-significant in two publications [4,11]. In this study, the GDP per capita was associated with a significant impact on clinical neurology research based on 3 out of the 6 productivity indicators (total cites, *h*-index and citations per document). In addition, the percentage of GDP spent on R & D was associated with a significant impact on the scientific output in the specialty using 4 out of the 6 indicators (total documents, *h*-index, citable documents and citations per document). Halpennny et al. [12] reported that the percentage of GDP spent on R & D positively correlated with the number of publications in high-ranking radiology journals. Meo et al. [4] reported a significant correlation between spending on R & D and pharmacological sciences research based on 2 out of 4 productivity indicators (citations per document and *h*-index). They also reported a significant correlation between the total number of universities and journals indexed in the Institute of Scientific Information (ISI) with research publications according to 3 out of 4 indicators (total documents, citable documents and *h*-index) [4]. Meo and Usmani [11] also reported that spending on R & D, number of universities, indexed journals, high technology exports and number of patents had a positive correlation with the number of published documents by European countries in various science and social subjects. In addition, Choung and Hwang [13] described a positive interaction between scientific and technological activities. They reported that universities perform a crucial role in expanding the number of publications and that their research activities were important in sustaining the progress of industrial technologies. In this study, we found that the number of universities in the world top 500 and the number of clinical neurology journals enlisted in SCR [5] were associated with a significant impact on the scientific productivity based on all the 6 indicators. The findings are not surprising as the ranking of the top 500 universities in the world is partially defined by the number of publications. Furthermore, as SCR was the source of data for the 6 productivity indices, it is therefore not unexpected that the number of clinical neurology journals listed in that website correlated with scientific productivity of the country. Data relating to the percentage of publications in the SCR journals that originated from the host country would have been be informative but this was not provided in the web site. Nevertheless, the results highlight the importance for a country to produce high impact factor journals and to have top ranking universities that can advance clinical neurology research nationally or globally through a collaborative approach.

There are a number of limitations to this study. The study was dependent on the accuracy of the web site search engine SCR. It is possible that there were errors particularly with multi-national publications. The study was also reliant on the correctness of the web sites used for the country-specific characteristics.

5. Conclusions

Based on data relating to the top 50 countries in clinical neurology research, the number of universities in the world top 500 and the number of clinical neurology journals listed in the SCR [5] appear to have a strong impact on clinical neurology productivity from a country. The GDP per capita and spending on R & D appear to have a moderate impact on productivity that is influenced by the indicator used. Furthermore, population size appears to have no significant impact on productivity in clinical neurology research.

Disclosure

The authors declare that there is no conflicting interest and that the study has not been supported or funded by a drug company or any organization.

Authors' contribution

BAJ: Data collection and manuscript writing.
ABJ: The idea of the study, data analysis and manuscript writing.

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