

Bibliometric analysis of the volume and visibility of Saudi publications in leading anesthesia journals

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ABSTRACT

Context: The quantity and quality of publications by a country indicates its contribution towards scientific development. **Aims:** To examine the volume and impact of the Saudi anesthesia publications in leading anesthesia journals. **Settings and Design:** Fifteen leading anesthesia journals were identified. Saudi publications in these journals from 1991 to 2011 were searched in the databases of Pubmed and Web of Knowledge. **Methods:** For each article, the journal and time of publication, the type of the article and the affiliation of the first author were analysed. The visibility of the publications was related to the number of citations and was analysed for the years 2000 to 2008. Data were compared with selected Arab countries. **Statistical Analysis:** Two visibility indices were used. The first relates the average citations per Saudi articles in the years following publication to the average global citations. The second relates the average citations per Saudi article in the two years following publication to the impact factor of the journal of publication. The h-index was used as a measure of both volume and visibility. **Results:** Anesthesiologists from Saudi affiliations published 173 documents in leading 15 anesthesia journals between the years 1991-2011, with a marked increase in the last 6 years. Anesthesia and Analgesia journal published 24% of Saudi articles. Saudi universities contributed to 55% of Saudi publications. The visibility of the Saudi articles was 0.7 of the international figures. **Conclusions:** Saudi anesthesia publications are increasing in recent years. Although the visibility of Saudi publications is below international figures, it compares favourably to Arab countries.

Key words: *Bibliometric, h-index, impact factor, scientometrics, visibility indices*

INTRODUCTION

The volume and quality of articles published by an institution or a country is an indicator of their contribution towards the creation of new knowledge in anesthesiology.^[1] It is usually the result of improved economic condition; and in turn the budget available for research,^[2,3] the encouragement given in the institution to academic production,^[4] and the existence of academic milieu (physically, intellectually, and by mentorship).^[5] Personal factors as self-motivation, promotion, or increased income may also play an important role.

The significance and visibility of published scientific articles is usually evaluated by the number of citations the article receives in the years following publication.^[6] By comparing this value to the global average citations per article or to the impact factor of the journal in which the article was published visibility indices can be derived.^[7]

The aim of this bibliometric analysis is to examine the volume and impact of the Saudi anaesthesia Publications in highly citable anesthesia journals. To the best of my knowledge this is the first report that reveals the contribution of authors from Saudi Arabia to research in the field of anesthesiology. The Saudi research will be compared also to that of selected Arab countries with good standing in the field of research.

METHODS

I performed a bibliometric analysis of the data available from PubMed and Thomson Reuters (TR) Web of Knowledge. PubMed database comprises over 21 million citations of biomedical literature from MEDLINE (the U.S.

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National Library of Medicine), life science journals, and online books. TR Web of Knowledge is a multidisciplinary science research platform covering journal literature from 1945 to present. It indexes 8300 major journals across 150 disciplines. Two applications of TR Web of Knowledge were utilized; Web of Knowledge databases and Journal Citations Report (JCR). The latter is an objective meant to critically evaluate the world's leading journals, with quantifiable, statistical information based on citation data.

Defining highly citable anesthesia journals

We searched JCR science edition 2010 for highly citable English language anesthesia journals. Fifteen titles were defined with impact factor from 0.718 to 5.264.

Quantitative analysis

A search was made in the databases of PubMed and Web of Knowledge for articles published in the 15 highly cited journals between 1991 and 2011, in which the first author was a member of anesthesia service in Saudi Arabia. For PubMed we used the electronic version (www.ncbi.nlm.nih.gov/pubmed) and searched for the following combined Keywords: "Saudi" affiliation + "Anesth* OR Anaesth*" affiliation + "The full names of the journals retrieved from JCR" journal. In the Web of Knowledge database the same search strategy was used. However, the search items "affiliation" and "journal" were replaced by "address" and "publication name," respectively.

Articles from both databases were merged together and then were analysed according to:

- Journal where the article was published
- Year of publication
- Affiliation of the first author
- Type of the article

Qualitative analysis

In my qualitative analysis, I used citation impact as the principal parameter. The number of citations obtained by each article in the subsequent 2 years of publication divided by 2 defines the real impact factor (RIF) of that article. The sum of all articles' RIF is the (Total RIF) and the value of the total RIF divided by the number of articles defines the (Average RIF) for the articles published by the Saudi-based anesthesiologists. This formula is equivalent to that used by JCR to calculate the impact factor of the journal.

The impact factor of the journal, in which the article was published, for the two years following publication was derived from the respective edition of the journal citation report. By averaging the sum of the two years' impact factor we have a value, which can be called the expected impact factor (EIF) of the article. The sum of all articles' EIF is

the (Total EIF) and the value of the total EIF divided by the number of the articles defines the (Average EIF) for the articles published by Saudi-based anesthesiologists. The visibility of Saudi publications can be estimated by relating RIF to EIF.

Since Web of Knowledge-JCR web-site publishes only reports for the years 2001 to 2010, we performed the above qualitative analysis on the Saudi articles published from the year 2000 to 2008.

Comparative analysis

I used Web of Knowledge to create a citation report for articles published from 2000 to 2008 for some of the Arab countries including Saudi Arabia, Egypt, Lebanon, and other countries of the Gulf Cooperation Council (GCC) in the highly cited anesthesia journals. The citation reports included:

- The number of articles found
- Sum of the Times Cited: The total number of citations (in the following years until now) to all of the articles found in the results
- Average Citations per article: This is the sum of the times cited count divided by the number of results found (a/b)
- h-index; which is indicated by a horizontal line. The number of items above this line, which is "h," have at least "h" citations. For example, an h-index of 20 means there are 20 items that have 20 citations or more. It depends on both the number of articles and the number of the times each article was cited.

In addition to the above, the number of the global (the entire world) articles published in highly citable anesthesia journals from 2000 to 2008 and the global average citations per article were calculated. The relation of the average citations, for each country, to the global average citations defines another measure for visibility of the articles published by that country.

RESULTS

In the period from 1991-2011, anesthesiologists from Saudi affiliations published 173 documents in the leading 15 anesthesia journals included in the JCR. Table 1 shows the number of the documents published in each journal and the impact factor of the journal as published in 2010 JCR. Seventy-six per cent of the publications were original articles; 14% were case reports, 8% were letters to the editor, and 2% were review articles and editorials. Figure 1 shows the number of Saudi publications in the leading anesthesia journals during the last two decades. It shows an increase in the years 1994-1996 and a trend to increase in the last 6 years.

Figure 2 reveals the number of publications in the leading anesthesia journals in relation to the affiliation of the first author. The university hospitals were responsible for 55% of the Publications of which 49% were from King Saud University, 31% were from Dammam University (previously called King Faisal University), and 20% were from King Abdulaziz University. The MOH (Ministry of Health) and specialist hospitals contributed to 23% of publications and within this group, King Khaled Eye Specialist Hospital and King Faisal Specialist Hospital and Research Centre were the main sources with 51% and 36%, respectively. The next major contributor was the MOD (Ministry of Defence) and NG (National Guard) hospitals with 16% of all publications. Finally, private hospitals contributed by a total of 10 publications representing 6% of all publications.

Sixty-four documents were published by the Saudi authors from the year 2000 to 2008 in the highly-citable anesthesia journals as retrieved from the TR Web of Knowledge

database. Seven documents were not cited in the two years following publications. The remaining 57 documents received 186 citations in the 2 subsequent years to that of the respective publication resulting in a total RIF of 93. By dividing this value by the total number of documents (64) we have the average RIF (1.45) for the Saudi publications in the leading anesthesia journals between the years 2000 and 2008. On the other hand, the average EIF for the Saudi publications, as derived from the journal impact factor of the titles in which the articles were published, was 2.2. The visibility index^a of the Saudi publications, as derived by dividing RIF/EIF is 0.66.

Table 2 shows the data generated by the Citation Report of the Web of Knowledge database for anesthesia publications in the years 2000-2008 for some selected Arab countries in the leading anesthesia journals. It shows that Saudi Arabia ranks favourably among Arab and GCC countries both quantitatively and qualitatively. By relating the average citations per Saudi anesthesia articles in the years

Table 1: The number and type of documents published by authors from Saudi Arabia in leading anesthesia journals from 1991 to 2011

Journal title	2010 impact factor	Total number of documents	Type of documents			Letter
			Original article	Case report	Review article or editorial	
Anesthesiology	5.486	10	8	2	0	0
British Journal of Anaesthesia	4.224	19	17	2	0	0
Anesthesia and Analgesia	3.274	41	26	6	0	9
Anaesthesia	3.008	13	10	3	0	0
Regional Anesthesia and Pain Medicine	2.807	3	3	0	0	0
Journal of Neurosurgical Anesthesiology	2.205	1	0	0	0	1
Acta Anaesthesiologica Scandinavia	2.196	9	8	0	1	0
Canadian Journal of Anaesthesia	2.180	23	19	4	0	0
Pediatric Anesthesia	2.173	9	2	1	3	3
International Journal of Obstetric Anesthesia	1.793	1	0	1	0	0
European Journal of Anaesthesiology	1.679	19	19	0	0	0
Journal of Cardiothoracic and Vascular Anesthesia	1.596	6	3	2	0	1
Journal of Clinical Anesthesia	1.279	3	2	1	0	0
Anaesthesia and Intensive Care	1.128	11	9	2	0	0
Journal of Anesthesia	0.718	5	5	0	0	0

Table 2: Citation report for the articles published in 2000-2008 by some of the Arab countries in leading anesthesia journals as generated by Thomson Reuters Web of Knowledge

	Saudi Arabia	Egypt	Lebanon	Other GCC
Results found	64	50	109	27
Sum of the times cited	521	552	873	188
Sum of times cited without self-citations	504	540	830	187
Citing articles	460	529	765	187
Citing articles without self-citations	444	518	744	186
Average citations per item	8.14	11.27	8.08	6.96
H-index	12	15	17	8.0

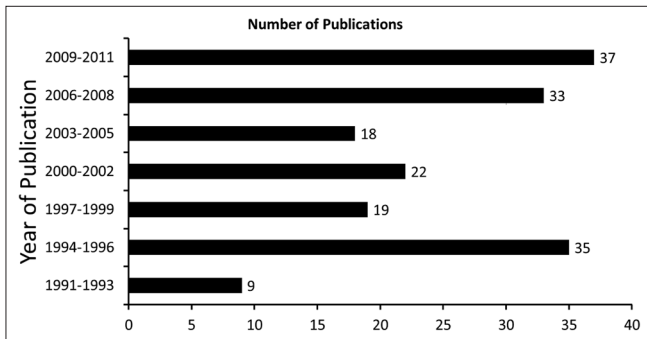


Figure 1: The changes in volume of Saudi Anesthesia publications in leading anesthesia journals over the years (1991-2011)

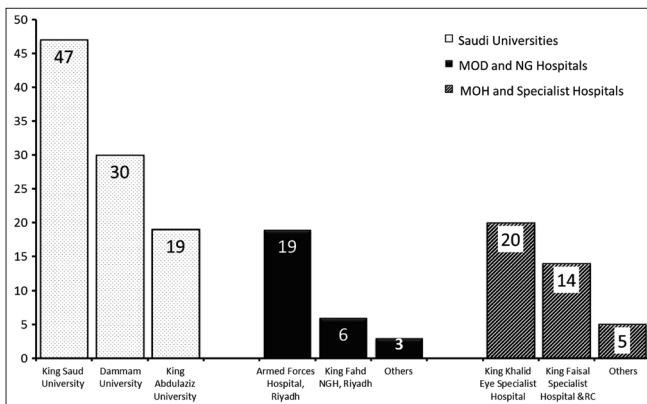


Figure 2: The number of publications in the leading anesthesia journals by Saudi Universities (55%), Ministry of Defence (MOD), and National Guard (NG) Hospitals (16%) and Ministry of Health (MOH) and Specialist Hospitals (23%). The remaining 6% (not shown in the figure) are from private hospitals

following publication (8.14) to the average global citations per anaesthesia articles published in the leading anesthesia journals (12.2) we get a visibility index^b of 0.67, which has a close value as the visibility index^a calculated above.

DISCUSSION

This bibliometric analysis showed that the volume of Saudi publications in the leading anesthesia journals increased markedly in recent years. It showed also that although the impact of Saudi output is below international values, it compares favourably among Arab countries.

Scientometrics is the science of measuring and analysing science or, in other words, the study of the quantitative aspects of science as a discipline.^[8,9] In practice, scientometrics is often done using bibliometrics, a measure of (scientific) publications.^[10] Any bibliometric search method can only show part of the full picture; however, one approach has been to look at a subset of journals in the field of anesthesia that have relatively high impact factors. We selected the highest impact factor English language anesthesia journals that were indexed in 2010 JCR.

Twenty-four per cent of Saudi articles were published in the Journal of Anesthesia and Analgesia. This is probably because Anesthesia and Analgesia publishes the highest number of articles compared to other high impact factor anesthesia journals.^[11]

The university institutions contributed 55% of the Saudi publications. One reason for the high research output by the universities is the need to show proof of publications for the purposes of promotion. It is to the credit of the other medical sectors that they publish although they do not have to, for the purposes of promotion or tenure.^[12] The presence of special budget allotted for research and the academic milieu opting to attract research oriented seniors to serve as mentors for young physicians, are other reasons for the high volume of publications by Saudi universities. It is interesting to note that in other sectors, certain hospitals are the major contributors (Riyadh Armed Forces Hospital for the Military Hospitals sector and King Khalid Eye Specialist Hospital and King Faisal Specialist Hospital for the MOH and Specialist Hospitals sector).

The introduction of the Science Citation Index (SCI)^[13] allowed qualitative evaluation of published work. The value of previous work is determined by the authors who cite it. Thus, the number of citations can be seen as a direct measure of the resonance or impact that a publication has had on the scientific community.^[14] The average citations per articles by an institution or a country can assess the visibility of these articles. Although this is highly correlated length of time since publication,^[6] it can be used over a fixed period of time to compare different countries and institutions. Also, relating it to the global average citation per article over the same period of time provide us with a measure of visibility (visibility index^b). To adjust for the effect of time since publication and to obtain a more universally accepted visibility index (visibility index^a), a different hypothesis was used. Published articles in any journal are expected to have the same impact factor of that journal. Thus, the expected impact factor of an article is the average of the impact factor of the journal in the two years following publication. On the other hand, the real impact factor of an article is the actual times cited in the two years following publication divided by 2. By relating the real to expected impact factors the visibility index is derived. It is very interesting to note that both visibility indices were almost equal therefore proving the validity of both methods.

The volume of research from Saudi Arabia in leading anesthesia journals is more than double the production of all other GCC countries. It is also more than Egyptian production during the years 2000-2008 but less than that

of Lebanon, both countries have long-established academic anesthesia departments. The visibility of Saudi publications, also, occupies a middle position Egyptian and Lebanese articles. The h-index is related to both the volume and visibility of publications.

Several broad lines can be suggested to enhance research production from Saudi Arabia. Budgeting is important for research. In addition to budgeting, every effort should be done to encourage research and develop a sound research culture in Saudi medical institutions. The linkage between promotions and research should be extended to MOH and MOD medical institutions. Research indices for promotion should evaluate both the volume and the impact of the journals in which articles were published. H-index, which depends on the volume and visibility of published articles, was found to be a sensitive indicator of academic activity among anesthesiologists.^[15,16] The Saudi Council for Health Specialties physicians' registration renewal system should add more weight to research completed by the candidate. Moreover, there should be anesthesia research fellowship arrangement and thesis-based qualifications. The publication and indexing of the Saudi Journal of Anaesthesia is a step in the right direction. Its inclusion in the JCR will add to the impact of the journal and the articles it publishes.

To conclude, Saudi articles published in leading anesthesia journals increased markedly in the last decade. Saudi universities contributed to more than half of the publications. Although the impact of the Saudi articles is less than the global values, it ranks favorably among Arab countries in terms of both volume and visibility.

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