Original Article

A Bibliometric Overview of 30 Years of Medical Sciences Productivity in Iran

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Abstract:

Objectives: The number of medical universities and their faculty members has significantly increased in Iran during the last 30 years. This development has led to the training of a large number of healthcare professionals. But, its effect on medical sciences productivity has not yet been fully analyzed. Here, we use a bibliometric analysis to assess the current status of Iranian medical sciences production in different subject areas.

Methods: The bibliographic data of Iranian medical subjects during the years 1978 – 2008 were collected from the Science Citation Index Expanded database and analyzed according to publication number, different medical subject areas, citations and the annual Iranian mid-year population.

Results: It was shown that Iranian scientists have established good collaboration with developed countries. The numbers of medical publications, even after normalization to the population size, and citations of these publications have significantly increased in recent years. It has also been shown that pharmacologic research constitutes the major theme in the Iranian medical research system and thus enjoys the highest rate of growth.

Conclusion: Strengthening of the non-pharmacologic research infra-structure is advised for both basic and clinical departments, keeping in mind the existing successful research model of pharmacology in Iran.

Keywords: Bibliometry, citation, Iran, medicine, production, science

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Accepted for publication: 30 January 2010

Introduction

Sustainable development necessitates scientific research in a wide area of subjects. Scientific research produces different outputs such as new instruments, methods and publications. But, as the results of research productions are usually reported in a wide range of publications, bibliometric analysis has been considered as the main approach for the measurement of scientific productivity.[1]

In 1985, a major restructuring within the higher education administration took place in Iran. As a result, medical universities were formed and the responsibility of medical education and research was

transferred from the Ministry of Higher Education to the newly formed Ministry of Health and Medical Education (MOHME).[2,3] Since then, MOHME has increased the number of medical universities and their faculty members and students. The number of medical universities has increased from 13 in 1978 to 42 in 2008. The number of faculty members has increased from 2908 to 27980 (more than 9 times) as well.[4] As could be expected, this development has led to the training of a higher number of skilled workers for provision of healthcare services.

Another issue of importance that should be addressed when dealing with expansion of universities is the effects of this development on scientific production.[5] As has been mentioned above, the most practical way to assess scientific output is a bibliometric analysis of published reports. Several databases of the indexed scientific publications are available which are produced and maintained by different commercial and not-for-profit organizations. The Web of Science database (www.isiwebofknowledge.com) of the Institute for Scientific Information is one of the earliest databases that used for this purpose.

Thus far, there have been a few studies that have reported Iran's status in all of the scientific areas. Here, we aim to specifically assess the current status of Iran's medical science subject areas by bibliometric data as derived from the Web of Science and determine their impact by citation analysis.

Materials and Methods

Bibliographic data were collected from the Science Citation Index Expanded (SCIE) database of the Web of Science provided by the Institute for Scientific Information (www.isiwebofknowledge.com). The database was accessed online from the 1st to 11th of March 2009. The advanced search was performed with the country tag for Iran for six, 5-year time periods of 1978 – 1982, 1983 – 1987, 1988 – 1992, 1993 – 1997, 1998 – 2002, and 2003 – 2007. After retrieval, documents were limited to medical subject areas and finally, the subject areas were matched with U.S. National Library of Medicine's (NLM) classification. In order to normalize the publications number in each year to the population of that year, the mid-year population data for years 1978 – 2007 were obtained from the United

States Consensus Bureau (http://www.census.gov/ipc/www/idb/). Data analysis was performed with Histcite software (Garfield 2004).

Results

A total of 11901 records were recovered during the years 1978 – 2007. Of the Iranian publications in the field of medical sciences, 11761 (98.8%) records were in English, 101 (0.8%) in French, 37 (0.3%) in German, 1 (0.008%) in Italian, and 1 (0.008%) in Turkish.

Evaluation of international collaborations showed that Iranian scientists established collaboration with scientists of 107 countries. Of these, the most frequent collaborations were with American scientists (22%). British (16.4%), Canadian (5.9%), Australian (3.7%), French (5.1%) and German (3.1%) scientists were next on the list. It was also shown that the percent of citations closely followed the percent of publications collaboratively produced.

Table 1 shows the trend of Iranian medical publications. The lowest number of publications was observed during 1983 – 1992 (Table 1). From 1993 onward, the number of publications increased significantly and reached the highest level in 2003 – 2007. When publication numbers were normalized to the population (number of publications per 1000,000 population), a similar trend was observed. Pharmacology and biochemistry were the most active whereas nursing and geriatrics were the least active research fields. No publication was indexed before 2003 for nursing and before 1993 for geriatrics.

To compare the relative contribution of each field to the total number of publications and citations, their percentages have been depicted in Figure 1. This figure shows that the contribution of pharmacological publications in total citations is higher than expected from their publication numbers. In contrast, the contributions of biochemical and microbiological publications in total citations are lower than what is expected from their publication numbers. In the other fields, citations are comparable to the number of publications.

An interesting observation is that Iranian medical universities are indexed in the SCIE database with different names. For example, Tehran University of Medical Sciences is indexed with 21 different names, Shiraz University of Medical Sciences with

Table 1. The distribution of Iranian medical publications listed in the Science Citation Index Expanded database from 1978 – 2007

	No. of publications in each period						Total no. of publications (%)	No. of citations (%)
	1978–82	1983–7	1988–92	1993–7	1998–2002	2003–7		
Pharmacology	83	34	70	136	430	1469	2222(14.35%)	10976(19.41%)
Biochemistry	85	43	44	95	217	951	1435(9.27%)	2564(4.54%)
Microbiology	18	9	20	85	186	931	1249(8.06%)	1136(2.01%)
Surgery	60	28	36	87	190	823	1224(7.91%)	3986(7.05%)
Nervous system	24	20	20	57	167	847	1135(7.33%)	4625(8.18%)
Hemic systems	28	7	2	22	158	593	810(5.23%)	2846(5.03%)
Ophthalmology	13	6	18	44	87	452	620(4.01%)	2739(4.84%)
Public health	70	31	23	29	76	348	577(3.73%)	2672(4.72%)
Cardiovascular system	53	12	7	13	117	368	570(3.68%)	1842(3.26%)
Practice of medicine	58	15	15	20	53	332	493(3.18%)	2370(4.19%)
Pathology	36	15	32	36	73	270	462(2.98%)	1559(2.76%)
Endocrine system	9	12	5	17	26	390	459(2.96%)	1801(3.19%)
Communicable diseases	74	26	19	33	56	228	436(2.81%)	2466(4.36%)
Digestive system	15	13	4	16	49	332	429(2.77%)	1336(2.36%)
Pediatrics	63	37	9	22	45	252	428(2.76%)	1378(2.44%)
Urogenital system	4	10	4	28	51	322	419(2.71%)	1411(2.49%)
Parasitology	37	9	17	28	49	258	398(2.57%)	1721(3.04%)
Obstetrics and gynecology	8	2	5	17	55	251	338(2.18%)	1031(1.82%)
Dermatology	14	4	4	27	58	216	323(2.08%)	1514(2.68%)
Radiology	34	11	14	14	58	191	322(2.08%)	1198(2.12%)
Dentistry	25	8	9	23	51	166	282(1.82%)	1820(3.22%)
Psychiatry	9	3	4	13	41	202	272(1.76%)	1199(2.12%)
Physiology	11	7	2	9	44	126	199(1.28%)	706(1.25%)
Respiratory system	12	1	6	3	24	78	124(0.80)	674(1.19%)
Musculoskeletal system	0	2	1	11	19	64	97(0.63%)	556(0.99%)
Otolaryngology	3	0	1	3	9	51	67(0.43%)	147(0.26%)
Anatomy	6	4	2	6	1	32	51(0.33%)	106(0.19%)
Nursing	0	0	0	0	0	28	28(0.18%)	75(0.13%)
Geriatrics	0	0	0	4	5	9	18(0.12%)	93(0.16%)
Total	**852**	**369**	**393**	**898**	**2395**	**10580**		
Grand total							**15487(100%)**	**56547(100%)**

20 different names, Iran University of Medical Sciences with 18 different names, and Isfahan University of Medical Sciences with 27 different names.

Discussion

We have shown that Iranian medical research productivity has increased in recent years as evident from increased bibliometric output. This could be due to strengthening of the research infrastructure, of which international collaboration is a notable factor. The value of international collaboration in improvement of the quality of research output has been emphasized in several previous reports.[6] Accordingly, Iranian medical scientists have developed good collaboration with international scientists. As a result, joint publications with scientifically advanced countries are higher than other countries. It has been
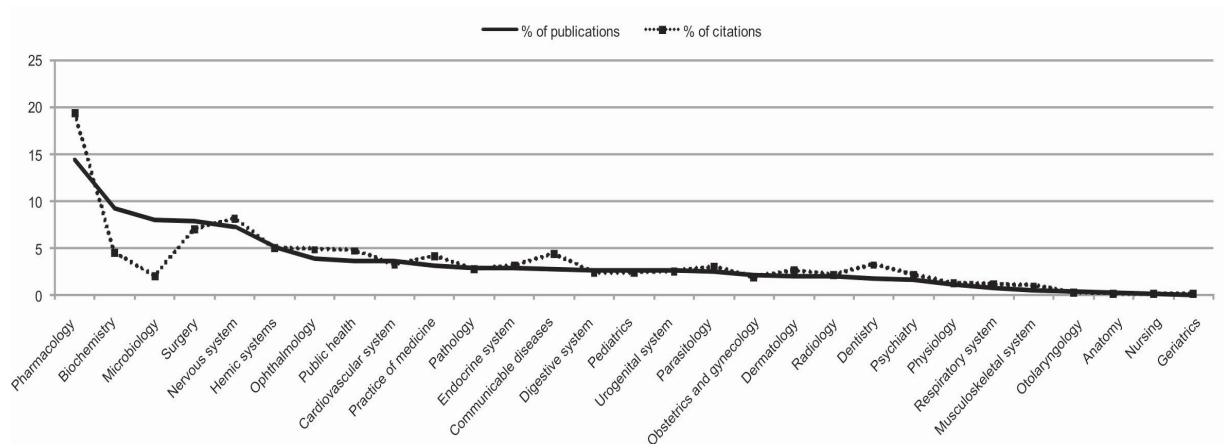
Figure 1. Comparison of the contribution of each field to the total publications and citations indexed with the country tag of Iran from 1978 – 2007.

determined that the research output which resulted from international collaborations have mostly propagated at the expected level, regardless of the location of collaboration.

The low number of publications observed before 1992 could be the result of the eight year Iran-Iraq war during which medical professional service was considered more critical than research activities. The post-war emphasis of the government on the value of research and development, and establishment of research facilities has boosted research output, particularly after 2002. When the bibliometric research output was normalized to the population size, a similar trend was observed. A similar study was reported from Lebanon in which bibliometric output steadily increased from 1988 – 2007 with a somewhat constant slope throughout this ten year period.[7] But in the United Arab Emirates, the bibliometric research output which has been normalized to the population size demonstrated a plateau phase during 1998 – 2007.[7] A similar observation has also been reported from Saudi Arabia.[8] This shows that, in comparison with similar countries, Iran possess an acceptable medical research system, although further efforts for optimization of this system are needed.

Table 1 shows that pharmacology, biochemistry, and microbiology are the three most prolific subject areas, whereas anatomy, nursing, and geriatrics are the least prolific. This is in accordance with another bibliometric study[9] that reports pharmacology and pharmacy as the second most prolific subject, after chemistry related research, within the whole area of

science during 1975 – 2002 in Iran. Figure 1 shows that with a few exceptions, propagation of research outputs is comparable to what is expected from the publication numbers in most fields. For pharmacology, the citations are much higher, and for biochemistry and microbiology are much lower than expected. This implies that pharmacology enjoys a strong research infra-structure and more efforts should be spent to strengthen the infra-structure in other fields. As a matter of fact, pharmacologic research is the major theme in many Iranian basic and clinical departments. The other issue that could be of relevance is the general research orientation and trend in biochemistry and microbiology. A review of the current research orientation in these fields may lead to design of studies whose results could be more relevant to the current needs and hence would be more propagated.

The other issue of significance is the variation in spelling in addition to different English translations of the names of Iranian universities as indexed in the SCIE database. This makes information retrieval of those universities somewhat complicated and may lead to an underestimation of the research output of Iranian universities as derived from bibliometric research.

It should be noted that although the citation analysis and the criteria used for selection of indexed journals by the Institute for Scientific Information are under criticism because of the influence of the financial profit of this institute on these factors,[10] these parameters are able to draw an overall picture of the status of medical research in a target region.

In conclusion, we have shown that the Iranian medical research system is rapidly improving in recent years. The pharmacology subject area possesses the strongest research infrastructure and therefore can be considered as an example for strengthening the infrastructures of other subject areas.

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