
Report

IRAN'S BIOMEDICAL SCIENCES' RESEARCH OUTPUT IN 2003: A BIBLIOGRAPHIC ANALYSIS OF MEDLINE AND EXCERPTA MEDICA DATABASES

Amir-Reza Radmard MD*, Hooman Khademi MD*, Pejman Azarmina MD MSc**, Mohsen Sadat-Safavi MD*, Mehdi Nouraie MD*, Shadi Kolahdouzan MD*, Reza Malekzadeh MD*

Introduction

Iran has been successful in its agenda to improve its international profile in biomedical sciences⁷ by constantly increasing the quantity and quality of articles published in peer-reviewed biomedical journals that are indexed by either Medline or Excerpta Medica databases (EMBASE).¹⁻⁵ Any article that is indexed by these two major bibliographic databases can be accessed and cited by a wider range of scientists and clinicians across the globe and would provide more recognition, scientific credentials, and continuous research funding for the scientists involved and/or the departments supporting those researches.^{6,7}

Previous studies^{1, 7} and anecdotal evidence suggest that biomedical scientific output of Iran originates mainly from research hot spots across the country that have a longer research tradition and better research and development infrastructure. Yet, the complexity around the nature of these research hot spots makes it difficult to judge, which departments or scientists should be given higher scientific credentials. Many factors like type of article, impact factor of the journal in which the article is published, forward citation of the article, and to some extent, the sheer number of articles by an author or from a department seem to be important factors and could be considered in evaluation of the research output.^{8,9}

This study was undertaken to gain a deeper understanding of the Iranian's biomedical sciences

research output and to identify and monitor departments that have had a substantial research output, both in terms of quantity and quality. The results of this bibliographic analysis would also highlight the impact of Iranian biomedical journals that have been indexed in EMBASE and contributed to an increasing presence of Iranian biomedical sciences in an international forum.

Methodology

Medline and EMBASE, which are among the most comprehensive and accessible biomedical bibliographic databases were selected for this analysis. All articles with the name of "Iran" in its affiliation department and "2003" in its publication date field were retrieved. After omitting double citations, which resulted from an overlap between Medline and EMBASE coverage, 1,157 articles were entered into a spreadsheet and the following fields were populated using sources that are mentioned in brackets: name of the author(s), title of the article, year-volume-page of the article, name of the journal, affiliation department of the article (all from Dialog DataStar¹⁰ gateway to Medline and EMBASE), impact factor (IF) of journals (from Journal Citation Reports^{®11}), and forward citation of that article (retrieved from ISI Web of Knowledge¹²). For those journals that IF was not readily available, an IF of 0.1 was assumed. As this database was going to be sorted, based on affiliation departments, another database was created which contained an organizational hierarchy of all academic and nonacademic departments and research centers. Using this database, a matching exercise was undertaken to analyze the affiliation departments and break them down into a uniform and consistent hierarchy.

Then, affiliation departments were grouped at university, department, and research center levels,

Authors' affiliations: *Digestive Diseases Research Center, Tehran University of Medical Sciences, Tehran, Iran, **Center for Health Informatics and Multiprofessional Education Archway Campus, University College London (UCL), London, UK.

Corresponding author and reprints: Reza Malekzadeh MD, Digestive Diseases Research Center, Shariati Hospital, North Kargar Ave., Tehran 14114, Iran. Fax: +98-21-2253635, E-mail: malek@ams.ac.ir.

and the following criteria were calculated for each of them: number of articles per university/department/research center, number of articles published in indigenous indexed journals, and sum and average of the IFs of the journals in which those articles were published. Universities, departments, and research centers were then ranked based on their total scores (sum of IFs) and the top tens in each category were identified.

Results

Almost two-third of the 1,157 articles included in this analysis were published in journals with IFs < 1, and one-third in journals with IFs between 1 and 3. Twenty-four (2%) articles were published in journals with IFs > 3. One hundred and seventy-six (15%) articles were published in four Iranian journals that are indexed in EMBASE: *Archives of Iranian Medicine*, *Daru*, *Iranian Journal of Medical Sciences*, and *Iranian Biomedical Journal*. In terms of subject area, chemistry and biochemistry accounted for highest number of articles (n = 245), followed by pharmacology (n = 175), and surgery and transplant (n = 87). In each of the specialty fields of endocrinology, dermatology, obstetrics and gynecology, immunology, gastroenterology and hepatology, pediatrics, and biology, 25 – 35 articles were published in 2003. Of 744 articles that were indexed in ISI from Iran in 2003, 213 (29%) had been cited at least once, 14 of which were cited seven times or more.

The main objective of this analysis, however, was to identify the top ten affiliation departments ranked by the total IFs of their published articles. Table 1 summarizes these institutions categorized by either the hierarchy of affiliation department (university, department, research center) or the dichotomy of clinical vs. basic science departments. Forty articles did not have any specific affiliation departments and the author(s) submitted them as an independent piece of work. The corresponding authors of 27 articles lived abroad. These articles were therefore excluded from further analysis.

Discussion

The first distinctive pattern in Iranian research output is its concentration in the Capital, Tehran with almost 4/5 of all top teners across disciplines. Tehran University of Medical Sciences, to which most of the publications belong, inaugurated as the first modern university of Iran 70 years ago (1935),

and is considered the mother of all universities in Iran. The presence of research leads and grant holders and the fact that more associate and full professors are concentrated in these institutions and a more developed infrastructure to nurture research and publication.

Only after one year of becoming indexed in EMBASE database,¹³ it is evident that the Iran's four indexed biomedical journals that have already contributed to indexing of almost 1/6 of the Iranian biomedical research output, do have a considerable potential to increase our international presence. It can be argued that by increasing high quality English-language Iranian journals, especially in the fields of basic sciences, pharmacology, and clinical medicine, a higher proportion of our research output would be published by them. This can be promoted by sustaining high standards until they become indexed in international citation systems and get more recognition.

It would have been ideal to critically appraise and score all our indexed articles in order to gain a more accurate assessment of their quality and credentials. Nevertheless, limitations in our resources and complexity of the process of critical appraisal for more than 1,000 articles in different disciplines, shifted us to use a simplistic, yet globally accepted criteria for assessing the articles, which was the IF.^{9, 14} IF can roughly estimate the quality of articles in a journal and implicitly the efforts and competition required to succeed in their peer-review process. Incorporating 'IF' in the formula to assess and monitor the quality of research output of departments and research centers, can actually function as a benchmark for directors and policy makers to set higher targets and constantly improve the quality of their research projects.

Another limitation of this study was its focus on high achievers in publications. Not including departments or disciplines with lower research output can actually limit our vision for a contrasting scene, which is quite essential to capture a more in-depth understanding of the inequalities in publications and to draw policies to improve research and publication opportunities for departments in deprived areas or neglected and less funded disciplines in biomedical sciences.

It seems that bibliographic analysis of this kind has been replaced by routine and systematic measures to monitor and assess departments and research centers. This is quite crucial for decisions about research funding of those institutions and to

Table 1. The top five Iranian biomedical universities, departments, or centers with the highest research output in 2003.

Affiliation department	Articles indexed in Medline or EMBASE	Articles published in Iranian indexed journals	Average impact factor (IF)	Score (sum of IFs)
Top 10 universities with highest biomedical sciences research output in 2003				
1 Tehran University of Medical Sciences	189	25 (13%)	0.80	151.5
2 Shiraz University of Medical Sciences	123	25 (20%)	0.62	76.7
3 Shaheed Beheshti University of Medical Sciences	89	16 (17%)	0.71	64.1
4 Tarbiat Modarres University	47	1 (2%)	1.15	54.4
5 University of Tehran	59	3 (5%)	0.91	53.8
6 Shiraz University	50	2 (4%)	0.94	47.1
7 Tabriz University of Medical Sciences	42	9 (21%)	0.97	41
8 Iran University of Medical Sciences	43	6 (13%)	0.82	35.6
9 Sharif University of Technology	18	–	1.82	32.7
10 Isfahan University of Medical Sciences	52	15 (28%)	0.45	23.4
Top 10 departments, centers, or hospitals at Tehran University of Medical Sciences in terms of research output in 2003				
1 Department of Pharmacology, School of Medicine	21	1 (4%)	1.93	40.7
2 Digestive Disease Research Center, Shariati Hospital	17	3 (17%)	1.24	21.2
3 Department of Pharmacy, School of Pharmacy	18	6 (33%)	0.63	11.5
4 Rouzbeh Psychiatric Hospital, School of Medicine	9	0	0.89	8.1
5 Rheumatology Research Center, Shariati Hospital	16	0	0.46	7.4
6 Department of Toxicology and Pharmacology, Faculty of Pharmacy	11	–	0.57	6.3
7 Sina Trauma Research Center	6	–	0.97	5.9
8 Department of Immunology	7	1(14%)	0.79	5.5
9 Endocrinology and Metababolic Research Centre	7	–	0.74	5.2
10 Children's Medical Center	3	–	1.12	3.4
Top 10 departments, centers, or hospitals at Shiraz University of Medical Sciences in terms of research output in 2003				
1 Shiraz Transplant Research Center, Namazi Hospital	11	1 (9%)	1.2	13.3
2 Department of Obstetrics and Gynecology	11	0	0.95	10.6
3 Department of Dermatology	12	0	0.73	8.9
4 Department of Pediatrics	8	3 (37%)	0.52	4.2
5 Department of Psychiatry	11	1 (9%)	0.33	3.7
6 Department of Pathology	5	1(20%)	0.72	3.6
7 Department of Medicinal Chemistry	4	1(25%)	0.69	2.8
8 Department of Biochemistry, Shiraz	5	3(60%)	0.53	2.7
9 Clinical Microbiology Research Center, Namazi Hospital	2	–	1.28	2.6
10 Gastroenterohepatology Res. Center, Namazi Hospital	1	–	2.46	2.5
Top 10 departments, centers, or hospitals at Shaheed Beheshti University of Medical Sciences in terms of research output in 2003				
1 Endocrine Research Center	18	1 (5%)	0.65	11.9
2 Department of Urology, Labbafinejad Hospital	6	0	1.37	8.3
3 Department of Pharmacology	7	1 (14%)	0.92	6.5
4 Neuroscience Research Center	3	0	2.13	6.4
5 Ophthalmic Research Center	7	0	0.50	3.5
6 Department of Neurology	1	–	3.48	3.4
7 National Research Institute of Tuberculosis and Lung Diseases	3	2(66%)	1.08	3.2
8 Department of Infectious Diseases, Boali	2	1(50%)	1.57	3.1
9 Department of Obstetrics and Gynecology	2	–	1.07	2.1
10 Department of Pharmacognosy	3	–	0.62	1.9
Top 10 institutions not affiliated with a university of medical sciences in terms of research output in 2003				
1 Pasteur Institute of Iran, Tehran	28	6 (21%)	1.34	37.6
2 Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan	15	0	1.28	19.3
3 Institute for Studies in Theoretical Physics and Mathematics (IPM), Tehran	3	0	1.32	4
4 Atomic Energy Organization of Iran (AEOI), Tehran	5	0	0.60	3
5 Tehran Hepatitis Center, Tehran	2	0	1.47	2.9
6 Research Institute of Forests/Rangelands (Tehran)	4	–	0.73	2.8
7 Avesina Research Center (Tehran)	1	–	2.67	2.7
8 Laboratory for Life Sciences (Tehran)	1	–	2.64	2.6
9 National Research Center for Genetic Engineering/Biotechnology (Tehran)	3	–	0.81	2.5
10 Chem./Chem. Eng. Res. Center of Iran-(Tehran)	3	–	0.79	2.4

Top 10 clinical departments or centers in terms of research output in 2003					
1	Digestive Disease Research Center, Shariati Hospital, Tehran University of Medical Sciences	17	3 (17%)	1.24	21.2
2	Department of Urology and Renal Transplant, Tabriz University of Medical Sciences	10	0	1.45	14.5
3	Shiraz Transplant Research Center, Namazi Hospital, Shiraz University of Medical Sciences	11	1 (9%)	1.2	13.3
4	Endocrine Research Center, Shaheed Beheshti University of Medical Sciences	18	1 (5%)	0.65	11.9
5	Department of Obstetrics and Gynecology, Shiraz University of Medical Sciences	11	0	0.95	10.6
6	Department of Dermatology, Shiraz University of Medical Sciences	12	–	0.73	8.9
7	Urology Nephrology Research Center, Labbafi Nejad Hospital (Shaheed Beheshti University of Medical Sciences)	6	–	1.37	8.3
8	Roozbeh Psychiatric Hospital	9	–	0.89	8.1
9	Rheumatology Research Center, Shariati Hospital, Tehran University of Medical Sciences	16	0	0.46	7.4
10	Sina Trauma Research Center	6	–	0.97	5.9
Top 10 basic sciences departments or centers in terms of research output in 2003					
1	Department of Pharmacology, Tehran University of Medical Sciences	21	1 (4%)	1.93	40.7
2	Pasteur Institute of Iran, Tehran	28	6 (21%)	1.34	37.6
3	Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan	15	0	1.28	19.3
4	Department of Pharmacy, Tehran University of Medical Sciences	18	6 (33%)	0.63	11.5
5	Department of Pharmacy, Tabriz University of Medical Sciences	7	0	1.10	7.8
6	Department of Pharmacology, Shaheed Beheshti University of Medical Sciences	7	1 (14%)	0.92	6.5
7	Neuroscience Research Center	3	0	2.13	6.4
8	Department of Toxicology and Pharmacology, Faculty of Pharmacy, Tehran University of Medical Sciences	11	–	0.57	6.3
9	Department of Immunology	7	1 (14%)	0.79	5.5
10	Razi Institute for Drug Research	6	–	0.85	5.1

provide some guidelines for doctorate candidates and postdoctoral fellows. Therefore, it can be recommended that every department or research center develop a database of their research output, which would be sent periodically to a central organization, which would evaluate research performance of every department and provide star rating for them. Models like Research Assessment Exercise (RAE) in the United Kingdom which is conducted every seven years could be used as a useful example to develop such a research performance assessment tool.¹⁵

References

- 1 Malekzadeh R, Mokri A, Azarmina P. Medical Science and Research in Iran. *Arch Iranian Med.* 2001; **4**: 27 – 39.
- 2 Moin M, Mahmoudi M, Rezaei N. Scientific output of Iran at the threshold of the 21st century. *Scientometrics.* 2004; **62**: 239 – 248.
- 3 Etemad S, Emami Y. Analysis of Iranian higher education system. *Majles and Pajouhesh.* 2003; **10**: 277 – 292.
- 4 King DA. The scientific impact of nations. *Nature.* 2004; **430**: 311 – 316.
- 5 Mehrdad M, Heydari A, Sarbolouki MN, Etemad S. Basic sciences in the Islamic Republic of Iran. *Scientometrics.* 2004; **61**: 79 – 88.
- 6 Dixon N. Writing for publication—a guide for new authors. *Int J Qual Health Care.* 2001; **13**: 417 – 421.
- 7 Wilson CS, Osareh F. Science and research in Iran: a scientometric study. *Interdiscip Sci Rev.* 2003; **28**: 26 – 37.
- 8 Kumar VP, Satku K, Wee JT, Pho RW. Objective assessment of research performance. *Ann Acad Med Singapore.* 1992; **21**: 436 – 438.
- 9 Callaham M, Wears RL, Weber E. Journal prestige, publication bias, and other characteristics associated with citation of published studies in peer-reviewed journals. *JAMA.* 2002; **287**: 2847 – 2850.
- 10 Dialog DataStar. Available from: URL: <http://www.dialog.com>. Accessed on 27 April 2005.
- 11 Journal Citation Report. Available from: URL: <http://www.isinet.com/products/evaltools/jcr>. Accessed on 27 April 2005.
- 12 ISI Web of Knowledge. Available from: URL: <http://wok.mimas.ac.uk>. Accessed on 27 April 2005.
- 13 Malekzadeh R, Azarmina P. Archives of Iranian Medicine: challenges of becoming indexed. *Arch Iranian Med.* 2002; **5**: 71 – 72.
- 14 Semenzato G, Rizzato G, Agostini C. Impact factor as measure of scientific quality. *Am J Respir Crit Care Med.* 2004; **169**: 1070.
- 15 Research Assessment Exercise. Available from: URL: <http://www.rae.ac.uk/default.htm>. Accessed on 27 April 2005.