Investigation of science production in Iran's type I universities of medical sciences, a 6-year assessment

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ABSTRACT

Introduction: Science production is one of the main dimensions of sustainable development in any country. Thus, universities as the major centers for science production play a key role in development. The present study aimed to assess the trend of science production in Iran's type I universities of medical sciences from 2007 to 2012.

Method: In this study, the universities' scores of empowering, governance and leadership, science production, student researches, and number of published articles were computed based on the evaluations of universities of medical sciences by the Ministry of Health, Treatment, and Medical Education from 2007 to 2012. Then, the data were analyzed using descriptive statistics and the figures were drawn by Excel software.

Results: This study assessed science production in Iran's type I universities of medical sciences and analyzed each university's proportion in publication of articles. According to the results, most of the published articles were affiliated to Tehran University of Medical Sciences. However, considering the role of number of faculty members, different results were obtained. With respect to the evaluation raw scores, Isfahan University of Medical Sciences showed a considerable reduction of scores in 2012, while other universities had a constant or ascending trend. Besides, indexed articles followed an ascending trend in all the universities and most of the articles had been published in index 1.

Conclusion: Similar to other studies, the findings of this study revealed an increase in science productions in Iran through the recent years. Yet, the highest scores of the studied indexes, except for student researches, were related to Tehran University of Medical Sciences. This great difference between this university and other universities might be due to accumulation of specific potentials and forces in this region. Overall, science productions followed an ascending trend in all type I universities of medical sciences. Yet, more attempts should be made to publish high-quality articles in reliable international journals. Thus, managers and policymakers are recommended to provide the ground for improvement and empowerment of knowledge and science production, development of leadership and governance capacity, empowerment of researchers, and provision of financial and infrastructure supports for development of fundamental, basic, clinical, and applied researches which can be presented at the international level.

Keywords: Research, Science production, Scientific growth, Universities of medical sciences

Introduction

Production of scientific information is one of the main dimensions of sustainable development in any country. Information is power and powerful countries are developed with respect to scientific information production (1). Universities as one of the main centers for science production play a critical role in development (2, 3). Thus, paying attention to this issue and providing the necessary structures are among the major concerns of each country's policymakers (4). Therefore, a considerable proportion of the countries' financial resources are normally contributed to research affaire which eventually leads to independence from other countries (5). Universities are the main centers for performance of research activities and play a determining role in this regard. Moreover, education which is the basis of science development can only achieve desirable development relative to the society's requirements through research. Hence, the more the faculty members present high-

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quality services, the more developed the country will be (2). It is quite obvious that financial and organizational planning of each university's research system requires evaluation of the university's science production through scientometric methods. Nowadays, quantitative and qualitative assessment of scientific articles is one of the usual methods for evaluation of the universities' research activities (4). Evaluation of the researches published by the faculty members of the universities of medical sciences is yet of a greater importance, because the results of such researches are used in treatment of disorders and education of medical students who are responsible for the society's health in future (6). Thus, supervision and continuous evaluation of the universities' are essential for optimal resources allocation, control, direction, organization, and encouragement of the universities.

One of the main axes of assessment of universities is the amount of scientific production and publication of articles in international journals (2). The more the number of articles published by a university, the higher the rank of that university will be (1). In addition, publication of scientific findings in international journals, itself, can represent the acceptable scientific level of the researchers' achievements (7). Therefore, attempts must be made to improve the quantity and quality of the articles published in low- and middle-income countries (8). This can be achieved by increasing and developing the capacities, increasing international cooperation, providing the researchers with appropriate consultation, and employing epidemiologists (9). According to the previous studies, financial problems are one of the major barriers to performance of research activities and elimination of such barriers requires scientific education and empowerment, culturalization, and improvement of attitudes and human relationships (10). Another reason for the negligible number of articles published by non-English speaking countries in international journals is lack of proficiency in English (11).The present study aims to investigate the results of evaluations of Iran's type I universities of medical sciences from 2007 to 2012, determine the factors affecting increase or decrease in each university's scores, and present strategies for improving the present status.

Method

This descriptive, cross-sectional study was conducted based on the documents of the evaluations performed by the Ministry of health, Treatment, and Medical Education (12). The research deputy of the Ministry of health, Treatment, and Medical Education evaluates the universities of medical sciences every year with respect to knowledge production, empowering, governance and leadership, and student researches indexes. Knowledge production index is scored based on the sum of scores of writing books, presenting articles in domestic and international congresses, publishing articles in international and domestic journals, referring to the articles published by the university in reference books, innovation and invention, gene registration, health marker products, clinical guidance, and localization of technology.Empowering index score comprises the sum

of scores related to international, national, and regional congressesand gaining the top ranks in Razi and Kharazmi festivals.Governance and leadership index is scored based on the sum of scores of research priorities, science and technology system, university's performance in scientific journals, and their cooperation in annual evaluation of the research activities. Finally, research proposals are scored based on student congresses, gaining top ranks in Razi and Kharazmi festivals, research tours financially supported by the university held for the members of the committee, workshops held by the members of the student research committee, and articles extracted from the theses and research proposals approved by the student research committee.

In the present study, 8 type I universities, namely Tehran, ShahidBeheshti, Isfahan, Shiraz, Mashhad, Tabriz, Ahvaz, and Kerman Universities of Medical Sciences, were investigated regarding empowering, knowledge production (number and index of published articles), governance and leadership, and student researches indexes from 2007 to 2012. Then, the data were analyzed using descriptive statistics and the figures were drawn by Excel software.

Results

Among the 8 type I universities of medical sciences, most of the articles published during 2007-2012 were affiliated to Tehran University of Medical Sciences. However, considering the largest number of faculty members in this university, per capita of the articles published by Isfahan University of Medical Sciences followed by Tehran and ShahidBeheshti universities of medical sciences was higher compared to the other type I universities of medical sciences in 2012 (Table 1).
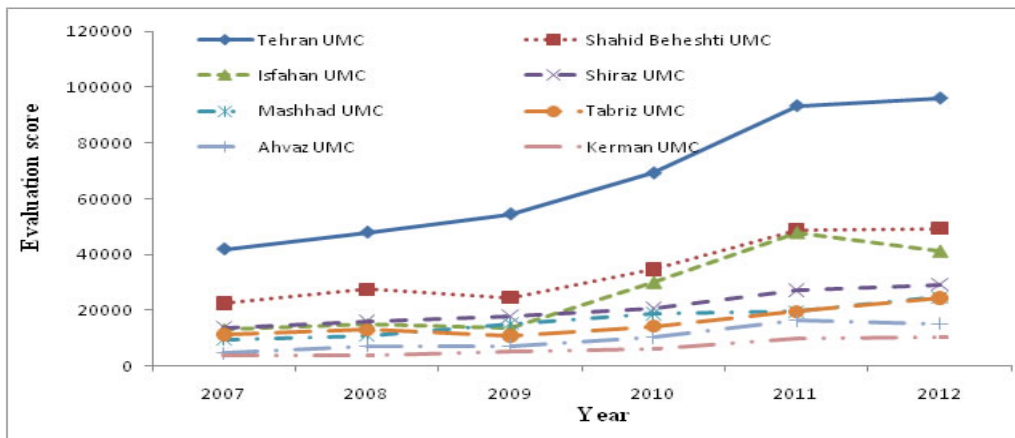
As Figure 1 depicts, Isfahan University of Medical Sciences showed a considerable reduction of raw score index in 2012, while other universities followed a constant or ascending trend in this regard. It should be mentioned that the ascending trend of the raw score obtained by Tehran University of Medical Sciences was more significant compared to other type I universities of medical sciences. According to Figure 2, the empowering index was higher in Tehran University of Medical Sciences in comparison to other type I universities. However, Shiraz and Mashhad universities of medical sciences followed a descending trend regarding this index in 2012 compared to 2011. This index had a fluctuating trend in other type I universities.

All the under study universities followed an ascending trend concerning knowledge production index. Yet, this index had a sharper slope in Tehran University of Medical Sciences (Figure 3).

Considering the governance and leadership index, Tehran University of Medical Sciences obtained the highest scores from 2009-2012. Shiraz University of Medical Sciences also considerably improved and reached this university in 2012. Isfahan and ShahidBeheshti universities of medical sciences were two other top universities in this index which had a similar growth between 2010 and 2012 (Figure 4).

Table 1. The frequency of published articles by Iran's type I universities of medical sciences from 2007-2012

| University	Number of article in 2007	Number of article in 2008	Number of article in 2009	Number of article in 2010	Number of article in 2011	Number of article in 2012	Number of faculty member in 2012	Number of article per faculty member in 2012
Tehran UMC	2216	2346	2438	3103	4201	4841	2049	2.36
Shahid Beheshti UMC	1207	1426	1272	1566	1907	2364	1289	1.38
Isfahan UMC	714	806	692	1257	1823	1877	701	2.68
Tabriz UMC	572	647	545	645	852	1149	660	1.74
Ahvaz UMC	278	317	324	428	613	741	585	1.27
Kerman UMC	218	217	258	321	423	550	385	1.43

Figure 1. The trend of earning points by Iran's type I universities of medical sciences based on the obtained raw
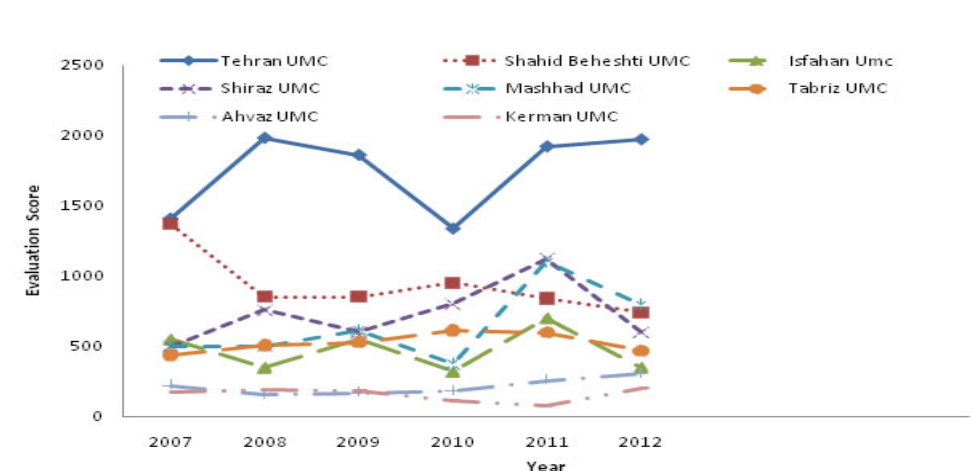
Figure 2. The trend of earning scores by Iran's type I universities of medical sciences based on empowering index
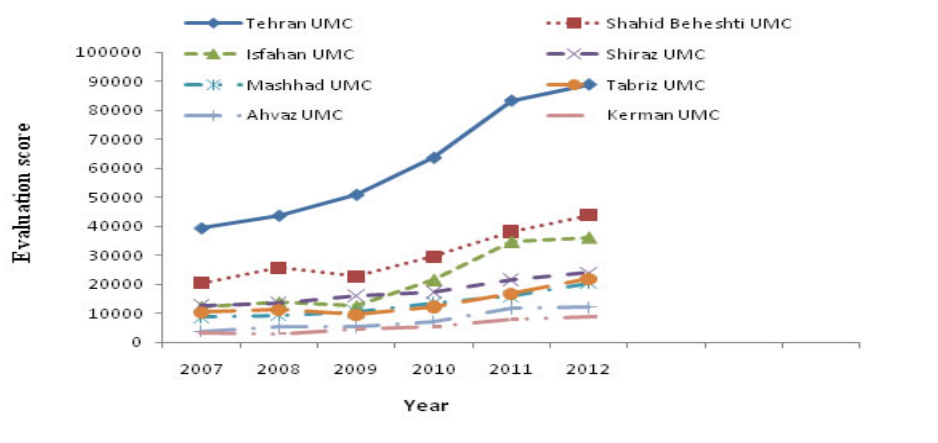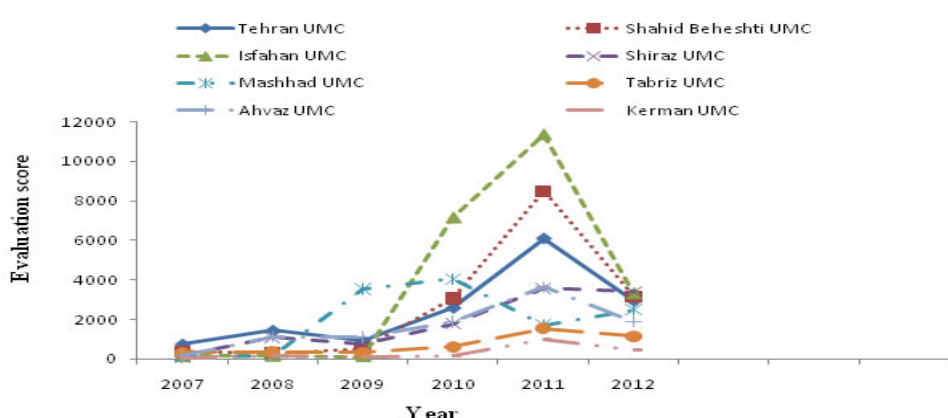
Figure 3. The trend of earning scores by Iran's type I universities of medical sciences based on knowledgefrom
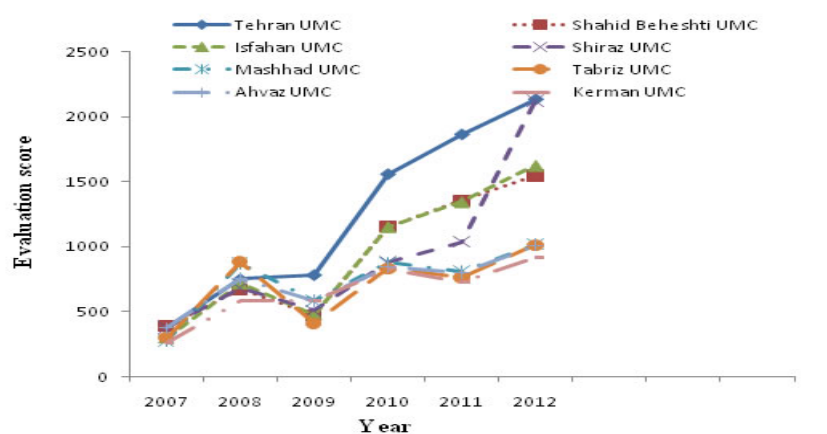
Figure 4. The trend of earning scores by Iran's type I universities of medical sciences regarding governance and leadership index from 2007-20122007-2012scores from 2007-2012

Based on Figure 5, all the type I universities under study followed an ascending trend with respect to student researches from 2007 to 2011. Isfahan University of Medical Sciences got the highest score of this index in 2011. Nevertheless, all the universities showed a reduction in this score between 2011 and 2012.

Figure 5. The trend of earning scores by Iran's type I universities of medical sciences based on student researches from 2007-2012

Table 2 presents the number of published articles in 4 indexes by the faculty members of type I universities of medical sciences from 2007-2012.
Accordingly, this measure was higher in Tehran University of Medical Sciences compared to other type I universities during 2007-2012. Also, the number of articles published in index 1 had an ascending trend in all the universities under study. This indicates the faculty members' attention to publishing their articles in credible index 1 journals.

Table 2. The number of published articles in 4 indexes by the faculty members of type I universities of medical sciences from 2007-2012

Year	2007				2008				2009			
Index	index1	index2	Index3	Index3	index1	index2	Index3	index4	index1	index2	index3	index4
Tehran UMC	1157	112	448	437	1234	154	442	487	1268	177	394	570
Shahid Beheshti UMC	484	81	169	357	664	95	173	414	523	66	172	494
Isfahan UMC	221	81	70	321	256	56	230	251	261	55	144	219
Shiraz UMC	337	117	91	77	454	40	115	127	490	76	108	156
Mashhad UMC	137	51	126	212	155	117	59	203	230	51	85	157
Tabriz UMC	229	65	58	181	251	58	113	214	229	78	57	176
Ahvaz UMC	38	25	95	92	100	37	54	113	101	32	54	117
Kerman UMC	49	22	40	76	48	20	41	67	84	33	29	89
Tehran UMC	1641	190	515	628	1862	320	1807	208	2354	521	733	1208
Shahid Beheshti UMC	633	110	336	445	768	124	953	23	1030	156	390	779
Isfahan UMC	336	132	288	461	559	270	950	30	560	537	320	442
Shiraz UMC	476	88	172	105	511	96	346	37	578	164	191	198
Mashhad UMC	308	74	170	142	362	79	286	42	488	109	241	171
Tabriz UMC	299	85	74	170	383	80	305	75	533	165	210	240
Ahvaz UMC	142	26	91	133	239	43	303	23	223	56	140	295
Kerman UMC	114	22	70	105	179	24	188	27	180	54	126	185

Discussion

Similar to the previous studies, the findings of the present study revealed an increase in scientific productions in Iran (13, 14). This study showed that evaluation raw scores and knowledge production index followed an ascending trend in all type I universities of medical sciences under study. Yet, irrespective of the changes in the figure slope, the highest scores of governance and leadership and empowering indexes were related to Tehran University of Medical Sciences. One of the main reasons for this considerable difference might be the accumulation of some potentials and forces in this specific region. Radmard et al. stated that one of the main problems in conducting researches in Iran was accumulation of these outputs in the capital; i.e., Tehran (15). This might be due to accessibility of financial resources and veterans of research, the effect of well-known professors, and existence of advanced structures for improvement of researches and publication of articles. Furthermore, since Tehran University of Medical Sciences has the largest number of faculty members in Iran (16), this rank was not quite unexpected. Based on the results of a research on ISI database, Sharif

University of Technology, Tehran University, Tehran University of Medical Sciences, Teacher Training University, and Shiraz University had the highest rate of cooperation in science production in 2004 (4). Moreover, another research was conducted in 2005 on the scientific products of basic sciences and interdisciplinary researchers from 1976 to 2003 and the results demonstrated that Tehran University of Medical Sciences had gained the highest rank in production of scientific articles indexed in Medline (17).

Considering student researches index, Figure 5 revealed an ascending trend in almost all the universities under study from 2007 to 2011. Yet, Isfahan University of Medical Sciences showed a more significant ascending trend during 2009-2011. This university also got the highest score with respect to student researches in 2011. However, this index had a descending trend in all the type I universities of medical sciences from 2011 to 2012. Since this index has decreased in all the universities, a common reason might be considered for this reduction. This can be justified by the change in evaluation statute of the deputy of research and technology in 2012 regarding decreasing

the coefficient of the articles extracted from student theses from 1.1 to 0.1 and considering a restriction in the number of proposals (12)).

Considering the fact that each research article is extracted from a research work, evaluation of the articles leads to a more accurate assessment of universities as the country's scientific poles (6). The present study investigated the contribution of Iran's type I universities of medical sciences to production of articles. Yet, irrespective of the role of number offaculty members, different results would be obtained and only production statistics would provide the criterion for superiority. Nevertheless, this is not a common, appropriate analysis because it is not logical to compare the rate of productions in universities with different number of faculty members (19).

In this study, the highest and lowest number of scientific productions was related to Tehran University of Medical Sciences (2049 documents in 2012) and Kerman University of Medical Sciences (385 documents in 2012), respectively. However, by considering the per capita of number of articles per faculty member, different results were obtained. Although the number of articles was higher in Tehran University of Medical Sciences compared to other universities, per capita of number of articles per faculty member was higher in Isfahan University of Medical Sciences compared to Tehran University of Medical Sciences (2.68 vs. 2.63). In addition, the lowest per capita (1.27) was related to Ahvaz University of Medical Sciences. This shows that the faculty members of Isfahan University of Medical Sciences published the largest number of articles compared to other type I universities. The study performed by Amin Pour also demonstrated the considerable improvement of scientific articles in Isfahan University of Medical Sciences since 2000 (4). The main reasons for increase of scientific productions in this university were provision of appropriate grounds for increasing the quantity and quality of research proposals, establishment and expansion of infrastructures, development of Internet in all the units affiliated to the university, subscription of reliable medical databases and information banks, improvement of information resources in libraries, establishment and empowerment of the reward system, provision of researchers with financial and spiritual support based on the credibility of the databases indexing the articles, and empowerment of science production motives. In the current study, the highest scores of evaluation and studied indexes, except for student researches index, were related to Tehran University of Medical Sciences. However, this university's per capita of number of articles per faculty member got the second rank after Isfahan University of Medical Sciences. The results of a research revealed that considering the academic forces in the Ministry of Health, Treatment, and Medical Education and the Ministry of Science, Research, and Technology, in case each faculty member publishes only one article a year, Iran is not only able to outpoint other countries in its neighborhood, but it also can be one of the top 10 science producing countries (10). This can be achieved in case all the faculty members of type I, II, and III universities of medical sciences, Ministry of Health, Treatment, and Medical Education, and Ministry of Science, Research, and Technology do their best to publish articles. Fortunately, the present study showed that the per capita of article per faculty member was above 1 in all the type I universities under study. This indicates that the number of articles per faculty member was more than 1. Nonetheless, this index took all the domestic and international articles together into account, while the number of domestic articles is quite higher than that of international ones. This might be due to proficiency in Persian language, difficulty in publication of articles in international journals, inability to publish articles in English language, ease of sending articles to regional journals, and professional and non-professional relationships between the faculty members and authorities of the domestic journals (18).

The findings of the studies by Razavi (1996), Lee (2003), and Ramashk (2004) on investigation of medical researches in various universities of medical sciences revealed that most of the researchers' scientific productions included articles, books, and research proposals, while the rate of scientific productions in international journals was quite low. This was probably due to lack of proficiency in English language. Also, long process of review and publication of articles in international journalsrequires much time and continuous follow-up, while the physicians and faculty members of universities of medical sciences spend most of their time on the patients' clinical affairs (18).

In some countries, including Iran, researchers are faced with difficulties in publication of articles in English due to lack of proficiency in this language. Therefore, they tend to publish their articles in domestic Persian-language journals.These journals, however, cannot be used by international researchers and also do not have a great chance to be indexed in reliable databases (4).Yet, some points should also be taken into accountwith respect to publication of articles in international journals which are mostly associated with Western countries. For instance, researchers should consider the fact that some regional diseases and problems might not be prevalent in Western societies and, consequently, are not highly welcomed by credible journals (3).

The findings of the present study revealed an increasing trend in the number of articles indexed in credible journals (Table 2). This might be due to supporting publication of articles in credible international journals and databases in the recent years as well as provision of faculty members with facilities to increase their contribution to global productions. For instance, faculty members are provided with long- and short-term scholarship, retraining programs are increased, research score is considered in professors' promotion, and post-graduate students are required to publish articles in the journals indexed in ISI database (10).

Conclusion

The current research presented a holistic view of scientific productions of Iran's type I universities of medical sciences

in the study period. To date, a developed community is superior to other communities with respect to science and information rather than economic or military powers (7). Considering the fact that universities are the main scientific poles of each country (19) and scientific development impacts economic, social, and cultural development, academic researchers have to make their best attempts to reach scientific independence and develop science and research (7). The findings of this study revealed an ascending trend in the annual evaluation score of the studied universities. Nonetheless, these annual evaluations have mainly focused on the quantity of published articles and less attention has been paid to their quality. In order to improve the quality of published articles, the authorities are suggested to increase and develop capacities, enhance international cooperation, provide researchers with consultation, and employ epidemiologists (20). The study results also indicated a growing trend in knowledge production index in research centers. This demonstrates that universities and research centers are going toward the same direction. Thus, empowering research centers not only strengthens research in the country, but it also directs researches toward the society's health priorities (21). Overall, considering the previous studies on obstacles to research activities, the necessary measures should be taken in this regard. In order to take steps toward performing fundamental, clinical, and applied researches which can be presented at an international level, managers and policymakers should provide the ground for research activities, science production, development of governance and leadership capacity, and empowerment of researchers and faculty members through development and execution of the country's comprehensive scientific plan, provision of financial support and fundamental structures, subscription of information banks and electronic journals, improvement of the researchers' use of English, holding workshops on research methods and article writing, empowerment of research centers, and establishment of systems to pay rewards to authors.

Authors' contributions

Mahnaz Yadollahi (MY) ,Narges shamsedind (NSH) ,Najmeh Haseli (NH) participated in Study concept and design. MY and NSH performed the data analysis, interpretation and drafting of the manuscript. MY and NH made critical revision on the manuscript.

Acknowledgements

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