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Abstract

One of the measures which used to calculate the scholarly collaboration of countries and organizations is co-authorship. Co-authorship is a process in which two or more authors/researchers collaborate with each other to create a joint work via collaboration channels and methods. Although many studies have been considered individual or domain co-authorships, but the organizational aspect of this type of collaboration has attracted less attention. Therefore, the aim of this study is to draw the organizational co-authorships among Iranian medical universities and to analyze the role of proximity and Matthew effect in this collaboration. Thus, 32 medical universities were selected based on a list prepared by the Iranian Ministry of Health and Medical Education (MHME), and the co-authored articles of these universities were extracted from Web of Science (WoS) database for the period 1990 to 2011. Findings show that top and first-rank universities in Iran such as Tehran University of Medical Sciences, Iran University of Medical Sciences, Shahid Beheshti University of Medical Sciences, and Shiraz University of Medical Sciences tend to collaborate more with universities like themselves. This confirms the Matthew effect in scholarly collaborations of top and first-rank universities. Besides, the proximity rule has an important role in the formation of scholarly collaboration in surveyed universities. Some suggestions made to improve this kind of organizational collaboration in Iranian universities.

Keywords

Matthew effect; Collaboration; Co-authorship; Proximity; Scientometrics; Medical Universities; Iran

Introduction

With the increasing growth of pervasive relationships beyond the geographical boundaries, experts and scholars have to move toward more scholarly communication and collaboration, because an expert can rarely have the whole expertise, skill, sources and necessary possibilities to overcome scholarly problems in this conditions ([Rahimi & Fattahi](#), 2007). Since one of the basic elements in scientific progress is the combination of ideas which have not existed yet, the efficient communication among the scientists is a significant component in scientific activities ([Tavakol](#), 1989).

Scholarly collaboration is working together through a defined, certain, real and planned participatory relationship among two or more groups of experts that create and produce new knowledge to develop the present knowledge. This kind of collaboration, in many cases, leads to production of scientific works such as books, articles, patents and so on ([Hasanzadeh & Baghaei](#), 2009). The survival and continuity of a scientific community requires a stable relationship among the components of a scientific community that according to [Hart](#) (2000), these relationships are formed formally and informally at the local, national, and global level.

Without a scientific collaboration, the knowledge production which is the production of knowledge and adding it to reservoir of human science, will not achieve success. Because of the participation of different people or organizations in a collaborative work, the number of references to the work and its impact factor will increase ([Apropos Planning](#), 2006).

Measurement of the rate of scholarly collaboration is done through different measures. One of the well-known indices for measuring collaboration rate among researchers and organizations is the co-authorship indicator. Katz (1997) as one of the leading researchers analyzed the increase of occurrence of collaborative articles with several writers, suggested that this kind of articles can be used for measuring collaboration among researcher groups ([Katz](#), 1997).

Co-authorship is one of the forms of scholarly collaboration that is manifested in scientific products such as books, articles, patents and etc. The collaborative work is the result of collective wisdom of noted researchers and in a way, shows the collectivism. The reasons for this kind of collaboration include increasing the quality of collaborative work, exploring the advantages of such scientific collaboration by researchers and accessing newly researched and developed technology ([Hasanzadeh & Baghaei](#), 2009). In addition, scholarly collaboration, using the expertise and learning from the collaborative writer, influences the promotion of article quality ([Hart](#), 2000).

Literature Review

Scholarly publication, collaboration, and communication have been analyzed based on some new variables. Matthew effect is an important phenomenon which has been considered in science production. Robert K. Merton in an article called "*Mathew effect in science*" analyzed existing inequalities in the systems of allocation of scientific credits and introduced "Mathew effect". He was the first

researcher who introduced this concept ([Merton, 1968](#)). The term Matthew effect is derived from the *New Testament Book of Matthew* (25:29), which states:

"For everyone who has will be given more, and he will have an abundance. Whoever does not have, even what he has will be taken from him."

Based on this verse, it can be seen that in academic communities, there are some universities that are superior scientifically than other universities and have more sources for conducting scientific research and collaborative activities. As the result, scientific productions and their collaborative works increase more ([Merton, 1968, p.7](#)). He also believes that inequality in communicative system among the scientists (like citation and even keeping the writer's name in the reader's mind) is due to the great visibility of the works of more famous scientists ([Merton, 1988](#)).

Scientometrics is one of the areas that consider Mathew effect. The studies have shown that the big universities are the big powers in scientific productions ([Strevens, 2006](#); [Carlos et al., 2009](#)). Although the big universities dominate the world of science, other universities try to decrease more the existing hole with increasing their own participation in scientific productions. Based on the Mathew's work, a scholarly collaboration is more efficient when it is introduced by a distinguished scientist in a scientific society ([Merton, 1968, p.4](#)).

Culture of participation in society, budget of collaborative activities, and internal trust among researchers has more influence on the rate of scholarly collaboration in Iranian faculty members ([Rahimi & Fattahi, 2007](#)). Therefore, it can be said that the most important factors that encourage researchers to have scholarly collaboration include the factors resulting from the individual characteristics of the researchers, but the most important inhibitors that do not allow researchers to do scholarly collaboration include some barriers imposed on researchers by the environment.

Regarding the reviewed studies, it should be said that a collaborative article by two or more authors, is an evidence to prove collaboration among them and this collaboration creates a co-authorship network and by analyzing these networks, the characteristics of the researchers or collaborative organizations in collaboration system and also the structure of collaborative networks can be realized. Researchers can share their knowledge, beliefs, hypotheses and equipments with scholarly collaboration and ask help from their counterparts to overcome the research problems ([Hasanzadeh & Baghaei, 40](#)). Besides, the big inter-disciplinary groups who act in a geographical region have more influence on each other and as the result, they collaborate more. Moreover, the physical proximity of collaborative researchers is an important factor in anticipating the scholarly effect of the research ([Lee et al., 2010](#)).

Additionally, some studies have shown that physical *distances/proximity/nearness* influence on scholarly collaboration rate (for example, [Lee et al., 2010](#)). Also, regarding the tacit nature of knowledge, geographical proximity increases the scholarly collaboration ([Ponds, Oort & Franken, 2006](#)). A great deal of research collaborations, particularly in applied sciences, has been formed in heterogeneous networks such as universities, firms and governmental institutions ([Etzkowitz & Leydesdorff, 2000](#)). In addition, geographical proximity plays a key and indirect role in both scholarly collaboration and exchange of information ([Howels, 2002](#)) and the number and continuity of scholarly collaborations ([Katz, 1994](#); [Liang & Zhu, 2002](#)).

Problem Statement

Scholarly collaboration and particularly co-authorship that has begun with *Price's* studies (e.g., [Price & Beaver, 1966](#)), have been studied from various perspectives and as the result, it has been shown in literature. This indicates the importance of this research field (e.g., [Wagner & Leydesdorff, 2005](#); [Bookstein et al., 2006](#); [Yamashita & Okubo, 2006](#); [Fry, 2006](#); [Persson et al., 2004](#); [He, 2009](#); [Zimmerman et al., 2009](#)).

Furthermore, scholarly co-authorships in Iran have been discussed from different points of view. Many studies have focused on the rate of scholarly collaboration and co-authorships. Based on these studies, non-academic centers in Iran have benefited from collaboration of experts in the internal universities more than foreign researchers. The highest rate of scholarly collaboration of research centers in Iran has been with the United States, followed by the United Kingdom, Canada, Australia, Japan, India and Germany ([Talebi, 1999](#); [Osareh & Zare, 2010](#)). This kind of collaboration has been confirmed in other countries ([Marshakova-Shaikerich, 2006](#)).

The highest rate of scholarly collaboration of Iran with the adjacent countries is with Russia, Turkey and Pakistan ([Velayati, 2008](#)). The collaborative articles have been published in the journals with the high impact factor. The industrial universities such as Sharif University of Technology, Shahid Beheshti University, and University of Tehran have the highest rate of collaboration with the adjacent countries.

The influencing factors on scholarly co-authorships of Iranians have been considered in some studies. In these studies, political relationships among the countries have affected the collaboration formation ([Velayati, 2008](#)). In addition, professors, which have more cultural capital and emotional energy, have more scholarly collaboration. There is an inverse relationship between the work experience of the faculty members and their scholarly collaboration and this shows that young forces tend to collaborate more ([Janalizadeh, Chubbasti & Akmal, 2008](#)). Familiarity with English language, research methods and scholarly information institutes (e.g., the Institute for Scientific Information: ISI) have a direct relationship with the number of published articles of faculty members of these universities in the journals covered by these institutes ([Nouri et al., 2008](#)).

Although in recent years, there has been an increasing interest in the idea of scholarly collaboration among the researchers and public circles of Iran and it has been accepted a lot and this idea should be encouraged, the pattern of scholarly collaboration in Iran is not well-illustrated and the structure of features of scholarly collaboration in Iran differs a lot from those of other countries. Nevertheless, Iran has experienced brain drain a lot and has developed scientifically to some extent and benefits from valuable forces in different fields, but research collaborations in Iran is in its primary step ([Harirchi, 2006](#)). Additionally, this subject has not been considered from an organizational or communication perspective. Therefore this study can fill the existing vacuum in scientometric studies in Iran.

Therefore, exploration of patterns of individual and organizational collaboration of Iranian researchers and institutions can show strengths and weaknesses of scholarly collaboration system in Iran. Also, awareness of scientific institutions about this collaboration system improves collaboration rate and thereby development of the collaborative network of researchers and institutions. However, this study aims to calculate and map the scholarly co-authorships of Iranian universities in medical sciences using the collected data of Web of Science (WoS). Also, this study aims to analyze Mathew effect in the collaboration in medical sciences in the studied universities.

Thus, since a part of this research reviews Mathew effect the scholarly co-authorships of Iranian universities in medical sciences, we want to answer following questions:

1. Do the big universities of Iran in medical sciences have only scholarly collaboration with big and famous universities?
2. Do the small universities collaborate with big universities to become more powerful in the field of production of science and

to decrease their distance with big universities?

Furthermore, a part of this study tries to analyze proximity of Iranian universities in medical sciences and to analyze their participation in the production of science. Therefore, in this part of research, the following question is answered:

3. Has geographical proximity influenced the co-authorship rate of Iranian universities in medical sciences?

Methodology

Sampling

In the recent ranking of Iranian universities of medical sciences that has been done by Ministry of Health and Medical Education (MHME) (www.behdasht.gov.ir) ([University Portal](#), 2010), universities have been divided into three ranks: 1st Rank, 2nd Rank, and 3rd Rank. We selected all universities which were introduced as 1st and 2nd ranks in medical sciences. Totally, 32 medical universities were selected as the sample.

Methods

A scientometric approach was used in this study and co-authorship was evaluated only through the published articles in Web of Science (WoS). Data gathering was based on published articles of superior universities of medical sciences in Web of Science. In WoS, and in Advanced Search option, by limiting the years to 1990-2011, the data for needed university was searched. The co-authorships were based on the affiliation which stated in each article. For example, when we have an article which has three authors of different universities (for example, Tehran Univ Med Sci, Shiraz Univ Med Sci, and Tabriz Univ Med Sci) this shows that this article belongs to those three organizations. The data used in this research were collected from Web of Science on February 16, 2011.

Findings

In order to answer the first two questions, scholarly co-authorship matrix of the studied universities was depicted and shown in Table 1. For this purpose, the number of published articles of a university from 1990 to 2011 (2011-02-16) was calculated. Then, the number of collaborative articles of this university with other universities (studied universities) was obtained.

As it is shown in Table 1 and Figure 1, all medical universities in Iran tend to have collaborative activities with Tehran University of Medical Sciences (TUMS). The highest rate of co-authorships of Iranian medical universities is with TUMS. It seems that Iranian medical universities are trying to reach the position of TUMS in Iran. They try to reduce the scholarly divide between this university and them. TUMS co-authored more with universities with higher scholarly productions such as Shahid Beheshti University of Medical Sciences. This confirms the existence of Mathew effect in scholarly co-authorships of these universities.

Table 1. Co-Authorship Matrix of Iranian Universities of Medical Sciences

	Baqiyatallah Med Sci Univ	Tehran Univ Med Sci	Shaheed Beheshti Univ Med Sci	Shiraz Univ Med Sci	Iran Univ Med Sci	Mashhad Univ Med Sci	Isfahan Univ Med Sci	Tabriz Univ Med Sci	Kerman Univ Med Sci	Mazandaran Univ Med Sci	Hamadan Univ Med Sci	Yazd Univ Med Sci	Urmia Univ Med Sci	Babol Univ Med Sci
Baqiyatallah Med Sci Univ		69	37	16	17	6	10	7	0	2	2	9	0	3
Tehran Univ Med Sci	69		448	171	312	125	134	102	129	100	38	31	7	17
Shaheed Beheshti Univ Med Sci	37	448		32	122	21	37	39	28	21	25	6	5	13
Shiraz Univ Med Sci	16	171	32		39	24	34	29	13	19	2	6	1	7
Iran Univ Med Sci	17	312	122	39		16	37	22	5	11	26	4	2	11
Mashhad Univ Med Sci	6	125	21	24	16		21	16	15	4	1	3	0	4
Isfahan Univ Med Sci	10	134	37	34	37	21		32	15	4	6	5	3	7
Tabriz Univ Med Sci	7	102	39	29	22	16	32		6	2	19	1	15	10
Kerman Univ Med Sci	0	129	28	13	5	15	15	6		25	2	2	2	2
Mazandaran Univ Med Sci	2	100	21	19	11	4	4	2	25		13	0	0	9
Hamadan Univ Med Sci	2	38	25	2	26	1	6	19	2	13		3	2	0
Yazd Univ Med Sci	9	13	6	6	4	3	5	1	2	0	3		2	1
Urmia Univ Med Sci	2	7	5	1	2	0	3	15	2	0	2	2		2
Babol Univ Med Sci	3	17	13	7	11	4	7	10	2	9	0	1	2	
Qazvin Univ Med Sci	2	21	8	0	8	8	5	2	2	0	0	0	0	1
Guilan Univ Med Sci	0	26	15	1	8	3	2	1	2	5	3	0	0	0

Kermanshah Univ Med Sci	1	40	17	7	15	13	17	16	0	0	15	0	2	2
Zahedan Univ Med Sci	2	38	16	5	17	8	8	4	7	0	6	0	3	2
Golesan Univ Med Sci	2	50	14	3	8	3	4	2	5	4	3	0	1	2
Kashan Univ Med Sci	1	24	6	2	11	2	4	5	3	0	0	0	0	0
Arak Univ Med Sci	1	25	3	6	4	0	14	1	2	0	0	1	0	0
Zanjan Univ Med Sci	0	43	10	6	4	7	7	20	2	1	4	0	3	0
Rafsanjan Univ Med Sci	0	12	5	1	1	6	0	2	12	0	0	0	0	0
Lorestan Univ Med Sci	8	15	5	16	10	0	7	2	8	0	2	5	0	0
Semnan Univ Med Sci	1	17	13	5	14	1	1	2	0	0	2	3	0	4
Shahed Univ Med Sci	1	15	3	1	2	0	0	0	0	0	2	0	0	0
Hormozgan Univ Med Sci	1	26	5	13	2	3	5	3	6	0	0	1	1	2
Ardabil Univ Med Sci	0	14	4	3	4	2	1	2	3	5	0	0	1	0
Birjand Univ Med Sci	1	4	5	1	1	13	0	0	1	0	0	1	1	0
Ahwaz Univ Med Sci	1	13	2	13	15	11	11	7	4	0	2	2	0	1
Pasteur Inst Iran	15	210	67	13	34	7	16	16	5	8	4	1	0	8
Univ Social Welfare and Rehabil Sci	0	13	5	1	6	0	14	0	0	0	0	1	1	2

Table 1. Co-Authorship Matrix of Iranian Universities of Medical Sciences (Continued)

	Kermanshah Univ Med Sci	Zahedan Univ Med Sci	Golesan Univ Med Sci	Kashan Univ Med Sci	Arak Univ Med Sci	Zanjan Univ Med Sci	Rafsanjan Univ Med Sci	Lorestan Univ Med Sci	Semnan Univ Med Sci	Shahed Univ Med Sci	Hormozgan Univ Med Sci	Ardabil Univ Med Sci	Birjand Univ Med Sci
Baqiyatallah Med Sci Univ	10	2	2	1	1	0	0	8	1	1	1	0	1
Tehran Univ Med Sci	40	38	50	24	25	43	12	15	17	15	26	14	4
Shaheed Beheshti Univ Med Sci	17	16	14	6	3	10	5	5	13	3	5	4	5
Shiraz Univ Med Sci	7	5	3	2	6	6	1	16	5	1	13	3	1
Iran Univ Med Sci	15	17	8	11	4	4	1	10	14	2	2	4	1
Mashhad Univ Med Sci	13	8	3	2	0	7	6	0	1	0	3	2	13
Isfahan Univ Med Sci	17	8	4	4	14	7	0	7	1	0	5	1	0
Tabriz Univ Med Sci	16	4	2	5	1	20	2	2	2	0	3	2	0
Kerman Univ Med Sci	0	7	5	3	2	2	12	8	0	0	6	3	1
Mazandaran Univ Med Sci	0	0	4	0	0	1	0	0	0	0	0	5	0
Hamadan Univ Med Sci	15	6	3	0	0	4	0	2	2	2	0	0	0
Yazd Univ Med Sci	0	0	0	0	1	0	0	5	1	0	1	0	1
Urmia Univ	2	3	1	0	0	3	0	0	0	0	1	1	1

Med Sci													
Babol Univ Med Sci	2	2	2	0	0	0	0	0	4	0	2	0	0
Qazvin Univ Med Sci	1	2	2	0	0	2	0	0	0	0	0	1	0
Guilan Univ Med Sci	0	1	3	3	1	1	2	1	0	0	0	2	0
Kermanshah Univ Med Sci		4	3	0	2	4	0	3	0	0	0	1	0
Zahedan Univ Med Sci	4		1	2	0	2	0	0	1	0	0	0	1
Golesan Univ Med Sci	3	1		0	0	0	0	2	0	0	0	3	0
Kashan Univ Med Sci	0	2	0		0	0	0	0	1	0	0	0	0
Arak Univ Med Sci	2	0	0	0		2	1	0	0	0	0	0	0
Zanjan Univ Med Sci	4	2	0	0	2		0	1	2	0	0	0	0
Rafsanjan Univ Med Sci	0	0	0	0	1	0		0	0	0	1	0	0
Lorestan Univ Med Sci	3	0	2	0	0	1	0		1	0	1	0	1
Semnan Univ Med Sci	0	1	0	1	0	2	0	1		0	0	1	1
Shahed Univ Med Sci	0	0	0	0	0	0	0	0	0		0	0	0
Hormozgan Univ Med Sci	0	0	0	0	0	0	1	1	0	0		0	0
Ardabil Univ Med Sci	1	0	3	0	0	0	0	0	1	0	0		0
Birjand Univ Med Sci	0	1	0	0	0	0	0	1	1	0	0	0	
Ahwaz Univ Med Sci	3	2	0	3	2	1	1	4	0	0	1	0	0
Pasteur Inst Iran	4	10	2	3	5	5	5	2	5	2	0	0	0
Univ Social Welfare and Rehabil Sci	0	2	0	0	0	0	0	0	0	0	0	0	0

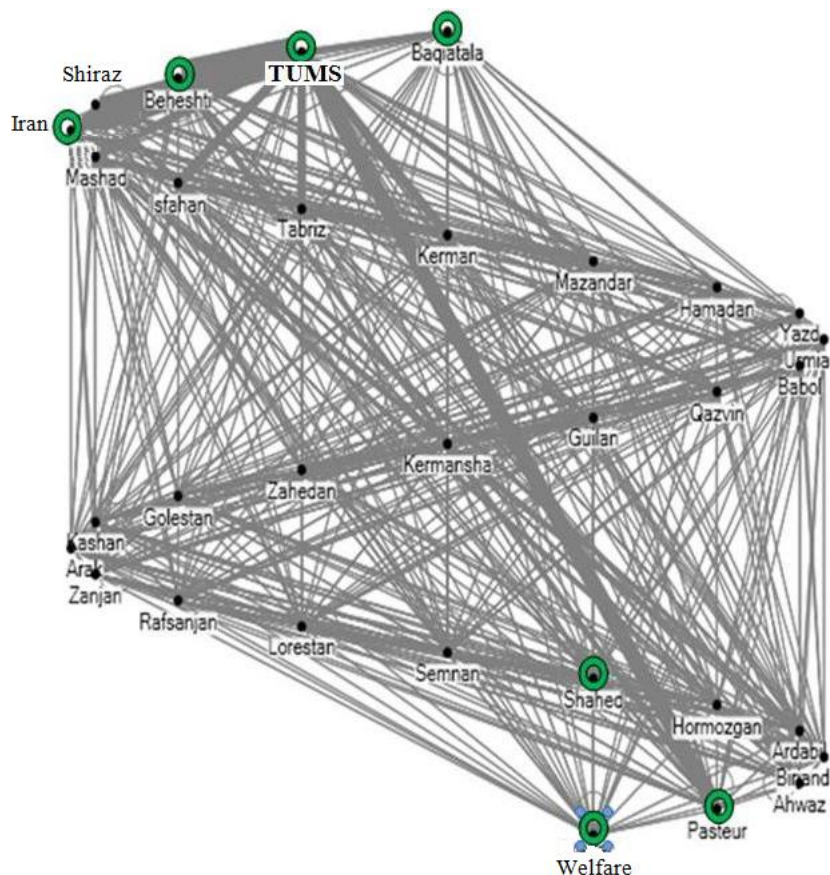


Figure 1. The highest rate of scholarly co-authorships among Iranian medical universities

Figure 1 illustrates the important role of TUMS in co-authorship with other Iranian medical universities. As we can see, most of communication network of TUMS is located in Tehran city. This means that powerful and first-rank universities in Iran have not any willing to collaborate with lower universities.

In order to know if geographical proximity affects the number of co-authorship between researchers in Iranian medical universities, the scholarly co-authorship network of universities located in Tehran are marked by green cycles in the above figure. Figure 1 demonstrates that top universities located in Tehran collaborate more with each other. Note that three outstanding universities including Iran Univ Med Sci (Iran), Tehran Univ Med Sci (TUMS), and Shahid Beheshti Univ Med Sci (Beheshti) have the least geographic distances with the other surveyed universities located in Tehran city. Pasteur Inst Iran (Pasteur), Baqiyatallah Univ Med Sci (Baqiyatallah), and Social Welfare and Rehabil Sci Univ (Welfare) are in the next ranks. When we ignore the co-authorships of Iranian medical universities with TUMS, we can reach some interesting findings (see Figure 2).

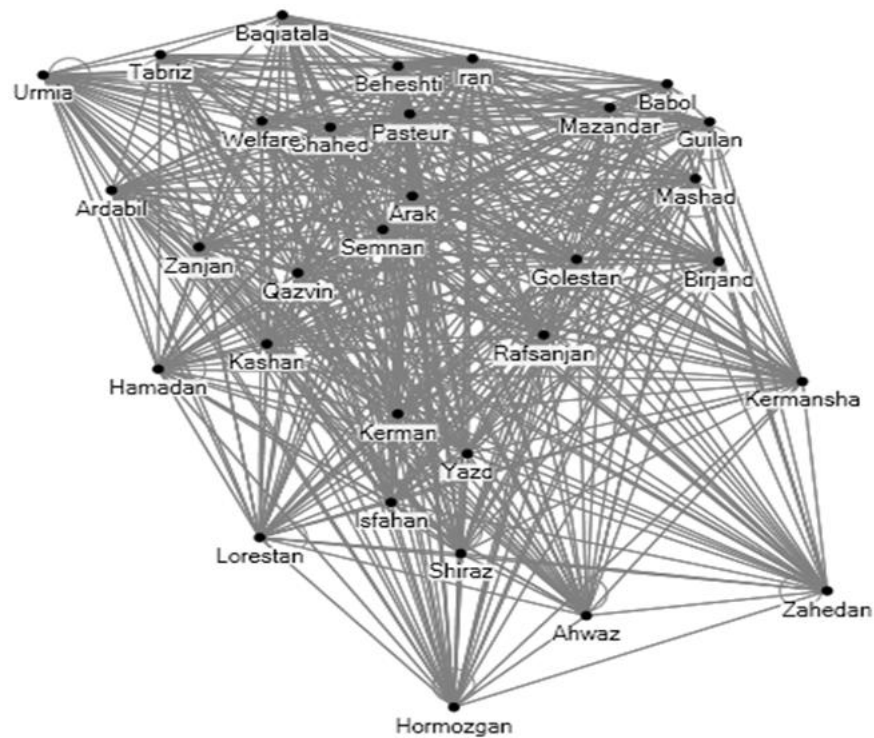


Figure 2. The highest rate of scholarly co-authorships among Iranian medical universities
(Note: Tehran University of Medical Sciences is ignored)

Once again we see that the strongest co-authorships of Iranian medical universities are with universities located in Tehran, such as Shahid Beheshti Univ Med Sci and Iran Univ Med Sci. We can conclude that Iranian universities of medical sciences tend to collaborate more with universities located in Tehran, probably, because of their scholarly production, aging, famousness, first-rankness, etc. On the other hand, the other important co-authorships among Iranian medical universities are with Shiraz Univ Med Sci, which is among top and aged universities in the field of medical sciences in Iran.

Moreover, Figure 2 shows that universities which are adjacent to Shiraz Univ Med Sci have more collaboration with this university. Thus, we can confirm the proximity factor in scholarly co-authorships of Iranian universities of medical sciences. But, this result is in second degree of importance, because, the most rate of scholarly co-authorships of Iranian medical universities is happened among outstanding, first-class universities.

Discussion and Conclusion

In this study, scholarly co-authorships of Iranian medical universities and the role of Matthew effect and proximity rule in it were analyzed. There were three research questions in this study, as following:

1. Do the big medical universities of Iran have only scholarly collaboration with big and famous universities?
2. Do the small medical universities collaborate with big ones to become more powerful?
3. Has geographical proximity influenced the co-authorship rate of Iranian medical universities?

As it was shown, the Iranian medical universities are co-authored based on the rank, famousness, and the size of universities. Besides, the proximity has the next most important role in the formation of this kind of scholarly collaboration. It means that the universities which have less geographical distances, had more scholarly collaboration and their collaborative works are higher than the others. Thus, these findings, confirm the role of proximity and Matthew effect in scholarly collaboration of surveyed universities (Question 1 and 3), and this confirms the results of previous studies. As previously noted, small and low-ranked universities have a good motivation to have a better positions in rankings, but this fact are associated with the decisions of big and first-ranked universities (Question 2).

The results of this study agree with results of [Howels \(2002\)](#), [Katz \(1994\)](#), [Liang and Zhu \(2002\)](#), [Lee et al. \(2010\)](#) and [Ponds, Oort and Franken \(2006\)](#) which confirm the influence of proximity and Matthew effect in academic collaborations. However, in Iran, since the universities which are located in Tehran are more famous than the universities out of Tehran, they tend to have more scholarly works together (confirmation of Mathew effect). Also, lowness of the geographical distance of these universities is another reason for this kind of collaborations (Question 3).

In order to improve the scholarly co-authorships of Iranian universities of medical sciences some changes and improvements are required. If Ministry of Health and Medical Education (MHME) which affiliates Iranian medical universities urge these universities to act collaboratively to produce scholarly works, the result may be the equalization of collaboration system in them. In order to do this, some financial and promotional factors are needed. For example, for the time being, the share of the first writer in collaborative articles is more than other writers except in the article which explicitly pointed that the writers have equal share in joint work. If in *regulations book of promotion of faculty members* that has been compiled by MHME, the articles and collaborative works be weighted more, the authors are more motivated to do collaborative activities.

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