# Delineation and analysis of co-authorship network among the academics of School of Dentistry in Kerman University of Medical Sciences in 2013 using network analysis method

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**Original Article**

## Abstract

**BACKGROUND AND AIM:** This study aims to explore the co-authorship in School of Dentistry at Kerman University of Medical Sciences, Iran, in three levels; individuals, other schools of KUU, and beyond the university.

**METHODS:** This is a cross-sectional study which is a part of a larger study conducted from September 2014 to December 2014. A comprehensive search in Scopus was conducted to find related articles published in 2013 by following these steps; first of all, a complete list of all faculties, based on the school and the department they worked in, was obtained. Second, all articles indexed with the affiliation of KMU were retrieved, using both keywords of "Kerman Medical University" and KUM Sciences." The data were analyzed using Social Network Analysis and Visone software.

**RESULTS:** The results showed an inadequate collaboration within departments; only two of them had collaboration. Co-authorship among departments illustrated a more satisfactory picture: although, it still has more rooms for improvement. Regarding collaboration between the Dentistry School and other schools of the university, the School of Dentistry is in a middle position, though it could have had more potential relationships. The School of Dentistry formed a few relationships with the organizations outside of the university.

**CONCLUSION:** Our study suggests that there are more rooms for improvement in the field of collaboration and co-authoring papers, which could consequently not only lead to a higher rate of publication and visibility but also affect the citation rates for authors.

**KEYWORDS:** Authorship Collaboration; Dentistry; Network Analysis; Social Networks; Co-Authorship

Scientific collaboration is described as complex social phenomena[1] which could be defined from the exchange of views to working together in a laboratory.[2] This sort of collaboration occurs at three levels of between; countries (macro level), organizations, and departments (meso-level), and individuals (micro level).[3]

In today's world, due to the existence of problems inquiring interdisciplinary solutions, and a growing demand for making scientific-based decisions, it is very essential to create such partnerships.[3,4] With regard to the area of health, many often complex issues are addressed, and many stakeholders are involved, therefore collaborations with

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different discipline are highly crucial.[4] For instance, oral health care is discussed to be related with general health, and also to provide the oral health care it is vital to have effective collaboration and use interprofessional approaches.[5]

Scientific collaboration could be gained through two main routes: First, team working with enormous funding, and second, increasing communications among scientists.[1] Since scientific collaboration is becoming more and more important as an effective approach to enhance productivity, quality and research effects,[6] it is more appealing than the first route because of increasing limitations of resource availability among nations.[1] Co-authorship, as the second route, is an indicator of scientific collaboration. Noteworthy, the relation between authors in academic world can be observed as co-authorship network.[7] And to measure the level of co-authorship networks, three main research methods have been suggested including qualitative (interviews), bibliography (counting), and networks.[8]

Social networks analysis (SNA) is a graphical method to examine the relationship between actors who create the network. The pattern of relationship and the structure of the network shed light on the type of behaviors and connections among individuals.[6] Co-author network is a type of social network, in which authors are the main actors, and their collaboration with each other in writing a paper is explored.[6] Moreover, co-authorship analysis can be conducted at three stages including individuals, organizations, and countries or region.[9] This sort of analysis can enhance our understanding on science production in a certain field. Furthermore, the authors with greater influence and more level of connectivity will be recognized.[3]

The current evidence indicates an increased rate of collaboration in publication of papers. However, this does not occur uniformly across different disciplines and domains.[5,10-12]

Iran, a Middle East country, has shown a very dramatic growth in scientific publication over the past year.[13] Iranian's co-authorship has been examined in a few studies, on different areas of social networks such examining the networks among the faculties of medical universities,[14] medical engineering,[15] medical emergency,[16] and research on three centers at Tehran University of Medical Sciences, Iran.[17]

To the best of our knowledge, in the area of dentistry, there is very limited literature on the co-authorship; only one document, conducted in Brazil. This study examined the network of co-authorship based on the information extracted from the Scopus on different levels of collaboration.[18] This study aims to explore the co-authorship in Dentistry School at the Kerman University of Medical (KUM) Sciences, Iran, in three levels; individuals, other schools in the universities, and beyond the university.

## Methods

This is a cross-sectional study which is a part of a larger study conducted from September 2014 to December 2014. The primary aim of this study was to know the co-authorship networks among faculties in Kerman Medical University (KMU) in the year 2013. This study presents results, which was related to the Dentistry School. In this study, a librarian conducted a comprehensive search in Scopus to find related articles by following these steps; first of all, a complete list of all faculties, based on the school and the department they worked in, was obtained. Second, all articles indexed with the affiliation of KMU were retrieved, using both keywords of "Kerman Medical University" and "KUM Sciences." Next, we excluded the articles without faculty authors; if the author was a student or a staff of the university, we did not include that for analysis. In total, 673 articles were examined; 237 were eligible out of which 26 were related to the School of Dentistry.

This was followed by retrieval of information related to the authors including

*http://johoe.kmu.ac.ir,    5 January*

name, family name, affiliation, departments, and schools. Finally, the data were weighed based on the number of faculties in each department, then entered in Excel matrices and finally, exported into Visone program (version 7.3.4) for network analysis. The data related to the School of Dentistry were excluded from other information before they were exported to the Visone.

The data were analyzed at four levels; within departments, among departments and schools, and between departments and institutions outside the university; via SNA. In this study, authors, departments, schools, and institutions outside the university were defined as nodes and their collaboration as edges (networks were described by a series of nodes and edges; nodes were actors and edges are their relations).[19] We used properties to describe the networks in this study. A network can be defined and illustrated with different methods; however, there are a number of properties which are commonly used to describe networks. The following is a brief overview of these approaches: Overall, network structure can be assessed by property such as density which in general means, how connected a network is;[19] the more connected, the more collaboration exists. Furthermore, it is possible to find each node attribute such as the betweenness centrality, the centrality degree, and the cut points. These all shows the importance of a node in the network. To make it more clear we present the results from collaboration at micro level (individuals) to macro one (beyond the university) in figures. Therefore, in each figure a node illustrates different entities; in figures 1 and 2 individuals, in figure 3 departments, in figure 4 schools, and in figure 5 connections beyond KMU. The centrality degree shows the number of connections that a node possesses;[20] this implies the importance of the node in the network. Betweennees centrality shows whether a node can play a role in building relationships between two other nodes.[7] Cut

points are those important nodes to form a bigger network that relates components of a network, so if they are removed the components will be separated.[19]
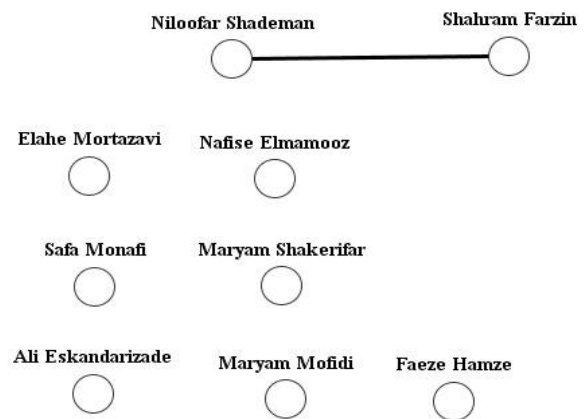


**Figure 1.** Co-authorship network among school of restorative dentistry in Kerman University of Medical Sciences, 2013

## Results

As mentioned in the section of method, the results are presented in a hierarchical order from micro to macro level.
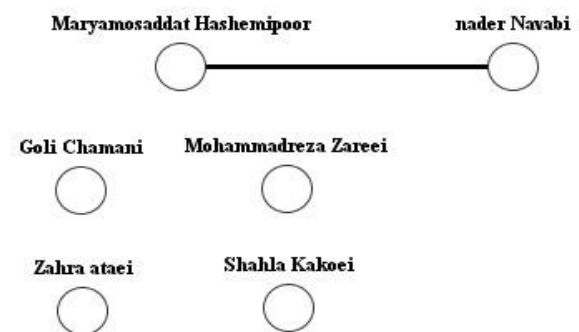


**Figure 2.** Co-authorship network among school of oral disease in Kerman University of Medical Sciences, 2013

*Co-authorship within departments of the Dentistry School of KMU:* Among the 10 departments of the School of Dentistry, the Departments of Dental Public Health and Restorative Dentistry had collaboration, and the relationship was formed only between two faculties in each of these two groups, figures 1 and 2, respectively. However, it is needed to have more than 2 relationships to

calculate network indices, since there was no such condition, we failed to calculate network indices. In figures 1 and 2, circles are nodes, showing the names of authors, while the lines between them show edges or relationships. Those authors with no lines had no collaboration with other faculties in the same department.

*Co-authorship between departments of the Dentistry School:* Among departments in the School of Dentistry, there was no collaboration between orthodontics, fixed prosthesis, denture, and restorative dentistry and other departments of the school. However restorative dentistry formed collaboration within its members. Other departments had collaborations and formed a network with a density of 1.16% (Figure 3). Dental public health and endodontics are cut points in this network with a higher score of betweenness 0.1 and 0.08, respectively. In addition, the Department of Endodontics had the most centrality among departments (Table 1).

*Co-authorship among the schools of KMU:* Different schools at the university could form a network of co-authorship. The school of dentistry had relationship with the school of medicine, health, and pharmacy.

While, there was no direct relationship between the school of dentistry and other schools such as nursing and management (Figure 4).

**Table 1.** Co-authorship among schools at the Kerman University of Medical (KUM) Sciences

| Department | Central degree (%) |
|---|---|
| Endodontic | 36.79 |
| Oral disease | 34.57 |
| Pediatric dentistry | 7.381 |
| Restorative dentistry | 6.10 |
| Oral and maxillofacial surgery | 5.54 |
| Oral and maxillofacial pathology | 4.90 |
| Oral and maxillofacial radiology | 4.60 |

The centrality of the School of Dentistry was 31.15%; which had the fifth centrality degree among the 7 schools of the current study. The most centrality belonged to the School of Medicine and Health, 31.15%, 27.22%, respectively. Based on the results of computation of Cut Points in NetDraw (version 6.0) software, the two schools of Medicine and Health Schools are the cut points of the network. Finally, the highest amounts of degree and betweenness centralities are related to Medicine and Health Schools, respectively.
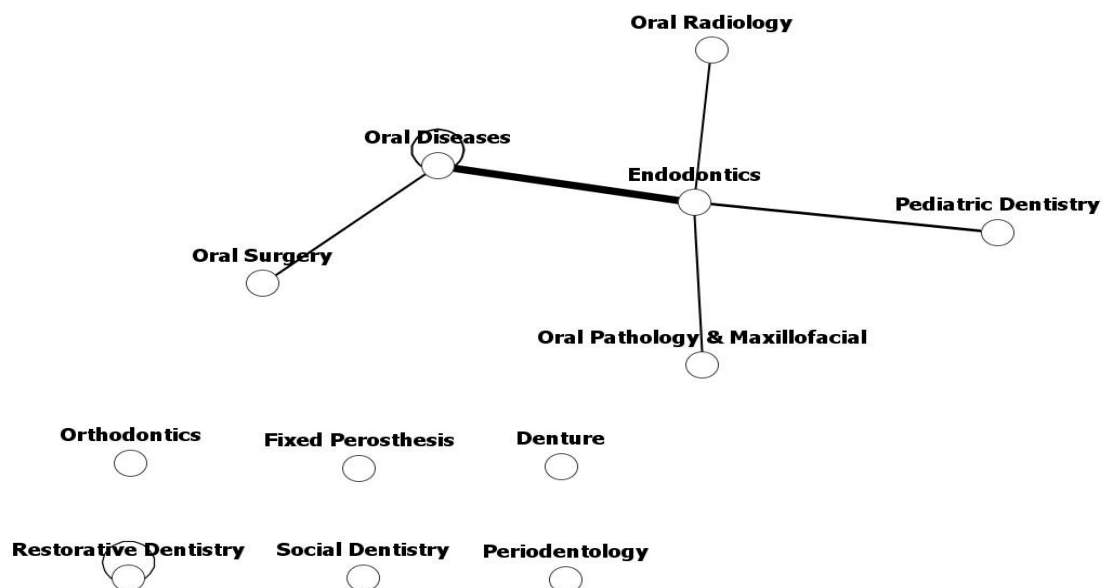


**Figure 3.** Co-authorship network among departments of the School Dentistry in Kerman University of Medical Sciences, 2013
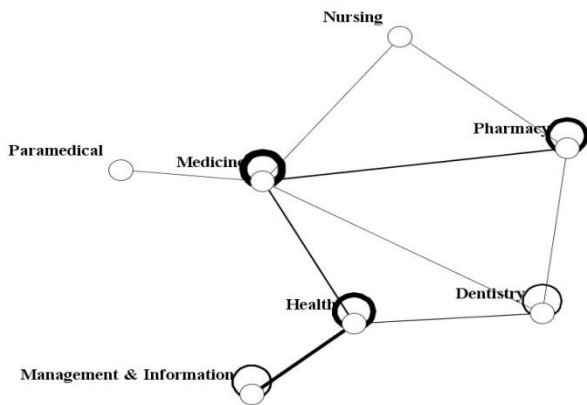
**Figure 4.** Co-authorship network among the schools in Kerman University of Medical Sciences

***Co-authorship between schools at KMU and institution outside the university:*** The amount of density for schools and other universities network was 0.195. Based on figure 5, there was no isolated node in the network. Cut point index was calculated and based on the result, no cut point was observed in this network. Figure 5 shows "Medical Sciences of Iran" category had the highest degree centrality in this network. "Health" school had the highest amount of this index among the schools of KMU (12.95%), in comparison with the Dentistry School with the lowest degree of centrality among the schools, 2.64%.

## Discussion

Considering all together, this study shows that co-authorship networks embodying papers, indexed in Scopus in the year 2013 from the Dentistry School, depicts a somewhat satisfactory picture. However, the level of collaboration fluctuates between different levels. For example, there is inadequate collaboration within departments; only two of them had collaboration. Co-authorship among the departments illustrated a more satisfactory picture although it had more rooms for improvement. Regarding the collaboration between the schools of the university, the dentistry school is in the middle position, though it could have more potential relationships. Two departments of the school of dentistry formed a few relationships with the organizations outside of the university.

Over recent years desirability of scientific publication enhancement has been emerged considerably. This led many countries compete with each other for producing more scientific documents. A publication called "lifeblood" of academic world[21] as it could bring financial and prestige motivations for faculties.[21] Scientific collaboration is discussed to be an effective way to increase knowledge and productivity. The collaboration is achieved not only through conducting research but also through co-authoring the papers.[6] The current evidence indicated a rising attention on such collaboration, for example in the field of evolutionary biology there has been a rapid growth in collaboration in Brazil,[3] also the same pattern has been observed in the field of physics in Malaysia.[22]
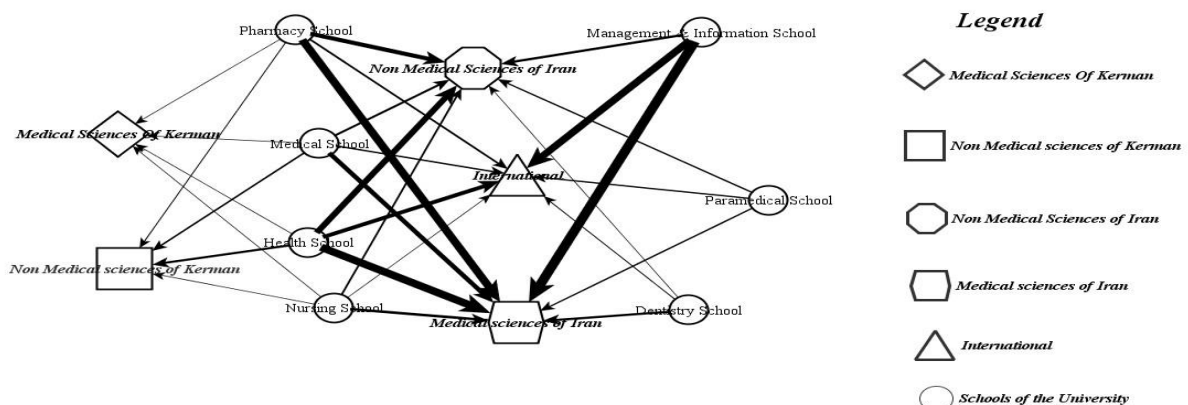


**Figure 5.** Co-authorship network among the schools of Kerman University of Medical Sciences and the other universities

In addition to deep understanding of the process of knowledge production in any scientific institution, the network of collaboration knowledge is necessary to know.[23]

SNA which has been widely used at the social literature has received growing attention in other disciplines including studying co-authorship networks. Examples of such studies are the following studies.[6,18,24,25] These studies, according to their own specific aims, analyzed the networks at different levels. For example in one study, conducted in Brazil, the networks of collaborations in the field of dentistry among universities across Brazil and beyond that were examined. Based on this study, the universities of Brazil were rather well connected with a density of 63.7%, which means 63.7 out of 100% of possible connections were created.[18] However, in one study conducted in Brazil in the field of evolutionary biology, the results found that the centrality degree in different universities ranged from 29.6% to 7.6%.[3] In our study, the degree of centrality was low among the faculties of the dentistry school, and there was no node between two other nodes. These indices show the impact and importance of a person on scientific collaborations.[25]

Iran is a developing country with a growing speed at scientific publication.[13] However, there are limit evidence about co-authorship network in Iran and some of them did not address the network structure straight forward.[26] One study suggested the existence of low connections networks among Iranian Medical Universities.[14] However, one study suggested acceptable levels of collaboration among the medical engineering students; 48% collaboration with international organization and 38% with national ones.

We found a low international collaboration among scholars at the Dentistry School, while in one study conducted in China on the management field about half of the published papers came through international collaboration.[27]

## Conclusion

Our study suggests that there are more rooms for improvement in the field of collaboration and co-authoring papers, which could consequently not only lead to a higher rate of publication and visibility but also affect the citation rates for authors.

## Conflict of Interests

Authors have no conflict of interest.

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