

RESEARCH ARTICLE

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# Research collaboration in health management research communities

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## Abstract

**Background:** This study uses scientometrics methodology to reveal the status quo and emerging issues of collaboration in health management.

**Methods:** We searched all the articles with the keyword “health management” in the period 1999–2011 in Web of Knowledge, then 3067 articles were found. Methods such as Social network analysis (SNA), co-authorship, co-word analysis were used in this study.

**Results:** Analysis of the past 13 years of research in the field of health management indicates that, whether the production of scientific research, or authors, institutions and scientific research collaboration at the national level, collaboration behavior has been growing steadily across all collaboration types. However, the international scientific research cooperation about health management study between countries needs to be further encouraged. 17 researchers can be seen as the academic leaders in this field. 37 research institutions play a vital role in the information dissemination and resources control in health management. The component analysis found that 22 research groups can be regarded as the backbone in this field. The 8 institution groups consisting of 33 institutions form the core of this field. USA, UK and Australia lie in the center by cohesive subgroup analysis; Based on keywords analysis, 44 keywords with high frequency such as care, disease, system and model were involved in the health management field.

**Conclusions:** This study demonstrates that although it is growing steadily, collaboration behavior about health management study needs to be enhanced, especially between different institutions or countries/regions, which would promote the progress and internationalization of health management. Besides, researchers should pay attention to the cooperation of representative scholars and institutions, as well as the hot areas of research, because their experience would help us promote the research development of our nation.

**Keywords:** Health management, Co-authorship, Network, Collaboration

## Background

The idea and practice of health management originated from America in 1950s, and then sprung up as an emerging subject in UK, Germany, France, Japan etc. In the 21st century, health management spread in the developing countries and was applied in government, business, medical institutions and the insurance industry. Now it has become a prospective health service model for many countries to improve their national health level and promote the society's sustainable development. Along with the increasingly popularity of health management,

research collaboration in this field has also increased. Research collaboration is becoming an important way of improving health management by extensive cooperation, which makes resources sharing and knowledge stocking possible. However, the co-authorship analysis in this field is seldom reported. Thus, the status quo of international collaboration in health management was revealed by scientometric methodology in this study.

## Literature review

It has been argued that co-authorship do not provide the entire view of the process of collaboration, however it is still advantageous for collaboration analysis through co-authorship as it is inexpensive and practical [1-4].

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Co-authorship can be analyzed at three levels (authors, institutions and countries/regions), such as the analysis of different countries/regions, institutions and authors for a certain time. It is a way to reveal the interrelationships of the domain, the intensity of these relations [5,6]. Also, all sorts of methods are applied to this field, including the frequently used Bibliometric techniques and social network analysis, as well as some new methods. Moreover, Zaida Chinchilla-Rodríguez had used block modeling to study the internal structure of co-authorship networks in the micro-level in 2012 [7].

Publications with more than one author have been on the rise, with many studies showing this trend [8-11]. However, these trends are not uniform, and must be contextualized by domain, country conditions and field of study [12-17]. Research in this respect has shown that there is a rise in institutional collaboration [18], but with the full caveats that this varies by discipline [19]. Especially in the biomedical fields, it tends to have high degrees of collaboration between institutions domestically, but not internationally [20].

The increase in international collaboration is not only a trend of the 21st century, but one that has been noted in scientometric studies for over a decade [21-26]. However, very few studies examined the collaboration activities in Health Management research field across multiple collaboration types [27-31]. This study intends to address this issue.

### Research questions

We intended to reveal current status of the collaboration activities and research topics in the Health Management field by using the method of co-authorship and co-word analysis so as to provide scientific evidence on research collaboration and suggestions for policymakers to establish a more efficient system for guiding and funding the Health Management research in the future.

Research Question 1:

What is the research collaboration trend in Health Management research?

Research Question 2:

Who/which are the most collaborative authors, institutions and countries/regions in Health Management research?

Research Question 3:

What are the research topics in Health Management research?

### Data and methods

#### Date collection

The documents which contain the word "Health Management" in their title, abstract or keywords were collected from the scientific literature database "Web of Knowledge". The scope was limited to the years 1999 through

2011. All documents regardless of type (e.g. article, meeting abstract, proceedings paper, review, editorial material, book review, letter, note, etc.) were processed. All documents from the Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Conference Proceedings Citation Index-Science (CPCI-S), and Conference Proceedings Citation Index-Social Science & Humanities (CPCI-SSH) were taken into account. The query yielded 3067 records, each of which has author names, affiliations, titles, sources, abstracts, total citations, key words and cited references.

#### Data Refinement

Articles coauthored by authors from more than one institution were classified as multi-institutional collaboration. A paper coauthored by authors from different countries/regions was considered a multi-national paper.

The names of authors and institutions have been normalized manually. For example, Zhao Y from Shanghai Univ was labeled "Zhao Y 1", while Zhao Y from Sch Management Beihang Univ was labeled "Zhao Y 2". Different variations of institution's name were assigned to one name.

Keywords Plus (Web of Knowledge supplied keywords in capital letters) is used in this paper.

#### Methods

In our previous studies, we revealed the collaboration activities in the oncology research field and cardiology and cardiovascular research field by means of co-authorship analysis, social network analysis and keyword analysis. We believe that these studies can provide suggestions for policy-maker in medical research management.

#### Bibliometrics

Bibliometrics is a quantitative analysis method by processing the literatures' characteristics and using mathematics and statistics methods to describe, evaluate and predict the status and future of science and technology.

#### Social network analysis

Social network is a network of individuals' communication including nodes and ties, especially for gaining one's specific ends. The node represents the individual or institution in the network, while the tie represents the content or way of communication [32,33]. Social network analysis (SNA) is the methodical analysis of social networks. Social network analysis views social relationships in terms of network theory, consisting of nodes (representing individual actors within the network) and ties (which represent relationships between the individuals, such as friendship, kinship, organizational position, sexual relationships, etc.) [34-37].

Pajek, a visualization toolkit for large-scale networks, was applied to map the collaboration. The node size in the graph is proportional to number of productions by authors, institutions or countries/regions, and the thickness of the lines represents the number of co-published papers.

### Centrality

Centrality is an important index to analyze the network. Whether the individual or institution lies in the center of social network will determine its influence on the network and its speed to gain information. Centrality measure includes degree centrality, closeness centrality, and betweenness centrality.

Degree Centrality of is defined as the number of ties that a node has. Degree Centrality represents the simplest notion of Centrality since it is just the number of neighbors of a node in the network.

The Closeness Centrality of a node is the number of others nodes divided by the sum of all geodesic distances between the node and all others, where larger distances yield lower Closeness Centrality scores. The closer a node is to all other nodes, the easier information may reach it, the higher its Centrality.

Betweenness Centrality rests on the idea that a node is more central if he is more important as an intermediary in the network. The Betweenness Centrality of a node is the proportion of all geodesics between pairs of other nodes that include the node.

The three centrality metrics can help us identify the "important" persons or organizations in the network.

### N-cliques and M-core

N-cliques insists that every member or a sub-group have a direct tie with each and every other member. M-core is a cohesive subgroup which meets the requirements that all line value in the subgroup are no less than M.

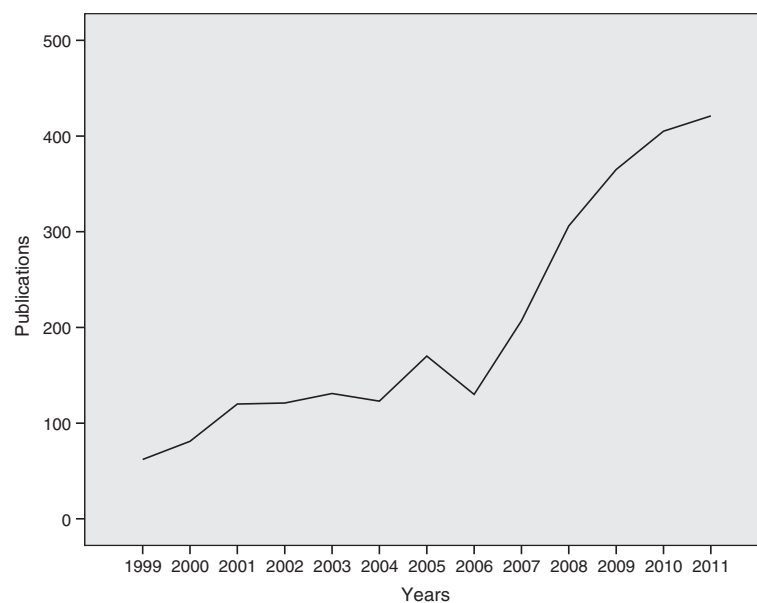
### Keyword co-occurrence analysis

Methods such as co-citation analysis, bibliographic coupling analysis and keyword analysis can be used to reveal the hot research topics. Co-citation analysis, bibliographic coupling analysis are two citation-based approaches. As many of our records have no citations, we chose keyword analysis in our study. If two keywords co-occur in many articles, it implies the close links between the topics to which they refer. Therefore, the analysis of the keyword co-occur frequency could reflect the relationship of the subjects. The keyword co-occurrence has been used in many studies to reveal research hot topics of some specific field or discipline [38-42]. In this study, keyword co-occurrence was used to provide an immediate picture of research collaboration topics in health management field.

## Results

### The trends of scientific production in the area of health management

From 1999 to 2011, the total amount of research papers in the field of health management has a significant growth (Figure 1). Figure 1 shows the total number of papers published annually. Overall, in 13 years the number of published articles increased by nearly six times from 62 in 1999 to 421 in 2011.



**Figure 1** Evolution of publications in health management research from 1999 to 2011.