

## Topic Analysis of Nursing Research Using Co-Word Analysis

### Abstract

**Background:** Nursing is one of the most important areas of medical sciences whose developments including its scientific publications can influence health care. Therefore, the aim of this study was to investigate nursing articles published from 2013 to 2018, and to provide a comprehensive view of common topical clusters in this research area. **Materials and Methods:** In this practical research, bibliometrics method and co-word analysis technique are used. The study population included all the articles in nursing area indexed in Web of Science from 2013 to 2018. The bibliometrics software, including BibExcel, UCINET, and SPSS was used to analyze the data. **Results:** Results indicated that the most frequently used nursing words in nursing research articles were “Quality of life,” “Aged,” “Education,” and “Nursing.” Moreover, the pairs such as “Anxiety-Depression,” “Education, Nursing-Students, Nursing” and “Depression--Quality of life” were the most frequent co-occurrences. The use of hierarchical clustering led to the formation of seven topical clusters in Nursing: “Nursing care for the Aged,” “Self-care,” “Physical, emotional, and social support, “Mother and child health,” “Preventing nursing care,” “Nursing profession Research,” and “Quality of nursing care.” **Conclusions:** The growth of nursing scientific productions is an indicative of the importance of this subject area in healthcare services; however, there is no balanced growth in various subjects.

**Keywords:** *Bibliometrics, nursing research, publishing*

### Introduction

Nowadays, the structure of knowledge in a given field can be explained by analyzing the bibliographic entities and tacit relationships within them.<sup>[1]</sup> The sociology of science can provide insights into definitions, boundaries, and researches in a scientific area so that it is possible to examine and identify the important concepts and paradigms governing the structure of a scientific area<sup>[2]</sup> and present a realistic image of that area based on the ontological and epistemological foundations of the social construction of knowledge. Previous studies have proved that bibliometric analysis of a specific area can reveal its current status and dynamic trend, and is helpful to further improve the quality of the area.<sup>[3]</sup> In this regard, scientometric specialists are working to draw up scientific maps of various areas through the processing, extraction, and sorting of information by using scientometric techniques, and provide analyzing, routing and presenting knowledge. In addition, they use scientometric techniques to facilitate access to information, reveal the knowledge

structure, and help knowledge seekers to achieve successful results.<sup>[4]</sup> Nowadays, scientometric specialists use various methods and techniques, such as co-citation, co-authorship, and co-word analysis to study the structure of knowledge in different areas.<sup>[5]</sup> One of the most common methods for analyzing knowledge maps in different areas is co-word analysis in which the relationship between words used in documents is examined.<sup>[6]</sup> In co-word analysis, it is assumed that the most frequently used words and co-words have more impact on an area than the less frequently used words. This type of analysis can identify the main issues of an area, the semantic structure and the evolution of that area over time.<sup>[7]</sup>

Nursing is an essential profession in the field of health care and plays an important role in promoting health services and improving a patient's status. In the nursing field, bibliometric or scientometric indicators are a fundamental tool to identify the structure of knowledge, number and distribution of publications, authorship, co-authorship, and the most cited articles.<sup>[8]</sup>

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This study could enable the readers from any region or country to understand the current state of nursing research in order to determine how research in this area has evolved over time and identify research gaps in nursing so that researches can be directed to the required topics.

The literature review shows that some bibliometrics studies has been carried out in the field of nursing,<sup>[3,8-16]</sup> but the study of knowledge structure in this field nursing using co-word analysis has not been the subject to research so far. Following is the following are some studies conducted in the field of nursing. Results of a bibliometric analysis performed by Yanbing *et al.*<sup>[3]</sup> on the Journal of Nursing Management published from 1993 to 2018 indicated that “nursing,” “nurses,” “management, leadership,” and “job satisfaction” are the most frequently used keywords in Journal of Nursing Management. “Nursing management,” “nursing leadership/leaders,” “nursing human resource management,” “nursing quality and safety management,” “nursing communication,” and “conflict management” have always been popular topics in this journal. Giménez-Espert and Prado-Gascó<sup>[8]</sup> perform the bibliometric analysis of the six most important nursing journals, of which 5,053 different terms appeared in the titles and abstracts were grouped by categories. The study inclusion criterion was a frequency of occurrence of  $\geq 50$ . In descending order of appearance, the following terms stand out: “nursing”; “student”; “practice”; “patients”; “program”; “simulation”; “intervention”; “quality”; “older”; “woman”; “family”; “cancer”; “adults”; “pain”; “mental”; “stress”; “critical”; “dementia”; “children”; “midwifery”, “chronic”; “needs”; and “communication”. Generally, their findings revealed that the topics most commonly researched by these authors were “job satisfaction,” “collaborative practices,” and “nurse leaders”. In their study, Mehdizadeh and Heydari<sup>[9]</sup> compared nursing research with other fields and investigated the citations of published articles in Web of Science (WOS) database. Based on co-word analysis of doctoral dissertations and master’s theses of nursing, Zhang *et al.*<sup>[10]</sup> studied the hot spots on nursing research field in China and presented nine topics within thematic clusters. Blažun *et al.*<sup>[11]</sup> reviewed 1,416 records on nursing ethical research in SCOPUS database in order to examine their current trends. Blažun, Kokol, and Vošner<sup>[12]</sup> reviewed 370 records in SCOPUS from 1981 to 2012 on “nursing competence” in order to examine the publishing patterns of them. The results showed that the US, UK, and Australia were the most active countries in this field, and the “Journal of Clinical Nursing” had focused more on studies conducted on nursing competency evaluation than other journals. Zhang and Liu<sup>[13]</sup> studied the development and formation of schizophrenia nursing in China from 2010 to 2014 using a scientometric analysis and the results demonstrated that 351 articles were published annually in this field and most of these studies had been published in the Medical Journal of the Chinese People’s Health. Zhang

*et al.*<sup>[14]</sup> reviewed studies conducted in the field of “cancer nursing” published from 2001 to 2011 and investigated 34 frequently used keywords in 2,933 articles. The results showed that studies conducted in this field could be classified into the three categories: (1) nursing practice, (2) nursing evaluation and education, and (3) nursing-related social support. Mendoza-Parra *et al.*<sup>[15]</sup> studied 13,208 records by Latin American in the field of nursing. Scott *et al.*<sup>[16]</sup> investigated the status of knowledge application of studies conducted in the field of nursing published from 1945 to 2004. The results showed a significant growth in this field and the evolution of the structure of the scientific community of knowledge application.

The literature review shows that today using techniques and scientometrics softwares, it is possible to reveal and analyze the complex relationships between co-words, and in this way, it can be drawn the structure of knowledge in various areas like nursing. Also, the literature review indicates that in the field of nursing, some studies have been done using scientometric techniques, but the study of the structure of knowledge in nursing area using co-words analysis has not been a research topic so far. According to the approaches used in this study, it seems that a holistic and valuable research is added to the nursing studies. Also, an understanding the structure of knowledge in nursing helps educational planners to review the nursing curriculum in order to improve the quality of education and keep up with the development of science. Therefore, the main purpose of this study was to explore the knowledge structure in nursing research using co-work analysis.

## Materials and Methods

This study is a practical research conducted using bibliometrics method and co-word analysis technique from 13 July to 21 November 2019. There were two reasons for choosing this time period: first, the number of articles published in the field of nursing was very large for topic analysis in terms of time and, second, the mapping of new studies in the field of nursing was conducted using both co-word analysis and network analysis. Co-word analysis was first proposed by Callon *et al.*<sup>[17]</sup> It has gradually developed and matured through the improvement of later generations, and has become the main method used in the exploration of research hotspots and the evolution of subjects. If two keywords occur simultaneously in a paper, they have a semantic relationship (co-word/co-occurrence). The higher co-occurrence frequency of two keywords implies the more correlative they are.<sup>[18]</sup> Co-word analysis not only finds mainstream keywords for a subject from the perspective of word frequency, but also identifies the connection between words, and then combines methods of social network analysis and cluster analysis to discover research hotspots and subject evolution laws.<sup>[19]</sup> Social Network Analysis (SNA) is a fast-developing scientific field that has grown sharply over the past 50 years, in terms

of the number of scientific publications and the different disciplines involved. An increased interest in the topic is to a large extent because of the emergence of the World Wide Web in the 1990s and online social networks in the 2000s. This inevitably led to the extension of thematic areas (including bibliometrics) where the methodology of network analysis is applied. Although the development of SNA has attracted the attention of many researchers, this attention has mostly been given to explorations of co-occurrence analyses in bibliometrics, such as co-word analysis, co-authorship analysis, and co-citation analysis.<sup>[20]</sup>

The study population consisted of all articles indexed in a 6-year period from 2013 to 2018 with the topic of Nursing in the Web of Science database. Unlike systematic reviews where several databases must be searched and articles retrieved, in bibliometric analysis, a large database, such as Web of Science or Scopus, was used to retrieve, analyze, and map the data. In addition, bibliometric analysis can provide information about citations and research collaboration.<sup>[21]</sup> We used Web of Science, because it is the friendliest and the easiest tool to use for bibliometric analysis services.<sup>[22]</sup> That is why at most bibliometric studies, records of Web of Science are used.<sup>[23,24]</sup> It seems that this timespan can map the knowledge structure in nursing area. To retrieve related articles, the following search strategy was used: (SU = Nursing) AND LANGUAGES: (ENGLISH) AND DOCUMENT TYPES: (Article OR Proceedings Paper OR Review), Indexes: SCI-EXPANDED, SSCI. Timespan: 2013-2018

After retrieving records related to nursing, keywords of 48,660 records were reviewed in order to perform co-word analysis in the first step. At this stage of the research, all the author-assigned keywords were extracted from the documents. The results showed that 46,697 keywords were repeated 185,594 times. The keywords were unified by editing, deleting, and modifying.

More precisely, because the keywords in the articles were assigned by the authors, a keyword may be written in different ways. Accordingly, Medical Subject Headings (Mesh) was used to select the preferred keyword, and the keywords that were not in the Mesh were determined by the subject experts as the preferred keyword and other synonyms were unified based on the preferred keyword. Also, the same form was chosen for singular and plural words. The keywords “nursing” because of its general meaning as well as name of countries and keywords indicating the type of research were excluded from the study. Finally, after several steps of trial and error, the 96 most frequently used keywords (each repeated at least 200 times) were selected and evaluated in the final co-word analysis. It should be noted that in various studies that have been conducted using co-word analysis, different thresholds have been used to include the main keywords in the final analysis. For example, Liu *et al.*<sup>[18]</sup> limited

their analysis to 66 most frequently used keywords, which accounted for about 55% of the total frequency and Hu *et al.*<sup>[25]</sup> limited their analysis to the 181 most frequently used keywords representing 29% of the total frequency. In this study, after preliminary evaluation, it was found that 96 keywords were repeated 52,235 times in articles with a minimum frequency of 200, representing up to 28% of the total frequency.

Hierarchical clustering can identify clusters of each keyword and show the relationships between them. For this reason, hierarchical clustering was performed using IBM SPSS software version 24. BibExcel software version 2017 was used to extract keywords from articles in order to determine the frequency of keywords and design co-word matrix. UCINET software version 6 was used to calculate the centrality and density of clusters in order to draw strategic diagram.

### Ethical considerations

This article does not contain any studies with human participants or animals and it was conducted on publications, so there is no need to observe principles of confidentiality, and since all retrieved records in the field of nursing according to search strategy have been included in the study no bias has occurred.

## Results

### How is the frequency distribution of keywords in nursing area?

Table 1 shows the 20 most frequent keywords used in nursing research as shown in Table 1, keyword “Nursing” with 3,855 repetitions had the highest frequency among all keywords. “Qualitative Research” with 2,083 repetitions and “Nurses” with 1,448 repetitions ranked second and third, respectively.

After determining the threshold for inclusion of keywords in co-word analysis, their co-occurrence was obtained. The frequency distribution of the 20 most frequent co-word pairs is shown in Table 2. The co-occurrence between the two keywords “Anxiety-Depression” has the highest frequency in nursing research and two pairs of “Education, Nursing-Students, Nursing” and “Depression-Quality of Life” ranked second and third, respectively. It should be noted that after consulting with nursing specialists, in the final analysis to illustrate clustering, multidimensional scaling and strategic diagram, keywords “nursing” and “name of countries” were excluded.

### What topic clusters are formed in nursing area by co-word cluster analysis?

Among the multivariate statistical methods, hierarchical clustering was performed. The dendrogram obtained from the hierarchical clustering is shown in Figure 1. According to this dendrogram, the analysis of the co-word findings led to the

**Table 1: The most frequently used keywords in the international nursing records**

Ranking	Keywords	Frequency	Ranking	Keywords	Frequency
1	Nursing	3855	11	Breast Feeding	846
2	Qualitative Research	2083	12	Caregivers	833
3	Nurses	1448	13	Evidence-Based Practice	825
4	Quality of Life	1278	14	Students, Nursing	757
5	Aged	1253	15	Adolescent	757
6	Education, Nursing	1231	16	Validation Studies as Topic	733
7	Education	1054	17	Child	719
8	Neoplasms	985	18	Exercise	657
9	Midwifery	883	19	Mental Health	629
10	Depression	880	20	Nursing Care	629

**Table 2: Co-occurrence Frequency Distribution of Top 20 co-word pairs**

Ranking	Co-word pairs	Frequency
1	Anxiety - Depression	208
2	Education, Nursing - Students, Nursing	156
3	Depression - Quality of Life	119
4	Heart Failure - Self-Management	116
5	Nurses - Qualitative Research	108
6	Education, Nursing - Simulation	105
7	Neoplasms - Quality of Life	99
8	Caregivers - Qualitative Research	95
9	Adolescent - Child	95
10	Psychometrics - Validation Studies as Topic	89
11	Child - Parents	77
12	Neoplasms - Qualitative Research	75
13	Nurse Practitioners - Primary Health Care	74
14	Midwifery - Nurses	72
15	Breast Neoplasms - Quality of Life	69
16	Aged - Qualitative Research	69
17	Caregivers - Dementia	68
18	Aged - Quality of Life	68
19	Midwifery - Pregnancy	68
20	Caregivers - Quality of Life	63

formation of seven subject clusters that the keywords in each cluster and the topic selected for that cluster were specified. In the following, a brief explanation of each subject clusters within nursing research was provided.

**Cluster 1: Nursing care for the Aged.** There were 10 keywords in this cluster. According to the keywords of this cluster (such as “Aged,” “Long term care,” “Dementia,” “Rehabilitation,” “Nursing home,” “Family,” and “Stroke”), the subject of this cluster could be related to nursing care for elderly or aged.

**Cluster 2: Self-care.** This cluster consisted of 6 keywords showing the lowest rate in terms of number of keywords. The most important keywords in this cluster included “Patient Education,” “Self-Management,” and “Self-Efficacy.”

**Cluster 3: Physical, emotional, and social support.** There were 24 keywords in this cluster that had the highest

number of keywords such as “Social support,” “Quality of life,” “Fatigue,” “Exercise,” “Anxiety,” “Stress,” and “Psychological Adaptation.”

**Cluster 4: Mother and child health.** This cluster consisted of 9 keywords, each of which could somehow be a subcategory of the more general concept of “mother and child health.” Some of these keywords included “Health Promotion,” “pregnancy,” “Women Health,” “Mental Health,” “Parenting,” “Smoking,” and “Breast Feeding.”

**Cluster 5: Preventing nursing care.** This cluster consists of 8 keywords such as “Risk Factors,” “Primary Health Care,” “Prevention and Control.”

**Cluster 6: Nursing profession research:** This cluster consisted of 22 keywords, such as “Ethics,” “Culture,” “Job Satisfaction,” “Professional burnout,” “Work Flows,” “Leaders” (Leadership), and “Hospitals,” representing studies conducted on “nursing profession” and “nursing management.”

**Cluster 7: Quality of nursing care.** This cluster included 17 keywords, such as “Instrument Development,” “Learning,” “Student Nursing,” “Quality Improvement,” “Education Nursing,” “Psychometrics,” “Validation Studies,” and “Quality of Health care.” These keywords represented a broader concept of “quality of health care.”

**How is the status obtained from clusters of co-word analysis in nursing area in terms of maturity and development?**

In this part of co-word analysis, the strategic diagram was drawn using concepts of centrality and network density. The frequency matrix and the correlation matrix were drawn separately for each of the seven clusters. The rank and density of each cluster were calculated using UCINET software and also the mean of each cluster was calculated. In the next step, based on the data related to the centrality and density of each cluster [Table 3], a strategic diagram was drawn in order to determine the maturity and cohesion of each topic. As depicted in Table 3, clusters 2, 1, and 6 had the highest density, respectively, and clusters 6, 3, and 7 had the highest centrality, respectively.

Figure 2 shows the strategic diagram of clusters obtained from co-word analysis in the nursing field. It should be

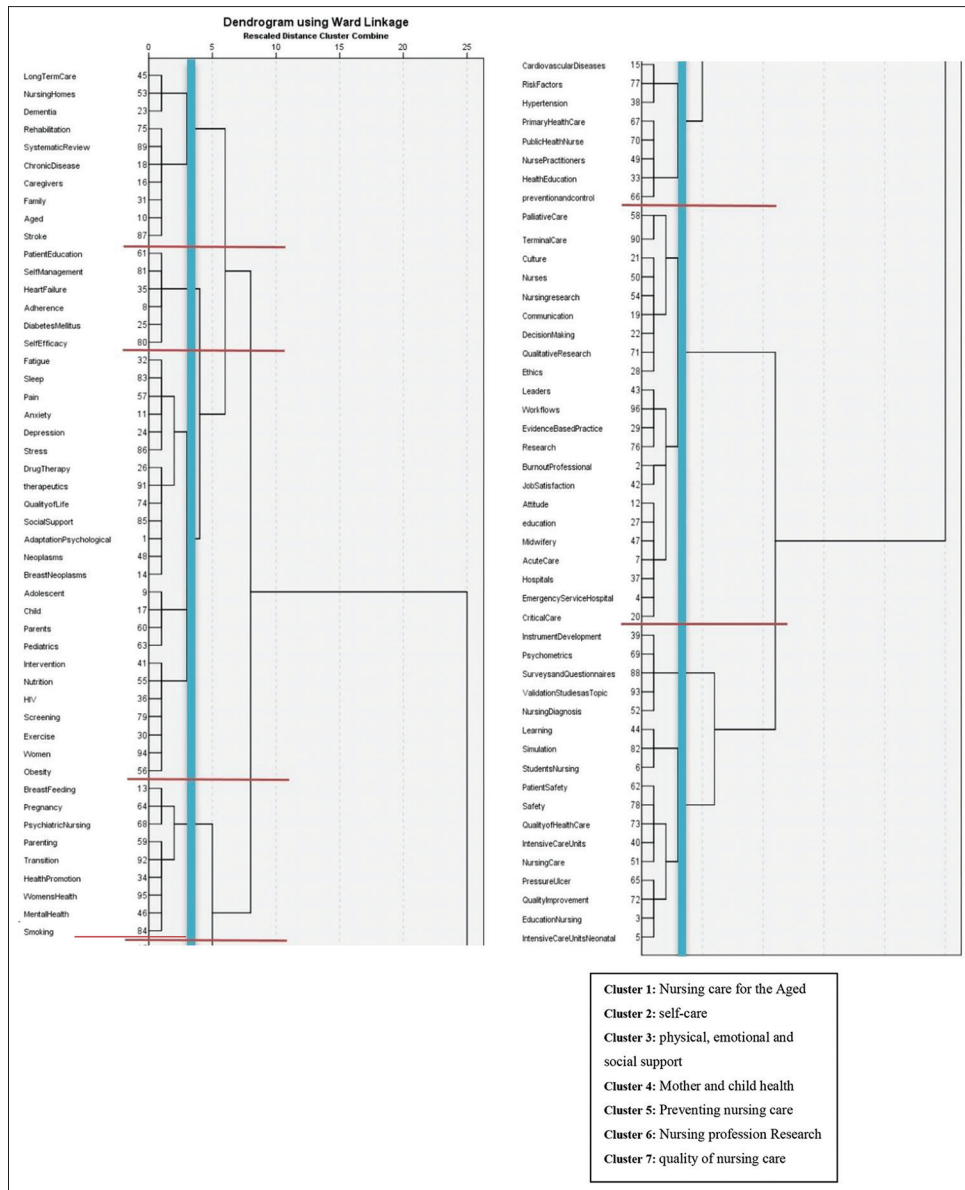


Figure 1: Dendrogram of hierarchical clustering by co-word

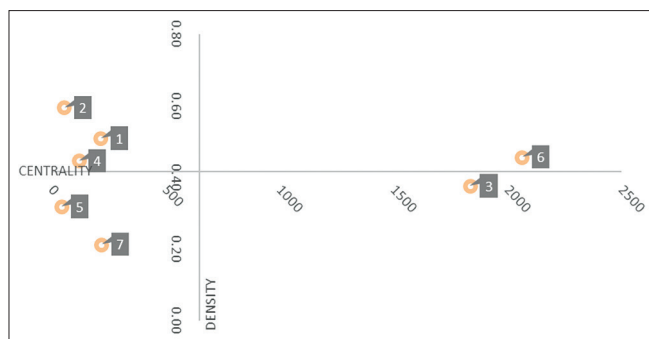
noted that the origin of the diagram was set to 647.90 and 0.416, respectively, based on the mean of centrality and density of the clusters. The horizontal axis in the strategic diagram shows the centrality and indicates the power of interaction of each cluster in the area under study. The greater the centrality of a cluster, the more central (i.e. important) position the cluster. On the other hand, the vertical axis indicates the density and the intrinsic relationship in a particular research area. The greater the density of a cluster, the greater is the cluster's ability to maintain and develop.

As shown in Figure 2, only cluster 6 (nursing profession research) had placed in the first section of strategic diagram. According to the basics of strategic diagram, this cluster had the highest centrality and density, it had a central role which was well developed.

Table 3: Density and centrality of clusters obtained from co-word analysis

Clusters	Centrality	Density
Nursing care for the aged	211.27	0.51
Self-care	53.33	0.59
Physical, emotional and social support	1834.25	0.38
Health promotion	116.88	0.45
Preventing nursing care	40.18	0.32
Nursing profession research	2062.24	0.46
Quality of nursing care	216.12	0.21

Clusters 1 (Nursing care for the aged), 2 (self-care), and 4 (mother and child health) had placed in the second section of strategic diagram. These clusters were not the important topics, but they are well developed. Clusters 5 (preventive nursing care) and 7 (quality of nursing care)



**Figure 2: Strategic diagram of clusters obtained from co-word analysis**

placed in third section of strategic diagram had lower centrality and density compared to other clusters, so they were marginal. Finally, cluster 3 (physical, emotional and social support), placed in the fourth section of strategic diagram, was an important topic but not developed.

## Discussion

Bibliometrics studies are one of the practical research methods that can help scientists and policy makers in any country in scientific planning. Co-word analysis, as one of the most widely used techniques in scientometrics, helps to identify saturated areas and existing subject vacancies (knowledge structure) in any area or profession for research, thereby helping to move research towards new topics. In this study, this recognition was obtained in nursing area. More precisely, in this research, using the co-word analysis and social networking tools as well as visualization software, the scientific map of nursing area was drawn and analyzed from 2013 to 2018.

The results of this study, like many scientometric studies<sup>[12,15]</sup> conducted in the field of nursing indicated an increase in scientific production in various nursing subjects. Our results also showed that the most frequent keywords were “Nursing,” “Qualitative Research,” and “Nurses” that were consistent with the results of Yanbing *et al.*<sup>[3]</sup> and Giménez-Espert and Prado-Gascó<sup>[8]</sup> suggesting that keywords “Nursing” and “Nurses” were the most frequent keywords. Regardless of keywords of “Nursing”, and “Nurses” that were so general, keywords “Quality of life,” “Aged,” “education, nursing,” “education,” “Neoplasm” were the most frequent keywords, indicating the great attention of nursing scholars to these topics. “Quality” and “Aged” or (elder) are issues of concern among nursing researchers, confirmed in Giménez-Espert and Prado-Gascó.<sup>[8]</sup> The existence of the keyword “Qualitative Research” as the second most frequent keyword in all nursing research indicates the importance of qualitative methods in nursing researches that may be due to the interaction of nurses with patients and their sick companions.<sup>[26]</sup> Also, 150 keywords (such as Social “support,” “Diarrhea,” and “Myocardial infraction”) had only 2 frequencies and 1,093 keywords (such as “Occupational stress,” “Older,”

and “Tendon”) had only one frequency. These results indicate that there is research vacuum in some topics. The results of this study are consistent with the study of Zhang *et al.* (2018) showing that community health nursing play an important role in nursing research.<sup>[10]</sup>

Co-occurrence of keywords refers to the common presence of two keywords. If two keywords occur simultaneously in a paper, they have a semantic relationship (co-word/co-occurrence). The higher co-occurrence frequency of two keywords implies the more correlative they are.<sup>[18]</sup> Co-occurrence of keywords “Anxiety--Depression” had the highest frequency in nursing research and two pairs of “Education, Nursing--Students, Nursing” and “Depression--Quality of life” were ranked second and third, respectively.

Using the hierarchical clustering analysis to identify the intellectual structure of the nursing field led to the formation of seven topic clusters including “Nursing care for the Aged,” “Self-care,” “Physical, emotional, and social support,” “Mother and child health,” “Preventing nursing care,” “Nursing profession Research,” and “Quality of nursing care.” A study of the frequency of keywords in the clusters showed that the clusters “Self-care,” “Physical, emotional, and social support,” “Nursing profession Research,” and “Quality of nursing care” have more keywords indicating authors’ attention to that topic. Study of clusters status in view of maturity and development showed that clusters “Self-care,” “Nursing care for the Aged,” and “Nursing profession Research” had the highest density and clusters “Nursing profession Research,” “Physical, emotional, and social support,” and “Quality of nursing care” had the highest centrality, respectively.

As we know, the horizontal axis in the strategic diagram represents the centrality and the power of interaction of each cluster in that topic area. When the centrality of a cluster is high, it would have significant and central position. On the other hand, the vertical axis indicated the density and the intrinsic relationship in a particular research area. The higher the density of a cluster, the greater the cluster’s ability to maintain and develop.<sup>[18,27]</sup> Only cluster 6 (nursing profession research) had placed in the first section of strategic diagram. According to the basics of strategic diagram, this cluster had the high centrality and density and it had a central role in nursing studies, which is well developed and well coherent. Also, clusters 1 (Nursing care for the Aged), 2 (self-care), and 4 (mother and child health) had placed in the second section of strategic diagram. These clusters were not the important topics, but they are well developed and tend to become specialized. Clusters 5 (preventive nursing care) and 7 (quality of nursing care) had placed in third section of strategies diagram. They had lower centrality and density compared to other clusters, so they were declining. Finally, cluster 3 (physical, emotional and social support), placed in the fourth section of strategic

diagram, was an important topic but not developed. This means that this cluster is one of the most important topics in nursing but not sufficiently developed. This result is consistent with the results of Zhang, Huang, and Li (2011)<sup>[14]</sup> demonstrating that “nursing-related social support” is one of the topic clusters in “cancer nursing” research.

Because this is a global bibliometric analysis, using records from Web of Science may limit the results. Many bibliometric studies use records indexed in the Web of Science, but the limited coverage of Web of Science in the Medical research may affect the results. However, according to the search strategy used to obtain records within Nursing Category, it was tried to include the most appropriate records in the analysis process as much as possible. Moreover, although the journals indexed in Web of Science are international in nature, less non-English articles are indexed in this database, and this can limit results as well.

## Conclusion

Nowadays science and technology are the most important factors for the development of any country. Understanding the knowledge structure in a field is a complex process that can be done with assessing the thematic relationships and performing comprehensive analyzes of published documents and the concepts discussed in them. Co-word studies have provided a tool that can be used to obtain a general understanding of a topic area, and in this way, research policy can be acted with a clearer vision and based on real criteria. Research managers can contribute to the growth and development of nursing-related concepts by relying on the findings of the present study. This study aimed to identify the key subjects of nursing area by using the relationships between keywords. From the results of this studies and other related studies, it can be inferred that the professional issues in nursing are very much considered by researchers and nursing community, that there is a need to use the results of this study in solving nurses' problems. Also, the results of this study demonstrated that “nursing care for aged” is not the important topic in nursing research, which requires more attention due to the large population of these people. The “physical, emotional, and social support” for patients is a central topic but not well developed so there is a research gap in this topic and there is a need to direct research towards it. Therefore, it is recommended that that department of nursing in universities should pay attention to the results of scientometrics studies in nursing area and use them to properly orient the nursing research in order to fill research gaps.

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## Conflicts of interest

Nothing to declare.

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