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Analysis and review of research in the field of medical ethics in the international arena

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Abstract:
Background and Objective: Syntax analysis is a reliable method for discovering relationships and revealing connections between different scientific fields and visualizing the intellectual structure of a scientific discipline. This study attempts to study the intellectual structure of knowledge in medical ethics research using the technique of synonymy.
Materials and Methods: The research method of the present study is descriptive-analytical, which analyzes the content of the text with a scientometric approach. The research community includes 3296 records in the field of medical ethics in the Web of Science database for the period 1998-2018.
Findings: The findings showed that in terms of frequency, the key terms bioethics and informed consent had the highest frequency in medical ethics studies.
The findings related to hierarchical clustering led to the formation of 9 clusters in this area, with the clusters of futility in medicine, informed consent, and medical education with a clinical ethics approach being in the best strategic position. Ethical considerations: Honesty and trustworthiness in the selection of articles, reporting, and citation of the text have been observed.
Conclusion: The present study showed that the analysis of synonyms and clustering can help to understand the structure of thematic relations in a field. The results of the analysis of the strategy diagram showed that "informed consent", "medical education with an ethical approach" and "nonsense in medicine" are the central clusters. In contrast, the four clusters "Doctor-Patient Relationship", "Ethics in Medical Research", "Medical Profession and Ethics" and "Easy Death" are emerging or declining clusters. Research is felt in some discussions and concepts such as abortion, simulation, sterilization and its vacuum.

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1 Introduction

The integration of science and ethics in various fields of knowledge has always been considered an important and certain principle for the material and spiritual advancement of mankind. In the realm of experimentation, especially in medicine, it has also been considered a gateway to a partial ethics of its own.

Medical ethics is an analytical activity in which various thoughts, beliefs, commitments, methods, behaviors, feelings, arguments, and debates in the field of ethical decision-making in medicine are carefully and critically examined and, where necessary, guidelines are issued. Medical ethics decisions, in the field of medical practice, determine the principles and values, good or bad, right or wrong, and what should or should not be done.[3]

Considering the position of science and medicine, which is related to the dignity of existence and the importance of the human soul, and considering the extensive application of medicine in human health, research in medical ethics is of dual importance.[4]

Much research is currently underway in various areas of bioethics, and many articles have been published on bioethics topics,[5] but there is a significant lack of research that examines this area in a scientific and objective manner, including international studies. In other words,

Identifying and presenting a visual representation without the mediation of the actual content of the issues raised in the field of medical ethics is necessary for the advancement of this field, so that in the light of that, it can anticipate the optimal use of society's resources and help the officials and policymakers in this field with the new knowledge and insight gained in this way.

Today, the emergence of scientometric techniques, along with the use of social network analysis techniques and science visualization software, has provided researchers with the ability to identify the structure of knowledge in various fields in a standardized way.

By using homonym analysis as one of the scientometric techniques, it is possible to examine the main topics of interest in research and study their thematic relationships. Synonym analysis is a content analysis technique that searches for patterns of occurrence of pairs of words or phrases within a set of texts to discover relationships between ideas in subject areas.[6]

Synonym analysis is based on the principle that research areas can be described based on patterns of word usage in publications.[7] This technique is a reliable method for discovering relationships

[3] Campbell,et,al.2001.
[4] Mekkizadeh and Osareh,2011.
[5] Larijani and Zahedi,2008.
[6] Chen X,et,al.2016.
[7] Soheili,et,al.2018.

and revealing connections between different scientific fields.[8] In this context, Chen and colleagues emphasized the feature of synonym analysis, that is, visualizing the intellectual structure of a scientific field.[9] Conceptually, synonym analysis is an appropriate method for discovering relationships between scientific research fields and reveals important connections that may be difficult to discover by other methods.[10]

In light of the above, the main objective of the study is to analyze the intellectual structure of knowledge in the field of medical ethics using scientometric techniques. The sub-objectives are: examining the growth trend of research conducted in the field of medical ethics, how the frequency distribution of key terms is distributed, identifying thematic clusters in the field of medical ethics, and the level of maturity and development of thematic clusters in this field.

Various studies have been conducted to study the research process and thematic structure using lexical correlation analysis in various fields, including medical education,[11] health literacy,[12] big data in medicine,[13] disaster medicine, medical tourism, and a comparative study of Chinese articles in the field of medical ethics. A review of the previous studies shows that Syntax analysis is a suitable method for drawing the structure of science and drawing thematic maps in various fields.

This study aims to introduce the research areas and thematic areas of the field of medical ethics with the help of the method of syntax analysis, identifying and introducing the emerging and emerging thematic areas of this field. In other words, the problem of the present research is to identify the intellectual structure of knowledge in the field of medical ethics using It is from the analysis of synonyms.

2 Ethical Considerations

In this study, honesty and trustworthiness in the selection of articles, reporting, and citation of the text have been observed.

3. Materials and methods

The present research method is a descriptive-analytical type that analyzes the content of the text with a scientometric approach. The research community includes journal articles available in the Web of Science database in the field of medical ethics that were covered by the database on the date of the search (1/27/2019).

Web of Science is one of the world's leading scientific information databases, developed by Thomson Reuters. This database provides bibliographic information for articles, along with abstracts, as well as bibliographic information for sources used. One of the features of this database

[8] Ravikumar,et,al.2015.
[9] Chen X,et,al.2016.
[10] Makkizadeh,et,al.2016.
[11] Ershad,et,al.2011.
[12] . Baji F, et al.2018.
[13] Hsu WC,2018.

is its comprehensive thematic coverage, which makes it a suitable tool for searching for information across all disciplines, especially interdisciplinary topics.

First, for the purpose of data collection, after entering this database, in the subject search field, to retrieve the background of the field of medical ethics through a combined search with the search term "Medical Ethics" in the subject field and applying the article restriction, a number of 3296 documents were retrieved and stored.

Due to the limitation of the Web of Science database analysis section, which can only extract 500 records at a time, the retrieved records were extracted in 500-record files in tab-delimited format and stored on a personal computer. Since some words or phrases may be written in different forms or have synonyms, key words were edited, corrected, deleted, and consolidated after obtaining the opinion of a subject matter expert.

For example, singular and plural items were converted to one case. Also, the keyword Medical Ethics, which was a common control, was excluded from the study. In the next stage, after several stages of review and trial and error by setting the inclusion threshold on keywords that were repeated at least 13 times, a total of 53 highly frequent keywords were identified and included in the final analysis.

Various studies using the homonym analysis method have used different thresholds to include the top keywords in the analysis. For example, Liu et al. limited their analysis to 66 keywords.[14] Makizadeh also limited his final analysis to 52 keywords.[15] After identifying the most frequent keywords, a homonym matrix was prepared for these topics. A symmetric matrix is a square that shows how many articles each topic has in common with other topics.

The number of rows and columns is equal to the number of selected concepts, and each column indicates the number of times the two keywords associated with the row and column appear together in a document, so the matrix is a symmetric matrix. The existence of these matrices provides automatic thematic analyses using methods such as social network analysis and clustering. In the next stage, hierarchical clustering was performed using SPSS 20 software and the resulting dendrogram was analyzed. Then, for data analysis and analysis, a research structure in the field of medical ethics was presented using a strategic diagram.

4 Findings

Scientific products in the field of medical ethics represented in the Web of Science database, which was extracted between 1998 and 2018, were retrieved in a total of 3296 articles. The results of the analysis showed that the growth of scientific products related to the field of medical ethics has been on an upward trend over the time frame of the research, with further acceleration in recent years.

[14] Liu, et al.2012.
[15] . Makkizadeh,2019.

Table 1 shows the twenty keywords with the highest frequency. As is clear, the keyword Bioethics with a frequency of 127 had the highest frequency among all keywords. The keywords Informed Consent and Physician Patient Relationship are in second and third place with frequencies of 156 and 89, respectively. The synonym map between the selected keywords is drawn below (Figure 1).

Synonyms in a document indicate that those words are related and that a major part of the document's content is related to those words, so if we measure the amount of these synonyms, we can draw the conceptual network of a scientific field.

Clustering is a descriptive activity that explores the identification of natural groupings of data. In the present study, an attempt has been made to identify the relationships between documents by organizing the topics of this field. The relationships between documents in each field have been written as an expression of coherence or density between topics. Meanwhile, if there is any thematic coherence in the documents in a field, it indicates the semantic relationships and richness of that field in a particular field or language.

In order to identify the intellectual structure that dominates the field of medical ethics, the conceptual relationships of the key terms in question were analyzed, which led to the formation of nine thematic clusters (Figure 2).

Next, an analysis of thematic relationships is presented. The results related to the clusters obtained from the hierarchical cluster analysis are presented below. Of course, it is necessary to mention this point that in some clusters, in addition to the main and important key words, sometimes there are key words that do not have a direct semantic relationship with the topic of that cluster, which is not uncommon in synonym analysis, because these key words are more frequent in terms of frequency and also the correlation coefficient compared to other key words in that cluster. They have a lower level of influence.

4.1 Cluster 1: Medical futility

The first cluster of issues raised in the field of medical ethics is medical futility. In medicine and medical ethics, the question of medical futility has been a frequent one, leading to numerous discussions and focus on this topic.

Futility in medicine is defined as a situation in which an intervention - whether performed for diagnostic, preventive, curative, or rehabilitative purposes or for other medical purposes - does not provide any benefit to the intended patient. Therefore, medical ethics dictate that a physician refrain from performing futile procedures.[16] (19). In line with the present study, this issue has been identified[17] as one of the most prevalent. issues in other studies in the field of medical ethics.[18]

[16] Aramesh,2008.
[17] Jiang L, et al.2012.
[18] Mekkizadeh and Osareh,2011.

4.2. Cluster 2: Doctor-Patient Relationship

The co-occurrence of key terms such as “healthcare”, “value”, “doctor-patient relationship”, “decision-making” and “managed care” shows that the ethical aspects of the doctor-patient relationship are still the most fundamental and controversial issues in professional medical ethics. This cluster consists of six key words, with doctor-patient communication being one of the most important words in this cluster. The results of this cluster are consistent with the research of Jiang et al.[19] on Chinese and non-Chinese medical ethics.

4.3. Cluster 3: Ethics in Medical Research

The third and largest cluster of topics in the field of medical ethics is the ethics of research, clinical trials, and human experimentation. Advances in medical science are due to research conducted on living beings, humans, and the environment. However, these advances are generally accompanied by harm to the subjects, which can endanger the health and rights of individuals or subjects. For this reason, the debate on ethics in research is one of the issues that has attracted the attention of medical researchers. In line with the present study, Jiang et al.[20] have addressed the issue of ethical review and medical research.

4.4. Cluster 4: Medical Profession and Ethics

The topics addressed in this cluster are medical profession, patient rights, and ethics. Real medicine is possible when the physician has learned the necessary duties and skills in dealing with the patient, the public, and society, or is familiar with the social ethics, manners, customs, traditions, and culture of his or her community. The physician's relationship with the patient must be such that the basic principles of medical ethics do not violate the patient's rights.[21]

4.5. Cluster 5: Assisted Death

The co-occurrence of terms such as “suicide or end-of-life decision,” “organ donation,” and “abortion” indicates that in research, physician-assisted suicide and assisted death are often considered to be the same from an ethical perspective, and these two terms are discussed more than once in ethics, although there is a clear legal distinction between them. Euthanasia is one of the most controversial topics in the field of end-of-life medical decisions.

There is some quantitative research on the attitudes of members of the public, especially nurses, who are more likely to be confronted with this issue than others.[22] It has also been mentioned as one of the concepts related to this field in the study of medical ethics by Jiang et al.[23]

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[19] Jiang L, et al.2012.
[20] Jiang L, et al.2012.
[21] Khademolhosseini,2009.
[22] A companion to applied ethics,2008.
[23] Jiang L, et al.2012.

4.6. Cluster: 6 Brain Death and Organ Transplantation

The topics that are located next to each other in this cluster are: “Brain Death”, “Organ Transplantation” and “Death”. This clustering expresses the idea that the issue of organ donation to patients at the time of death is one of the important and challenging ethical debates that takes place in different societies, cultures and religions based on their values and laws.

Two major challenges in organ donation in patients at the time of death are determining the time of death and how to make decisions about organ donation. The correct diagnosis of brain death and the ethical issues in organ transplantation are very complex due to the many social factors (religion, culture, and traditions of the community) that influence it.[24]

4.7 Cluster 7: Palliative Care with an End-of-Life Approach

The topics discussed in this area (palliative care, end of life, quality of life, end of life care, and medical opinion) support the point that palliative care is the science and art of improving the quality of life at the end of life or the end of life.

In this approach, the characteristics of the concept of palliative care, especially at the end of life or in cases such as improving the life of the patient and his family, improving the physical, mental and social well-being of the patient, paying attention to spirituality and relieving physical pain, have been identified. In line with the present study, other studies have also included palliative care as a basic care approach for the care of individuals at the end of life.[25]

4.8. Cluster 8: Informed Consent

The synonyms of key terms such as “autonomy”, “informed consent”, “privacy” indicate that the patient’s independence, self-determination and voluntary participation in medical treatment and health care research are matters of patient rights.

In general, the basis and foundation of informed consent is the principle of autonomy, and if there is one central concept in the bioethics movement, it is autonomy. Autonomy, or respect for the patient’s choice and freedom, is the first principle of medical ethics, and compliance with these principles is among the duties of the medical team.[26]

Autonomy and informed consent were the most frequent in terms of the degree of concordance of homozygous couples and ranked first in the table of homozygous couples. Some studies similar to this study have referred to the issue of informed consent.[27]

[24] Bazmi, et al. 2009.
[25] Schneider, et al. 2010.
[26] Seyyed, et al. 2018.
[27] Jiang L, et al.2012.

4.9. Cluster 9

Cluster 9 covers the topic of medical education with a clinical ethics approach. Clinical ethics, as one of the main pillars of medical ethics that explains the ethical rules governing the doctor-patient relationship and emerging issues arising from new biomedical technologies, has confronted the medical community with a wide range of ethical issues, including experimental testing, genetics, organ transplantation, clinical examinations, medical reproduction, and providing necessary information to patients.

It seems that among the main axes of medical ethics, the need to expand and expand clinical ethics and institutionalize it in the comprehensive health system is the one that has received the attention of researchers.[28]

In the following, in order to gain a more comprehensive and better insight into the structure of issues in the field of medical ethics, a strategic diagram was used. In this way, first, an abundance matrix and then a correlation matrix were created separately for each of the clusters.

Then, using the UciNet software, the rank centrality and density of each cluster were calculated and the average of each cluster was obtained. In the next step, based on the data related to the centrality and density of each of the nine clusters (Table 2), a strategy diagram was designed. As can be seen in the table, clusters 1, 8, and 9 have the highest density and highest centrality, respectively.

This means that the informed consent cluster, which contains the most frequent key terms, has the highest centrality, both in terms of influence and connection with other topics, as well as linkages between other key terms. A schematic diagram of the clusters resulting from medical ethics research is presented in Figure 3.

The strategic diagram has a horizontal axis representing centrality (the degree of cluster cohesion) and a vertical axis representing density (the degree of internal connection strength of each cluster).

Clusters 1, 8, and 9 (medical futility and informed consent) are located in section 1 of the diagram. These clusters are pivotal and have a high level of centrality and density compared to the other clusters. Cluster 6 (brain death and organ transplantation) is located in section 2 of the diagram. This cluster is not pivotal and is at a lower level in importance than the clusters in Section 1.

Clusters 2, 3, 4, and 5 are located in Section 3 of the diagram, and are at a lower level than the other clusters in terms of both centrality and density. These clusters are emerging and underdeveloped. Cluster 7 (Palliative care with an end-of-life approach) is an immature and underdeveloped cluster in Section 4 of the diagram.

[28] Abbasian and Abbasi,2009.

5. Discussion

Price, in his book Little Science, Big Science (1963), a seminal work in information science, noted that the number of scientific articles doubles every fifteen years. Such a rate of growth cannot be attributed to a single factor, and it can be concluded that this growth is part of the nature of science.[29]

An examination of the results obtained also shows that the process of scientific production in the field of medical ethics has been on the rise[30]. In line with the research results, the growth of scientific resources in other subject areas [31](15, 17, 9-10) has been confirmed in recent years. The research findings showed that the key terms,[32] bioethics and informed consent, are the most widely used terms among the studies in the field of medical ethics.[33]

Therefore, it seems that the field of bioethics has contributed a lot to the research in medical ethics. The results showed that the structure of the synonym network of the field of medical ethics and other thematic areas obtained formed a continuous and coherent network in terms of the intellectual structure network of the field, which in a way strengthens the intellectual and spiritual structure of this field.

The use of hierarchical clustering analysis to identify the intellectual structure in the field of medical ethics led to the formation of 9 thematic clusters. Multiple clusters created by sharing common characteristics within each group have a structural relationship with each other.

Therefore, paying attention to the clustering of topics in the field of medical ethics can help identify trends and understand the basic concepts of this field, and ultimately contribute to the growth and development of this field. Among the clusters that emerged, the cluster of medical education with a clinical ethics approach (Figure 2) appeared to be the main area of focus of all the topics.

Clinical ethics is one of the three main axes of medical ethics that covers the issue of recognizing, analyzing, and resolving value conflicts that arise during medical care in hospitals and medical centers.[34]

[29] Price,1963.
[30] Makkizadeh,2019.
[31] Hu Y-,et al.2013
[32] Baji, el al.2018.
[33] Hsu WC,,2018
[34] Abbasian and Abbasi,2009.

Table 1: Ranking of key terms in the field of medical ethics based on frequency

Rank	***Keyword***	***Abundance***	***Rank***	***Keyword***	***Abundance***
1	Bioethics	127	11	Research ethics	43
2	Informed consent	156	12	Patient autonomy	38
3	Physician Patient relationship	89	13	Clinical ethics	37
4	Autonomy	86	14	End of life care	36
5	Medical ethics education	80	15	Human rights	36
6	Euthanasia	71	16	End of life	32
7	Medical education	69	17	Confidentiality	31
8	Decision making	66	18	Clinical trials	29
9	Professionalism	50	19	Professional ethics	29
10	Palliative care	43	20	Conflict interest	28

Table 2: Density and centrality of clusters obtained from synonym analysis

Cluster	Centrality	Density
Anesthesia in Medicine	8/3	3/66
Doctor-Patient Relationship	2/46	2/3
Ethics in Medical Research	0.890	0.866
Medical Profession and Ethics	1	0.833
Easy Death	1	1/90
Brain Death and Organ Transplantation	3/33	0.5
Palliative Care with an End-of-Life Approach	2/6	3/16
Informed Consent	7/16	7/66
Medical Education with a Clinical Ethics Approach	8/3	3/66

Key discussions and explanations that influenced the formation of the clusters were described and Their role is discussed in the relevant sections in the Findings section. The strategic diagram resulting from the analysis of the similarities in the field of medical ethics showed that the topics of futility in medicine, informed consent, and medical education with a clinical ethics approach are located in section 1 of the strategic diagram, which means that the aforementioned clusters have a central role in medical ethics studies and are expanding, which seems to be due to their similar nature.

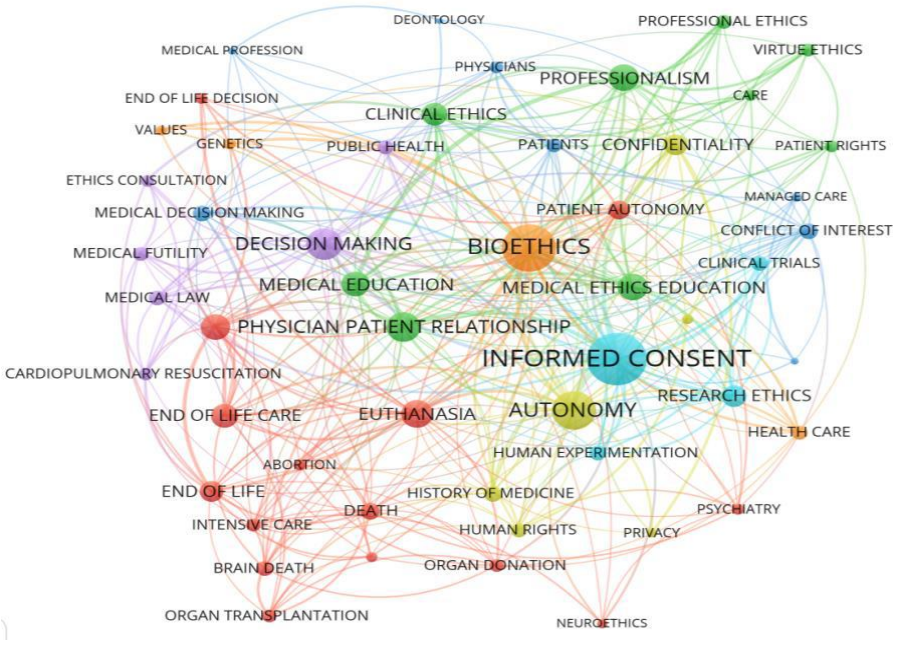

Figure 1: Network structure of 53 high-frequency keywords in the field of medical ethics

These areas of study are of a specific nature of ethical studies. Cluster 6, namely brain death and organ transplantation, is located in section 2, and this indicates that the aforementioned cluster is not central, but rather an expansion, as it seems that researchers take different approaches to the topic of brain death and organ transplantation due to cultural, religious, legal, and ethical issues. Therefore, it is not a core and central topic, but there is a possibility of its development.

One of the items worth mentioning in the strategic diagram is the existence of a minor cluster of "palliative care with an end-of-life approach." From this, it can be concluded that researchers have not done enough research on the topics related to this cluster. The topics of this cluster have the potential to become the topics of the main clusters.

Another notable result in the strategic diagram is that the presence of the clusters "Doctor-Patient Relationship", "Ethics in Medical Research", "Medical Profession and Occupational Therapy" in section 3 of the diagram, i.e., they are underdeveloped. In other words, these clusters are marginal and have attracted little attention.

The findings of the study are consistent with the results of determining research priorities by Bakri,[35] in that the aforementioned study introduces the issue of the doctor-patient relationship and ethics in medical research as one of the issues that should be considered. Although these clusters

[35] Bagheri,2011.

contain recurring topics and seem to be part of the main clusters, the reason for this is the relatively low density in this cluster, which indicates weak connectivity of topics within these clusters.

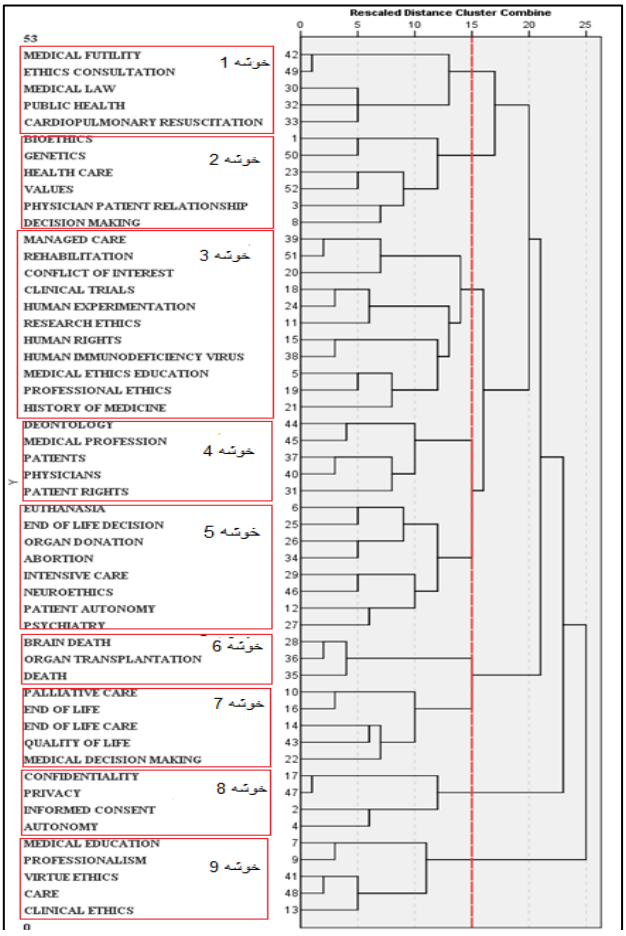

Figure 2: Diagram (dendrogram) resulting from hierarchical clustering using the synonymy method in the field of medical ethics

Another finding in the strategy diagram is the presence of a minor cluster "Palliative care with an end-of-life approach". This result is consistent with the study by Abbasi et al.[36] because in the aforementioned study, which examined articles in this field from 1991-2013, they also mentioned the categories of palliative care and spiritual health as new concepts in the medical institution and stated that, although research on this topic is growing, the number of studies is not large. The topics of this cluster have the potential to become topics of the main clusters.

6. Conclusion

Discovering conceptual relationships between documents in a scientific field is a complex process, so the results obtained from it also require deep understanding. This problem is more common in

[36] Abbasi, et al. 2014.

most interdisciplinary fields. Therefore, analyzing this field from any perspective, whether through the methods presented in this study or other methods, is challenging, and its results may not be universally accepted, but the process of this type of research, which is carried out with the aim of understanding a scientific field, ultimately leads to its strengthening and management. In general, the method of explicit and systematic assimilation makes it possible to present the structure of the internal and external relations of thematic factors objectively and without exaggeration. This issue can help to understand the structure of thematic relations in a field.

Therefore, by using the results obtained from the present study, it is possible to gain information about the current situation, research topics and the relationship between them, and important terms in the field of medical ethics and provide clear analyses.

The results of the present study revealed that the conceptual structure of knowledge in medical ethics research using science visualization approaches played a more colorful role in nine clusters, and in some discussions and concepts such as abortion, the foundations of medical ethics in Islam and the West, simulation, sterilization, and vacuum, it is felt that researchers in the field of medical ethics could pay more attention to such issues.

Also, considering the capabilities of scientometric studies, the use of other methods such as citation analysis, journal citation, author citation, and the like can provide a more telling picture of medical ethics research.

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