Research paper

Clustering of the Iranian Asthma and Allergy Specialists' Clinical Information-Seeking Behavior by Neural Network Analysis

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Abstract

Introduction: The aim of this study was to determine the information retrieval and information therapy behavior of Asthma and allergy specialists in the country, based on cohonen self-organized neural network model.Methods: The methodology of the present study, which is an applied study in terms of purpose, has been done by descriptive-survey method using neural network technique. The tool of this research is a researcher-made questionnaire that was distributed among a sample of people in the community (149 people). After collecting the data, the neural network was selected for data clustering and using MATLAB software version 14, Asthma and allergy specialists were clustered based on the main components of the research. Then, by removing each of the main sub-components of the research, the most effective and least effective option in their information-seeking behavior in working with information resources in this specialized field was determined.Results: The most effective component in clustering information barriers, was "lack of time due to workload" and the least was "distance of libraries and information centers". About information retrieval skills, the most effective component is "I know what keywords to use when searching the Internet, and I am familiar with synonyms and terms related to the information I need."Conclusion: By studying the clustering of information behaviors resulting from the information needs of Asthma and allergy specialists, their needs are met, and this is one of the measures that provides the basis for effective research, appropriate findings and, consequently, informational decision-making for those involved in this field.

Keywords: Clustering, clinical information-seeking behavior, cohenon self-organized neural network, Asthma & Allergy Research Institute (IAARI), Iran.

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1. Introduction

The country's medical universities and related research centers, pay attention to library services and information needs of users is described as important elements that use the content and information in the library [Mirghafoori, 2020; Edwards and Browne, 1995; Kiran and Diljit, 2012]. Paying attention to the opinions and demands of users is an important principle of any successful information system and information centers cannot complete their mission completely without considering the role of the user. Considering the importance of health information in the current era and need to get it by Iranian Asthma and allergy specialists, as inexpensive and more cost-effective treatment strategies are felt. Information therapy including easy, available and low cost treatment methods that nowadays in most developed countries can be used as one of the important therapeutic approaches alongside other therapies[Zare_Farashbandi, 2015].

On the other hand, in reviewing the literature on the quality of e-library services provided by Historically, library services have generally meant reference and information services, curricula, interlibrary loan services, and bibliographic search services [Kiran and Diljit, 2012]. However, over the past two decades, technology has been used to introduce many new services, such as providing existing services through electronic media or developing and implementing entirely new services for searching, delivering, and using information [Poll, 2005; Kiran and Diljit, 2012]. Advances in information and communication technology have led to operational changes to the electronic form. In addition, various new services such as access to electronic collections (online information, e-journals, e-books and digital collections), electronic printing, e-portal, online book submission, online document delivery and online and computer library guidance are considered. This action leads to access to relevant information, shared information and related with incredible speed [Ahmad and Abawajy, 2014b]. Therefore, awareness of users 'information needs in the search for electronic resources is considered as an integral part of recognizing users' information therapy behaviors and providing information resources to provide efficient information services [Mirza and Mahmoud, 2012].

As universities increasingly collaborate with each other today, libraries have become the engine and platform for the creation, preservation, sharing and use of knowledge [Lee et al., 2020; Kennedy, 2018; Sinclair, 2014; Ahmad and Abwaji, 2014 a]. Therefore, paying attention to the importance of quality services in university libraries and increasing users' demand for better services, paying attention to information seeking behavior and their information needs in all areas of specialization, including; The country's health system, and improving the quality of services provided to those in charge, especially in the field of information therapy activities, is one of the most important challenges studied in the present study, and library managers try to focus on customer behaviors and responses. To meet their needs, to achieve the highest quality of library services and to provide opportunities for excellence in the quality of their library services [Brooks et al., 1999]. According to Dadzi (2005), electronic information resources are an important research tool that complements print information resources in traditional library services. Libraries of medical universities are important centers in universities that are vital to support educational, research and study missions, and the main challenge facing them is efficiency and effectiveness [Lane et al., 2012]. Also, the importance of the university library and related research centers is such that it has been described as the heart of learning in the medical community and the health care system, which provides a place for the advancement of research and knowledge of students, professors and health researchers [Kiran, 2010; Li et al., 2020; Montgomery, 2014; Kim, 2016].

2. Literature review

2.1. Clinical Information needs and information seeking behaviors

The terms information, information need, and information seeking behavior are all used in different ways. Within the context of user studies, information has been used "to denote factual data or advice or opinion, a physical object, such as a book or journal, or the channel through which a message is conveyed, for example, oral or written communication" (Rohde, 1986, p. 50-51). Within library and information science, information has been defined as "any stimulus that reduces uncertainty". The term information need has also been used in a variety of ways. Information need is a subjective, relative concept only

in the mind of the experiencing individual (Wilson and Streatfield, 1981).

 In other words, information seeking begins when someone perceives that the current state of possessed knowledge is less than that needed to deal with some issue (or problem)". Scientific information has been growing at an exponential level for several centuries and shows no signs of abating. Within library and information science, *information* has been defined as "any stimulus that reduces uncertainty" (Krikelas, 1983, p. 6-7). Today, new studies show that global science in all fields, including health, is increasingly dependent on scientific collaborations and synergies [Nabovati, 2014], and is essentially one of the distinguishing factors between Developed societies with poor and growing societies, their power and strength in accessing information and knowledge resources in any field [Parhamnia, 2008; Moghaddassi, 2012; Nabovati, 2014]. The World Wide Web had become a widespread platform for the use of information access and delivery, but had not achieved the nearly ubiquitous and saturated use it has now (Hersh, 2020). Mirza and Mahmood (2012), stated that universities make great use of electronic library resources and services. As a result, university library services have improved, and most faculty members have been satisfied with e-services and support staff. According to Zhang et al. (2011), understanding the needs of users to improve productivity and the value of using electronic resources for manufacturers and providers of electronic resources has changed to a major challenge (Mirza and Mahmood, 2012). There is also plenty of evidence for growth of the scientific literature in medical and health. In 2010, it was estimated that 75 clinical trials and 11 systematic reviews were being published per day. However, for over 20 years, Health Informatics has offered a broad range of titles (McCaffrey, 2019; Mirghafoori, 2020, Hersh, 2020). some address specific professions such as nursing, medicine, health administration, …; others cover special areas of practice such as immunology, asthma and allergy specialists.

2.2 Immunology, Asthma & Allergy Research Institute (IAARI) [http://iaarien.tums.ac.ir/About-Center_2728.html]

The great advances made in basic and clinical immunology in the recent decades and the remark-able rise in the number of patients with asthma and other types of allergies necessitated the establishment of a research center in Iran to encourage and disseminate clinical and basic researches in the above fields. Immunology, Asthma & Allergy Research Institute (IAARI) officially began its scientific activities at the hospital of the Children's Medical Center on January 31st 2001. This institute by improving the knowledge and technology tries to promote the health indices of the society in the diseases of the immune system, asthma and allergy, based on its strategic plan. UNESCO Chair in Health Education has also been established in this institute since 2004 and collaborates in inter-national projects of research and education.   Currently, 22 researchers and 13 executive personnel are working in this institute and several academic staff from different medical universities also collaborate actively with this institute.

2.4 Kohunen self-organized neural network

Data mining leads to realistic decisions, re-examining past issues and saying which decisions were right and profitable and which were wrong and harmful. This ensures that harmful decisions are not repeated and profitable decisions are repeated. Accordingly, in the present study, data mining is a suitable tool that can analyze the existing data and identify the main clusters and nodes in each area to identify weaknesses and turn them into strengths. Therefore, the aim of this study is to determine and predict the information seeking behavior of Asthma and allergy specialists with data mining approach and using mathematical algorithms. For this purpose, cohenon's self-organized neural network, which is a subset of data mining, was used, so that the information-seeking behavior of the researchers in the study community was clustered based on items such as motivation and information goals, information resources and services, and then clusters.

 In a study, entitled, determining the information-seeking behavior of scholars of Khorasan Razavi University of Medical Sciences with a **neural network approach**, the results showed that the most important component in information-seeking skills is awareness of their information needs, the most effective way to access information, use electronic resources are the least effective way to buy resources. The most effective barrier is lack of

time due to work pressure and the least effective barrier is the distance of libraries and information centers [Naimi and Mohammadesmaeil, 2019; Naimi and Mohammadesmaeil, 2016; Badr and Mohammadesmaeil, 2017].

In this paper, we report the results of our research conducted at Tehran University Medical Sciences, Iran, on the effects of occupational factors in information need, information seeking behavior and library usage of the scholars in Asthma and allergy, which using of medical digital library (http://diglib.tums.ac.ir) by cohenon self-organized neural network.

Research Method

The present study has been exploratory in terms of its tendency to be practical and in terms of data collection by descriptive exploratory survey method, because the aim of this study was to determine and predict the information seeking behavior of Asthma and allergy specialists with data mining approach and using mathematical algorithms. For this purpose, cohenon's self-organized neural network, which is a subset of data mining, was used, so that the information-seeking behavior of the researchers in the study community was clustered based on items such as motivation and information goals, information resources and services, and then clusters. Using neural network technology, this research explores the order and rules governing the information-seeking behaviors of Asthma and allergy specialists and predicts their behaviors in the future and puts them in the relevant cluster and presents future priorities. In the present study, due to the lack of required data in the databases of the studied libraries, a researcher-made questionnaire was prepared as a data collection tool and sent and distributed to members of the community by e-mail or in person. The statistical population included Asthma and allergy specialists, including 149 people. Due to the proper distribution of questionnaires among the classes of flow, assistant professor, associate professor and professor, the whole census method was used. This questionnaire has been designed by studying the theoretical foundations and other researches in this field. To determine the validity of the measurement tool, it was reviewed by experts in the field of information retrieval and finalized using their

corrective comments. To check the reliability, 21 questionnaires were first distributed among similar statistical samples by default and using SPSS software .

Findings

In response to the **first** question, *How can the barriers can be predicted by clustering in order to establish the information therapy approach in the pediatric medical center?* The subcomponents of each factor with 18 input neurons for each group were designed separately according to the subcomponents in the questionnaire (Table 1). By removing each of the components and examining its effect on clustering, the most effective and least effective component in identifying the purpose and motivation of Asthma and allergy specialists was identified.

1- How can the barriers can be predicted by clustering in order to establish the information therapy approach in the pediatric medical center?

In response to this question, the subcomponents of the main component with 18 input neurons were designed according to the subcomponents of the questionnaire (Table 1). By removing each of the items and examining its effect on clustering, the most effective and least effective barriers to information for Asthma and allergy specialists were identified.

Table 1: Sub-components related to the main component of information barriers

Row	Sub-components	Row	Sub-components	Row	Sub-components
1	Unfamiliarity with resources	7	Lack of proper study hall	13	Incomplete information
2	Unfamiliarity with the use of resources	8	Insufficiency of library rules and regulations	14	Feeling no need to use resources
3	Lack of individual skills	9	Lack of access to resources	15	Lack of proper internet access

	in resource search			
4	There was no personal interest	10	Lack of cooperation of librarians and information specialists in responding and preparing information in a timely manner	16	Remote libraries and information centers
5	Lack of fluency in English	11	Access restrictions	17	Expensive resources
6	Lack of resources in the library	12	Lack of time due to work pressure	18	Lack of information retrieval skills

The community of Asthma and allergy specialists of the country was divided into three clusters based on information barriers. Based on the interpretations and analyzes performed on the commonalities and differences of scholars in each cluster, the level of information barriers in the first cluster was moderate, in the second cluster was high and in the third cluster was low. Findings from statistical analysis of data related to the community of Asthma and allergy specialists were based on information barriers as described in Table (2).

Table 2: Statistical analyzes related to the clustering of Asthma and allergy specialists in the country based on information barriers

Criterion: Information barriers		Clusters		
		The first cluster	*The second cluster*	*The third cluster*
Number of people in the cluster		۳۸	۷۸	۳۳
Percentage of the number of people in the cluster		*25.5*	*52.34*	*22.14*
Sum of cluster scores		۲۱۹۸	۵۳۳۸	۱٤۱٦
Average scores of clusters		*57.84*	*68.43*	*42.9*
Maximum scores of clusters		۹۰	۹۰	۹۰
Percentage of number of Asthma and allergy specialists in the country based on scientific rank	*Instructor*	*18.18*	*17.95*	*28.95*
	Assistant Professor	*48.48*	*41.03*	*36.84*

	Associate Professor	27.27	28.21	23.68
	Professor	6.06	12.82	10.53
The most effective component in clustering	Lack of time due to work pressure			
The least effective component in clustering	Remote distance of libraries and information centers			

As can be seen in Table (1,2), 25.5% of the study population are in the first cluster and their average score is 57.84. The percentage of people in the research community in the second cluster is 52.34% and the average score of this cluster is 68.69. 22.14% of the research population are in the third cluster with an average score of 42.9. Therefore, according to the mean scores, there is a significant difference between the people of the three clusters. The people of the first cluster at the intermediate level, the people of the second cluster at the high level and the people of the third cluster at the lowest level face information barriers. It is noteworthy that the most effective component in clustering was "lack of time due to workload" and the least effective component in clustering was "distance of libraries and information centers".

Figure 1: Shows the number of cluster people Asthma and allergy specialists in the country based on information barriers using neural network algorithm
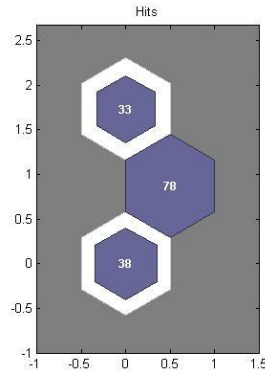
2- How can the level of information retrieval skills be predicted in order to establish an information therapy approach, by clustering Asthma and allergy specialists in the country?

In response to this question, the main component subcomponents with 8 input neurons were designed according to the subcomponents in the questionnaire (Table 3). Using the omission of each item and examining its effect on clustering, the most effective and least effective component of information retrieval skills of the sample was identified.

Table 3: Sub-components related to the main component of information retrieval skills

Row	*The following components are*
1	When I need information on a topic, I know how to look for the information I need.
2	I am fully acquainted with different types of information sources and know how to use each one.
3	When searching the internet I know what keywords to use and I am familiar with synonyms and terms related to the information I need.
4	I am fully acquainted with search tools on the Internet such as search engines, topic guides, indexes, etc.
5	I am fully acquainted with the methods of searching the Internet and databases such as simple search, advanced search, search with Boolean operators, shortening and proximity.
6	I am fully acquainted with databases related to my field and specialty and I know how to search for information in each.

7	I read the texts obtained from the searches performed and I can find the information I need from them (selective information search).
8	I can tell if the information from the search meets my information needs.

The community of Asthma and allergy specialists were divided into two clusters based on information retrieval skills. Based on the interpretations and analyzes of the commonalities and differences of the experts in each cluster, no significant difference was observed between their information retrieval skills. Findings from statistical analysis of data related to Asthma and allergy specialists in the country are based on information retrieval skills as described in Table (4).

Table 4: Statistical analysis of data related to the clustering of Asthma and allergy specialists in the country based on information retrieval skills

Criterion: information retrieval skills		*Clusters*	
		The first cluster	*The second cluster*
Number of people in the cluster		٩٥	٥٤
Percentage of the number of people in the cluster		*63.75*	*36.24*
Sum of cluster scores		٢٨٣٩	١٦٣٢
Average scores of clusters		*29.88*	*30.22*
Maximum scores of clusters		٤٠	٤٠
Percentage of number of Asthma and allergy specialists in the country based on scientific rank	*Instructor*	*20.37*	*21.05*
	Assistant Professor	*40.74*	*42.11*
	Associate Professor	*27.78*	*26.32*
	Professor	*11.11*	*10.53*
The most effective component in clustering	*When searching the Internet, I know what keywords to use and I am familiar with synonyms and terms related to the information I need.*		

The least effective component in clustering	-

As can be seen in Table (4), 63.75% of the sample population are in the first cluster and their average score is 29.88. The percentage of the population of the sample population in the second cluster is 36.24% and the average score of this cluster is 30.22. Therefore, according to the mean scores, the information retrieval skills of the first cluster individuals and the second cluster individuals are not similar and have no significant difference. Therefore, the least effective component in clustering has not been determined, and the most effective component is "I know what keywords to use when searching the Internet, and I am familiar with synonyms and terms related to the information I need."

Figure 2: Representation of the number of clusters of Asthma and allergy specialists in the country based on information retrieval skills using neural network algorithm
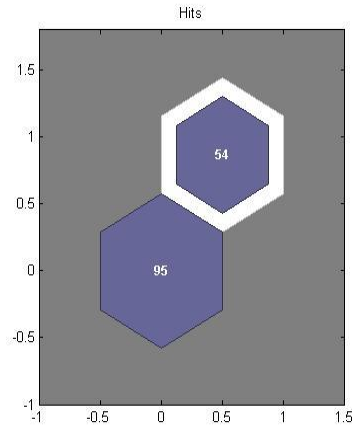
Discussion

In today's world of competition, where information is the main force, we try to move from empirical decision-making to information-based decision-making, so policymakers and top executives in organizations also have a duty to use From data and consequently information-oriented decisions, identify and predict the information needs and information-seeking behavior of specific audiences in their field and take steps to provide them properly and in a timely manner and meet the main goal of satisfying them based on the customer-centric principle. The use of data mining techniques in the analysis of users' information transactions, planning and goal setting leads to effectiveness and will lead professors and researchers with scientific courage based on research and determination to develop scientific and efficient sciences and topics related to this field. In the country, and achieve access to the fields of knowledge. Currently, most health care systems around the world focus on improving the quality of services and care for patients, and refer to it as a strategy to meet the health needs of people with the highest possible level of standards. [WHO, 2006].

Therefore, in order to obtain better results in the field of the above studies, clustering using neural network algorithm is recommended to Asthma and allergy specialists, which in this study aims to identify skills, barriers, goals and motivation for information and Determining and predicting the resources (electronics), information services and ways of accessing the

information contained in them were performed using the information of the log files of the scholars of the study community and compare the obtained results with the results of the research.

The following are suggestions for improving the library of Pediatrics Medical Center and improving the level of satisfaction and information seeking behavior of their library users:

- Surveys of users to create thematic coverage in the resources they need, according to the frequent requests of users in the received questionnaires
- Updating the printed and electronic resources of the library and trying to make the resources and information available in the library as accessible as possible, in order to increase the level of desirability in terms of information control
- Improving the performance and services of the website by using the opinions of librarians and users to achieve the desired level for optimal use of it

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