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Analysis of Crucial Influencing Factors of Library Health Information Service Quality based on DEMATEL

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Abstract

Identifying and analyzing crucial factors affecting the quality of library health information services can effectively improve the quality of library health information services and promote the library transform into a public health information center. The article uses the literature survey method and the Delphi method to construct a library health information service quality influencing factor model including four dimensions and sixteen influencing factors. It uses the DEMATEL method to identify and analyze the crucial influencing factors. Finally, it is proposed that the library should strengthen the construction of health information service content, improve the health information service platform, improve the quality of health information librarians, and strengthen the construction of health information resources to improve the quality of health information services.

Keywords

Library; health information; service quality; influencing factors; DEMATEL.

1. INTRODUCTION

With the in-depth advancement of the "Healthy China" [1], the health awareness of Chinese residents and the demand for health information have increased significantly. Simultaneously, the Internet has also become an essential source of health information for the people. However, the rapid increase in the amount of health information on the Internet has caused various "health rumors" and "false medical information" to continue to breed and spread widely through the Internet. It has seriously affected the people acquire and use authoritative health information, and even endangered people's health. As a cultural information center for the public, libraries should actively transform and develop, extensively develop health information services, and provide the public with high-quality health information. Therefore, identifying and analyzing the crucial influencing factors of library health information service quality is of great significance improving library health information service quality and the transformation and development of libraries.

2. LITERATURE REVIEW

In recent years, domestic and foreign research on library health information services has mainly focused on the following four aspects. (1) Development status. Zhou X analyzed the status quo of health information services of British and American public libraries and pointed out that domestic public libraries should actively integrate into the national development plan and start health information services [2]. Zhang X, Xu X, Zhang J, etc. analyzed the current status of health information services in public libraries at home and abroad through literature review, and put forward suggestions for domestic libraries [3-5]. (2) Health information literacy

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education. Deng S pointed out after analyzing successful foreign cases that it is necessary and feasible for domestic libraries to participate in promoting public health literacy [6]. Lantzy, Beyer, Hallyburton, Ajuwon, etc. pointed out through case studies that libraries can improve the health information literacy of undergraduates, graduate students, and medical staff through teaching activities [7-10]. (3) Health information librarian. Noh studied the qualifications of health information librarians. He consulted the job advertisements for health information librarians and interviewed with in-service librarians. Finally, he concluded that health information librarians usually need to have a double bachelor's degree in library information and health sciences and two years of work experience in library or user-health practice [11]. Tan D analyzed the training of health information librarians in the United States, and pointed out that the United States mainly relies on consumer health information professional certification and personal learning programs [12]. (4) Factors affecting service quality. Zhang X constructed a model of influencing factors of public library health information service satisfaction based on grounded theory [13]. Based on a survey of public libraries in Pennsylvania, Whiteman pointed out that public libraries should strengthen cooperation with health departments to improve the quality of health information librarians and the quality of health information services [14].

Generally speaking, in terms of research results, compared with foreign countries, the domestic start is late and the results are less. In terms of research content, domestic research focuses more on analyzing the current development of library health information services at home and abroad. In contrast foreign study covers various fields, and there is a lack of domestic and foreign research on factors affecting service quality. Therefore, this article starts with the factors affecting the quality of library health information services, and aims to provide a theoretical reference for libraries to develop and improve health information services.

3. BUILD A MODEL OF INFLUENCING FACTORS

3.1. Literature Survey Method

The author uses CNKI and SSCI index as the source of domestic and foreign literature data, the time is 2015-2020, and the retrieval time is June 23, 2020. CNKI's search subject is (Library AND (health information OR health information OR medical information OR health information)), and the source journals are core journals, CSSCI, and CSCD journals. The subject of the SSCI search is (library AND (health information OR medical information)), and the document type is journaled articles and literature reviews. After excluding irrelevant documents, 174 valid records were obtained, including 38 Chinese documents and 136 English documents.

3.2. Delphi Method

The author invited 12 teachers and librarians from Hangzhou Medical College and Lishui College who have medical informatics, library and information science, and other related disciplines and have senior associate titles or above to form an expert group to propose amendments to the construction of the model. After a comprehensive literature survey and expert opinions, a model of factors affecting the quality of book health information services, including four dimensions and sixteen influencing factors, was finally constructed, as shown in Table 1.

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202011_6(11).0015

Table 1. Model of influencing factors of library health information service quality

Dimension	Influencing factors	Influencing factor meaning	Source
Health Information Resource Content A	Resource Comprehensiveness A1	Coverage of resources such as popular science articles and disease rehabilitation cases	Literature [3-5,13-14]
	Resource Authority A2	The credibility of various resources such as articles and videos	Literature [3-5,13-14]
	Resource Diversity A3	Number of resource types such as books, videos, articles, etc.	Literature [3-5,13-14]
	Resource Timeliness A4	Update speed of resources such as books and databases	Expert Opinion
Health Information Service Content B	Health Knowledge Learning B1	Health science push, online health courses, online expert lectures, health book recommendations, etc.	Literature [22,24-25]
	Health Information Consultation B2	Internet health information query, library health information resource query	Literature [22,24-25]
	Health Information Resource Construction B3	Introduction of local medical resources, personal health management, disease drug database, etc.	Literature [22,24-25]
	Health Information Literacy Education B4	Medical database use, Internet health information evaluation, etc.	Literature [9-10,21]
	Public Health Incident response B5	Epidemic knowledge popularization, epidemic prevention and control guidelines, etc.	Literature [17-18,21]
	Disease Treatment Decision Consultation B6	Expert doctor consultation, offline doctor free consultation, etc.	Expert Opinion
Health Information Librarian C	Librarian Professional Qualification Certification C1	Consumer health information expert certification	Literature [12,19]; Expert Opinion
	Librarian Health Information Literacy C2	Ability to understand, acquire and evaluate health information	Literature [11,23]; Expert Opinion
	Librarian Professional Ethics C3	Protect user privacy and service attitude	Literature [11,23]
Health Information Service Platform D	Platform Cooperation Degree D1	Degree of cooperation with other institutions such as medical and scientific research	Literature [15-16,20]
	Platform Diversification Level D2	The number of online websites, social media, and offline services	Literature [3-4]
	Degree of Platform Openness D3	Types of users allowed to access, number of access channels	Expert Opinion

3.3. Reliability and Validity Test

The author uses the questionnaire survey method to test whether the model constructed is representative. A total of 200 questionnaires were issued this time. After excluding invalid questionnaires such as too short filling time and filling in the same option, 178 valid questionnaires were obtained, and the questionnaire efficiency reached 89%. The author uses SPSS 26.0 to test the reliability and validity of the questionnaire. In terms of reliability, Cronbach'sα is 0.821 (greater than 0.8). In terms of fact, the KMO value is 0.675 (greater than 0.6), the Bartlett sphere test significance is 0.000 (less than 0.001), and the cumulative variation value is 65% (greater than 50%). It can be seen that the questionnaire has good reliability and validity.

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202011_6(11).0015

4. IDENTIFICATION AND ANALYSIS OF CRUCIAL INFLUENCING FACTORS

4.1. DEMATEL Method

The Decision-making Trial and Evaluation Laboratory (DEMATEL) was proposed by American scholars A. Gabus and E. Fontela in 1971. This method regards complex systems as directed graphs with weights and uses the experience of experts. Knowledge is combined with graph theory and other mathematical theories to obtain the direct influence relationship between various factors of the system [34], as shown in Figure 1. Due to the large number and wide range of influencing factors involved in the quality of library health information services, and a specific connection between the various influencing factors, it can be regarded as a complex system. The DEMATEL method can effectively identify and analyze the crucial impacting factors.

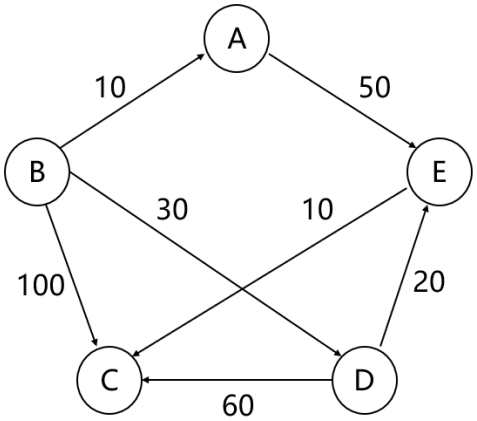

Figure 1. DEMATEL method

4.2. Identification of Crucial Influencing Factors

4.2.1 Constructing a direct evaluation matrix M

According to the model in Table 3, the members of the expert group will compare the horizontal and vertical elements one by one under the condition of being anonymous and not communicating with each other, and score according to the degree of influence (0=no influence; 1=weak influence; 2=medium influence; 3=strong influence). Summarize the scoring values of the 12 experts, calculate the arithmetic average, and round up to obtain the direct influence matrix M, as shown in Figure 2.

M=

	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	C1	C2	C3	D1	D2	D3
A1	0	0	0	0	3	3	3	3	1	0	0	0	0	0	0	0
A2	0	0	0	0	3	3	3	3	3	0	0	0	0	0	0	0
A3	0	0	0	0	3	3	2	3	1	0	0	0	0	0	0	0
A4	0	0	0	0	3	1	2	1	3	0	0	0	0	0	0	0
B1	0	0	0	0	0	0	0	2	3	3	0	0	0	0	0	0
B2	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0
B3	0	0	0	0	2	2	0	1	2	0	0	0	0	0	0	0
B4	0	0	0	0	3	3	2	0	2	0	0	0	0	0	0	0
B5	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0
B6	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
C1	0	0	0	0	3	3	3	3	3	0	0	0	0	0	0	0
C2	0	0	0	0	3	3	3	3	3	0	3	0	0	0	0	0
C3	0	0	0	0	2	3	2	3	3	0	2	0	0	0	0	0
D1	3	3	1	0	3	0	3	3	3	3	0	0	0	0	1	0
D2	0	0	0	0	3	2	0	3	3	2	0	0	0	0	0	3
D3	0	0	0	0	3	3	0	3	2	1	0	0	0	0	0	0

Figure 2. Direct influence matrix M

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202011_6(11).0015

4.2.2 Calculate the comprehensive influence matrix T

The author uses MATLAB2019a software to select the row and maximum method to normalize the direct influence matrix M to obtain the normalized matrix N. Then normalized matrix N is substituted into the formula T=N(I-N)-1 (where I is the identity matrix and (I-N)-1 is the inverse matrix of (I-N)) to calculate the comprehensive influence matrix T, as shown in Figure 3.

T=

	A1	A2	A3	A4	B1	B2	B3	B4	B5	B6	C1	C2	C3	D1	D2	D3
A1	0.00	0.00	0.00	0.00	0.18	0.17	0.15	0.17	0.12	0.04	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.20	0.17	0.15	0.18	0.21	0.04	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.00	0.00	0.00	0.18	0.16	0.10	0.16	0.11	0.04	0.00	0.00	0.00	0.00	0.00	0.00
A4	0.00	0.00	0.00	0.00	0.18	0.06	0.09	0.09	0.18	0.03	0.00	0.00	0.00	0.00	0.00	0.00
B1	0.00	0.00	0.00	0.00	0.05	0.02	0.01	0.11	0.15	0.14	0.00	0.00	0.00	0.00	0.00	0.00
B2	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.02	0.14	0.09	0.00	0.00	0.00	0.00	0.00	0.00
B3	0.00	0.00	0.00	0.00	0.11	0.10	0.01	0.07	0.12	0.02	0.00	0.00	0.00	0.00	0.00	0.00
B4	0.00	0.00	0.00	0.00	0.16	0.14	0.09	0.04	0.14	0.03	0.00	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.16	0.02	0.01	0.15	0.04	0.02	0.00	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.09	0.05	0.00	0.01	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
C1	0.00	0.00	0.00	0.00	0.20	0.17	0.15	0.18	0.21	0.04	0.00	0.00	0.00	0.00	0.00	0.00
C2	0.00	0.00	0.00	0.00	0.22	0.19	0.17	0.20	0.23	0.05	0.13	0.00	0.00	0.00	0.00	0.00
C3	0.00	0.00	0.00	0.00	0.16	0.18	0.11	0.19	0.21	0.04	0.09	0.00	0.00	0.00	0.00	0.00
D1	0.13	0.13	0.04	0.00	0.27	0.10	0.19	0.24	0.25	0.18	0.00	0.00	0.00	0.00	0.04	0.01
D2	0.00	0.00	0.00	0.00	0.21	0.14	0.02	0.19	0.21	0.13	0.00	0.00	0.00	0.00	0.00	0.13
D3	0.00	0.00	0.00	0.00	0.18	0.16	0.01	0.17	0.15	0.08	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3. Comprehensive influence matrix T

4.2.3 Calculate the comprehensive impact relationship

According to the data in the total influence matrix T, calculate the influence degree D (the sum of the rows in T), the influence degree C (the sum of the columns in T), the centrality M (D+C), and the cause degree R (D-C), as shown in Table 2. Finally, take centrality and cause degree as the X-axis and Y-axis, and combine the centrality and cause degree data of each influencing factor to construct a causality diagram, as shown in Figure 4.

Table 2. Comprehensive influence relationship of library health information service quality

NO.	The influence degree D	The influenced degree C	The centrality degree M	Centrality ranking	The cause degree R	Cause factors ranking	Result factors ranking
A1	0.82	0.13	0.95	13	0.69	8	-
A2	0.94	0.13	1.07	11	0.81	5	-
A3	0.76	0.04	0.80	15	0.71	7	-
A4	0.63	0.00	0.63	16	0.63	9	-
B1	0.48	2.59	3.06	1	-2.11	-	1
B2	0.29	1.83	2.11	4	-1.54	-	4
B3	0.43	1.25	1.69	5	-0.82	-	5
B4	0.61	2.17	2.78	3	-1.56	-	3
B5	0.40	2.47	2.87	2	-2.06	-	2
B6	0.18	0.98	1.17	8	-0.80	-	6
C1	0.94	0.22	1.16	9	0.72	6	-
C2	1.19	0.00	1.19	7	1.19	2	-
C3	0.98	0.00	0.98	12	0.98	4	-
D1	1.58	0.00	1.58	6	1.58	1	-
D2	1.03	0.04	1.07	10	0.98	3	-
D3	0.74	0.14	0.88	14	0.61	10	-

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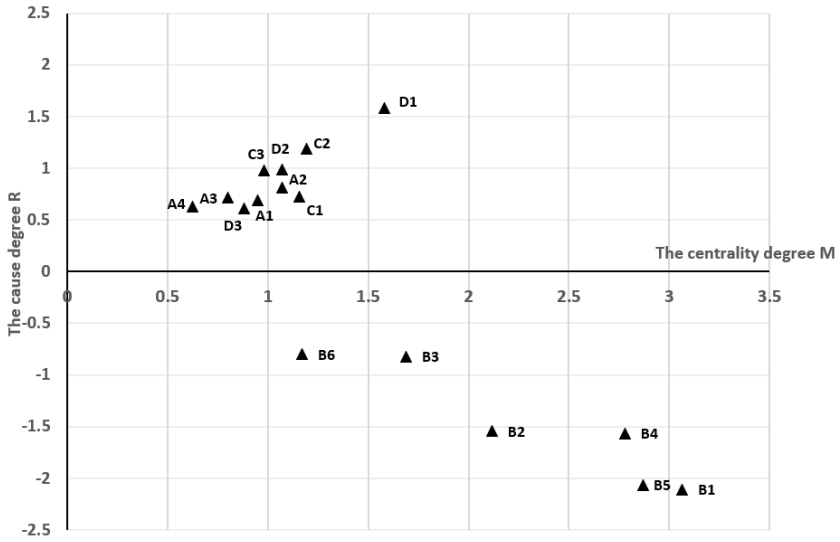

Figure 4. Causality diagram

4.3. Analysis of Crucial Influencing Factors

4.3.1 The centrality degree analysis of influencing factors

The centrality degree M of the influencing factor is the sum of its influence D and the influenced degree C. Its meaning is the degree of importance of the influence factor in the influence factor network [26]. The greater the centrality, the greater the influence of this factor on the quality of library health information services. It can be seen from Figure 4 that the top five influencing factors of centrality are B1, B5, B4, B2, B3, which belong to the health information service content (B). It can be seen that the health information service content has a significant impact on the quality of the library health information service. Among the five crucial influencing factors, the centrality gap of the three items B1, B5, and B4 are relatively small, and the remaining two items have a particular hole. The author believes that the main reason is that these three services are actively provided by the library to the general public, such as holding health lectures and pushing knowledge on epidemic prevention and control. Compared with other service content, the audience is more expansive, and it also plays a role in propaganda, helping the public better understand and participate in library health information services. Therefore, these three services are crucial services in the content of health information services, and libraries should focus on them when developing health information services. Also, D1 also has a high centrality, with a centrality of 1.58, ranking sixth, indicating that the degree of platform cooperation also has a specific impact on the quality of library health information services. The main reason is that the problems of resources, technology, and talents involved in improving the service quality of the library are challenging to solve by itself. Therefore, the library needs to strengthen cooperation with other platforms.

4.3.2 The cause degree analysis of influencing factors

The cause degree R of the influencing factor is the difference between the influence degree D and the influenced degree C. Its meaning is the contribution degree of the influence factor to the formation of the entire influence factor network [26]. (1) Influencing factors with a cause degree greater than 0 belong to cause factors. The greater the degree of cause, the greater the influence of this factor on other factors [34]. As shown in Figure 4, ten factors in total, among which the top five are D1, C2, D2, C3, and A2. Among them, D1 has the largest cause and impact of all influencing factors, both at 1.58. It can be seen that the degree of cooperation of the platform has a substantial indirect effect on the quality of library health information services. Therefore, the library should strengthen its cooperation with other medical services. Relevant institutions or platforms have established good cooperative relations. (2) The influencing

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factors whose cause degree is less than 0 are result factors. The smaller the cause degree of the result factor, the more easily the factor is affected by other factors [26]. According to Figure 4, there are six result factors, which are sorted from small to large in order of cause, namely B1, B5, B4, B2, B3, B6. Among them, B1 has the smallest cause degree, which is -2.13, indicating that it is most easily affected by other factors. Therefore, when libraries develop or improve health knowledge learning-related services, they should comprehensively consider information resources and platforms from multiple perspectives.

5. SUGGESTIONS FOR IMPROVING THE QUALITY OF LIBRARY HEALTH INFORMATION SERVICES

5.1. Strengthen the Construction of Health Information Service Content

According to the analysis results, the library should first strengthen the content construction of health information services to improve the quality of health information services. Specifically: (1) Improve the rationality of service content. Different libraries have different resources, such as funds, technology, talents, and service user groups. Therefore, libraries need to rationally allocate resources according to their conditions, develop health information services according to local conditions, and focus on health knowledge learning and public health incidents. The response, health information literacy education and other services. (2) Improve the refinement of services. In the specific implementation process of services, each library should formulate relevant regulations to standardize its service process and improve the efficiency and quality , and more detailed services should be provided to groups such as the elderly and children.

5.2. Improve Health Information Service Platform

From the analysis results, there are two crucial influencing factors in the health information service platform, among which the degree of platform cooperation (D1) has the highest degree of cause. Therefore, libraries also need to improve the health information service platform to enhance the quality of health information services. Specifically: (1) Strengthen cooperation with other institutions. The collaboration between the library and the medical and health, information technology, and other departments or enterprises can make up for the library defects in resources and technology. For example, libraries can design and develop library systems that are more suitable for creating health information services through cooperation with information technology companies. (2) Improve the diversification of service platforms. Most libraries only provide health information services through official websites and WeChat official accounts, which are not attractive to some young users. Therefore, libraries should increase the diversity of health service platforms and make full use of Tiktok, Microblog, Zhihu, etc. New media platforms launch services.

5.3. Improve the Quality of Health Information Librarians

From the analysis results, the health information literacy (C2) and professional ethics of librarians (C3) among health information librarians (C) are both crucial influencing factors. When libraries improve the quality of health information services, they should also Take measures to comprehensively improve the quality of health information librarians. Specifically: (1) Improve the health information literacy of librarians. Libraries can choose to serve as health information librarians from librarians with relevant professional backgrounds such as the library and information science and medical informatics, and at the same time, improve the business skills of health information libraries by offering training courses and equipping instructors. (2) Improve the professional ethics of librarians. Libraries should carry out professional ethics training for health information librarians. On the other hand, through user questionnaire return visits, regular spot checks, etc., the health information librarian's work

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effect, service attitude, user privacy protection, and other professional ethics literacy should be assessed.

5.4. Strengthen the Construction of Health Information Resources

According to the analysis results, the resource authority (A2) in the constructing of health information resources (A) is a crucial influencing factor. Therefore, when libraries build health information resources, they should focus on the authority of the resources. Specifically: (1) Strengthen resource review. For popular health science articles, online health information courses, and books, the library should conduct a substantive review of the author's qualifications, sources, and primary content, and strictly ensure the correctness and authority of the content. (2) Establish a reporting mechanism. Libraries should improve the reporting mechanism of false health information and provide users with reporting channels by setting up website message boards and offline suggestion boxes to enhance the authority of resource content. Besides, libraries should also pay attention to the timeliness of health information resources, continue to pay attention to the development of the medical and health field, and conduct periodic review and update of various paper resources and digital resources.

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