

A study on literature obsolescence and core journals' cost-benefit in citations of the 'Scientific Medical Journal of Ahwaz'

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ABSTRACT

Introduction: One of the methods of identifying core and popular resources is by citation evaluation. Using citation evaluation, the librarians of the Acquisition Department can use quantitative methods to identify core and popular resources among numerous information resources and make serious savings in the library's budget, by acquiring these core resources and eliminating useless ones. The aim of this study is assessing literature obsolescence and core journals' cost-benefit in citations of the 'Scientific Medical Journal of Ahwaz'.

Materials and Methods: This study is a descriptive and cross-sectional survey that uses citation analysis. Sampling is objective sampling from all documents from years 1364 (1985) to 1385 (2006), and the population comprises of 6342 citations of the articles published in 'Scientific Medical Journal of Ahwaz'. Data collection is done through referring to the original documents and the data is analyzed using the Excel software, and for descriptive and analytical statistics the cost-benefit formula and Bradford law formula are used. **Results:** Findings showed that the average citation for each document in the 'Scientific Medical Journal of Ahwaz' was 15.81. The average citation to international sources was 14.37, and the average citation to national sources was 1.44. The literature obsolescence of Farsi documents in this study was 15 years, while it was equal to 20 years for English documents. The highly cited Farsi journals were (sorted based on citation in descending order): 'Scientific Medical Journal of Ahwaz', 'Daroudarman', 'Nabz,' and 'Journal of Medical School, Shahid Beheshti University of Medical Sciences'. The highly cited English journals were (sorted based on citation in descending order): 'Pediatrics', 'The New England Journal of Medicine', 'Gastroenterology' and 'Medicine'. All of these four journals are part of the ISI database and have good impact factors in the Journal Citation Reports (JCR). Also their cost-benefit was reasonable based on the frequency of their use. **Conclusion:** The authors of the investigated journal were more inclined to use international

references. The resources used by the authors of this journal are relatively obsolete and the authors ought to use more up-to-date resources. The subscription for high citation English and Farsi journals is still available in this university. Also the authors of this journal have used accredited ISI journals as their resource, which is a sign of the credibility for the 'Scientific Medical Journal of Ahwaz'.

Key words: Bradford Law, citation analysis, core journals, cost-benefit, literature obsolescence, Scientific Medical Journal of Ahwaz

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INTRODUCTION

At present, attention to citation of scientific documents has increased as a means to evaluate new documents and to analyze their contents, as well as to find relations between the new documents. Citation study is used to investigate the conceptual relationship of documents and the relation between the citing and the cited documents. A citation analysis is an attempt to identify the rules governing these relations.^[1] A citation analysis study was first performed by Gross and Gross (1927) and continued by Braun, Garfield, Martin, and others. Citation analysis studies still receive suitable attention due to their use in the analysis of periodic publications. The rated lists of journals obtained using this method are currently used by many libraries, to select journals.^[2]

Egghe and Rousseau, cited in Zunde, state that citation analysis has three main objectives: (1) The quantitative and qualitative evaluation of publications, scientific institutions, and the opinions of various scientists; (2) modeling of the history of science and technology, and (3) research and data recovery uses.^[3]

Periodicals journals are among the most valuable resources in professional libraries and information centers. These resources are usually acquired using foreign currency for a set amount of time and are responsible for the bulk of the cost, time, resources, and human resources of the libraries.^[4]

Increase in the annual cost of acquiring books and periodical journals, decrease in the academic libraries' budget due to international financial problems and inflation, decrease of the value of national currency compared to currencies like the dollar, and lack of enough space for storing them are among the problems that have always occupied the minds of the people working in the Order and Acquisition Departments of the libraries, who are in charge of identifying, selecting, ordering, and acquiring resources and creating a suitable set to answer the needs of their users. These problems motivated the librarians to use a more careful and thorough approach for acquiring information resources, especially journals, so as to acquire the most efficient and the most widely used resources for the library, and thus reduce the time wasted by the users.^[5]

One of the ways of identifying core, popular sources is using a citation study. By using the citation study, the librarians of the Order and Acquisition Department can identify the popular core sources among many different information sources using quantitative methods, and thus, decrease the budget, space, and time spent, drastically, by ordering these sources and eliminating the useless ones.^[6]

Citation analysis is one of the quantitative methods of bibliometrics. One can use citation analysis to create a rated list of core information sources in different disciplines and use these lists for ordering and purchase in libraries. If the citation analysis of the information sources, including that

of periodical journals, is done in a continuous and timely manner, not only will it prevent subscription of useless journals, but it can also help replace them with popular and useful journals, in any discipline. Citation analysis also helps create a logical collection in the libraries, solves the problems of limited space, and helps make great savings in the costs and resources.^[6]

Researchers can use statistical citation analysis methods to identify core (popular) authors and journals, which are important in two aspects:

- This information helps those gathering sources for libraries and information centers to identify popular documents and journals in different disciplines, and thus, decrease costs, needed resources, human resources, and the time and budget spent for the acquisitions
- Identifying key authors in different scientific disciplines can help guide the users and readers to use a more targeted approach in their searches and avoid marginal and unrelated subjects, in order to save their time and energy.

The first articles on citation analysis, in Iran, were published by Dayani, titled 'bibliometrics',^[7] and one by Horri, which was titled 'Citation Analysis and its Similarities with Elm al-Hadith'.^[1] The use of citation analysis methods in postgraduate dissertations of the library and information science and research articles received special attention after the publication of this article.

Osareh investigated the citation of Farsi journals of the Tehran University of Medical Science, Shahid Beheshti University, and Ferdowsi University of Mashad, in her dissertation. She stated that the Iranian doctors, who were the authors of these journals, used the same citation behavior as their western peers. Five core journals were selected in this study using the Bradford's law, four of which were shared among all three universities. Most of the citations were for journal articles, 80.96% of them were for English articles, and the number of citations for Farsi articles was very low. This study also showed that the cited articles were four years older than the citing article.^[8]

Jahed investigated 1606 DVM dissertations of general medicine in the Shahid Beheshti University of Medical Science, using an analytical survey study and the citation analysis method. Due to the large number of samples, he selected 20% (321) of the dissertations using the random sampling method and analyzed them. The results of the analysis of these dissertations and the 5060 documents extracted from them were as follows: Sixty-five percent of the citations referred to articles and 34% of them to books and the dissertations had a lower level of self citation. The average citation of the dissertations was 15, with an average of five citations to Farsi and English books and 10 citations to Farsi and English journal articles. Also the half life of Farsi sources was seven years, while that of the English sources were 14 years.^[9]

Koulaian, in his study, used citation analysis to investigate the articles in the Journal Archives of the Razi Institute and evaluated the citation behavior of this institute's researchers. He reported that there were 6173 citations in a total of 545 articles. The highest citation (83.12%) was to periodical journals; 62.54% of the citations were to English articles. In total, 819 journals were cited, among which, 22 journals belonged to the first three groups (based on the Bradford's law) and had 43.12% of all the citations and 798 journals belonged to the next four groups with 56.79% of the citations. The highest half life of 15.28 years belonged to the periodic journals, while dissertations had the lowest half life of 5.71 years. The average number of citations was 11.23 citations per article.^[10]

Shahbazi Youzband and Mehrad investigated 544 articles published by the faculty members of the Tabriz University of Medical Science and Shiraz University of Medical Science in Iranian journals (Farsi and English) between the years 1374 and 1378. This study used the bibliometric method and its goal was to determine the practical half life of periodic journals, creating a rated list of journals, determining the level of cooperation between researchers in the medical field, and identifying the active sections and departments of the two universities. Their findings showed that the half life of English journals were the same in both universities and was equal to 10 years. Also analyzing the rated list of these universities and comparing it to similar lists in the other studies showed that *Lancet*, *Br. Med. J.*, and *New Engl. J. Med.* had the first to third ranks, respectively.^[11]

Koochak investigated the dissertations of DVM students from the Ahwaz Shahid Chamran University. His findings showed that the Bradford's law was true for the foreign journals present in the references of the dissertations and used it to identify the core journals. The Bradford's law was not used for the Farsi journals cited due to their small number and the most cited journals were identified. The investigation of the cited materials in the dissertations showed that the most cited Farsi sources were books, while the most cited foreign sources were journals. Also, investigation of the dates of the citations showed the obsolescence to be eight years for Farsi and 12 years for English sources, pointing to an average half life of 10 years. The average number of citations per dissertation was 45 and the rank of the core journals in the Journal Citation Reports (JCR) was also investigated.^[12]

Mohammadi studied the citations of all English medical articles published in Iran. His study used a descriptive method for the citation analysis of articles published in the English medical journals of Iran, and also for the determination of the level of free access to the articles in the website of those journals. The statistical population was all the articles published in year 2000, in three journals, including, the *Medical Journal*, *Iranian Journal of Medical Science*, and *Acta Medical Iranica* of the Islamic Republic of Iran, which consisted of 171 articles and 3162 citations. The average number of citations was 18.9 and an investigation of the publication dates of the journals

showed that the *Iranian Journal of Medical Science* had more recent citations, with 65.25% of the citations being from the years 1990 to 1999. The half life of the documents in the investigated journals was 8.7 years. With regard to the types of the documents cited, journal articles had the majority of citations with 89.42% of the total, books took up 8.9% of the citations, and conference reports, dissertations, computer documents, and scientific letters each had less than 1% of the citations.^[13]

Udofia in a study titled 'Selecting Veterinary Medical Periodicals through Citation Analysis' used citation analysis to determine core journals for a veterinary library. In this study, 105 journals from a five-year period, from 1982 to 1986, were investigated. The results showed that the journals followed the Bradford's law. Also this study identified eight core journals that had published 1067 or 66.2% of all the cited documents.^[14]

In an article published by Torricella Morales, HooyDonk, and Araujo Ruiz J. called 'Citation Analysis of Cuban Research. Part 1. A Case Study: the Cuban Journal of Agricultural Science,' they performed a citation analysis on the Cuban Journal of Agricultural Science or CJAS. The possibilities and probabilities of citation analysis for Cuban scientific publications generally and for CJAS specifically were investigated. The results showed that between years 1988 and 1999, 14% of the Cuban publications were cited in the Web of Science. From 3620 articles published by Cuban Scientists, 546 articles (15%) were published in CJAS, and therefore, the highest number of citations was for this journal. Also the number of articles published by Cuban authors in journals indexed by the Web of Science had increased from year 1988 to 1998.^[15]

In Malaysia Tiew *et al.* conducted a study titled 'Citation Analysis of Journal of Natural Rubber Research 1988-1997,' in which they investigated the Journal of Natural Rubber Research between the years 1988 and 1997. In this study 4181 citations of 250 articles and 18 small notes were examined. The results showed that journals were the most popular citations, with a frequency of 72.04%. It was also stated that there was a trend for joined studies by two or more than two authors and that 61.56% of the articles were such studies. The knowledge of the authors was up to date and most of the citations were recent. 55.97% of the citations were to sources published in the period 1978-1997. This study also showed that chemistry and technology were the most popular subjects, with 6.60% of total articles.^[16]

'Analysis to Pursue a Core Collection of Journals of Communication Disorders' is the name of a citation analysis study conducted by Black (2001), which investigated two periodic journals to empirically identify the core journals concerning Communication Disorders. The core collection that was produced in this study consisted of journals containing 80% of the examined articles. Also ordering one of these journals was quantitatively investigated and problems with regard to the selection of interdisciplinary sources were

highlighted. Also some date was prepared based on the types of the cited sources and the time of the citations.^[17]

The necessity of the current study and choosing this journal as the target is that this study aims to identify core journals, identify the status of the sources based on type, language, and the obsolescence of the cited sources, and also provides recommendations to librarians for selecting useful information sources^[18-19]. This study will also be able to help researchers (including professors and students) in using information sources and identifying the core authors of their discipline. Therefore, the current study aims to investigate the 'Scientific Medical Journal of Ahwaz' for a 20-year period from 1985 to 2006 (1364 -1985) and provide the answer to the following questions: (1) What is the status of citations in this journal based on number, language, and cited documents? (2) What is the literature obsolescence in the citations of the Scientific Medical Journal of Ahwaz? (3) What are the core journals used in the citations of the Scientific Medical Journal of Ahwaz? (4) What is the cost- benefit of each core journal based on the number of citations it receives? And (5) what is the rank of the core journals identified in this study in the Journal of Citation Reports (JCR)?

MATERIALS AND METHODS

The current study is a descriptive, cross-sectional, and used citation analysis, which was done by referring to the original documents (journal articles). Sampling was done using the census method and all of the documents between the years 1985 and 2006 (1364-1385) were studied. The statistical population consisted of 401 articles in 47 volumes of the 'Scientific Medical Journal of Ahwaz' and 6342 documents were extracted from their citations.

Data gathering was done by referring to the original documents (all the citations of the articles) and entering the data to specially prepared notes. The data was then entered into the Excel software, which was used to gather, sort, and count the data and show them in charts and tables. This software was also used for the necessary data analysis.

Frequency distribution, frequency percent, cumulative frequency, mean, and average were used to create tables and charts. The following two formulae were used in the analytical statistics in this article:

- Cost-benefit formula $C = a/b$
 - a: Cost of each journal
 - b: Number of citations to the journal
 - c: Cost-benefit
- Bradford's law: $R(n) = a.n^b$

$R(n)$: Cumulative frequency of all of the documents
 a: Highest number of citations of the most cited journal
 b: Bradford's coefficient
 n: Number of core journals

Findings

- The status of documents based on number, language, and document type:

The total number of citations in 401 examined articles was 6342. From these citations, 5763 of them were to foreign sources and 579 of them were to Farsi sources. The average number of citations for each document was 15.81, the average number of citations to foreign sources was 14.37, and the average number of citations to Farsi sources was 1.44.

The average number of citations for each document in this journal was 15.81, which showed that each article in the 'Scientific Medical Journal of Ahwaz' had at least 16 citations. The average number of citations to foreign sources was close to 14 and the average number of citations to Farsi sources was close to one citation. In other words every article in the 'Scientific Medical Journal of Ahwaz' has at least 14 citations to foreign sources and one citation to Farsi sources. This shows that the authors were more inclined to use foreign sources in their articles.

Based on the language of the citations, foreign sources were more widely used compared to Farsi ones, hence, from 6342 citations, 5763 (76.94%) citations were to foreign sources and 579 (23.06%) were to Farsi sources. In other words the use of foreign sources was 10 times more than the use of Farsi sources. This meant that the authors considered foreign sources to be more credible.

The types of the cited documents were examined, to answer the question of what type of documents were more commonly cited by the authors (dissertations, journal articles, books, etc.). The findings showed that among 6342 citations in the 'Scientific Medical Journal of Ahwaz', the most commonly used documents were journal articles, with 4592 (72.41%) citations. After journals, books held the second place with 26.66% (1564) of the total, among these, foreign books had 1321 citations and Farsi books had 243 citations. After that, the third place belonged to dissertations with 0.95% of the total citations. Among these numbers Farsi dissertations had 50 citations and English dissertations had 10 citations. The least used documents were CDs (0.015%), news articles (0.03%), and documents (0.05%). Other types of sources like seminars and congresses, research projects, reports, and internet were between these two groups. It can be seen that a very small percentage of citations belonged to documents other than journal articles and books, which shows the importance of these sources in professional researches.

- Literature obsolescence of the documents:
 To answer the question of how old the cited sources were compared to the articles in the 'Scientific Medical Journal of Ahwaz' or in other words how much of the literature was in obsolescence for this journal, the dates of the cited documents were examined. Findings showed that the dates of the Farsi sources ranged from year 1340 (1961) to 1383 (2004) and the dates of foreign sources were from 1745 to 2006. The largest

number of citations to Farsi sources belonged to the year 1369 (1990) and later, which is 15 years older than the documents investigated. In other words the literature obsolescence for the Farsi documents was 15 years. Also the most number of citations to foreign sources was to documents from the year 1987 and later (61.01% of citations), which meant that the literature obsolescence for the foreign documents is 20 years.

Based on Table 1, the literature obsolescence of the Farsi documents was: For books 58.02% of the citations were to documents dated from 1369 to 1383 (1990-2004), which shows a half life of 15 years. On the other hand 48.93% of the citations to journal articles were to those published from 1374 to 1383 (1995-2004), which shows a half life of 10 years. For congresses and seminars, 50% of citations dated from 1374 to 1383 (1995-2004) with a half life of 10 years. Dissertations had a half life of 15 years, with most citations being to ones from 1369 to 1373 (1990-004). Since 80% of other sources did not have dates, it was impossible to calculate their half life.

Table 2 shows that among all the cited sources, the number of citations to foreign sources was the highest from 1987 to 1996. Based on Table 2, the literature obsolescence of foreign sources was as follows: Books have a literature obsolescence of 20 years, with 64.27% of the citations being between 1987 and 2006. In journals, 59.71% of the citations are in the same time frame thus their literature obsolescence is equal to books (20 years). For seminars and congresses, 47.62% of the citations are between 1997 and 2006, giving them a literature obsolescence of 10 years, and dissertations have a literature obsolescence

of 30 years with 60% of the citations between 1977 and 2006. Other sources have a literature obsolescence of 40 years, since 48.08% of the citations are between 1967 and 2006.

• Core Journals:

In total, the authors of the examined journal had 4592 citations to 1860 Farsi journals and foreign journals. From these citations, 4356 citations cited to 1753 foreign journals and 233 of them cited to 106 Farsi journals.

In order to identify the core cited journals in the references of the examined journal during the investigated time period, the Bradford Law test was used. However, this test was only possible for the foreign cited journals, as the number of citations to Farsi journals in the 'Scientific Medical Journal of Ahwaz' were too few. As a result only the Farsi journals with the largest number of citations were identified. Investigating Farsi journals with the largest number of citations shows that the authors of 'Scientific Medical Journal of Ahwaz' usually cited Farsi journals with the science and research ranks. These journals, sorted by the number of citations are: 'Scientific Medical Journal of Ahwaz', 'Daroudarman', 'Nabz,' and 'Journal of the Medical School', Shahid Beheshti University of Medical Sciences. A search in the central library of the Ahwaz Jundishapur University of Medical Sciences showed that all these journals were available there and the subscriptions of those still being published were acquired. Also it is worthy to note that the number of self citation was 13.73% of the citations to Farsi journals and 0.7% of the total number of citations, which is at an overall acceptable level.

In order to conduct the Bradford Law test on the

Table 1: Frequency distribution of the number of citations based on publication year and separated by document type for Farsi documents from 1364 (1985) to 1385 (2007)

| Year | Book | | Journal | | Seminar and congress | | Dissertation | | Others | | Total | |
|-------------|--------|---------|---------|---------|----------------------|---------|--------------|---------|--------|---------|--------|---------|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Before 1363 | 28 | 11.52 | 14 | 6.01 | 0 | 0 | 4 | 8 | 1 | 4 | 47 | 8.12 |
| 1364-1368 | 42 | 17.28 | 32 | 13.73 | 3 | 10.71 | 9 | 18 | 0 | 0 | 86 | 14.85 |
| 1369-1373 | 81 | 33.33 | 58 | 24.90 | 8 | 28.57 | 15 | 30 | 2 | 8 | 164 | 28.33 |
| 1374-1378 | 41 | 16.87 | 75 | 32.19 | 11 | 39.29 | 20 | 40 | 1 | 4 | 148 | 25.56 |
| 1379-1383 | 19 | 7.83 | 39 | 16.74 | 3 | 10.71 | 2 | 4 | 1 | 4 | 64 | 11.05 |
| No date | 32 | 13.17 | 15 | 6.43 | 3 | 10.71 | 0 | 0 | 20 | 80 | 70 | 12.09 |
| Total | 243 | 100 | 233 | 100 | 28 | 100 | 50 | 100 | 25 | 100 | 579 | 100 |

Table 2: Frequency distribution of the number of citations based on publication year, separated by document type for foreign documents from 1364 (1985) to 1385 (2007)

| Year | Book | | Journal | | Seminar and congress | | Dissertation | | Others | | Total | |
|-------------|--------|---------|---------|---------|----------------------|---------|--------------|---------|--------|---------|--------|---------|
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| Before 1966 | 31 | 2.35 | 205 | 4.70 | 0 | 0 | 1 | 10 | 0 | 0 | 237 | 4.11 |
| 1967-1976 | 82 | 6.21 | 381 | 8.74 | 0 | 0 | 0 | 0 | 2 | 3.85 | 465 | 8.07 |
| 1977-1986 | 359 | 27.17 | 1170 | 26.84 | 2 | 9.52 | 2 | 20 | 12 | 23.08 | 1545 | 26.81 |
| 1987-1996 | 531 | 40.20 | 1688 | 38.72 | 0 | 0 | 3 | 30 | 7 | 13.46 | 2229 | 38.67 |
| 1997-2006 | 318 | 24.07 | 915 | 20.99 | 10 | 47.62 | 1 | 10 | 4 | 7.69 | 1248 | 21.65 |
| No date | 0 | 0 | 0 | 0 | 9 | 42.86 | 3 | 30 | 27 | 51.92 | 39 | 0.68 |
| Total | 1321 | 100 | 4359 | 100 | 21 | 100 | 10 | 100 | 52 | 100 | 5763 | 100 |

cited foreign journals, first the database of the journals was sorted in Excel software, based on the number of citations, using the 'sort' option in descending order, and then the total number of citations was counted, which showed a total of 4359 citations. Then the core journals were identified after categorizing the citations. The results showed that the core cited foreign journals in the 'Scientific Medical Journal of Ahwaz' were Pediatrics, the New England Journal of Medicine, Gastroenterology, and Medicine (sorted in descending order based on the number of citations). These journals were compared to the list of available journals in the central library of the Ahwaz Jundishapur University of Medical Sciences and it was observed that all four journals were available in the central library and that their subscriptions were ongoing. The results obtained from the number of citations, number of journals, and the percentage of their citations in shown in Table 3. This table shows that:

- The number of citations is almost equal in all four groups of journals and each group has around 25% of all the citations
- The first group contained a small number of journals (28 titles) that were cited 1040 times. The second group contained more journals and 1045 citations. The third group had an even larger number of journals, which were cited 1039 time. The fourth and last group had the largest number of journals, which were cited 1235 times. As evident in Table 3, the first group had only 1.60% of the journals, but 23.86% of citations were to the journals in this group. On the other hand the fourth group contained 70.45% of the journals, but had an almost equal number of citations as that of the first group.

The final results of the Bradford's Law test on the foreign journals cited in the 'Scientific Medical Journal of Ahwaz' show that these journals follow the Bradford's Law. In other words a small number of journals were cited a great many times, therefore, it is more affordable to just acquire the subscription of these popular journals due to the limited available resources.

- Cost-benefit of the core journals:
In order to determine the cost-benefit of the core journals based on the number of citations to them, it is necessary to first identify the cost of each journal, which was done by referring to the Ulrich compact disk. Then by calculating the ratio of the journals cost to the number of its citations (as a scale for journal's frequency of use) the cost-benefit of

these journals was determined [Table 4]. For example the cost-benefit of the Pediatrics journal is 1.86\$, which means that each use of this journal costs 1.86\$ (\approx 30000 Rials) for the library

- Ranks of the core journals in the Journal Citation Reports: In order to identify the rank of the core journals, the compact disk of Journal Citation Reports published by the Institute for Scientific Information (ISI), 2007 edition, was used. A search on the medical journals in this database showed a total of 6417 journals. These journals were sorted based on the impact factor (IF), in descending order. As a higher impact factor meant that the influence of the journal was higher, it could be used to identify their ranks.

The results of the search in the JCR were as follows. The first journal in the core journals, 'Pediatrics', which had a total of 96 citations, had an impact factor of 4.473, and was the 435th journal among the total of 6417 medical journals. The 'The New England Journal of Medicine,' which had the second rank with 77 citations, had an impact factor of 52.589 and was the second journal among 6417 medical journals. The third journal, 'Gastroenterology,' which had 74 citations, had an impact factor of 11.673 and a rank of 81 among 6417 medical journals, according to JCR. Also the fourth journal, 'Medicine,' which had 70 citations, had an impact factor of 4.721 and according to JCR was the 388th journal among 6417 medical journals.

DISCUSSION AND CONCLUSION

The number of citations to foreign sources was greater than the number of citations to Farsi sources. On an average, each document in this journal had 15.81 citations, 14.37 of which were to foreign sources and only 1.44 of them were to Farsi sources. A literature survey showed that in a study by Koulaian, the average number of citations of articles on life science was 11.23 per article.^[10] Shahbazi Youzband and Mehrad investigated the articles published by the Tabriz University of Medical Science and Shiraz University of Medical Science and reported an average number of 13.01 citations per article for the University of Tabriz and an average of 14.50 citations for the University of Shiraz.^[11] Mohammadi reported an average number of 18.9 citations per article, for articles related to medicine.^[13] Comparing the findings of the current study with the aforementioned reports, shows that the number of citations used by the authors was almost similar in all cases.

Table 3: Categorization of the citations to foreign journals in the 'Scientific Medical Journal of Ahwaz' used to determine the Bradford coefficients

| Group | Citations (J.A) | | Journals (J) | | Bradford coefficient (bK) |
|-------|-----------------|---------|---------------|---------|---------------------------|
| | Number | Percent | Number | Percent | |
| 1 | 1040 | 23.86 | 28 | 1.60 | - |
| 2 | 1045 | 23.97 | 117 | 6.67 | 4.17 |
| 3 | 1039 | 23.84 | 373 | 21.28 | 3.18 |
| 4 | 1235 | 28.33 | 1235 | 70.45 | 3.31 |
| - | \sum J.A=4359 | 100 | \sum J=1753 | 100 | \sum bK=10.66 |

Table 4: Cost and cost-benefit of the core foreign journals

| Rank | Journal name | Publication type | Cost (\$) | Number of citations | Cost-benefit |
|------|-------------------------------------|------------------|-----------|---------------------|--------------|
| 1 | Pediatrics | Monthly | 179 | 96 | 1.86 |
| 2 | The New England Journal of Medicine | Monthly | 159 | 77 | 2.06 |
| 3 | Gastroenterology | Monthly | 468 | 74 | 6.32 |
| 4 | Medicine | Monthly | 236 | 70 | 3.76 |

With respect to the literature obsolescence of the citations used in the articles of the 'Scientific Medical Journal of Ahwaz', the results showed that the literature obsolescence was 15 years for Farsi and 20 years for foreign sources. One can somewhat justify the obsolescence if one were to assume that it takes two years for a book to be published and another two years for it to receive citations, and also considering the amount of time it takes for foreign journals to be delivered to the libraries in Iran. The effect of the delays in deliveries to the Ahwaz University of Medical Science is apparent in the current study. One other issue is the unfamiliarity of researchers with electronic resources and their reliance on hard copy documents. One also needs to consider the fact that sometimes it takes up to two years for an article to be published, which will give an illusion of obsolescence concerning its references. In general the half life of the cited sources in the examined documents was estimated to be 17.5 years.

Burman estimated that the half life of journals in Biochemistry was 11 years.^[20] Osareh investigated medical journals of three universities and reported a half life of 7.4 years for the examined citations.^[8] Jahed in his study on medical dissertations estimated the half life of Farsi sources to be seven years, while the half life of foreign sources was estimated to be 14 years.^[9] In a study by Koochak the literature obsolescence was calculated to be eight years for Farsi sources and 12 years for foreign sources, which gave a half life of 10 years.^[12] Mohammadi estimated that the half life of periodic journals in medicine was 8.7 years.^[13] It is evident from comparing previously reported half lives with the half life estimated in the current study that the sources used in the 'Scientific Medical Journal of Ahwaz' are obsolete even compared to the older studies and other journals of the same discipline (medicine). However, the long period investigated in this study (21 years from 1985 to 2006) could explain this obsolescence to a certain degree.

The results concerning the language of the sources used in the 'Scientific Medical Journal of Ahwaz' showed that the ratio of foreign sources to Farsi sources was 10 to 1. Therefore, most of the citations were to foreign sources. This was in agreement with a study by Horri, who reported that more than 50% of the citations in Farsi studies were to foreign sources.^[21] The findings by Osareh,^[8] Koulaian,^[10] Koochak,^[12] Shahbazi Youzband^[11] and Mehrad, Parsaei Mohammadi,^[4] and Abdolmajid^[6] also reported that the number of citations to foreign sources was larger than the number of citations to Farsi sources.

With regard to the type of cited documents, the results showed that among 10 types of sources, 97.07% of the citations were to books and journal articles and only 2.93% of them were to other sources. Previous studies also agreed with these results, showing that medical researchers preferred journal articles to books as their sources. The findings of Burman about Microbiology,^[20] Gooden about Chemistry,^[22] Osareh about Medicine,^[8] Jahed about Medicine,^[9] and Koochak about Veterinary Medicine^[12] showed that the number of

citations to journal articles was larger than the number of citations to books, in natural sciences.

The Bradford law's test showed that the foreign sources cited by the 'Scientific Medical Journal of Ahwaz' followed this law. Therefore, among 28 journals of the first group, four journals were considered most cited and the number of citations to these four journals was close to a quarter of the total number of citations [Tables 3 and 4].

A comparison with the previous studies shows that the Bradford's law is applicable to all the previous studies as well. As for the reason behind why some journals become core journals and receive most of the citations — some believe in the accessibility principal, which means no obstacles in accessing the journals. However, the accessibility principal is a prerequisite, but not sufficient.^[4] The previous studies have emphasized that even if other journals are also accessible, the core journals receive more citations. Therefore, one can conclude that there are other conditions for core journals, other than accessibility, which require separate studies.

The current study regarding cost-benefit of the core journals showed that the core journal 'Pediatrics' with a cost-benefit of 1.86\$ had the first place among the core journals. After that, 'The New England Journal of Medicine,' with a cost-benefit of 2.06\$ and 'Medicine' with a cost-benefit of 3.76\$ had the second and third ranks, respectively. However, 'Gastroenterology' which had the third rank based on the number of citations is in fourth place with regard to the cost-benefit and had a cost-benefit of 6.32\$ per use.

All these four journals have suitable cost-benefits. Although the cost-benefit of 'Gastroenterology' is higher than the others, meaning it is more expensive to use, the number of uses these journals receive is a suitable counter to the cost of their acquisition, as the larger the cost-benefit is, the more expensive a single use of the journal will be. In a study by Koochak, five core journals have been identified for veterinary medicine with cost-benefits of 0.69\$, 1\$, 1.39\$, 8\$, and 13\$, which show that the cost of a single use for the first three is lower and each use of the last two core journals is more expensive. Parsaei Mohammadi has also reported that the cost of each use for the five core journals of Psychology is 3.06\$, 3.69\$, 4.51\$, 5.55\$, and 23.66\$, respectively. The fifth core journal did not have a suitable cost-benefit compared to the others, having a more expensive cost per use.

With regard to the ranks of the core journals, the results showed that all four core journals were ISI journals and had suitable impact factors, based on the JCR. The results showed that based on JCR, the core journals had ranks of 435, 2, 81, and 388, respectively. This shows that the ranks of the four core journals were relatively high among 6417 journals of medicine, meaning that the authors of the 'Scientific Medical Journal of Ahwaz' used credible journals as the source for their studies. The high impact factor of these journals shows their scientific credibility and places

them among the best journals of medicine. Citation to these journals increases the scientific value of the articles published by the 'Scientific Medical Journal of Ahwaz'. These credible sources also increase the quality of the articles and increase their credibility.

Suggestions

Based on the findings of this study and in order to optimize the performance of the 'Scientific Medical Journal of Ahwaz', it is suggested that:

- As the most important problem in the examined documents is that some authors do not follow a uniform pattern for recording of bibliographic data of the cited source, it is necessary for the 'Scientific Medical Journal of Ahwaz' to create guidelines for correct recording of bibliographic data for authors and insist that the reference section of the articles must be written based on these guidelines
- The list of journals with large number of citations should be used for acquiring core journals for the central library of Ahwaz Jundishapur University of Medical Sciences and for subsidiary (faculty) libraries
- As English language is the most common language in the citations, it is suggested that the librarians of the central library of Ahwaz Jundishapur University of Medical Sciences and the subsidiary libraries spend more effort in acquiring English sources
- As the literature obsolescence of the documents cited in the 'Scientific Medical Journal of Ahwaz' is larger than the average obsolescence in the medical field and due to the importance of up-to-date studies in medical science, the authors of the 'Scientific Medical Journal of Ahwaz' need to make use of more recent sources.

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