Development of Citation Measures and the Socio-Cultural Factors Affecting Citation Behaviour in an Emerging Scientific Community

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Abstract

This thesis presents the development of theoretical and empirically applied citation_ based bibliometric indicators of scientific research performance and applies them to Iranian medical research. In the absence of any pre-existing bibliometric data to provide objective indices to aid decision-making processes, a new body of information related to medical journals publications in Iran was manually collected. A database of all articles 10876) in the 90 Iranian medical journals published from 2002 to 2004 was developed and populated and used as a basis for comprehensive analysis of bibliometric indicators of Iranian medical publications.

One of the outcomes of the citation analysis was discovering that there is an unexpectedly low rate of citation to internally published articles. To seek possible reasons for this, a survey analysis of the cultural and social factors influencing citation behaviour of Iranian medical scholars was undertaken.

Further analysis revealed that the Garfield (ISI) impact factor was not an effective tool for making decisions regarding subject specific collections. Although previous authors have alluded to this drawback, the solutions were often too complex for them to be used by librarians. To address these shortcomings, two new practical measures (Indices) have been developed. The DSI supports individual subscription decisions with regard to the level of specialism of a journal within a particular discipline. DPI is a decision-making tool for libraries that indicates the proportion of all citations within a particular discipline that had been received by a particular journal.

Iranian medical researchers' relationship with international journals was further considered by investigating the rate of publication of articles by these researchers in two different databases (Science Citation Index and PubMed) from 2002 to 2004.

In addition, to allow medical librarians in Iran to make more informed procurement choices with regard to internationally published journals, data were gathered to determine the extent to which Iranian medical researchers use them.

Finally, based on the experiences obtained from the empirical data collection, the findings from data analysis and the responses from the survey analysis, a number of policy recommendations and suggestions for taking these ideas further are proposed.

Acknowledgment

There are many persons to whom I am grateful for making my time at the London Metropolitan University, so rewarding. I have benefited greatly from knowing the Faculty of Computing and hope that this relationship will endure. I am grateful to my supervisors, Professor Robert Gilchrist and Dr Farhi Marir for their support and encouragement. Whatever merits this thesis possesses is due primarily to their guidance and suggestions.

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Chapter 1:

An Introduction to Citation Analysis and its Applications to Iranian Medical Journals

1.1 Introduction

Review of Journals Ranking Methods

Two broad approaches exist to assessing the quality of journals. These can be described as subjective and objective or qualitative and quantitative, respectively. In this chapter, these two broad categories will be discussed, with reference to their advantages and disadvantages. The discussion will begin with an assessment of the subjective methods which rely entirely on peer review procedures, followed by an analysis of the quantitative methods, where the growth of information sources and technology has replaced usage studies with bibliometric methods, and citation analysis in particular.

Qualitative Methods (Peer Review system)

As scientific output increased, placing a greater demand on publications, journals needed a mean of selecting articles on the basis of their quality in terms of the contribution that they could make to the particular field of study. Peer review systems have developed to address this need and later for also assessing journals quality.

Peer review studies provide an alternative measure of the journal quality. They allow experienced people to evaluate journal quality based on their knowledge and experience.

In general, two types of qualitative system are in use for ranking journals in a given field or subfield: author's prominence scale and ranking based on direct analysis of content. Following a discussion of each of these systems, the advantages and disadvantages of the peer review system as a whole are examined here.

Author's prominence scale for ranking journals

Based on author's prominence scale for example, Tracey and Guthrie (1999) ranked the top 100 law journals. Their methodology for conducting the study was based on assigning a score between 25 and 1000 to authors by adopting the author prominence scale originally developed by Jarvis and Coleman (1997). The journals were ranked on the basis of the average author-prominence score over five volumes of publication. For instance, an article written by the president of the United States receives the most points-1000-while thirty-nine other job categories receive a decreasing number of points. For detailed information see appendix A. This method was criticized by Korobkin (1999)

and others for its failure to offer an adequate explanation and justification for the employed methodology and failure to provide a direct incentive for authors to improve the value of their work.

Rankings of journals based on content analysis

Theoretically, content analysis is a desirable means of analyzing directly communication via texts or transcripts since it would not create incentives for journal editors to select (and, therefore, for authors to write) articles based on factors that might not indicate quality, such as author's job title or the possibility of citation attraction due to the article's subject matter. The two main rankings that are directly based on scholarly quality are user surveys and analysis of scholarly value.

User surveys

It is apparent that one of the best approaches would be directly assessing a journal's value to users by simply asking them for their opinions. Studies based on survey analysis assume that the quality of a journal can be correctly evaluated by the readers of the journal. In this method, typically individual scores are collected to compile a ranking of journals in a particular discipline. For instance, Coe (1983a) requested departments chairman to rank finance journals and in 1983b, he made a similar request of marketing professors to rank management journals. In a study of accounting journals, Brinn, Jones and Pendlebury (1996) surveyed only academics conducting considerable research to rank journals. However many studies reported different subsets of respondents yield different journal ratings; Jones, Brinn and Pendelebury (1996) and many other researchers found significant positive correlation between citation counts and survey based ratings.

Analysis of scholarly value of journals

In this technique, journals are ranked on the basis of expert evaluations of scholarly value of journals. Some of the limitations of user survey methods, including lack of consistency and lack of knowledge may be avoided through the appointment of a panel of experts to read and rank journals regularly in a given field. The problem of consistency would be avoided by structuring a panel of high-level experts with a high track record in publishing, experts in epistemology, research methodology and design. Assessment parameters and judgment criteria in relation to the particular field of

research and how to apply them should be given to each reviewer. The knowledge problem could be prevented if panel members would agree to read, in its entirety, each set of journals that they were asked to rank. In this method, each journal would be assessed annually and would be given a score for its quality. The assessment would be made independently of the institution sponsoring it, the society it represents and the other factors that may confer pseudoprestige on it.

Advantages

Readers' voice

Assuming an academic journal in a given field intends to provide information needs of anticipated readers, the voice of the users could play an important role in improving the performance of the journal and virtually guide editorial decisions on development of an effective quality policy. In addition the voice of the readers can help to determine readers' requirements for further implication strategies.

Disadvantages

Subjectivity in methodology

This methodology would be more reliable if such survey responses were consistently available. However, this approach, which is primarily a reflection of respondents' perceptions, may be affected by subjective attitudes and result in some potential measurement biases including the possibility of respondent insufficient knowledge on which to base judgments and implicit criteria that are probably not consistent from person to person, Meho and Sonnenwald (2000).

Many studies indicated that responses to survey are subjective and vary with the sample selected and the group that responds. Studies of Walstrom, Hardgrave and Wilson (1995); Hamilton and Ives (1983) and Extijt and Smith (1990) comparing differences in journal rating depending upon whether the respondents have had an article published in the journal, showed that faculty rated journals higher if they had published in the journal. Similar studies (Beattie and Ryan, 1989; Howard and Nikolai, 1983 and Outreville and Malouin, 1985) investigating faculty at PhD granting institutes versus faculty at universities without PhD programmes showed that respondents teaching PhD

courses gave high rating to academic journals while faculty who only teaching undergraduate courses prefer practitioner journals.

Time consuming

According to Oriogun and Cook (2003) the main problem with content analysis is that it is time consuming. It takes long time for the experts to read each issue of a specific journal, keeping in mind the sharply increasing volume of journals.

Selection of committee members

Another problem with using experts to evaluate and rank journals is that few potential evaluators are actually experts in the broad range of subject areas covered in a given field of science. For example, a urology journal may have published, within one year, articles on "Urologic oncology", "Endo-urology and stone disease" and "Neuro-urology". Asking a professor specialising in a particular field of urology to evaluate this journal is not likely to lead to a ranking in which "scholarly value" is uniformly rewarded, Korobkin (1999).

Summary

Peer review methods for the analysis of research performance has been the traditional way of assessing both the quality of research with a view to publication and the quality of scholarly journals. Peer review methods offer the advantage of allowing scholars in a particular field to evaluate the quality of journals in that field. In particular, for some types of specialist journals, expert evaluations might be the most appropriate ranking methodology. A panel of experts might be able knowledgeably to rank journals relative to each other since the small number of journals in a particular category would make it feasible for experts to read every issue of each journal. In spite of these advantages, both of the above mentioned methods are susceptible to subjective biases.

Given the mentioned distortion, it can be concluded that, although subjective approaches suffer from these shortcomings; it should be taken into account that subjective attitudes are not entirely negative. In any evaluation, there should be specific position for the intuitive insights of experts.

In connection with this, concern has been expressed by Baird and Oppenheim (1994) in their review of citation based studies as follow:

> "[T]here is not, and never can be, one single measure of the value of information that will be universally acceptable. However, there are number of measures that might, in combination, lead to some sort of index of the value of a piece of information, an individual's contribution, or a collection of information" p.13.

Quantitative Methods

Usage studies and bibliometric analysis are the two of the mains quantitative approaches to research performance analysis. In contrast to the qualitative methods, these techniques rely on objectively measurable data. In this section, these two types of analysis will be compared with a view to discussing the factors considered in deciding the most appropriate method for the available medical research data in Iran.

Usage studies

This method involves the ranking of journals on the basis of how often they are consulted by users. Librarians mainly do these sorts of studies, which award a journal a "point" each time one of its issues is taken off from the reserve shelf. For example, McBride and Behm (2003) used this method, based on 20 random samples to identify low-use current journals considered for cancellation, low-use bound journals for storage decisions and the most popular journal titles for keeping in the core collection. As well as being time-consuming according to Korobkin (1999), usage studies will often produce skewed results, since some journals with a regional focus will be consulted frequently in their home region and rarely elsewhere, Goldblatt (1986). Today, since many journals are consulted online, libraries are not able to record the rate of use towards library usage studies. In addition, researchers and especially scholars usually use journal articles provided by their colleagues. Designing a methodology to capture all these methods of consultation of the resources seems to be difficult if not impossible.

Citation Analysis

The gradual development of citation behaviour in scientific publishing has created a new resource for research and policy-making, namely, citation data. Some publications are cited by researchers more than others. The number of citations received by a publication could be taken as being indicative of the level of its influence or usefulness (of course, it could also be argued that citation analysis in this way does not distinguish between fame and infamy). In other words, the number of times an article is cited can be taken as an objective measure of its impact, influence or quality. Figure 1.1 illustrates the notion of citation analysis. The same is true of the articles published by a particular scientist, research group, journals, institution or even country. Consequently, scientometrics, in which citation analysis has a central position, is defined as the quantitative study of scientific communication according to Narin (1976).

Citation analysis provide researchers an effective indicator measurement of the level of quality, importance, influence, or performance of individual documents, persons, journals, groups, domains (subject areas, fields, or disciplines) or nations (Garfield 1983a and Borgman and Furner, 2002).

The Institute for Scientific Information (ISI) was founded by Eugene Garfield in 1960. It was acquired by Thomson Scientific in 1992 and is therefore now often referred to as Thomson ISI, first introducing three indices to measure research performance; the impact factor, the immediacy index and the cited half-life. These are now published annually in the Journal Citation Reports (JCR).

For a researcher who is working in the field of library and information sciences, bibliographic data constitute one of the important data sources for quantitative research. The term bibliometrics is used to describe the quantitative analysis of bibliographic data. It reveals some of the key components related to a publication, which can be extracted from large bibliographic databases.

Scientific articles cite previous articles that the current authors are building upon or refuting. In turn, the current article may be cited in future articles. These citing articles may themselves be cited by articles down the line. The higher the number of citations, the more prestigious the article is deemed to be in terms of its intellectual value.

As an evaluative tool, bibliometric indicators based on citation count, are used as a reflection of research productivity and quality as well as the interactions between individuals, groups, institutions, sectors and nations and map the structure and changing shape of knowledge resources within society. Bibliometric indicators as objective tools, for example in terms of periodical selection for a given library, suggest that there will be a core nucleus of journals that will be highly productive in terms of articles related to a specific area, and allow librarians to make informed decisions in their collection development.

This is represented as a cycle in figure 1.1 which presents the relationship of different interpretations of the citation in information sciences and science policy schematically.

Figure 1.1: *The process of re-interpreting the notion of citation and its consequences adapted from Glänzel and Debackere (2005a)*

Bibliometric Indicators	Citation	Explanation
	Indicator of information use	No citation = not used High citation = Influential
Consequences of incentives	↑ ↓	Re-interpretation
Assessment Procedures	Incentives	No citation = low quality High citation = high quality

Bibliometrics has grown out of the realization that literature is increasing and changing at a rate with which no librarian or information worker equipped with traditional bibliographic skills and methods could keep abreast. Bibliometric indicators have at least four areas of application consisting of performance analysis of scientific information and contributions, mapping the structure of science, information retrieval and library collection management. These are outlined below.

Performance analysis of scientific information and contributions

The use of citation ranking, or citation counts, for evaluating research quality is based on the assumption that citations are a form of giving credit to or recognizing the value, quality, significance or impact of the author's work, Cole and Cole (1968). For a detailed discussion on this point, see (Gilbert, 1978; Smith, 1981; Van Raan, 1996 and White, 1990).

Citation studies have been used to compare different departments around the world by Nederhof and Noyons (1992), including the analysis of research economics units in the Netherlands by Nederhof and Van Raan (1993). Similar works were done at international level in medical research by Fava, Ottolini and Sonino (2001) and third world nations' research by Garfield (1983c). Winclawska (1996) compared various departments' output within a country in the same subject area. For example, studies of Oppenheim (1995) and Seng and Willet (1995) demonstrated that there is a strong correlation between citation counts and the Research Assessment Exercise (RAE) ratings of UK academic departments.

Mapping the Structure of Science through Co-Citation Analysis

Since specialists publish the result of their investigations, the state of a field is supposed to be reflected in the content of their publications. Of the many ways that publications can be analysed and considered, perhaps the most informative kind of data is the references cited by practitioners in their publications. Making references to earlier literature within an article is utilized as an indicator of the author having profited from the work of others.

Co-citation is a measure of the extent of which the works of two or more authors are related. Two authors are considered to be co-cited when at least one document in each author's publication occurs in the same reference list. For e.g. if papers A and B are both cited by paper C, they may be said to be related to one another, although they don't directly cite each other. Figure1.2 presents this concept schematically.

Figure 1.2: Paper A and B are co-cited by paper C
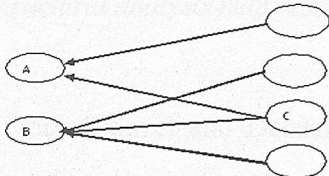
Bibliographic coupling operates on a similar principle. If papers D and E cite B, they may be related. The more papers they are cited by, the stronger their relationship is. The following figure is served to illustrate this point.

Figure 1.3: Both paper D and E cite paper B
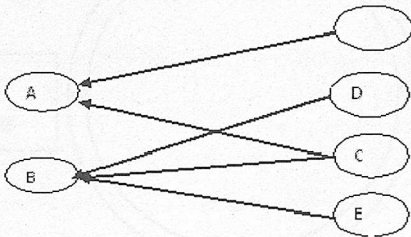
The pioneering work of Price (1965) revealed the relationship between the network formed by scientific works and the formation of a particular scientific field, Guerrero, Moya, Moya and Solana (2002).

The application of Price's methods has recently been used for textual data mining by Lagus and Kaski (1999b) and in particular to generate topological maps of a set of documents, even categorizing the zones of influence of each word or term. For detailed information see (Anegón, Herrero-Solana and Guerrero Bote, 1998; Anegón et al., 1999; Chen et al. 1998; Guerrero Bote 1997; Guerrero Bote, Moya Anegón and Herrero-Solana 2002; Lin 1997; Kohonen et al. 1999 and Lagus et al. 1999a).

The assumption underlying Price's method, according to Garfield, is that science is a "mosaic of small units", rather than a structural monolith. This leads to many questions some of which have been identified by Garfield (1979):

> *"What is the nature of this structure? Are there any relationships between them? Are there a variety of configurations at the infrastructure level? How dynamic are the configurations? Is there a relationship between configuration and research performance? Can structural analysis help research to form more effective science policy decisions?"*

The following figure adopted from Glänzel and Debackere (2005b) presents schematic visualization of the feedback of policy use of citation analysis on a scientific community:

Bibliometrics

Citation Behaviour

Research Management

Research funding
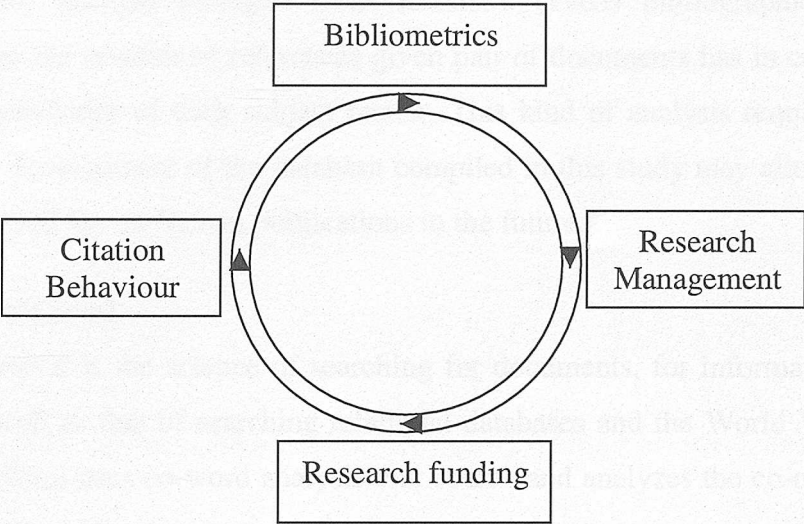
The analysis of common references (co-citation) was evaluated by Kessler (1963) and then extended by Vladutz and Cook, (1984). Later it was implemented in the ISI databases. Price (1965, 1967) used citation patterns to explore the structure of Physics and one of its specialties. Studies of (Small and Griffith, 1974; Marshakova, 1973 and Small and Sweeney, 1985) have further extended this work to produce a similar map of the social sciences. This technique has also been used for the study of authors and journals such as works of (White and Griffith, 1981; White, 1981, 1993; White and McCain, 1998; Van den Besselaar and Leydesdorff, 1997 and Persson, 1994).

Co-citation clustering extends the concept of co-citation to include webs and nodes indicating the relationships between several pieces of work. Author co-citation analysis is an example of co-citation clustering. In author co-citation analysis, a set of authors representing a research area is selected and relationships between them are analysed. Using co-citation counts as similarity measures and multivariate analysis techniques as analysis tools can reveal the intellectual structure of the research area and infers the characteristics of the corresponding scientific community.

In summary, co-citation clustering was designed to test at least the following hypothesis. This is that science is made of structure of area of expertise which can be found out by objective means. According to Garfield (1979) to define the structure of a science, a particular citation measure consisting common interest between two documents can be used. Co-citation strength emerged from Kessler's (1963) bibliographic coupling concept that uses the number of references given pair of documents has in common for measuring the similarity of their subject matter. This kind of analysis requires a huge dataset. Future development of the database compiled in this study may allow for such studies to be carried out on Iranian publications in the future.

Information retrieval

Information retrieval is the science of searching for documents, for information within documents, as well as that of searching relational databases and the World Wide Web. Information retrieval uses co-word analysis that counts and analyzes the co-occurrences of keywords in the publications on a given subject.

Co–word analysis is based on the assumption that a paper's key words constitute an adequate description of its content. Two keywords co-occurring within the same article are an indication of a relationship between the subjects to which they refer, Cambrosio et al. (1993). Co–word analysis discloses patterns and trends in a specific area by measuring the association strengths of terms representative of relevant publication produced in that area. Generally it is based on counting the number of times certain indicators occur or co-occur, developing information with regard to author co-citation, journal co-citation, keyword co-citation, and so on.

Visualizing the intellectual pattern of a given discipline into diagrams of the conceptual space of that discipline is the main characteristic of co-word analysis.

The main steps for implementation of this technique are data collection, data standardizing and data mapping. In other words, as Egghe and Rousseau (1990) have indicated, the patterns in frequency distribution in a bibliographic database can be applied to determine important characteristics, which can be useful retrieving important information from these databases.

Many researchers have used co-word analysis as an important method to explore the concept of networks in different fields, for instance, in software engineering by Coulter et al. (1998), polymer chemistry by Callon, Courtial and Laville (1991), neural network research by Noyons and Van Raan (1998), Van Raan and Tijssen (1993), biological safety by Cambrosio et al. (1993), acidification research by Law and Whittaker (1992), patents by Courtial, Callon and Sigogneau (1993a), optomechatronics by Noyons and Van Raan (1994), bioelectronics by Hinze (1994), medicine by Rikken, Kiers and Vos (1995), biology by Rip and Courtial (1984), Looze and Lemarie (1997) and condensed matter physics by Bhattacharya and Basu (1998).

As with co-citation analysis, a much larger dataset than is available at present would be needed for the co-word analysis of Iranian Medical literature. However, this may be possible in the future.

Library management

Finally, bibliometrics data is used to manage the collections in libraries. In the absence of a suitable bibliography for list checking, citation data can be used as mean of checklist to compare a library's holding for assessing the quality of all or part of a collection.

Citation analysis as a tool for collection evaluation can be traced back to the work of Jewett in 1848, Ching and Chennupati (2002). In the 1960s, Coal evaluated the Latin American Colonial History collection at Chicago's Newberry library using bibliographies of a group of scholarly monographs, cited by Lancaster, Dilivio and Lee (1993).

The broad application of citation analysis to collection management in research libraries began in the 1960s after the publication of ISI Citation Indices that enabled access to systematically collected and organized citation data from major journals in different disciplines.

Recently Sylvia (1998) analysed the serial titles cited by psychology students in their research bibliographies to evaluate journals usage for the purpose of selection or deselection. In another study using doctoral dissertations, Buzzard and New (1993) investigated library collection used by doctoral students in the humanities, science and social sciences. Similar citation analysis was undertaken by Pancheshnikov (2007) for the management of the University of Saskatchewan collection and found that students to be citing more monographs, as well as theses and dissertations than faculties in their researches. Ching and Chennupati (2002) used citation analysis techniques for evaluation of library collection of the Ministry of Education in Singapore and found a need for a change in acquisition policy with more focus on books and a reduction in non-used journals. Dulle et al. (2004) analyzed the citation patterns of agricultural scientists in Tanzania in order to create a core journal collection for agricultural research and found that generally agricultural scientists in the country had limited access to current journals. They recommended a number of options to improve the situation, with a focus on electronic journal provision supported by international organizations. A comprehensive overview of citation analysis as a collection management methodology can be found in the works of Egghe and Rousseau (1990).

Part of the current study involves the use of citation data from our compiled database to evaluate the rate of internationally published journals usage in Iran, as reflected in publications in medical research between 2002 and 2004.

Summary and conclusion

In summary, whilst expert judgment procedures are susceptible to some subjective biases, including negative bias against younger persons or newcomers to the field, according to Horrobin (1990) and Moxham and Anderson (1992) opinions of experts can provide valuable insights into research performance. In contrast, citations given to research work can be considered as a vote in favour of the work cited. Clearly, Peer Review is a subjective approach and citation analysis being independent of personal perception and according to many bibliometricians like Brown and Gardner (1985a) is an objective evaluative technique. Both of these approaches are not without criticism since no research methodology is perfect and each approach has strengths and weaknesses.

Basically citation indices attempt to evaluate an article's impact by determining how many times it is cited by other researchers. The more the article is cited, the higher the impact and the more influential that article is considered to be. Typically survey analyses based on individual scores are aggregated to compile a ranking. The higher the aggregate score, the higher the ranking.

Our view of citation analysis is the same as expressed by Garfield, the founder of Science Citation Index in1979, cited in Brown and Gardner (1985b).

> *"The only responsible claim made for citation counts as an aid in evaluating individuals is that they provide a measure of the utility or impact of scientific work. They say nothing about the nature of the work, nothing about the reason for its utility or impact. Those factors can be dealt with only by content analysis of the cited material and the exercise of knowledgeable peer judgment. Citation analysis is not meant to replace such judgment, but to make it more objective and astute."*

Despite the limitations, citation analysis remains the most widely used method for evaluating scholarly impact according to (Beamish, 2006 and Li and Tsui 2002). Responding to critics, Baird and Oppenheim (1994) argue citation count as follow:

> *"What is embarrassing for the critics of citation counting is this fact: whatever measures you take for the eminence of an individual scientist or of a journal or an institution, citation counts provide strong correlation with that result. This must be very frustrating for the persons who criticize citation counting, but demonstrates that, despite the 'noise' produced by the vagaries of citations, the 'signal' still comes through strongly."* cited by Peng and Zhou (2006).

1.2 Current Research Performance Indicators in an Emerging (Iranian Medical Research) Community

According to the latest list of The Iranian National Committee of Medical Sciences Journals (INCMSJ), Iranian medical universities, research institutions and various medical associations publish 90 scientific journals. However, these publications are mainly supplied free of charge and are not based on any kind of analysis as to their effectiveness or value, to the extent that even their circulation is arbitrary. Moreover, indirect costs are not taken into consideration when measuring the cost of publication to the departments concerned. Cost-benefit analysis is not carried out as to the effectiveness of these journals and the continuation of the journal publication is not based on any evaluation.

After the end of War between Iran and Iraq (1980 to 1988) a succession of 5-year development programmes were conceived aimed at setting deadlines for socio-economic development. During the first and second development programmes, both the number of universities and research institutions and the quantity and quality of research production have grown significantly. According to Osareh and Wilson (2002) many factors were important to this increase; among these are the ending of an 8-year war with Iraq, basic changes in the political environment brought by the Reformers, the changes in the Iranian government's research funding policy during Reformers supremacy, the growth of the economy, expansion of the Iranian national journal publications, the return of a large number of Iranian overseas students, the inclusion of publication records in the promotion of academic faculty and the growth of international relations of scholars. Although, external factors also account for the increased productivity, such as the acceptance of three Iranian journals by the SCI, increased access to international databases through the internet and better electronic communication facilities for international collaboration, the most important and significant factors that caused this rise seem to have been the government's research policies in the last few years. A study conducted by Etemadi et al (2003) showed that the number and proportion of original articles in foreign journals increased significantly in 1990s, from 127 to 1140.

In the medical sciences, the number of academic members has increased from 1000 to more than 11400 between 1990 and 2003 (Ministry of Health and Medical Education, 2004). In 1978 a total of 175,675 individuals were studying for BA/BSc, MA/MS, PD

(professional doctorate) and PhD degrees at institutions sponsored by the Ministry of Health and Medical Education. This figure rose to 625,380 in 1998. If the number of students studying at the private Islamic Azad University (610,000) were added to this figure, the total number of students studying in higher education would surpass 1,200,000, UNESCO (1997). The majority of students belong to social sciences and humanities (42.3 %), technology and engineering (19.0 %), medical and health sciences (15.7 %) and basic sciences (14.3 %). Agriculture and fine arts make up the remainder. In medicine the number of students graduating as general practitioners (MD), doctor of pharmacy (Pharm D), dentist (DMD) and medical laboratory scientific officers (MLSO) increased from 1,138 in 1980 to about 8,800 in 1996, Malekzadeh et al. (1999). 2060 articles from researchers working in Iran from 1991 to 2002 were indexed in Medline according to Malekzadeh et al. (1999).

The recent increase in the rate of Iranian medical scholars' publications indexed in journals covered by SCI is shown in Figure 1.4.

Figure 1.4: Trend of articles published by Iranian medical researchers in journals indexed in SCI from 2001-2007
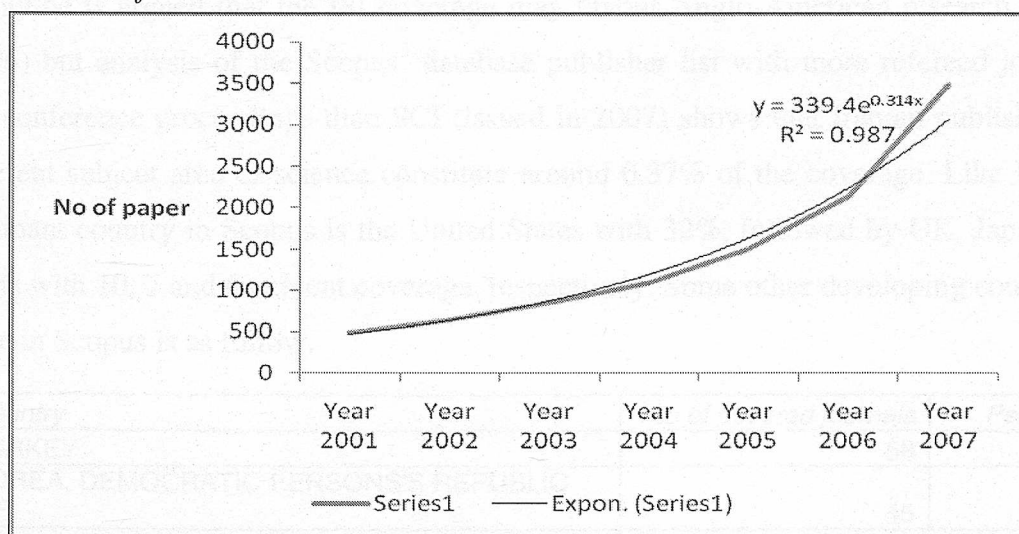
The above figure shows the trend of publication pattern of Iranian medical scholars in journals indexed in SCI between 2001 and 2007. The number of publications being around 500 articles in 2001 has been increased to more than 3500 (seven fold) in 2007.

In spite of the rapid increase in research output in both science and medicine by Iranian researchers, this was not reflected in the inclusion of Iranian medical journals within the ISI database until 2007-8. One of the criteria for inclusion in the ISI database is the number of citations that a journal receives from those already within the database.

The lack of inclusion of Iranian journals can be traced to Iranian researchers' interest to publish in overseas journals, rather than Iranian journals. This matter is explored later in chapter 6. In a study of science information within the third world, Garfield (1983c) reported that Iran ranks 9th with 196 articles receiving 444 citations. 25 years on, in 2007, 5 medical journals (published in English) of more than 120 Iranian medical journals have become eligible to be indexed among ISI journals. These are as follow:

1. Iranian Journal of Allergy Asthma and Immunology (2004)
2. Iranian Journal of Pharmaceutical Research (2007)
3. Iranian Journal of Public Health (2007)
4. Iranian Journal of Reproductive Medicine (2007)
5. DARU-Journal of Faculty of Pharmacy (2007)
6. Archives of Iranian Medicine (2007)

However in pure science, three Iranian journals (Iranian Journal of Science and Technology, Iranian Journal of Chemistry & Chemical Engineering and Iranian Polymer Journal) qualified in 2002.

It may be is argued that the ISI coverage may favour Anglo-American research, Kärki (1996) but analysis of the Scopus[1] database publisher list with more refereed journals and conference proceedings than SCI (issued in 2007) shows that Iranian publishers in different subject area of science constitute around 0.37% of the coverage. Like ISI the dominant country in Scopus is the United States with 32%, followed by UK, Japan and China with 10, 7 and 6 percent coverage, respectively. Some other developing countries' share in Scopus is as follow.

Country	No of covered journals	Percent
TURKEY	58	1.18
KOREA, DEMOCRATIC PERSONS'S REPUBLIC OF	45	0.91
TAIWAN	39	0.79
CHILE	20	0.41
IRAN, ISLAMIC REPUBLIC OF	18	0.37

The comprehensive analysis of Iranian medical journals, application of citation analysis and the consequent findings could play a useful role in the evaluation of nationally

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1. In 2004, Scopus (scopus.com) as a similar database to that of Web of Science was launched by Elsevier. Although it covers more refereed journals and conference proceedings than Web of Science (15,000 titles compared with 8,700) Scopus provides citation searching only from 1996 onwards, whereas Web of Science goes as far back as 1900.

published medical journals. Such authoritative information is essential in the further development of medical research and researchers who need to know which journals are substantial at least at the national level, when writing for and submitting articles for publication. For example, such information and analysis would enable decision-makers to evaluate journals on the basis of their impact, rather than on the current basis[2], which uses evaluative criteria that are unrelated to the effectiveness or usefulness of the journal. Quantitative studies of science and technology are a rapidly developing field that are linked to a number of general tendencies in the global science system.

National governments and research organisations and institutions need efficient and explicit evaluations to make as effective as possible their research allocations, re-directing their research support, to interpret from a rational standpoint research organisations, reforming research in particular fields, or increasing research productivity. Evaluative bibliometrics is a subfield of quantitative science and technology studies, aimed at constructing indicators of research performance from a quantitative analysis of scholarly documents. Citation analysis is one of its key methodologies.

This study is designed to analyse the research performance of medical publications of Iranian medical scholars from a bibliometric point of view. The first step in this process was the creation of an appropriately populated database, which would then facilitate further investigations including whether the conclusions based on citation data from developed countries are applicable to other countries (in this case, Iran).

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[2]. The current Iranian medical journal assessment is based on five main criteria. 1: Scientific credibility of journal, which is mainly based on being indexed in local, regional, and international abstracts and indices.2: Constancy and existing for specific time such as frequency of publication and updated publication. 3: Journal administration: such as format of title page, provision of information related to editorial board, description of the scope of journal and guidance to authors with regard to the format of the work for submission.4: Technical features including quality of used papers, press, bounding, tables and figures.5: Forms of accessibility such as having web site, online submission possibility and researchability of articles via internet through different search options.

1.3 Aims of Study

To address the question of the lack of bibliometric databases for Iranian medical publications, the first aim of this study was to create a database of Iranian medical publications. The procedures for this substantial task are explained in Chapter 2.

To provide objective indices to aid decision-making processes, in chapter 2, the database developed for this research is used to determine what the main bibliometric indicators of Iranian Medical Publications (2002-2004) demonstrate.

To address the shortcoming of the impact factor, the Discipline Specialism Index (DSI) was developed to make authors' individual subscription. The Discipline Proportion Index (DPI) has been proposed as a decision-making tool for libraries. The procedures for this substantial task are described in Chapter 3.

The cost of procurement of international journals can often be prohibitive. To allow medical librarians in Iran to make more informed procurement choices, in chapter 4, the data are analysed to determine the extent to which Iranian medical researchers use international publications.

Iranian medical researchers' relationship with international journals was further considered by investigating the rate of publication of articles by these researchers in two different databases (SCI and PubMed) from 2002 to 2004. The corresponding results are presented in chapter 5.

To determine whether or not citation data from different cultures are comparable, chapter 6 seeks to answer questions relating to how citation is valued (in terms of research performance analysis). In addition, to address the observed differences in, and to determine the possible reasons for, such differences, a survey analysis of the cultural and social factors influencing citation behaviour of Iranian medical scholars was undertaken.

Chapter 2:
Bibliometric Analysis
of
Iranian Medical Journals
(Existing Indicators)

2.1 Introduction

There is a growing international interest in the impartial evaluation of scientific research. Research output can be assessed in a number of ways. For example, publication counts are being used to assess scientific activity or the number of patents issued, King (1987). While publication data give a measure of the total volume of research output, they provide no indication of the quality of the work performed. However, though citations data have some limitations for evaluation, the most prevalent method to assess the quality of journals is based on the number of citations they receive. When an article is cited, it usually suggests that it contributed significantly to the literature on which the citing article builds, and so the number of citations that an article receives is a commonly used indication of its quality within its particular discipline. When we add up the number of citations that all the articles published by a certain journal receive, we therefore obtain a measure of journal quality.

Preliminary Work to Establish an Iranian Citation Index Database

In order to apply citation indicators to measure Iranian medical journals, it was necessary to develop an Iranian citation index database.

The development of this database was a prerequisite for achieving the main aims of this study which was to develop bibliometric indicators and apply them to the evaluation of Iranian Medical Journals articles published between 2002 and 2004. This consisted of a total of 90 research-based Iranian Medical Journals. The estimated number of records based on a sample of 100 articles was 150,000. Each record consisting of all of the bibliographic information related to each article, including all of the references.

For each of these records, it was necessary to gain access to every article in each of the issues published between the required dates for each of the 90 journals. Initially, it was estimated that around half of these might be obtainable by electronic means through the publishers. In practice, it was found that publishers did not keep electronic records of their publications. In the very few cases where electronic copies were kept, these were in scanned graphic format that was not searchable.

With no recourse to electronic versions, the data had to be gathered and entered manually using existing resources, such as hard copies in libraries and networks of friends. As the project progressed, ideas emerged for speeding up the data entry process.

These included scanning and the use of Optical Character Recognition (OCR) software. However, the required hard copies were not all obtainable from a single source and it was necessary to travel to several libraries in different cities in order to obtain the required journal issues.

Before data entry could begin, the database had to be designed, developed and tested.

Microsoft Access was chosen as the preferred database management system. The factors influencing this decision are summarized below.

Access ™ is an integral part of the popular Microsoft Office Professional suite. Its user-friendly development features allow tables to be created and readily linked. In addition, the popularity of the software means that support is widely available in the form of existing pool of users and online forums.

The software is widely used in Iran, where it was planned to be implemented. The availability of Farsi language versions (before the advent of the Unicode system) meant that the software was either already familiar to the intended users, or that local expert knowledge was at hand. Furthermore, compared to other software with similar capabilities, MS access is an economical, yet wholly suitable alternative, particularly since data can be ported to more sophisticated applications if future requirement were to surpass its capabilities.

Having been designed to integrate with other packages within the Office suite, it also had the advantage of allowing seamless data transfer directly from queries to Excel™ for data manipulation and analysis.

The details of the developmental process involved in the design and implementation of the database has been presented in appendix B. Once the database had been created, a demo version was presented in the Third Regional Conference on Medical Journals of the Eastern Mediterranean Region in Shiraz. Since then, there has been a wave of interest in bibliometrics within the scientific community which originated within the medical field. A further challenge was to train personnel to enter data as prescribed. This was not as simple as was anticipated and the following section describes the many issues that were addressed and fortunately resolved.

Methods of data collection

In the first instance, letters were sent to the publishers to request that the journals be sent in electronic format. However, none of the publishers were prepared to provide this, although some said that their journal archives for the years in questions were available online in PDF format. In most instances, even these were found to be incomplete.

Data collection began with personal visits to a library where there was a complete collection of over 80 % of the 90 printed medical journals published between 2002 and 2004. The remainder was obtained either online or through direct contact with the publishers. The following describes the various stages during which a number of problems were identified and resolved.

Initially, around seven technicians were employed and trained to enter the data into the database by keying in the relevant information from each issue into the specially designed forms.

One of the problems that were encountered was that the necessary resources for networking the computers were not available. As such, the data were entered into independent databases. Hence, it was not possible to check data integrity or to avoid repetition. Therefore, when the data were received, it was necessary to merge the records and to reassign primary keys and to remove duplicate data.

Another major drawback was the lack of supervision following initial training since the researcher was based in the UK, whilst the data entry was being carried out in Iran. Consequently, data entry was excruciatingly slow (25% accomplished in 5 months) and inaccurate, particularly with regards to the foreign language (English) references, where the technicians were not able to place the appropriate sections of each reference into the correct field in the forms. In addition, since the data were in two languages, they encountered problems with swapping keyboards (Farsi ←→ English).

The consequent errors were unacceptably high and required more time to address than the data-entry itself! This was compounded by the fact that in the pilot study, where an average of 15 references per article was found, and the data entry was estimated to take around six months to complete. However, in practice, the data showed an average of 18 references per article, a 20% increase on the expected data entry time.

Eventually, the most practical solution was found to be scanning and conversion to electronic format for processing in the UK. Whilst the Latin components of the text could be read electronically via OCR software, the Farsi components again needed to be entered by hand as the existing Farsi OCR was found to be woefully ineffective. However, this time, to reduce data entry errors, the technicians were not required to split the text. Rather; they were asked to type the entire reference into word-processing software so that they could be manipulated systematically later. This procedure made the initially designed data entry forms redundant.

The data was transferred to Word for Windows™ format, where the text could be manipulated using the software's advanced features, such as macros, conversion to tables and exporting to various database- and spreadsheet readable formats (see appendix D).

In practice, it was found that what had been achieved inadequately in five months was completed satisfactorily in less than one month with minimal data entry errors.

Having overcome the problem of data entry errors, inconsistencies were found in referencing styles within each article, let alone each issue of each journal. In addition to inconsistencies in syntactic styles and spelling errors, there were arbitrary abbreviations and acronyms and in some cases, key information, such as journal name, volume number and page numbers were missing. Examples of such inconsistencies are shown in appendix E.

The tabulated data from Word™ were transferred to Microsoft Excel™ where further text manipulation (through the use of advanced formulae) resulted in effective separation of the text into the required fields, suitable for exporting to the Access™ database.

In reality, it was found that due to the relatively low citation count of Farsi references compared to English ones (around 10,000 out of 160,000), the Farsi data were completed and analysed (see Chapter 2) considerably faster, in spite of the Farsi text having been entered manually.

Following the design and testing of the database and the relevant data entry forms, many unforeseen problems were encountered. However, eventually, it was possible to find ways of collecting the data accurately and reliably for entry into the database and for

subsequent analysis although inconsistencies in referencing styles within the articles had to be resolved manually.

The source of this part of study is based on the developed citation database of Iranian medical publication between 2002 and 2004. In this study, a number of existing measures of research output have been determined, each providing different types of information, as listed below.

Table 2 1: Bibliometric indicators used in this study

Measurement objective	Measurement	Bibliometric indicator
Publication output or productivity	Absolute	Total publication
The most productive authors.	Relative	Total publication >25
The most cited authors.	Relative	Total citation>10
The most cited articles.	Relative	Total citation>5
Author and journals self-citation rate.	Relative	Percentage of Authors or Journals self-citation in relation to the total number of citations.
The immediacy or recency of citation (how soon after publication are articles being cited)	Absolute	The immediacy index indicate how often articles published in a journal are cited within the same year.
The impact factor of Iranian medical journals.	Significance of absolute citation frequencies	The journal impact factor is a measure of the frequency with which the 'average article' in a journal has been cited in a particular year.

2.2 Results

In this chapter, the researcher attempted to measure two things: research output and research impact. Research output is the amount of author's productivity, while research impact is the influence of published papers on contemporary and future scientific research. Bibliometric indicators are often used to measure research output and impact.

The required data was extracted from our database for all bibliometric indicators, and the findings organized into data summaries (see tables 2.1-2.13).

Figure 2.1: Trend of articles published by Iranian medical researchers in 90 Iranian medical journals from 2002-2004.
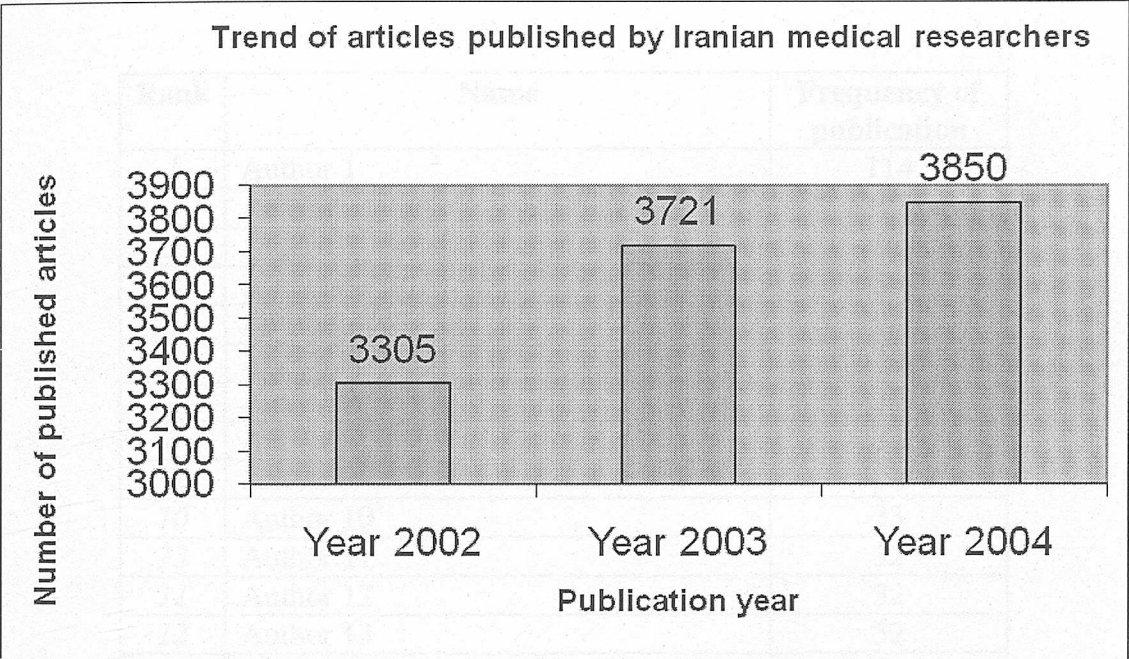
In a total 10876 papers were published in 90 different scientific journals. Of the 10876 papers, 5540 (50.94%) appeared in journals published by the universities or scientific research centers located in Tehran. The name of journals published by the universities and research centers situated in Tehran are in italic (see appendix C).

The first is the Journal of Iran University of Medical Sciences with 350 published papers. The Journal of the Faculty of Medicine with 293 articles and the Journal of Research in Medical Sciences of Esfahan MSUJ with papers 287 took second and third places, respectively. In general, journals with broad subject field published more articles than those belonging to a specific area. The list of journals and number of articles published by each journal is presented in appendix C.

Prolific Authors

The collected data allowed for author productivity to be measured on the basis of the number of articles published. The results are shown in the following table.

Table 2.2: Shows the 31 most productive authors[3] between 2002 and 2004.

Rank	Name	Frequency of publication
1	Author 1	114
2	Author 2	103
3	Author 3	88
4	Author 4	59
5	Author 5	58
6	Author 6	40
7	Author 7	39
8	Author 8	34
9	Author 9	34
10	Author 10	33
13	Author 11	32
11	Author 12	32
12	Author 13	32
15	Author 14	31
14	Author 15	31
16	Author 16	30
17	Author 17	30
18	Author 18	30
19	Author 19	30
21	Author 20	29
20	Author 21	29
22	Author 22	28
23	Author 23	27
25	Author 24	27
24	Author 25	27
26	Author 26	26
27	Author 27	26
28	Author 28	26
29	Author 29	25
30	Author 30	25
31	Author 31	25

[3] In most cited authors list when two or three or more scholars' ranking are tied, the alphabetical order of their last name is used.

Figure 2.2: Shows the percentage of authors' contribution in relation to the percentage of articles production.
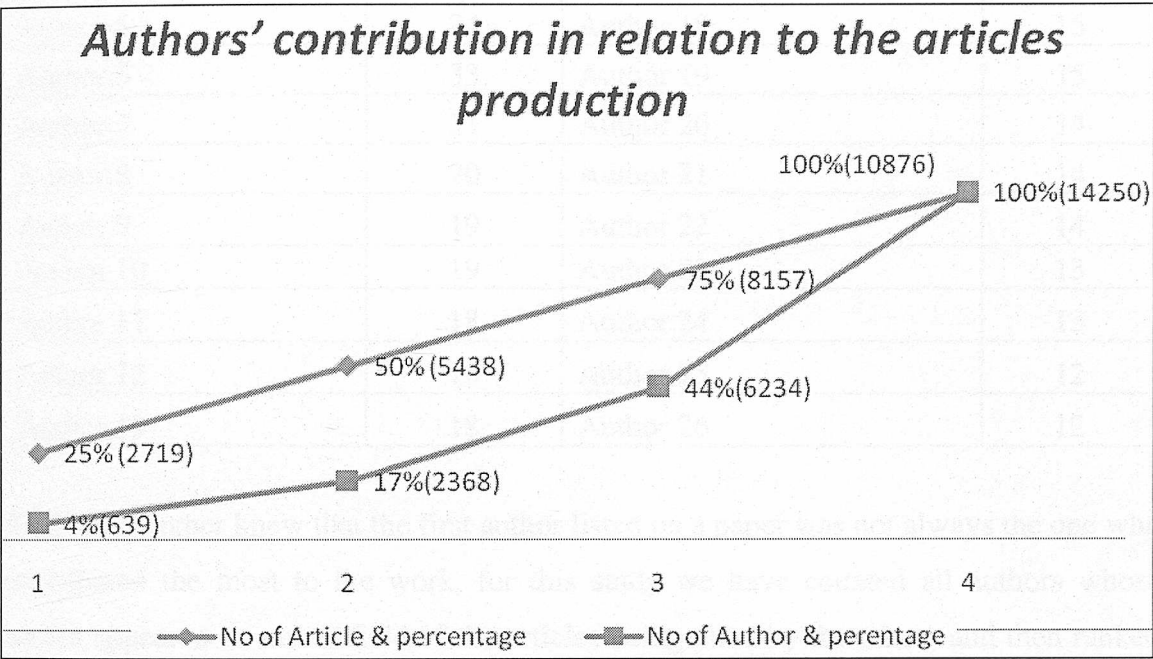
14250 authors (each with various numbers of publications between 1 and 114) were responsible for the publication of 10876 papers. The above graph shows that 4. % (639) of authors was responsible for the 25% of articles production. 50% of articles had been published by 17% (2368) of authors and 75% of articles were produced by 44.8% (6234) of Iranian medical researchers.

The Most Cited Authors

Citation analyses are important in academia for faculty, and also may provide insights into major topics and common themes in research. There are benefits to authors of being cited in various outlets, including the popular press, but the number of citations by other researchers is a key indicator for scholars to know who are the most influential researchers in a field.

Table 2.3 lists authors with more than 11 citations received from 2002 to 2004.

Table 2.3: Author's citation count from 2002 -2004

Name	Count of Citation	Name	Count of Citation
Author 1	52	Author 14	17
Author 2	41	Author 15	16
Author 3	39	Author 16	16

Name	Count of Citation	Name	Count of Citation
Author 4	35	Author 17	15
Author 5	34	Author 18	15
Author 6	33	Author 19	15
Author 7	31	Author 20	14
Author 8	20	Author 21	14
Author 9	19	Author 22	14
Author 10	19	Author 23	13
Author 11	18	Author 24	13
Author 12	18	Author 25	12
Author 13	18	Author 26	12

As the researcher knew that the first author listed on a paper was not always the one who contributed the most to the work, for this study we have counted all authors whose names appeared in author field of the articles being cited by the others and then ranked the name by frequency. Authors 1 and 2 were ranked first and second taking into account the times of citation.

Author Self-Citation

Author self-citation has long been of interest to those working in bibliometrics for what it reveals about the publishing behavior of individuals and their relationships within academic networks.

The table 2.4 shows the frequency of author self-citation with 3 and more than three times.

Table 2.4: Author self-citation rate

Author Name	Frequency of Author Self Citation
Author 1	15
Author 2	14
Author 3	11
Author 4	7
Author 5	7
Author 6	5
Author 7	5
Author 8	5
Author 9	5
Author 10	4
Author 11	4
Author 12	4

Author Name	Frequency of Author Self Citation
Author 13	4
Author 14	3
Author 15	3
Author 16	3
Author 17	3
Author 18	3
Author 19	3

Academic writers have an obligation to cite previous publications that they relied on to develop their research, even their own publications. The above table shows that most self cited authors are those of most prolific and cited authors. Therefore, authors who publish frequently tend to be cited often. Considering the citation count of each author and authors' self citation, 40% of citations received by author number 2 were self citation, the percentages for other most cited authors like number 4, 3 and 1 are 35%, 33% and 28.8% respectively. In total of 828 citations, 399 (more than 48%) were self-citations.

To test this assumption a correlation analysis was undertaken between the number of prolific authors and the frequency of their citation. Correlation analysis shows a correlation of 0.6 between the number of articles of Iranian prolific authors in medical sciences and their received number of citations, including the number of self-citations during the time of study.

Authorship Pattern

This is a clear indication that team research is the most prevalent research process in medical sciences. Different disciplines interpret the number of authorship differently.

Katz and Hicks (1997) demonstrated that, in general, the impacts of UK papers in any discipline or sector are higher if there is a collaboration of some kind. Sole author papers appear to be in the minority and have less impact. The last few decades have witnessed a growth in collaborative endeavors, Subramanyam (1983). To see authorship pattern in medical sciences in Iran, table 2.5 and figure 2.3 serve to illustrate the point.

Table 2.5: The collaboration pattern of Iranian medical scientists from 2002 to 2004.

No of author	No of articles	% of total authors	Cumulative %
Single author	1586	12.39	12.38
2 authors	2896	26.71	39.10
3 authors	2807	27.38	66.48

No of author	No of articles	% of total authors	Cumulative %
4 authors	1806	16.86	83.34
5 authors	964	8.75	92.09
6 authors	419	3.99	96.08
7 authors	184	1.85	97.93
8 authors	103	0.97	98.90
9 authors	46	0.44	99.35
10 authors	21	0.21	99.56
11 authors	13	0.13	99.69
12 authors	7	0.07	99.76
13 authors	6	0.06	99.82
14 authors	7	0.07	99.89
15 authors -20 authors	9	0.09	99.98
>20 authors	2	0.02	100.00

With respect to the authors, Table 2.5 shows that, overall, about 88% wrote in multiple-author status whereas about than 12 % wrote in single-author status.

Figure 2.3: The collaboration pattern of Iranian medical scientists from 2002 to 2004
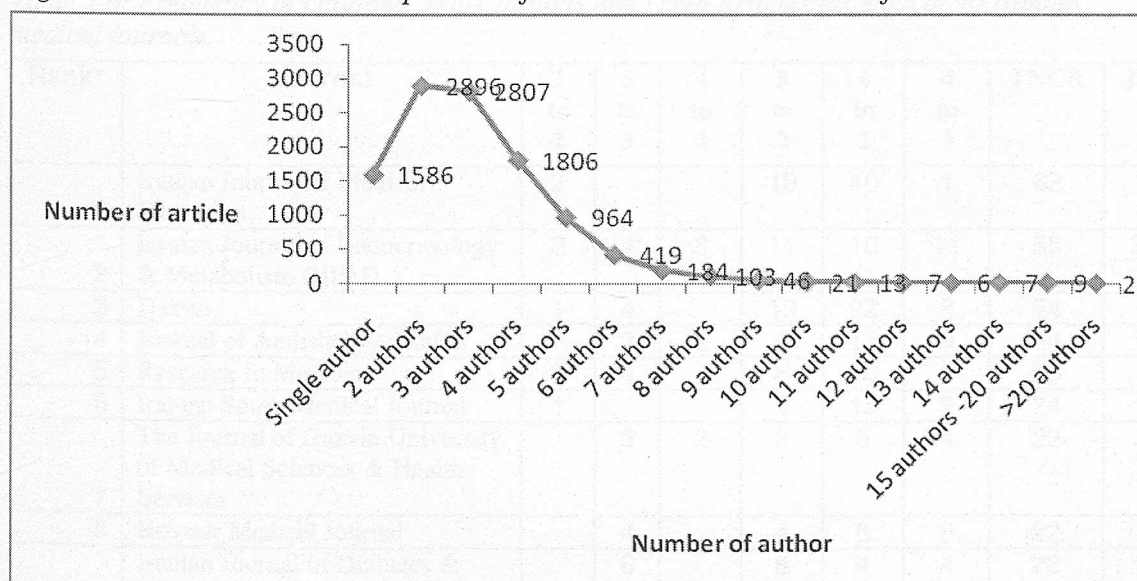
Table 2.5 shows that the contributions of triple authors are more than those of single and double authors. The multiple authorship pattern has the most productive publications, (88%) papers, while the single authorship pattern has (12%) papers. Although the trend

is toward multi-authorship, the majority of items published by Iranian medical researchers have two and three authors. The average number of authors per item was about 3 persons (in total 31436 authors being responsible for the publication of 10876 articles). Of the 10876 items designated in this study, 1,586 articles (12%) were by single authors. The number of articles written by two authors, three authors, and four authors were 2896 (26.71%), 2,807 (27.38%) and 1,806 (16.86%) respectively. Of the 10876 investigated items just two articles have more than 20 authors.

Overall the results show a trend that more researchers and medical professionals are coming together to execute the research projects and studies in medical field.

Iranian Medical Journals Citation Count

In order to determine the productivity of the journals in this study,
Table 2.6 Summarize the number of citations for each journal: 2002-2004.
Key:
02 to 02 = Citation in 2002 to articles published in 2002
03 to 03 = Citation in 2003 to articles published in 2003
04 to 04 = Citation in 2004 to articles published in 2004
03 to 02 = Citation in 2003 to articles published in 2002
04 to 02 = Citation in 2004 to articles published in 2002
04 to 03 = Citation in 2004 to articles published in 2003
TNCR=Total Number of Citations Received
JSF=Journal Self-Citation
NCA=Number of Cited Article

Table 2.6: Frequency of citations, Self-Citations and Cited Articles for each of 90 Iranian medical journals.

Rank*	Journal	2 to 2	3 to 3	4 to 4	3 to 2	4 to 2	4 to 3	TNCR	JSF	NCA
1	Iranian Journal of Medical Education	2			19	40	1	62	14	53
2	Iranian Journal of Endocrinology & Metabolism (IJEM)	3	4	8	11	18	11	55	31	32
3	Hakim	1	4		19	22	8	54	3	14
4	Journal of Andisheh Va Raftar		3	2	7	13	9	34	8	17
5	Research In Medicine	4	4		6	10	5	29	3	23
6	Iranian South Medical Journal	1			9	12	2	24	2	10
7	The Journal of Gazvin University of Medical Sciences & Health Services		9	2	3	5	4	23	1	16
8	Kowsar Medical Journal		4		4	8	6	22	2	13
9	Iranian Journal of Diabetes & Lipid Disorders		6		8	4	4	22	16	16
10	Journal of Veterinary Research	1	2	2	1	9	5	20	10	18
11	Journal of Medical Council of I.R.I.		2	1	2	10	3	18	1	12
12	Journal of Military Medicine	2		1	2	8	4	17	7	13
13	Iran J Med Sci	4		3	2	5	3	17	6	12
14	Bina Journal	1	2	1	5	5	2	16	13	10

Rank*	Journal	2 to 2	3 to 3	4 to 4	3 to 2	4 to 2	4 to 3	TNCR	JSF	NCA
15	Journal of Research In Medical Sciences of Esfahan Msuj	2	1		4	4	5	16	1	12
16	Journal of Medicinal Plants	2		1	6	5	2	16	9	14
17	Iranian Journal of Fertility & Sterility	1	2	1	1	5	4	14	8	9
18	Archives of Iranian Medicine	3	1		2	5	3	14	6	13
19	Iranian Biomedical Journal	1	2	2	3	3	3	14	3	11
20	Journal of Mazandaran University of Medical Sciences			2	4	1	6	13	2	11
21**	...									
	Total	44	66	40	197	316	165	828	249	601

*Ranked by TNCR
** The remainder is shown in appendix F.

As table 2.6 shows the Iranian Journal of Medical Education with 62 citations received took the first place, followed by Journal of Endocrinology and Metabolism with 55 citations and the Journal of Hakim with 54 citations. So far among 90 journals 7 of them did not receive any citations at all during the time period of analysis. Of total number of citations 249 (30%) are journal self citations and, of the total number of articles published from 2002 to 2004, only 601 (around 5%) articles had received citations during the time of study.

Iranian Medical Journals Impact Factor

As Bradford's law[4] predicts, a small number of journals accounts for a large percentage of what is published and even smaller percentage accounts for what is cited. In other words, there are diminishing returns in trying to cover the literature exhaustively. Careful selection is, therefore, an effective way to avoid "documentary chaos." This term, coined by Samuel C. Bradford, the former librarian of the Science Museum in London, refers to the anxiety that one feels in contemplating the information explosion, Garfield (1994).

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[4] Also known as the Pareto principle, the law of maldistribution, the law of the vital few and the principle of factor sparsity, the vital few and the trivial many, the 80/20 rule states that for many phenomena, 80% of the consequences stem from 20% of the causes. The principle was first suggested by management thinker Joseph M. Juran, who named it after the Italian economist Vilfredo Pareto, who observed that 80% of income in Italy was received by 20% of the Italian population.

Source: Trueswell, R. (1969). Some behavioral patterns of library users. The 80/20 rule. Wilson Library Bulletin, 46, 458-461.

The Immediacy Index

Table 2.7: The immediacy index of Iranian medical journals from 2002 to 2004.

Rank*	Journal	Citation 02 to 02	Citation 03 to 03	Citation 04 to 04	Immediacy Freq.
1	Iranian Journal of Endocrinology & Metabolism (IJEM)	3	4	8	15
2	The Journal of Gazvin University of Medical Sciences & Health Services		9	2	11
3	Research In Medicine	4	4		8
4	Iran J Med Sci	4		3	7
5	Iranian Journal of Diabetes & Lipid Disorders		6		6
6	Journal of Andisheh Va Raftar		3	2	5
7	Hakim	1	4		5
8	Journal of Iran University of Medical Sciences	2	1	2	5
9	Iranian Biomedical Journal	1	2	2	5
10	Journal of Veterinary Research	1	2	2	5
11	Iranian Journal of Fertility & Sterility	1	2	1	4
12	Bina Journal	1	2	1	4
13	Tanaffos	1	3		4
14	Kowsar Medical Journal		4		4
15	Archives of Iranian Medicine	3	1		4
16	Iranian Journal of Radiation Research (IJRR)		2	2	4
17	Journal of Research In Medical Sciences of Esfahan Msuj	2	1		3
18	Advances in Cognitive Science	1	2		3
19	Teb Va Tazkieh	2		1	3
20	Journal of Medicinal Plants	2		1	3
21**	...				
	Total	44	66	40	150

*Ranked by immediacy index

** The remainder is shown in appendix G.

As table 2.7 shows the total number of immediacy citations is 150 (18% of total number of citations). 40 Iranian medical journals did not receive any citation within the same

year of publication during the time period of study at all. . The Iranian Journal of Endocrinology & Metabolism (IJEM) with 15 citations and the Journal of Gazvin University of Medical Sciences & Health Services with 11 citations ranked first and second with regard to the immediacy index respectively. To reveal to what extent number of citations correlates with the number of articles, number of journal self-citation and immediacy index of 90 Iranian medical journals, an analysis of correlation was undertaken that the table below shows the result.

Table 2.8: Spearman's correlation matrix between the number of citation, number of article, number of journal self citation and immediacy index

		No of Citations	No of Articles	No of Journal Self Citation	Immediacy Index
No. Citations	Correlation Coefficient	1.000	.489(**)	.687(**)	.761(**)
	N	90	90	90	90
No. Articles	Correlation Coefficient	.489(**)	1.000	.226(*)	.376(**)
	N	90	90	90	90
No of Journal Self Citation	Correlation Coefficient	.687(**)	.226(*)	1.000	.590(**)
	N	90	90	90	90
Immediacy Index	Correlation Coefficient	.761(**)	.376(**)	.590(**)	1.000
	N	90	90	90	90

** Correlation is significant at the 0.01 level (2–tailed).
* Correlation is significant at the 0.05 level (2–tailed).

It can be seen that there is a statistically significant correlation between all correlation matrix items. The highest correlation exists between the number of citations and the immediacy of citations, which can be interpreted, as those journals with high immediacy index have more potential to receive more citation. Another interesting result is the correlation between the number of citations and the number of journal self-citations indicates journal self-citation play an important role in achieving more citation by a given journal in the field of medicine in Iran. The 30 percent of journal self-citation (249/828) is higher than the self-citation rates of all German journals in 2000, as well as in 2005, at 12 % Biglu (2006).

Iranian Medical Journals Ranking According to Impact Factor

In section two, it was explained that the impact factor measures the frequency with which the average number of articles in a journal have been cited in particular year. It helps evaluate a journal's relative influence within a field.

As far as was possible the impact factor for the year 2002 and 2003 was calculated for some of the Iranian medical journals. The formula used in table 2.8 was based on the total number of citation received by a journal in a given year for the articles published in the two previous years divided by the total number of articles published by the journal in the same two previous years. Tables' 2.9 and 2.10 show the results.

Table 2.9: Ranked list of Iranian medical journals according to their corresponding impact factor in 2002.

Rank*	Journal	No of Art. Published in 2000+2001	Cit. Received in 2002 for Articles published in 2000+2001	Impact Factor (2002)
1	Journal of Andisheh Va Raftar	59	16	0.27
2	Hakim	83	14	0.17
3	Teb Va Tazkieh	85	14	0.17
4	Yakhteh	56	9	0.16
5	Physiology And Pharmacology	46	6	0.13
6	Iranian Journal of Endocrinology & Metabolism (IJEM)	166	20	0.12
7	Iranian Journal of Medical Education	27	3	0.11
8	Iranian Journal of Fertility & Sterility	65	7	0.11
9	Journal of The Faculty of Medicine	236	24	0.10
10	Iranian Journal of Diabetes & Lipid Disorders	10	1	0.10
11	Scientific Medical Journal	41	4	0.10
12	Behboud	73	7	0.10
13	Journal of Shahid Sadoughi University of Medical Sciences & Health Services	193	18	0.10
14	Journal of Mazandaran University of Medical Sciences	86	8	0.10
15	Journal of Medical Council of I.R.I.	86	8	0.10
16**	...			

*Ranked by Impact Factor

** The remainder is shown in appendix H.

The results of table 2.9 indicate that Journals of Andisheh Va Raftar, Hakim, Teb Va Tazkieh and Yakhteh ranked first to fourth, respectively. It was not possible to calculate the impact factor for the remaining journals (39 titles) since they did not receive any citations during the time under investigation.

Table 2.10: Ranked list of Iranian medical journals according to their corresponding impact factor in 2003.

Rank*	Journal	No of Art. Published in 2001+2002	Cit. Received in 2003 for Articles published in 2001+2002	Impact Factor (2003)
1	Iranian Journal of Diabetes & Lipid Disorders	30	19	0.63
2	Hakim	86	27	0.31
3	Iranian Journal of Endocrinology & Metabolism (IJEM)	171	38	0.22
4	Iranian Journal of Medical Education	106	20	0.19
5	Yakhteh	48	9	0.19
6	Koomesh	43	8	0.19
7	Journal of Andisheh Va Raftar	74	13	0.18
8	Journal of Medicinal Plants	42	7	0.17
9	Iranian Journal of Basic Medical Sciences	57	9	0.16
10	Teb Va Tazkieh	79	11	0.14
11	Journal of Mazandaran University of Medical Sciences	95	10	0.11
12	Journal of School of Public Health & Institute of Public Health	32	3	0.10
13	Scientific Journal of Kurdistan University of Medical Sciences	65	6	0.10
14	Bina Journal	98	9	0.10
15	Journal of Mashhad Dental School	45	4	0.09
16**	...			

*Ranked by Impact Factor

** The remainder is shown in appendix I.

The results of table 2.10 show that the Iranian Journal of Diabetes & Lipid Disorders followed by the Hakim, the Iranian Journal of Endocrinology & Metabolism (IJEM), the Iranian Journal of Medical Education and the Yakhteh scored first to fifth, respectively. It was not possible to calculate the impact factor for the remaining journal (25 titles) since they did not receive any citations during the time under investigation.

In order to be able to calculate the impact factor index for 2004 for the all of the 90 medical journals a modified formula (MIF) has been employed by extending the citation window. The formula here is based on citations received by all articles published in 2002-2003 from articles published in 2002-2004, as illustrated in the following formula.

$$\frac{\sum\limits_{2002/2003}^{2004} Citations}{\sum\limits_{2002}^{2003} Articles} = MIF$$

The restriction of the citation windows to two years may be considered a weakness in our methodology in view of the average number of citations articles receive in a year. However, the immediacy index shows that the percentage of current year citations (citations in 2002 to articles published in 2002, citation in 2003 to articles published in 2003) compared with total number of citations during the applied two years is noticeable. Therefore, the low number of citations is not a reflection of the relatively narrow citation window; rather it shows that overall citations to internal journals are low. The possible socio-cultural reasons for this are explored later in this study.

Table 2.11: Ranked list of Iranian medical journals according to their corresponding impact factor in 2004.

Rank*	Journal	No of Art. Published in 2002+2003	Cit. Received in 2004 for articles published in 2002+2003	Modified Impact Factor (2004)
1	Hakim	97	54	0.56
2	Iranian Journal of Medical Education	112	62	0.55
3	Iranian Journal of Endocrinology & Metabolism (IJEM)	91	47	0.52
4	Iranian South Medical Journal	51	24	0.47
5	Iranian Journal of Diabetes & Lipid Disorders	55	22	0.40
6	Journal of Andisheh Va Raftar	84	32	0.38
7	Journal of Iranian Anatomical Sciences	40	13	0.33
8	Iranian Journal of Radiation Research (IJRR)	27	8	0.30
9	Iranian Biomedical Journal	46	12	0.26
10	Research In Medicine	116	29	0.25
11	Kowsar Medical Journal	91	22	0.24
12	Journal of Medicinal Plants	67	15	0.22
13	Journal of Medical Council of I.R.I.	86	17	0.20
14	Yakhteh	48	9	0.19
15	Govaresh Journal	49	9	0.18
16**	...			

*Ranked by Impact Factor

** The remainder is shown in appendix J.

Analyses of the results in table 2.11 have revealed that the average number of citation per article based on the formula for the calculation of MIF in 2004 is about 0.09.

It can be observed from table 2.11 that the Hakim Journal with a score of 0.56 ranked first, and the Iranian Journal of Medical Education, the Iranian Journal of Endocrinology & Metabolism (IJEM), the Iranian South Medical Journal, and the Iranian Journal of Diabetes & Lipid Disorders ranked second to fifth, respectively. Seven journals did not receive any citations during the period of investigation.

The mutual citations ratio is an important measure of the impact of one journal on another to the citations of the later to the former. Correlation analysis indicates a relatively moderate relationship (0.4) between giving and receiving citations among Iranian medical journals. The table 2.12 lists Iranian medical journals according to the number of citations received from other Iranian medical journals.

Table 2.12: Number of input citations of Iranian medical journals from 2002-2004

Rank*	Journal	Input citations
1	Iranian Journal of Endocrinology & Metabolism (IJEM)	44
2	Iranian Journal of Diabetes & Lipid Disorders	41
3	Tabib-E-Shargh	36
4	Behboud	23
5	Iranian Journal of Fertility & Sterility	18
6	Iranian Journal of Medical Education	18
7	Journal of Mazandaran University of Medical Sciences	18
8	The Journal of Gazvin University of Medical Sciences & Health Services	17
9	Payesh	16
10	Journal of Babol University of Medical Sciences (Jbums)	16
11	Journal of Iranian Anatomical Sciences	16
12	Bina Journal	15
13	Journal of Shahid Sadoughi University of Medical Sciences & Health Services	15
14	Koomesh	15
15	Journal of Military Medicine	15
16**	...	

*Ranked by number of citations received.

** The remainder is shown in appendix K.

With the exception of Hakim journal, which took first place based on impact factor in 2004 and which also has more of a recipient role than that of a donor, it can be seen that the two journals which had high impact over 2002-2004, also ranked first and second

according to the number of citations they received from other Iranian medical journals. Revealing the extent to which such relationships exist may stimulate editorial broads and reviewers to influence Iranian authors' citation practice.

The data accumulated in chapter 2 reveals that only 828 citations were made to the 10876 articles published in Iranian Medical Journals between 2002 and 2004. This is equivalent to 92.5% of the citations being to foreign sources.

The above discussion is based on a citation rate of 7.5% to internally published sources. Investigation of international publication rate in Iranian medical research (see chapter 4) compared with Brazilian medical articles reveals that Brazilian authors tend to select Brazilian sources 86 % of the time, Cunha-Melo, Santos and Andrade (2006). Another study conducted by Salomon, Sagasti and Sachs (1994) shows that essentially 22% of third world scientists cite references from non-mainstream scientific literature. These figures suggest that the internal rate of citation by Iranian medical researchers is low in comparison with other non-English speaking countries. The possible reasons for this difference were considered in the light of feedback received from the survey analysis discussed in chapter 6.

Intriguingly, a significant proportion of those who responded to the survey suggested that the low rate of citation to internal sources was due to the low quantity of internal publications. To investigate this suggestion, 15 subjects were chosen for further analysis.

Subject Production and Citation Count

To compare the distribution of citation within subjects, the required information of published articles in 15 categories between 2002 and 2003 has been extracted from the database and their received citations in 2004 have been searched and viewed to see whether or not the articles published in 2004 have used or cited articles which have been published between 2002 and 2003. The corresponding results are shown in table 2.13

Key:

NA in 02=Number of published articles in 2002
02 to 02 = Citation in 2002 to articles published in 2002
NA in 03=Number of published articles in 2003
03 to 03 = Citation in 2003 to articles published in 2003
03 to 02 = Citation in 2003 to articles published in 2002
04 to 02 and 03 = Citation in 2004 to articles published in 2002 and 2003
NCA=Number of Cited Article
TNCR=Total Number of Citations Received

Table 2.13: Number of articles and citations for 15 selected subjects.

Subject	NA in 02	02 to 02	NA in 03	03 to 03	03 to 02	04 to 02 and 03	NCA	TNCR
Chest tuberculosis	5	0	4	0	0	1	9	1
Blood sugar	9	0	8	1	0	0	17	1
Heart surgery	5	0	5	0	0	0	10	0
Depression	4	1	2	0	1	1	6	3
Caesarean	22	4	24	0	0	3	46	7
Thalassemia	28	0	36	0	0	4	64	4
Amblyopia	1	0	1	0	0	0	2	0
Cholesterol	7	0	4	0	0	0	11	0
Helicobacter pillory	13	1	21	0	1	2	34	5
Asthma	11	0	5	0	1	1	16	2
Epilepsy	9	0	8	0	0	0	17	0
Haemodialysis	1	0	1	0	0	2	2	2
Breast cancer	9	0	10	0	0	1	19	1
Schizophrenia	2	0	5	0	1	1	7	2
Scrupulous disease	8	0	4	0	0	1	12	1
Total	134	6	138	1	4	18	272	29

Of the 272 papers published in 15 subjects, only 29 citations were made, an average of 0.1 citations per paper. The result of the total journal citation evaluation being about 0.07 citations per article (601/10876), it can be concluded that the low rate of co-citation might not be affected by the rate of publication, as respondents to the survey analysis had suggested.

The most cited articles

Table 2.14: The top 7 most cited articles

Article	Authors	Times cited
Study of Mental Health Status of Individuals Above 15 Years of Age In Islamic Republic of Iran In The Year 1999	NOUR BALA A.A., MOHAMMAD K., BAGHERI YAZDI S.A., YASAMI M.T.	26
An epidemiological study of psychiatric disorders in Iran (year 2001)	MOHAMMADI M.R., DAVIDIAN H., NOUR BALA A.A., MALEK AFZALI H., NAGHAVI H.R., POUR ETEMAD HAMID REZA, BAGHERI YAZDI S.A, RAHGOZAR M., ALAGEH BAND RAD J., AMINI HOMAYOUN, RAZAGHI O.M.	12
Epidemiology of mental disorders in urbanized areas of Natanz	OMIDI A., TABATABAI A., SAZVAR S.A., AKKASHE G.	9
Study in quality of education status of medical students in basic sciences courses Hamadan university of medical sciences 1989-94	YOUSEFI MASHOUF R., SAEEDI-JAM M.	8
Evaluation of dried blood spot TSH-IRMA kit produced for the first time in the I.R. Iran	NAJAFI ASADOLLAHI R., MOHARAMZADEH M., OWLYA A., POURABDI M., GHAFOURIAN H., ORDOUKHANI A., HEDAYATI M., MIR MIRAN P., HAJI POUR R., AZIZI F., MAHDIANI B	7
Bone mineral density variations in 20-69 yr. Population of Tehran Iran	PAJOUHI M., HOSSEIN-NEZHAD A., SOLTANI A., MAGHBOOLI Z., MADANI F.S., LARIJANI B.	6
Epidemiological survey of suicide through the forensic medical center in the province of Kerman	YASAMI M.T., SABAHI A., MIRHASHEMI S.M., SEIFI SH., AZAR KEYVAN P., TAHERI M.H	5

The following figure shows the distribution of 828 citations received by 601 articles published in domestic journals from 2002 to 2004.

Figure 2.4: Distribution of 828 citations within 601 articles which received citations.
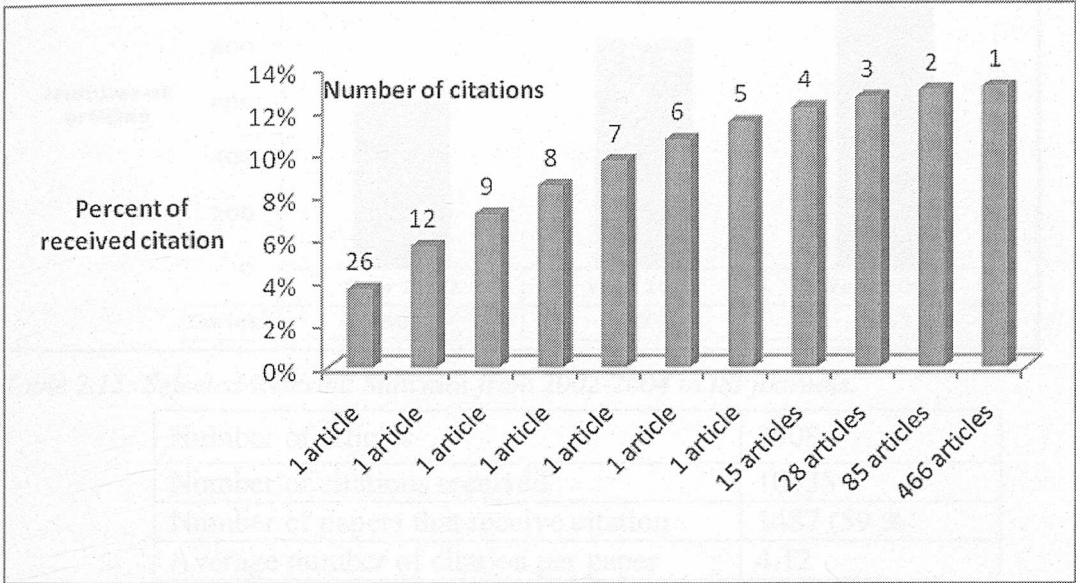
It is interesting to see that just 1% articles which received citations account for 11 percent of total citations. The percentage of articles with 4, 3, 2 citations is about 13 percent. Of 601 articles which received citations, 446 articles get only 1 citation.

2.3 Comparison of Iranian domestic medical articles vs. articles published in ISI journals

The Impact factor findings described in section 2.11 led to an exploration of the status of Iranian medicals articles indexed in the SCI databases during the same time period to acquire a comprehensive overview about Iranian medical publication status.

Queries about the term "Iran" in address or affiliation field refined by publication year to 2002-2004 were made and the records were observed and analysed from different aspects for removing duplicate publication. Finally the search yielded entries 2508 articles. Figure 2.5 summarizes the results.

Figure 2.5: Distribution of articles published by Iranian medical researchers in journals indexed in SCI from 2002-2004
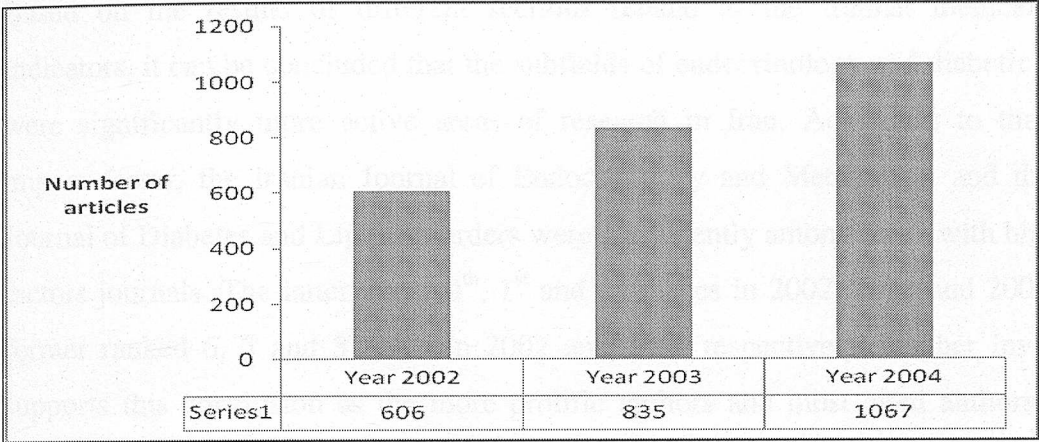
Table 2.15: Selected Relevant Statistics from 2002-2004 in ISI journals.

Number of articles	2508
Number of citations received	10335
Number of papers that receive citation	1487 (59 %)
Average number of citation per paper	4.12

The figures of the table show the growth rate of publication from Iran in SCI databases. Articles published in journals covered by the SCI received 10335 citations. In other words, the average number of citations in the SCI per article is about 4.12. Of 2508 indexed articles in SCI 1021 (40%) had not received any citations by the time of analysis (August 2008). If the citation per paper for original articles indexed in SCI is taken into account, the average number of citation per original article is more than 6 citations. This number for review articles is 10.

Table 2.16: Selected Relevant Statistics from 2002-2004 in domestic medical journals.

Number of articles	10876
Number of citation received	828
Number of papers that receive citation	601 (5.5 %)
Average number of citation per paper	0.076

A comparison between articles indexed in SCI and those published in domestic ones with regard to the number of articles which received citations and citation per article, indicate a large difference. 59 percent of articles indexed in SCI had received citations and more than 4 citations per paper for them is far from 5.5 percent of articles being cited in domestic medical journals. The average number of citations per paper for domestic medical articles is only 0.08.

2.4 Summary and Conclusions

Based on the results of different sections related to the Iranian medical journals indicators, it can be concluded that the subfields of endocrinology and diabetic disorders were significantly more active areas of research in Iran. According to the journals impact factor, the Iranian Journal of Endocrinology and Metabolism and the Iranian Journal of Diabetes and Lipid Disorders were consistently among those with high impact factors journals. The latter took 10th, 1st and 5th places in 2002, 2003 and 2004 and the former ranked 6, 3 and 3 between 2002 and 2004 respectively. Further investigation supports this conclusion as the more prolific authors and most cited authors (such as authors 1, 2 and 5) are active in the subfield of endocrinology and its related matters. Furthermore, taking into account the immediacy index as the indicator of the recency of citation, it can be seen that the Iranian Journal of Endocrinology & Metabolism (IJEM) and the Iranian Journal of Diabetes & Lipid Disorders took first and fifth places, respectively.

The Hakim Journal covering all medical subjects is one of the influential journals in Iranian medical communication as its received citations increased from 14 in 2002 to 54 in 2004. The impact factor also indicates this, since this journal ranked first in 2004 and took second place in 2002 and 2003.

Another influential journal is the Journal of Andisheh Va Raftar, focusing on behavioural subjects, which had received 61 citations and ranked first place in 2002 and took 4th and 6th places in 2003 and 2004 respectively.

Another finding of the citation analysis of Iranian medical journals is that author and journal self-citations play an important role in the citation practice of medical researchers. The results showed that over 30% of citations were author self-citations and over 40% of citations to journals were journal self-citations. Iranian medical researchers' perceptions of the relative value of self- citations is a factor that may contribute to this finding. On the other hand, it could be that there are low number of specialized journals to serve a specific subfield and also a low number of leading persons in certain subject areas.

Overall citations to internal articles were found to be lower than in other countries and in similar studies. This finding prompted the search for possible socio-cultural reasons explored later in chapter 6.

3.1 Introduction

Chapter 3:

A new look
at the role of disciplines in
citation analysis

3.1 Introduction

Different groups with various purposes are interested in journal ranking, such as librarians, publishers, scientists and science evaluators. For instance, librarians are interested in journal evaluations based on local circulation data and impact factor for selection and deselection purposes, Van Hooydonk (1995). Researchers who need to know which journals to choose in a given subfield for the purpose of individual subscription, writing or submitting articles for publication. Publishers and editors may account significant relationship between high citation rate and successful editorial practice and policy. Information brokers are concerned about subscription data to find out sources that have potential for satisfying the customers' information needs. Universities and research institutions may be interested in journal impact to evaluate their researchers' visibility. Science evaluators want objective criteria for evaluating the past performance of individuals, departments and institutions, Garfield (2003).

Currently the Impact Factors, as introduced by Garfield (1979), of around 7500 scientific journals in different specialist disciplines are readily available through the ISI. To overcome subscription funds limit, libraries tend to select journals with high Impact Factor (IF).

The journal IF, as defined by the ISI calculates values for a journal's IF by dividing (a) the number of citations received in the current year by papers published in the journal in the previous two years, by (b) the number of papers published in the journal in the previous two years. In effect, the IF is a measure of the number of citations received in a given year by the "average" paper in a given journal.

The IF of a journal is used in the literature as a measure of expected citations for each of the papers published in it is as an indirect measure or proxy of their quality and impact. However, this point is controversial among research performance evaluators.

The value of the impact factor is affected by different factors such as subject area, type of documents or length of the citation measurement window. The skewed distribution of citations within a journal is another shortcoming of the impact factor since a few articles receive much higher numbers of citations. Seglen (1997) suggests that much of the variation originates from the "nature of the research area" that any given journal covers, and from the length of articles typically published in a journal (long papers and review

articles tend to receive more citations), as well as from the "quality of the typical submission" cited in Borgman and Furner (2002).

On the other hand, the validity of the impact factor is supported by the strong negative correlation showed between the value of the IF and the level of citedness, Van Leeuwen, Moed and Reedijk (1999). In other words, taking into account the numbers of uncited articles in a given set of journals affects their impact factor and the positive correlation between citation count, publication productivity, peer ratings, and awards of grants and prizes documented by many studies (see Bayer and Folger 1966 and Cole and Cole 1967).

Finally, a lack of correlation between observed and expected citations has been reported by different authors such as Seglen (1992). Something similar happens between Peripheral and Core countries papers where peripheral (undeveloped or developing) countries' papers are less cited than those of central countries. In connection with the information given in this section, the following sections aim to describe methodological procedures which have been undertaken to overcome some limitations of ISI's impact factor.

Difficulties of impact factor

Many studies have showed that a higher impact factor has been described for "reviews" than for other document types, and "basic research" receives higher impact factors than "applied science". Thus, research by Woodward and Hensman (1976) has shown that review journals tend to have higher impact factors. Van Raan and Hartmann (1987) developed a measure; termed "comparative impact," which graphically depicts the citation record for each type of publication in a journal, e.g., letters, editorials, and "normal" articles and a differentiation between them based on impact factor can be made.

Furthermore, calculation of IF based on two -year citation windows is judged too short to extract the real impact of publications in "slow" growing disciplines Bordons, Fernandez and Gomez (2002). On the other hand, impact factor when based on total citations received is in favor of the older, larger, or more frequently published journals, Romano and Ratnatunga (1996). Scanlan (1987) has offered a harsh criticism of impact factor from the perspective of publishers, noting that the type and length of articles and a research field's size, style, and citation tradition, as well as journal self-citations can

influence impact factor. Consequently, impact factors should be used with caution and comparisons should be limited to comparable units. The wide use of the IF, in spite of its weaknesses, has provoked information science researchers to seek to improve the algorithm for the calculation of the IF or to develop alternative journal citation measures altogether.

Modifications of journal rankings based on impact factor citation windows

Asai (1981) introduced an "Adjusted Impact Factor" and found that more precise statistics could be considered provided that the period- count is based on months rather than a year. He proposed to count a weighted sum of citations per month over a time period of four years.

The three-year citation window based on Glänzel and Schoepflin' study (1995) claimed to show a good compromise between the fast obsolescence of technology oriented literature and of the slowly ageing theoretical subjects and mathematical matters in physics.

Sombatsompop, Markpin and Premkamolnetr (2004) introduced the cited half-life into the IF calculation as an alternative to setting the citation window at an absolute number. The Cited Half-Life impact factor formula is based on replacing the two-year citation window with the journal's cited half-life in the IF calculation.

Modifications of journal rankings based on averaging impact factor

With regard to yearly fluctuations of journal ranking, Christenson and Sigelman (1985) averaged impact factor of 56 political science and 61 sociology journals for three years for the purpose of comparison with the subjective rankings studies of political science journals and sociology journals conducted by Giles and Garand (2007) and Glenn (1971), respectively. Feingold (1989) averaged IF data from 1985 to 1986 and ranked 52 journals in eight subfields of social science psychology (each subfield journals were ranked). A similar approach was undertaken by Colson (1990) to rank 35 public administration journals to compensate for yearly fluctuation.

Whilst Garfield's Impact Factor ranks journals by the number of citations received, it does not take into account the field of study from which that citation has been received. Baldi and Hargens (1998) stated that the citation process could be considered a dynamic

relationship between the citing and cited document. "A cited document cannot exist without the existence of a citing document." 'Citing documents' do not exist in a vacuum. They only have relevance when put into the context in which they are cited. This context is absent in Garfield's Impact Factor measure / index.

When ranking a list of journals within a subject discipline, it is inadequate to only compare the IF without consideration of subject bias.

Modifications of journal rankings struggling to triumph over subject and field biases

Hirst (1978) introduced "Disciplinary Impact Factor" (DIF) to rank journals within a subject discipline. His idea is based on the average number of times a journal was cited in a sub-field rather than the entire SCI database. Since knowledge of the core journals is a prerequisite to determine the core journals of a given field, the result of different studies may differ due to the baseline of calculation. Hirst himself pointed out the subjectivity of this process.

His formula is described as follow:

DIF=nc/ns, where nc is the number of citations of a given journal (J) by journals determined as core(C) over a time period tc and ns is the number of citable items published by (J) over a time period ts.

Vinkler (1987) introduced the "citation strategy indicator," which relates a journal's impact factor to the mean impact factor of other journals in its specialty. Vinkler (1991) also introduced a new indicator so-called "Standard Journal Impact" (SJI) as a comparable impact indicator for journals in different subfields. The SJI proposed by Vinkler (1991) "was based on the number of citations obtained in year Y, where the impact factor was calculated, to papers published in a single X year, prior to year Y, divided by the number of papers published in year X. The number of years used for SJI index was then calculated using a period which lasted from the maximum SJI value to its half", cited by Sombatsompop, Markpin and Premkamolnetr (2004). He stated that the main reason for the lower impact factor journals was mainly caused by lower extent of the application of their results by other subfields.

Ramírez, García and Río (2000) proposed a renormalized IF which was calculated based on the maximum IF and median IF of each category. The applied methodology was

taking from each category listed in the JCR the maximum value of the impact factor (Fmax) and the median impact factor (Fmed). For a given journal their renormalized impact factor formula was as follow:

$$Fc = (F - Fmed)/(Fmax - Fmed)$$

The character c indicates that Fc is category dependent. In case of a given journal listed in more than one category, the following additional formula was applied: $Fr = \dfrac{\sum Fci}{n}$.

Fci is the indication of for each category so the sum is performed over the n categories where the journal was listed. This quantitative parameter allows the direct comparison among different research areas without introducing other considerations. The main limitation of Fr (Renormalized impact factor) is the absence of a lower bound, which made difficulties for comparison between journals with Fr=0.

Pudovkin and Garfield (2004) suggested a rank normalized impact factor to be calculated across subject categories as below:

Rank-Normalized Impact Factor (rnIFj) = (K - Rj + 1)/K, where Rj is the JCR rank of journal j and K is the number of journals in its specialty category.

JCR displays each category journals in descending order based on their corresponding rank. For example, the journal Genetics is the 17th from the top in the JCR category for Genetics & Heredity. In 2000, this category contained 114 journals. Thus, rnIF Genetics = (114-17+1)/114 = 0.860. The value of rnIF is very easy to interpret: if a journal j has rnIFj = X it means that 100% x (1 –X) of the journals in its JCR category have higher IF values. So, for the journal Genetics 14% of the journals in its category have higher IFs. According to Pudovkin and Garfield (2004) the top journals in each subject category have rnIF equal to 1.0 and the median journals will have rnIF close to 0.5. When a journal is assigned by the JCR to two or more different categories we average the rnIF values.

Whilst the rnIF can be used as a method of reducing bias between disciplines, it does not address the problem of differences within each discipline and it just convert the JCR rank of a given journal to the range 0 to 100 percent.

Similarly, the same problem was approached by Sombatsompop et al. (2005) who introduced a new mathematical index, the "Impact Factor Point Average" with the specific aim to allow across-field comparison of IF.

Whilst measures allowing comparisons between disciplines are useful, they suffer from a number of drawbacks such as being complicated to be used by librarians and the selection of core specialist journals based on their level of specialism.

Whilst the number of citations received per article is a readily available measure, it does not provide any discipline-specific information that would allow the librarian to determine which of the journals within the field of, for example, Dermatology are used most often within that discipline.

Utilizing Garfield's (1994) Impact factor measure assumes that the citations received by a journal relate directly to its specialist discipline. However, in the course of this study it became clear that this is an inadequate method and better measures need to be developed.

Economic constraints require libraries to prioritize their journal subscriptions. In order to best serve their clients, they need to maximize their usefulness whilst minimizing the number of journal titles purchased. For example, if a medical library serving a department specializing in Dermatology could determine that of the 29 journals serving this discipline, 4 titles receive 40% of all citations within the field of Dermatology; this would allow the library to maximize its return on purchases.

On the other hand, the impact factor would be less useful to an individual researcher in the Dermatology field since s/he is most likely to be looking for a journal that attracts a large proportion of readership from within the field of Dermatology.

At first glance, this may appear to be an academic distinction. However, it will be shown that when each of these perspectives is addressed separately, this can result in significantly different rankings in journals within a particular discipline.

Consider the following two fictitious journals. Journal A publishes ten articles per week on the subject of Pharmacology and Journal B publishes 10 articles per month on cardiovascular disease.

Table 3.1 shows the Impact factor of these Journals, based on the number of articles and the number of citations received.

Table 3.1: Impact factor of two fictitious journals

	Articles published	Citations received	Impact Factor
Journal A	1040	1000	0.96
Journal B	240	500	·2.08

Based on their Impact Factors, it would appear that the quality of articles published in Journal B is superior to that published in Journal A. However, the latter has received twice as many citations as the former. Therefore, in absolute terms, over the previous two years, Journal A has received twice as many citations, which could be argued to mean that it has been more influential, even though its Impact Factor is less than half of journal B. However, the average quality of each article in journal B may be considered to be greater than journal A. In many cases decision makers are interested in the overall influence of journals rather than the average quality of articles in that journal.

A useful analogy may be to compare countries per capita income (GDP) with their degree of international influence.

According to the World Bank in 2006 Luxemburg ranked first with a per capita income of $102,000. The United States, on the other hand, ranked forth with $46.000 per capita. However the Gross National Income (GNI) of these countries was $42bn and $ 13,194bn, ranking the 65th and first respectively.

Similarly the number of citation received by a journal can be considered to be its level of influence, whilst the impact factor is similar to the per capita GDP, indicating the average number of citation per article.

From the above example, we conclude that factoring the number of articles per journal into a measure of journal quality can be misleading and may not be necessary. This argument is further developed below to justify the new index being introduced here.

3.2 Development of Two Proposed Alternative Measures for Intra-Disciplinary Comparisons

The limitation of the Garfield (1994) impact factor being addressed in this study is in relation to its applications for the ranking of journals in a particular discipline. Using the above A&B journals, table 3.2 serves to illustrate the point.

Table 3.2: The detail of A and B journals

Journal A (Pharmacology)					
Article citation rankings	Articles published	Citations received	Impact Factor	Total Citations in field	The Discipline Proportion (Share) Index (DPI)
Cardiovascular Agents	400	700	1.75	2000	0.35
Endocrine Agents	430	200	0.47	400	0.5
Toxicology	210	100	0.48	300	0.33
Total	1040	1000	0.96		
Journal B (cardiovascular)					
Cardiovascular Agents	50	60	1.20	2000	0.03
Cardiovascular Diseases	90	350	3.89	10000	0.035
Cardiovascular Diagnosis	100	90	0.90	500	0.18
Total	240	500	2.08		

Both of the above journals share a common interest in the field of 'cardiovascular agents.' If we were to only consider the impact factor of these articles, Journal A would have a higher GIF in this discipline than journal B (1.75 vs. 1.20). However, Journal A's articles on cardiovascular agents have received 700 citations in comparison to the 60 citations received by journal B. The newly developed index discussed in this section addresses this issue. Later, the practical applications and implications of this measure are discussed.

The example in the above section served to demonstrate that the Garfield Impact Factor (GIF) does not effectively distinguish between the overall impact of a journal and its impact in relation to a particular discipline. This difference is important to both librarians and individual researchers who are interested in procuring journals for use within a particular discipline. As the example shows, there is currently no measure to

indicate that Journal B, in spite of its lower GIF, receives a great share of citations in the field of Cardiovascular agents. Therefore, for the librarian and the researcher interested in this particular field, it would be more efficient, and possibly more cost-effective to buy the Journal with the lower GIF and higher index related to the specific discipline. This problem has been addressed previously by other researchers. Hirst (1978) has proposed a Discipline Impact Factor (DIF). This is similar to GIF which measures the average number of times a paper in a given journal is cited, except that DIF measures the number of times a paper in a given journal is cited in the core literature of the given discipline. Since knowledge of the core journals is a prerequisite for the calculation of DIF, depending on the choice of core journal (baseline) journals would be ranked differently. Another limitation of both DIF and GIF is that for ranking purposes, average citations per article are used. In other words, the number of citable items are figured in the calculations (denominator). However, here, it is argued that neither librarians nor individual researchers are interested in 'average' impacts, rather, they are interested in 'value for money' in terms of the extent to which a journal, irrespective of the number of articles contained within it, addresses issues related a particular discipline of interest.

It is also argued here that the kind of information (index) required by librarians is different from those of researchers. The difference arises because libraries are interested in maximising coverage for a particular discipline such that the highest number of researchers within that discipline will make use of the resource.

On the other hand, individual researchers are interested in the level of specialism of a particular journal such that the highest number of citations are received by the journal from all articles published within their particular discipline.

The new indices proposed here, the Discipline Proportion Index (DPI) and the Discipline Specialism Index (DSI) seek to address the different needs of these two target groups respectively.

The Discipline Proportion (Share) Index (DPI)

This index was developed to address the need of librarians for an effective measure of the share of citations that a journal receives from articles in a particular discipline.

The DPI is defined as the proportion of the total citations to a particular discipline (from all journals) that is received by a particular journal:

DPI =	*No. of citations from a particular discipline received by articles in a particular journal from a given time period*
	Total number of citations given to that discipline by all journals in the same given time period

Applications of DPI

The discipline of Dermatology (as a sample) has been used here to illustrate the application and the merits of DPI. One of the advantages of this index is that the required data for calculation it is already available in the ISI database. The required data were retrieved from the online database of Web of knowledge on October 2007 for citations received for articles published from 2005 through to 2006 by December 2007.

Table 3.3 shows a list of the 29 Journals that have been classified by ISI to belong to the Dermatology discipline, along with data relating to their DPI.

Table 3.3: DPI-related data (for citations received for articles published from 2005 through to 2006 by December 2007) for the 29 Dermatology Journals (from ISI)

Journal	No of Dermatology citations received (NDR)	DPI (% of All Dermatology citations)	Cumulative %
British journal of dermatology	1270	15.3%	15.3%
Journal of the American academy of dermatology	1100	13.3%	28.6%
Journal of investigative dermatology	998	12.0%	40.6%
Archives of dermatology	755	9.1%	49.8%
Dermatology	458	5.5%	55.3%
Dermatologic surgery	322	3.9%	59.2%
Journal of the European academy of dermatology and venereology	314	3.8%	63.0%
International journal of dermatology	305	3.7%	66.6%
Experimental dermatology	286	3.5%	70.1%
Clinical exp dermatology	274	3.3%	73.4%
Contact dermatitis	270	3.3%	76.7%
Journal of cutaneous pathology	187	2.3%	78.9%

Journal	No of Dermatology citations received (NDR)	DPI (% of All Dermatology citations)	Cumulative %
Burns	182	2.2%	81.1%
Acta dermato-venereologica	171	2.1%	83.2%
J of dermatological sciences	169	2.0%	85.2%
European journal of dermatology	162	2.0%	87.2%
Journal of dermatology	156	1.9%	89.1%
Pediatric dermatology	155	1.9%	90.9%
American journal of dermatopathology	154	1.9%	92.8%
Cutis	103	1.2%	94.0%
Annales de dermatologie et de venereologie	81	1.0%	95.0%
Am j clinical dermatology	76	0.9%	95.9%
Clinics in dermatology	69	0.8%	96.8%
Hautarzt	67	0.8%	97.6%
Dermatologic clinics	63	0.8%	98.3%
Seminars in cutaneous medicine and surgery	49	0.6%	98.9%
Mycoses	43	0.5%	99.4%
Leprosy review	27	0.3%	99.8%
Journal of cutaneous medicine and surgery	20	0.2%	100.0%
Totals	8286	100%	

The above table shows that using the DPI index, a librarian can determine that the top four Journals have received almost 50% of all Dermatology citations. In other words, a library can provide 50% of the information needs of its Dermatology specialists by subscribing to only 4 of the 29 Journals classified as specializing in Dermatology. Another analysis by the researcher based on 35 years data with regard to the most cited internationally published journals by the Iranian dermatologists indexed in SCI from 1874-2008 confirm that of 2043 citations to dermatologic journals the top four recommended journals by the DPI were ranked first to fifth.

Discipline Specialism Index (DSI)

This index was developed to address the need of individual researchers for an effective measure of the extent to which the citations received by a journal reflect their particular specialism.

The DSI is defined as the proportion of the total citations to a particular Journal which relate to articles in a particular discipline:

DSI =	*No. of citations from a particular discipline received by articles in a particular journal from a given time period*
	Total number of citations given to that Journal in the same given time period

Applications of DSI

To allow comparison of this index with DPI, the discipline of Dermatology has again been used here to illustrate its applications and merits. Again, one of the advantages of this index is that the data that is required to calculate it are already available in the ISI database.

Table 3.4: DSI-related data (for citations received for articles published from 2005 through to 2006 by December 2007) for the 29 Dermatology Journals (from ISI)

Journal	No of citation	No of Dermatology citations received (NDR)	DSI (% of citations that are Dermatology)
Dermatology	648	458	70.7%
Cutis	157	103	65.6%
Pediatric dermatology	241	155	64.3%
Contact dermatitis	425	270	63.5%
Journal of cutaneous medicine and surgery	32	20	62.5%
Annales de dermatologie et de venereologie	132	81	61.4%
Seminars in cutaneous medicine and surgery	80	49	61.3%
American journal of dermatopathology	253	154	60.9%
Archives of dermatology	1241	755	60.8%
Journal of dermatology	258	156	60.5%
Journal of the european academy of dermatology and venereology	528	314	59.5%
Acta dermato-venereologica	292	171	58.6%
Journal of the american academy of dermatology	1966	1100	56.0%

Journal	No of citation	No of Dermatology citations received (NDR)	DSI (% of citations that are Dermatology)
European journal of dermatology	293	162	55.3%
Hautarzt	123	67	54.5%
Dermatologic surgery	609	322	52.9%
International journal of dermatology	578	305	52.8%
Clinical exp dermatology	521	274	52.6%
Leprosy review	53	27	50.9%
British journal of dermatology	2516	1270	50.5%
Journal of cutaneous pathology	417	187	44.8%
Clinics in dermatology	164	69	42.1%
Burns	434	182	41.9%
Experimental dermatology	688	286	41.6%
Dermatologic clinics	153	63	41.2%
Am j clinical dermatology	195	76	39.0%
J of dermatological science	497	169	34.0%
Journal of investigative dermatology	3014	998	33.1%
Mycoses	275	43	15.6%
Totals		8286	

The above table shows that using the DSI index, an individual Dermatology specialist can identify those journals where the greatest proportion of citations received are from Dermatology related articles.

Comparison of DSI, DPI and Garfield's Impact Factor

The most prolific use of Garfield's Impact Factor is for the ranking of Journals. The output of a comparison of the ranks of journals on the basis of these three indices using Spearman's Rank Correlation is shown in table 3.5.

Table 3.5: Rank Correlation Analysis (Spearman's Rho) of the three Indices

		DSI	DPI	GIF
DSI	Correlation Coefficient	1	-0.005	-0.355
	N	29	29	29
DPI	Correlation Coefficient	-0.005	1	0.199
	N	29	29	29
GIF	Correlation Coefficient	-0.355	0.199	1
	N	29	29	29

The table 3.5 reveals that there is no correlation between DSI and DPI or between GIF and either DPI or DSI. Therefore, it can be concluded that each of these three indices is measuring something different. As such, each should be used in the appropriate context in order to derive maximum value from citation data.

Practical application

The Ministry of Health and Medical Education of Iran oversees 43 medical universities. Based on criteria such as the number of academic members, knowledge production and the number of seminars and workshops held, these universities have been categorized into three types comprising 9, 20 and 14 universities respectively. The former are mainly situated in Tehran. Based on the information obtained from the undersecretary of Health and Medical Education in Iran, between 1995 and 2007, the average budgets allocated for internationally published journal subscriptions for type two and three were around $50,000-60,000 and $30,000-40.000 respectively (Ministry Health and Medical Education of Iran, Deputy of research and technology 2007). This allocation, allowed one unit of type 2 universities to subscribe to 90-100 and type three to 60-70 medical journals. With huge priority having been given to the information needs of departments training resident medical students, other departments can only afford a maximum 2 journals. For example, the dermatology department of Urmia Medical Sciences (type two) subscribed to the "Archives of Dermatology" and "Dermatologic clinics" (Khosroshahi, 2008)[5]. Similarly, the Dermatology department of Birjand University of Medical Sciences, another type two university, subscribed to the "Journal of American Academy of Dermatology" and "The American Journal of Dermatopathology" Bidbakhti (2008)[6].

With such limited budgets, the need to apply well-informed criteria for decision-making to maximize the usage becomes most valuable. Consider the following scenario:

You are responsible for a library serving the needs of dermatologist in a specialist dermatology research unit. You have a limited budget and can afford to subscribe to 3 journals. Several of the specialist users of the library ask you to subscribe to a number of different journals. What can you do?

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[5] Khosrovshahi (2008) private communication.

[6] Bidbakhti (2008) private communication.

Use the DPI to choose your 3 journals. If these are not on the list of your users, then talk through your reasons for not subscribing and suggest that your users base their choice on DSI. In this way, they get what they need for the specific needs of their research (can use their individual research budgets for this) and the library will cater for the more general needs of the discipline.

An assessment of the dermatologic journal titles ordered by the above universities using the DPI index derived from this study indicates that through the above titles, Birjand and Urmia universities were able to cover 14.2% and 10% of dermatologists' information needs respectively. However had they subscribed to the two titles suggested by the DPI index, i.e. British journal of dermatology and Journal of the American academy of dermatology, they would have provided more than 28% of their dermatologists' information needs.

Where efficient system for sharing of resources between libraries and individuals are in place, it may be advantageous for different libraries to subscribe to different journals, thus adding to the pool of journals available to the researcher across the cooperating libraries and individuals. However where such a culture is lacking then the DPI and DSI is the index of choice. DPI and DSI could also be used to informing subscription choice where two or three libraries or individuals are able to share resources. The merits of the use of DPI and DSI depend on the culture and administrative context in which they might be used.

3.3 Summary and conclusions

In this paper it has been argued that GIF is not a satisfactory decision-making tool in a number of important circumstances. The influence of the field of study (or discipline) on the impact factor of journals has been highlighted. Although several previous researchers had pointed out this limitation and have suggested ways of correcting it, it has been shown here that the previous indices were too complicated to be widely utilised by librarians. In addition, the previous studies did not address the two main problems of core specialist journal selection and the level of specialism of journals.

To address these shortcomings, two new measures (Indices) have been developed in this work.

The DSI is an aid to decision-making with regards to the level of specialism of a journal within a particular discipline and serves to inform researchers in the field who wish to make individual subscription decisions.

DPI has been proposed as a decision-making tool for libraries as it indicates the proportion of all citations within a particular discipline that had been received by a particular journal.

The data required to calculate the values of these indices for each journal is readily available, making them easily accessible.

The DPI as applied to the Dermatology Journals example appears to support Bradford's 20/80 rule. Through the use of DPI, it will be possible to determine which journals fall into the '20' category and which into the '80'.

Since the size of a journal, as reflected in the number of articles, affects the rate of citations that it receives; it is not surprising to see a significant correlation between the DPI ranking and the number of articles for a given journal publishes. Within the 29 dermatology journals with which this index was tested, the strength of the correlation was ($r=0.85$). These variations in the number of articles accounts for 73% (r^2) of the variation in the number of citations received. Here it is argued that, whereas GIF is a measure of the average quality of the articles published by a particular journal, the number of citations received within any particular discipline is a better indicator of a journal's influence than either the number of articles that it publishes or its GIF.

Differences between DPI and DSI

In comparison with GIF and DIF, the DPI focuses on the overall impact of a journal rather than the average quality of papers published in a journal. Both of the newly proposed indices do not take into account the number of citable items published by a journal in the calculation.

Another advantage of both of the newly developed indices is that the data required for their calculation is already available making them less time consuming than pervious techniques and can be performed manually by librarians without the need for data manipulation or the acquisition of additional information.

Both of the newly-developed/proposed indices in this paper have been applied to actual data from ISI for the Dermatology discipline. The results have confirmed the usefulness of each and the need for two separate indices. In addition, Spearman's Rank Correlation analysis has confirmed that both of these indices are measuring different phenomena and that they are both significantly different from GIF.

Based on the results of this chapter a paper has been submitted for possible publication in the journal of Library Quarterly (see Appendix Y) and following editor's comments with regard to the language polishing and formatting to comply with journal style it has been re-submitted. The feedback of the reviewers has informed improvements to parts of this chapter.

Chapter 4: Data Analysis II
An Investigation of International Journal usage
by Iranian Medical Researchers

4.1 Introduction

Evaluation of citation patterns can help librarians to assess the extent to which information sources are used at the micro (obligations to librarians in specific libraries or librarians in specific difficulties) and macro (within a field) levels. These can be measured through performing library collection usage studies, by a user survey method or by checking library holding against lists of core journals or other standardised reference sources.

Library collection usage studies require that data be collected regarding the number of times a particular resource has been accessed. Different libraries employ different methodologies for determining the rate of usage of a particular resource. However, all of these methods are labour-intensive, time-consuming and consequently draw precious resources away from other tasks. For example, in a closed system, access to resources would need to be requested explicitly and the data collected regarding the number of such requests can be used for usage analysis. Alternatively, in an open system, users are asked not to return resources to the shelves so that the number of times that the resource has been taken off the shelf can be monitored.

In user survey methods, questionnaires or interviews with users or suggestion boxes can be employed to obtain data regarding the level of satisfaction of users and their specific requirements.

With regard to checking of library holdings, an example is the use of the guide to reference books and journals which suggests that a university medical faculty should hold, at least, a specific set of resources, including standard reference texts and journals, Brandon and Hill (2000); Balay (1996). Despite their high cost, being purely quantitative, the methods described above are limited in their evaluative scope. In other words, it is not possible to determine whether a borrowed or consulted item has been beneficial in any way. Therefore, there is a growing interest amongst libraries in the use of citation data as a decision making tool. Such information is particularly important in the case of expensive resources. At present, Iranian medical libraries purchase international journals at relatively high costs. In this study, citations drawn from Iranian medical articles were used to evaluate the usage rate in Iran of internationally published journals.

4.2 Literature Review

Studies ranking the use of journals at many libraries have long been reported as aids in purchasing, cancellation, and storage decisions. Gross and Gross (1927) revealed that very few journals were cited often in the Journal of the American Chemical Society, whereas many journals were only cited once. Their findings coincide with Zipf's Law, which states that while a few items occur often, many items occur rarely, Wyllys (1981). Libraries should be able to supply most of the needs of their users with a small number of journals. Reviewing the rate of journal use is a recognized way of studying the effectiveness of the most expensive sources of the libraries, although it remains controversial. This process is routinely carried out in the libraries of developed countries, Masjedi et al. (2004). In the third world, however, the absence of bibliographic databases makes it impractical to measure the exact usage rate of information sources at the national level.

Citation analysis is now commonly used to determine what titles to buy, to cease, or to weed. Since the costs of journal subscriptions rose in the 1970s (Smith 1981), the use of citation analysis was extended to determine the ratio of serials versus monographs that should be purchased (White 1981). This use of citation analysis was employed by Kriz (1978) and has been followed by others, covering a broad range of subjects from Theology to Geology (Devin and Kellogg 1990). An analysis of the bibliographic citations of research papers by Sylvia (1998) was used as one basis for Psychology journals selection and deselection in academic libraries. The findings confirmed that the most cost-effective and the most used materials were usually held by libraries. Titles that met these criteria and were not held are good candidates for new subscriptions. Likewise, the least cost-effective and least-used titles are candidates for cancellation.

In Iran, each year about $10M is spent on purchasing scientific journals for the country's medical universities by the Undersecretary of Research and Technology of the Ministry of Health and Medical Education, Masjedi et al. (2004). Globally, each year, the subscription fee of medical journals increases by an average of 10 %. A study by Kean (2005) confirms that the price for U.S. periodicals increased by an average of 10.4 % since 1999. This figure is higher in Iran because of currency restrictions, American trade embargos (approximately 40 % of core medical journals are published in the

United States) and bureaucracy prohibiting direct purchase, resulting in much higher costs.

Publishers Communication Group Inc. (2005) which provides a detailed example of trends influencing journal subscription, cancellation and renewal for scholarly publishers also studied trends in journal subscription renewal and cancellation. The findings show that between July 2004 and June 2005, 56 % of the subscriptions included in the sample were cancelled.

Publishers Communication Group Inc. study highlighted a number of factors that influence an institution's decision to cancel a subscription. The Group investigated why the specific subscription in question was cancelled in place of another subscription. When the topic was explored in greater detail, the librarians who had been contacted explained that because of reductions in collection budgets, they were forced to apply a number of cost-cutting exercises including usage studies, faculty surveys and the elimination of duplicate subscriptions. Tally of responses clearly demonstrates that, of the cancellations identified in their sample, 22 % were motivated by low usage, 22 % were due to electronic availability of the content and the library's budget prevented a renewal of 15 % (Publishers Communications Group, Inc. 2005).

A study by Masjedi et al. (2004) shows that about two-thirds of the journals present in four educational and research centers in Tehran were used less than three times per month. In a similar library collection usage study performed on the international journals held at the libraries of Shaheed Beheshti University Medical School between 1990 and 1992, Sooresrafil (1993) found that over 31 % of the journals were only consulted once in 3 months and 67 % were not even used once in the same period.

In another research Forouzi (1995) evaluated the usage rate was evaluated of the Latin periodical (Internationally published Journals) in Tehran, Amir Kabir and Elm-o-Sanat universities. The maximum usage was 4 times for a time period of three months and the minimum cost per use was $29.6. Meanwhile about 60 % of the journals in Tehran University, 75 % in Amir Kabir and 80 % in Elmo-Sanat Universities were not even used once. In another study with regard to internationally published journals' usage Kiani (1998) conducted in the libraries of Biomedical and Biophysical Research Centers of Tehran and Tarbiat Modarres Universities, it was found that the average cost per use for each international journal was $43.75 and $60.37, respectively. Another survey

performed on the libraries affiliated to Medical School of Tehran University, showed that during the time period of 1994-1995 around 68.07 % of international journals were not even used once, Sulaimani (1999).

The literature on Iranian Journal usage has centered on "off the shelf" studies. This method is unreliable since taking a resource off the shelf, or even borrowing, is not necessarily an indication that the resource has been used or useful. In addition, each of these studies is limited to one or two libraries, which may be informative at the individual library level, but does not provide a national picture.

In the present study, data have been collected and presented that allow citation criteria to be applied to investigate the usage rate of international journals cited by medical faculties. One such criterion is what is known as the journal half-life. This is the number of journal publication years, going back from the current year, that account for 50 % of the total citations received by the cited journal in the current year. The data collected here facilitate the calculation of the half-life of the most cited journals between 2002 and 2004. For decision-making purposes, the half-life is a further useful measure, as it provides an indication of the expected frequency of usage. As the literature ages, it receives fewer and fewer citations. This phenomenon is known as "ageing" or "obsolescence", Ya, sar Tonta and Yurdagül (2006). The measure of half-life as the median age of cited sources has also been used to study the obsolescence of literature, Earle and Vickery (1969); Line (1970).

The age of materials is useful in developing guidelines for retrospective collection development and storage. Whilst the half-life is a useful measure for helping with archiving decisions, 'citation frequency' is used as a decision making tool for acquisitions. Such analysis is also made possible by the data collected in this study.

Other useful measure includes material allocation formulae which often include a factor for the relative importance of journals versus monographs. Awareness of medical scholars' citation patterns may assist in developing formulae.

The main aims of this chapter are to determine, a) the formats of materials used in Iranian medical research b) the age of cited items c) high use journal titles which are critical to maintaining the core collection d) the half-life of the most cited journals and to rank them accordingly.

4.3 Methods

Raw data from an Iranian medical citation database, compiled mainly from printed sources, which was being developed by the author for the purpose conducting bibliometric studies such as this, were transferred into a spreadsheet and each record was tabulated on the basis of the consistent contextual elements of bibliographic information, such as (;) or (,). However, in many cases, due to the lack of consistency, many of the records were tabulated manually. The usage for each journal was then counted and tabulated according to frequency.

The citation half-life for each of the most cited titles were then calculated by working out the time taken to receive 50 % of the total number of citations from the current publication year backwards.

The 140,000 bibliographic citations in around 10876 articles that appeared in the 90 Iranian Medical Journals published between 2002 and 2004 were analyzed and journals were grouped according to Bradford's Law (1948) of Scattering. By applying Bradford's categories to foreign journals cited by the Iranian Medical Scholars, journals are grouped into three zones. Zone 1 consists of a few journals which have received the largest number of citations (the core cited journals), the second, larger group (Zone 2), has journals cited somewhat less frequently and Zone 3 contains a much larger set of journals cited relatively infrequently (candidates for substitution or cancellation).

4.4 Results and Conclusions

The result section begins with analyzing the age of cited materials from 2002 to 2004 followed by the investigation of different media usage by Iranian medical researchers under the time of investigation. Internationally published medical journals having essential contribution in Iranian medical researchers' scientific production was then extracted along with their corresponding percentiles to help librarian while archiving those journals.

Material Age

Obsolescence is a one of the major foci of information source use and citation study.

Obsolescence aim to answer how long a publication will continue to be used after it has been published. According to Line (1970) obsolescence implies a relationship between use and time and can be investigated by synchronous and diachronous methods. Understanding the extent to which library users rely on older materials can be useful in determining which materials can be moved to remote storage, Ackerson (2001). In this study for each year of the investigation, different types of cited media based on publication date were analyzed. Tables 4.1, 4.2 and 4.3 show the age of media for different formats according to 25, 50 and 75 percentiles. Materials were grouped into 8 format categories for analysis: journals, books, reports, conference papers, web resources, theses, research projects and patents. Tables 4.1-4.3 illustrate the age of different materials from 2002 to 2004.

Table 4.1: Age of Materials in 2002

	Valid	25th Percentiles	50th Percentiles	75th Percentiles	Half-life
Foreign journals	21922	1988	1994	1998	10
Farsi journals	1152	1995	1998	2000	6
WWW	136	1999	2001	2001.75	3
Foreign books	5501	1991	1996	1999	8
Farsi books	1109	1992	1996	1998	8
Foreign reports	104	1990	1995	1999	9
Farsi reports	59	1995	1998	1999	6
Foreign conferences	93	1989	1994	1998	10
Farsi conferences	400	1995	1998	2000	6
Foreign thesis	25	1990.5	1995	1998	9
Farsi thesis	458	1992	1995	1998	9
Foreign projects	26	1991.75	1997	1999	7
Farsi projects	115	1994	1997	1999	7
Patent	1				

Table 4.2: Age of Materials in 2003

	Valid	25th Percentiles	50th Percentiles	75th Percentiles	Half-life
Foreign journals	32127	1989	1995	1999	9
Farsi journals	1366	1996	1998	2000	6
WWW	274	1998	2001	2002	3
Foreign books	6763	1992	1997	2000	7
Farsi books	1340	1992	1996	1999	8
Foreign reports	129	1989.5	1996	1999	8
Farsi reports	60	1996	1998	2000	6
Foreign conferences	149	1988	1997	2000	7
Farsi conferences	425	1996	1999	2000	5
Foreign thesis	34	1987	1995	1997.25	9
Farsi thesis	502	1993	1996	1998	8
Foreign projects	19	1994	1997	1999	7
Farsi projects	125	1992.5	1998	2000	6
Patent	7	1951	1962	1985	

Table 4.3: Age of Materials in 2004

	Valid	25th Percentiles	50th Percentiles	75th Percentiles	Half-life
Foreign journals	41929	1990	1996	2000	8
Farsi journals	1588	1997	1999	2002	5
WWW	370	2000	2001	2003	3
Foreign books	7528	1993	1998	2000	6
Farsi books	1013	1993	1997	2000	7
Foreign reports	178	1991	1995.5	1999	8.5
Farsi reports	72	1997	1999	2001	5
Foreign conferences	221	1994	1999	2001	5
Farsi conferences	356	1997	2000	2001	4
Foreign thesis	52	1986.75	1996.5	1999.75	7.5
Farsi thesis	647	1993	1996	1999	8
Foreign projects	32	1992.25	1997.5	2000	6.5
Farsi projects	111	1995	1998	2000	6
Patent	9	1986	1991	1999.5	

The results show that the age of materials cited varied from one type to others; however there is a slight tendency to get younger within each type of materials age from 2002 to 2004 except web resources.

50 % of Foreign Journals cited were published within the previous 9 years whilst 50% of Farsi Journals on the average were cited within the previous 6 years. As may be expected, the youngest items cited were web resources with 3 years old. Half of Foreign books were ranged from 8-6 years old, while 50% of Farsi books were cited more than seven years on average. Half of the cited Farsi and Foreign reports were published within the last 5 and 7.5 years, respectively. The half-life of cited conference papers tend to be more current than books on the whole; however, there is a slight difference between the age of usage of Foreign and Farsi conference papers (more than 7 years to 5 years, respectively). Half of Farsi and Foreign theses cited were published more than 8 years ago.

Figures 4.1: Distribution of foreign journals cited over the years in Iranian medical articles from 2002-2004.

Distribution of internationally published cited journals by years (N =94383)
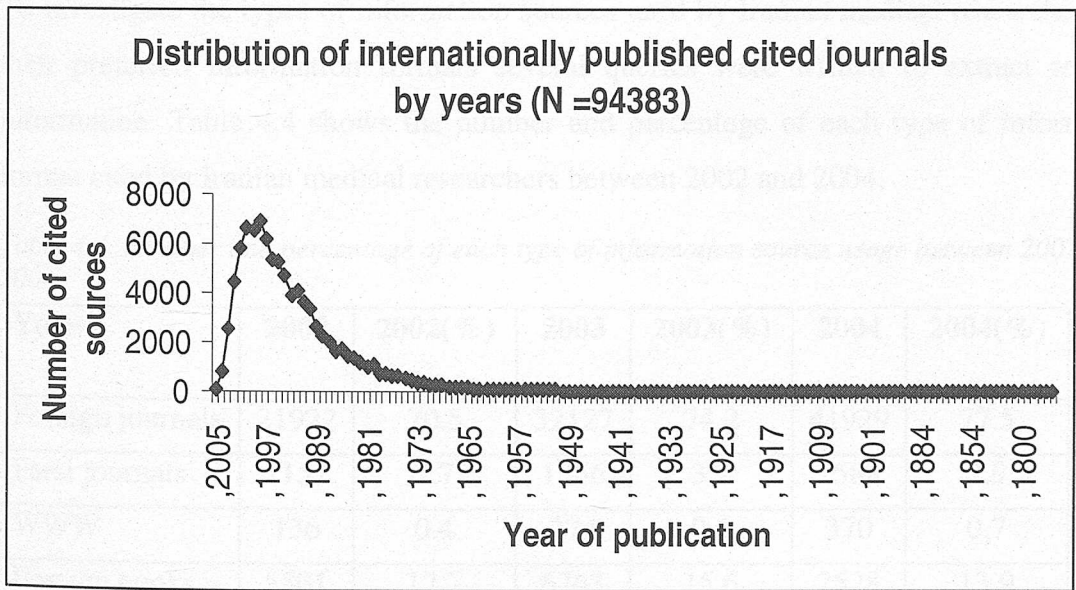
Figures 4.2: Distribution of domestic journals cited over the years in Iranian medical articles from 2002-2004
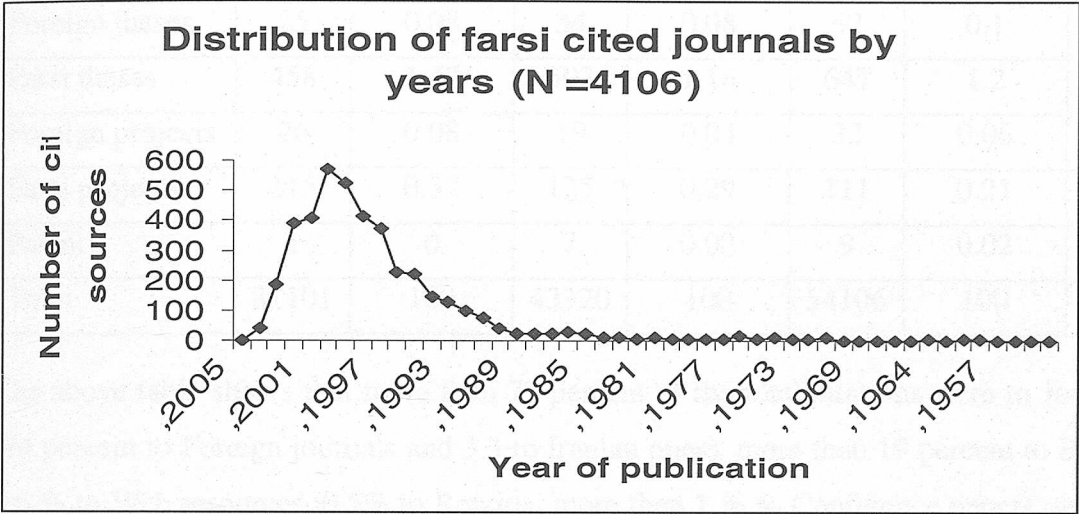
The practical application of these findings is that individual libraries could benefit of such information for archiving decisions depending upon the availability of space.

Usage of information resources by Iranian medical researchers

To investigate the types of information sources used by Iranian medical researchers and their preferred information formats several queries were written to extract relevant information. Table 4.4 shows the number and percentage of each type of information format cited by Iranian medical researchers between 2002 and 2004.

Table 4.4: Number and percentage of each type of information source usage between 2002 and 2004

Years	2002	2002(%)	2003	2003(%)	2004	2004(%)	Average percent
Foreign journals	21922	70.5	32127	74.2	41929	77.5	74.07
Farsi journals	1152	3.7	1366	3.2	1588	2.9	3.27
WWW	136	0.4	274	0.6	370	0.7	0.57
Foreign books	5501	17.7	6763	15.6	7528	13.9	15.73
Farsi books	1109	3.57	1340	3.09	1013	1.87	2.84
Foreign reports	104	0.33	129	0.3	178	0.33	0.32
Farsi reports	59	0.19	60	0.14	72	0.13	0.15
Foreign conferences	93	0.3	149	0.34	221	0.41	0.35
Farsi conferences	400	1.29	425	0.98	356	0.66	0.98

Years	2002	2002(%)	2003	2003(%)	2004	2004(%)	Average percent
Foreign theses	25	0.08	34	0.08	52	0.1	0.09
Farsi theses	458	1.47	502	1.16	647	1.2	1.28
Foreign projects	26	0.08	19	0.04	32	0.06	0.06
Farsi projects	115	0.37	125	0.29	111	0.21	0.29
Patent	1	0	7	0.02	9	0.02	0.01
Total	31101	100	43320	100	54106	100	100.00

The above table shows that more than 77 percent of the total citations were to Journals (74 percent to Foreign journals and 3.3 to Iranian ones), more than 19 percent to Books, 0.6 % to Web resources, 0.5% to Reports, more than 1 % to Conference papers, and 1.3 % to theses, 0.30 to research projects and just 17 citation were made to Patents.

Of 9400 Foreign journals, 4532 (more than 48 %) occurred as one citation, the mean number of citations per article was 12 of which 75 % were journals, 3.4 % were conference proceedings and 6.4 % were other formats such as books and electronic resources.

The internationally published leading scientific medical journals in Iranian medical researchers papers

In this study half-life index is used to determine international journals' archiving policy. To this end, the publication dates of each cited journal were transferred to SPSS to divide total of each title publication dates into four quartiles.

Investigation based on records of Iranian medical universities to foreign journals subscription, available in the Ministry of Health and Medical Education in Iran, showed that 15% of Iranian medical universities libraries, all of which are based in Tehran, have very large collections as they are also responsible for supporting other libraries through such mechanisms as interlibrary loans. The database showed that 95% of the remaining 85% of medical libraries subscribed to 150-180 international journals. When all of the foreign journals that were cited by Iranian medical researchers were ranked in order of the number of citations received, Bradford's (1984) criterion was used to categories the journals into 3 zones. The top third most cited journals called (zone 1) constituted of more than 98 journals that received more citations. Therefore 33 % information needs coverage per three-year period served as threshold to determine the international core

journals set in medical sciences in Iran. However this threshold can be adjusted to meet the needs of individual universities, depending upon factors such as budgets.

Tables 4.5, 4.6 and 4.7 list the first twenty of the most cited non-Iranian journals and their corresponding percentiles. These account for around 12 % of the total number of citations to non-Iranian journals. Appendix 10, 11 and 12 contain a list of all the top third journals accounting for 33% of the total number of citations from 2002 to 2004. These can be used for classification of the three chronological steps in weeding and archiving decisions. Again this threshold can be adjusted to meet the needs of individual universities, depending upon factors such as available space.

Over the course of the 3 years under investigations, 134,536 citations representing almost 100 % of the total number of references have been analyzed from the 90 journals whose bibliographic data has been entered into the database. The majority of cited items were non-Iranian journal articles (95978 citations).

Table 4.5: The 20 most cited journals in 2002 and their corresponding half-life are listed in the following table.

*Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	NEGM	362	1999	1985.75	1992	1997	5	10	16.25
2	LANCET	300	1999	1984	1991	1997	5	11	18
3	BMJ	219	2000	1985	1993	1998	4	9	17
4	FERTIL_STERIL	187	1991	1988	1993	1998	4	9	14
5	JAMA	186	1995	1984	1993	1997	5	9	18
6	AM_J_OBSTET_GYNECOL	175	1995	1987	1994	1998	4	8	15
7	OBSTET_GYNECOL	158	1997	1991	1996	1998	4	6	11
8	PEDIATR	151	1992	1986	1992	1998	4	10	16
9	AM_J_CLIN_NUTR	146	2000	1988	1994.5	1998	4	7.5	14
10	CIRCULATION	143	1998	1985	1994	1998	4	8	17
11	DIABET_CARE	141	1997	1993.5	1997	1998	4	5	8.5
12	ANN_INTERN_MED	118	1992	1985	1991	1995	7	11	17
13	CANCER	113	1996	1976.5	1987	1996	6	15	25.5
14	J_PEDIATR	112	1994	1983	1992	1996.75	5.25	10	19
15	J_CLIN_ENDOCRINOL_METAB	104	1984(a)	1983	1989	1994.75	7.25	13	19
16	ARCH_INTERN_MED	101	1998	1985.5	1992	1997	5	10	16.5

*Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
17	HUM_REPROD	99	1998	1994	1997	1998	4	5	8
18	CHEST	98	1988	1988	1992	1995.25	6.75	10	14
19	BRAIN_RES	90	1995	1985.75	1991.5	1995	7	10.5	16.25
20	J_BONE&JOINT_SURG	87	1988(a)	1976	1988	1994	8	14	26
21**									

*Ranked by number of citations.

** The remainder is shown in appendix L

a. Multiple modes exist. The smallest value is shown.

Table 4.6: The 20 most cited journals in 2003 and their corresponding half-life are listed in the following table.

*Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	NEGM	438	1995	1987	1993.5	1997	6	9.5	16
2	LANCET	383	1997	1985	1992	1997	6	11	18
3	HUM_REPROD	275	2000	1995	1997	2000	3	6	8
4	FERTIL_STERIL	273	1997	1990	1996	1999	4	7	13
5	BMJ	245	1998	1982.5	1993	1998	5	10	20.5
6	JAMA	236	1999	1987	1993	1998	5	10	16
7	J_CLIN_ENDOCRINOL_METAB	233	1998	1988	1996	1999	4	7	15
8	AM_J_OBSTET_GYNECOL	224	1997	1986	1993.5	1998	5	9.5	17
9	ARCH_INTERN_MED	215	1994	1991	1994	1998	5	9	12
10	OBSTET_GYNECOL	202	2000	1988.75	1995	1999	4	8	14.25
11	DIABET_CARE	185	1998	1995	1998	2000	3	5	8
12	PEDIATR	182	1996	1985	1994	1998.25	4.75	9	18
13	CIRCULATION	181	1999	1992	1996	1999	4	7	11
14	J_BONE&JOINT_SURG	178	1990	1975	1986	1994	9	17	28
15	GASTROENTROLOGY	163	1997	1991	1996	1998	5	7	12
16	AM_J_CLIN_NUTR	160	2000	1988	1994	1998	5	9	15
17	CANCER	158	1989	1982.75	1990	1996	7	13	20.25
18	PROC_NATL_ACAD_SCI_USA	157	1996	1990	1995	1998	5	8	13
19	ANN_INTERN_MED	150	1992	1985	1992	1997	6	11	18
20	J_UROL	148	1992	1987	1993	1998	5	10	16
21**									

*Ranked by number of citations.

** The remainder is shown in appendix M

Table 4.7: The 20 most cited journals in 2004 and their corresponding half-life are listed in the following table.

*Rank	Journal	N	Mode	25	50	75	In shelf	Active archive	Passive archive
1	NEGM	617	1998	1989	1994	1998	6	10	15
2	LANCET	478	1999	1986.75	1993	1998	6	11	17.25
3	JAMA	371	1999	1988	1995	1999	5	9	16
4	AM_J_CLIN_NUTR	308	1999	1989	1997	2000	4	7	15
5	J_UROL	287	1997	1989	1994	1998	6	10	15
6	BMJ	280	1994	1986	1994	1998.75	5.25	10	18
7	CIRCULATION	265	1997	1990	1996	1999	5	8	14
8	OBSTET_GYNECOL	264	1998	1990	1996	2000	4	8	14
9	AM_J_OBSTET_GYNECOL	258	1998	1987	1995	1998.25	5.75	9	17
10	FERTIL_STERIL	254	2001	1990	1997	2000	4	7	14
11	J_CLIN_ENDOCRINOL_METAB	231	2000	1990	1996	2000	4	8	14
12	DIABET_CARE	227	1998	1994	1998	2001	3	6	10
13	HUM_REPROD	212	2001	1996	1998	2000	4	6	8
14	ANN_INTERN_MED	186	1998	1984	1992	1997	7	12	20
15	OSTEOPOROSISINT	184	1998(a)	1997	1999	2001	3	5	7
16	PEDIATR	183	2001	1989	1996	2000	4	8	15
17	J_CLIN_MICROBIOL	178	1998	1992	1997	1999.25	4.75	7	12
18	J_PEDIATR	165	1995(a)	1984.5	1995	1999	5	9	19.5
19	AM_J_MED	158	1991	1988	1993	1999	5	11	16
20	AM_J_CARDIOL	157	1998	1989.5	1995	1998	6	9	14.5
21**									

*Ranked by number of citations.

** The remainder is shown in appendix N.

a. Multiple modes exist. The smallest value is shown

The New England Journal of Medicine was the most cited journal, having been referenced a total of 1417 times. The second most-used journal, The Lancet was cited 1161 times.

As may be expected, the publication frequency might be related to the citation frequency. Therefore it is not surprising to see that the three weekly-published journals are ranked the highest, whereas monthly journals tend to be cited less frequently.

It seems that the half-life of journals in a specific clinical discipline is relatively lower than those belonging to the general medicine.

The results show that the half-life of the most cited journals varied from one title to the other. However there is a slight tendency that almost all journals' half-life has increased more or less taking into account 2002 half-life as a baseline.

Since the rank of journals based on frequency of citation varied from one year to the other, to see a significant correlation between the 2004 ranking of journals and their corresponding ranks in 2002 and 2003 a Spearman rank correlation within the 50 most cited journals was tested. The strength of the correlation between 2004 and 2002 was (r=0.74) and 2004 and 2003 was (r=0.77).

Archiving and preservation refers to the processes and procedures required to ensure the content of journals remain accessible well into the future. Since library shelves run out of space, academic and research libraries of all types and sizes have to make decision to storage possibilities. To this end, based on quartiles of usage, the three steps "in shelf" (first quartile), "active archive" (second quartile or half life) and "passive archive" (third and fourth quartile) are proposed to preserve journals. In accordance with 25, 50 and 75 percent of quartiles libraries could decide for how long each journal could be kept in shelf or transferred to active or passive archive.

4.5 Conclusion

Evaluation of journals usage is a difficult but necessary task considering the wide range of choices available. Limited funding and space, as well as other factors, dictate the need for a carefully planned strategy of journal selection. Citation frequency can help deal with the series of decisions involved in the establishment and maintenance of an effective library collection.

In summary, although, publication strategies differ according to country and to scientific discipline, the Iranian medical sciences rely mostly on journal articles for research, as over 77 percent of all references were to journals. This number is slightly lower than the commonly used number of 80 percent for the sciences in general (Bowman 1990; Devin and Kellogg 1990). However the results support Haigh (1982) who indicates that third world scientists cite references primarily (78%) from mainstream scientific literature. If

the Iranian medical libraries decide to give the priority to their funding situation, this figure can be used to determine the serials budget.

The pattern of citation by media remained constant over the three years of the study, with journals being the most preferred format of citation over the relatively short period under investigation.

The results with regard to the age of cited materials show variations across the different types and there is a tendency to get younger within the age of each type of media form 2002 to 2004, except web resources (see tables 4.1-4.3).

The citation half-life of Foreign Journals is 9 years whilst 50% of Farsi Journals on average were cited within the previous 6 years. These results are approximately in accordance with the study of Musser and Conkling (1996) and Kushkowski, Kathy and William (2003) who found the majority of materials cited were less than eight years old.

The lowest half-life belongs to web resources with 3 years old. Further investigation might also determine the patterns of use of electronic resources, such as Internet sites or eBooks.

The most cited internationally published journals, providing 33% of Iranian medical researchers information needs, can be used by Iranian medical libraries as a baseline for subscription; along with their corresponding quartiles as a criterion for storage policy.

The concluding list of most used internationally published journals list is based on the total number of 95978 records extracted from the articles published in 90 domestic journals between 2002 and 2004 and the data taken for the same period from SCI (40803) is presented in appendix P.

The zone 2 comprises 522 journal titles providing around a further 33% of information needs of Iranian medical researchers for the time frame under investigation.

The extraction of concluding list of zone 1 journal titles has enabled us to determine most frequently referred titles within 25 subject categories. The corresponding list of journals belonging to each subject categories is presented in appendix O.

Based on the results of this chapter a paper was submitted in LIBERS and published in September 2008. The information of this publication is presented in appendix Y.

Chapter 5: Data Analysis III

An Analysis of the International Scientific Publications of Iranian Medical Researchers in SCI and PubMed (2002-2004)

5.1 Introduction

In developing countries, where improvements in healthcare and medicine are most needed, knowledge creation, and especially, applications of findings are key factors in their development. Since the most prevalent healthcare problem in Iran was a shortage of well trained professionals where they were most needed, a succession of 5-year development programmes were conceived, aimed at setting deadlines for socio-economic growth.

During the second and third development programmes, which ended in 2004, both the number of universities and research institutions and academic members has grown considerably (the corresponding data was presented in Chapter 1).

From a single Iranian paper indexed in Science Citation Index (SCI) in 1972, Beiki and Beiki (2005) in conjunction with the fast growing scientific publication elsewhere in the world, studies of Habibi, Rashidi and Feldman (2006) and Osareh and Wilson (2004) have shown Iran to have been making considerable movements towards collaboration in the world of scientific productivity. Struggling to improve Iran's position in the world of science, since 1999 Iranian researchers have been encouraged to publish their findings in highly ranked international scientific journals (Habibi, Rashidi and Feldman 2006). The main sources for such measurements have been the bibliographical databases compiled by the Institute for Scientific Information and PubMed.

With reference to the SCI, Osareh and Wilson (2004) have shown that Iran's total publication output in science and technology increased 2.8-fold over the 1995–1999 period. Of the total of 2060 articles indexed in Medline from 1991 to 2002, only 44 were indexed in Medline in 1991 and this figure rose to 508 in 2002(Azizi et al. 2004).

The results of chapter 2 of rates of domestic publications (see Chapter 2); showed that Iranian medical researchers had published 10876 articles in 90 domestic medical journals between 2002 and 2004. At the same time, for the broadest possible exposure and acknowledgement of their work, many Iranian medical researchers also attempted to publish their findings in the highly recognized international journals, such as those indexed by SCI and PubMed. This chapter focuses on the latter and analyzes their patterns and trends in comparison with other scientific output studies and considers their

implications. Accordingly, this section was designed to answer the following two questions:

1. To what extent did three successive 5-year development programmes (1990-2004) influence Iranian medical scientists' publication in international scientific journals?

2. What is the trend in the rate of international publications by Iranian medical scientists (2002-2004) and how does this trend match the previously found trend by Osareh and Wilson (2004)?

In addition, with regards to bibliometric indicators the aims of this section are also to identify a) the format of materials used in Iranian medical research, b) the age of cited items, c) the most frequently used journal titles which are critical to maintaining a core collection; and d) the half-life of the most cited journals.

5.2 Methods

The PubMed database was queried based on the term "Iran" in the "affiliation" field and refined by specifying date range to 2002-2004. There were 2502 publications that met the selection criteria.

Since the focus of this investigation was on medical literature and SCI covers articles from other disciplines, a similar strategy as that used for searching PubMed would not have been appropriate. Therefore, to begin with, the total number of articles recalled when the term "Iran" was entered in the address field was subsequently limited by selecting a date range of 2002-2004. The bibliographic data of the 9706 publications that met this selection criterion were transferred to Microsoft Excel™. The contents of this file were then searched manually and those where the subject categories of articles related to healthcare or medicine were selected individually. Further confirmation of the author's affiliation was obtained by checking the address for the authors.

Since some journals are indexed in both PubMed and SCI databases and since unlike PubMed, articles retrieved from SCI contain citation data and cited materials for each paper, the 1575 duplicate data were removed from the 2502 articles found in PubMed and the 2507 articles found in SCI. This resulted in a total dataset of 3435 papers (2508 indexed in SCI and 927 in PubMed) representing Iranian medical scholars' publications.

This dataset was examined from different perspectives, including year of publication, language of article, type of publication, the most productive authors, universities, the authorship pattern, core subject areas and journals. In addition citation data of the articles published in journals indexed in SCI were analyzed separately, from different points of view. The citation half-life for each of the most cited titles were then calculated by working out the time taken to receive 50% of the total number of citations from the current publication year backwards.

5.3 Results

During the three –year period from 2002 through to 2004, 3435 articles were indexed in PubMed and SCI by Iranian medical researches.

Publication trend in SCI and PubMed

Figures 5.1: Iranian medical scholars' publication trend in SCI from 2002-2004.
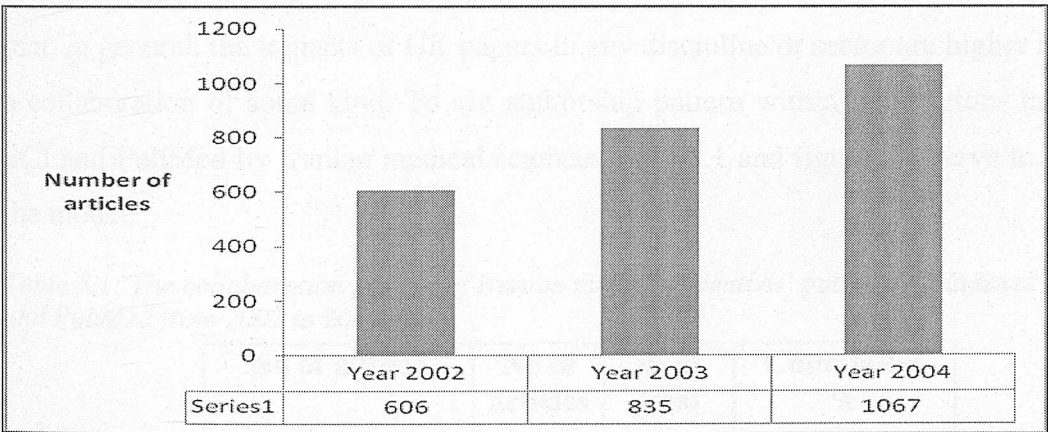
Figure 5.1 shows the growth rate of medical publications from Iran in the SCI database. The absolute productivity of Iranian medical papers has almost doubled from 606 papers in 2002 to 1067 papers in 2004.

As has been mentioned, of 2052 papers indexed in PubMed, 1575 papers duplicated in both databases were removed. Therefore the following table only shows the trend of the remaining Iranian medical researchers' publications (927 papers) in PubMed.

Figures 5.2: Iranian medical scholars' publication trend in PubMed from 2002-2004.
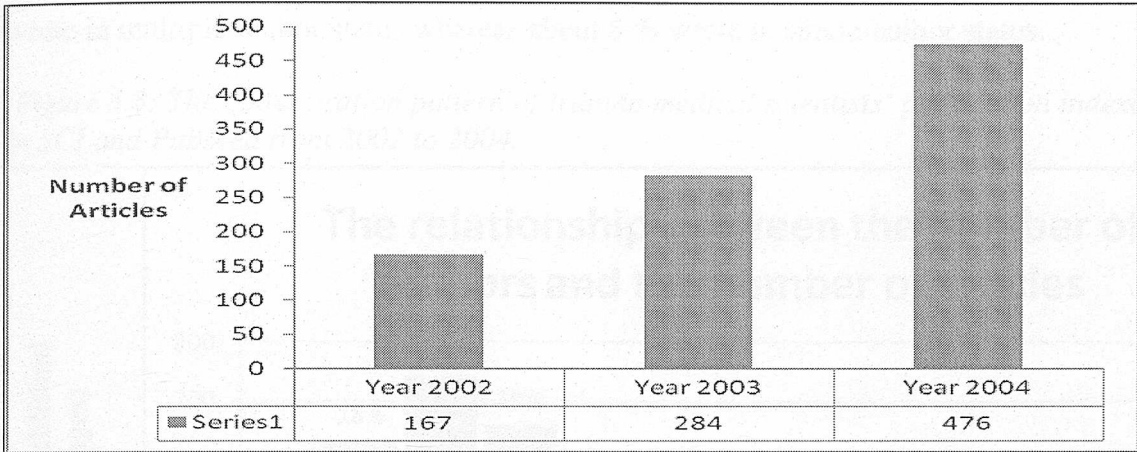
The same trend of growth of publication in SCI can be seen in PubMed.

Authorship

The last few decades have witnessed a growth in collaborative endeavours (Subramanyam 1983) and as mentioned before by Katz and Hicks (1997) demonstrated that, in general, the impacts of UK papers in any discipline or sector are higher if there is a collaboration of some kind. To see authorship pattern within publications indexed in SCI and PubMed by Iranian medical sciences table 5.1 and figure 5.3 serve to illustrate the model.

Table 5.1: The collaboration pattern of Iranian medical scientists' publication indexed in SCIs and PubMed from 2002 to 2004.

No of author	No of articles	% of total	Cumulative %
Single author	281	8	8.2
2 authors	629	18	26.5
3 authors	738	21	48
4 authors	658	19	67.1
5 authors	449	13	80.2
6 authors	234	7	87
7 authors	167	5	91.9
8 authors	101	3	94.8
9 authors	66	2	96.7
10 authors	45	1	98
11-15 authors	59	2	99.8
16-20 authors	46	1	100

With respect to the authors' collaboration, table 6.1 shows that, overall, about 92% wrote in multiple-author status whereas about 8 % wrote in single-author status.

Figure 5.3: The collaboration pattern of Iranian medical scientists' publication indexed in SCI and PubMed from 2002 to 2004.
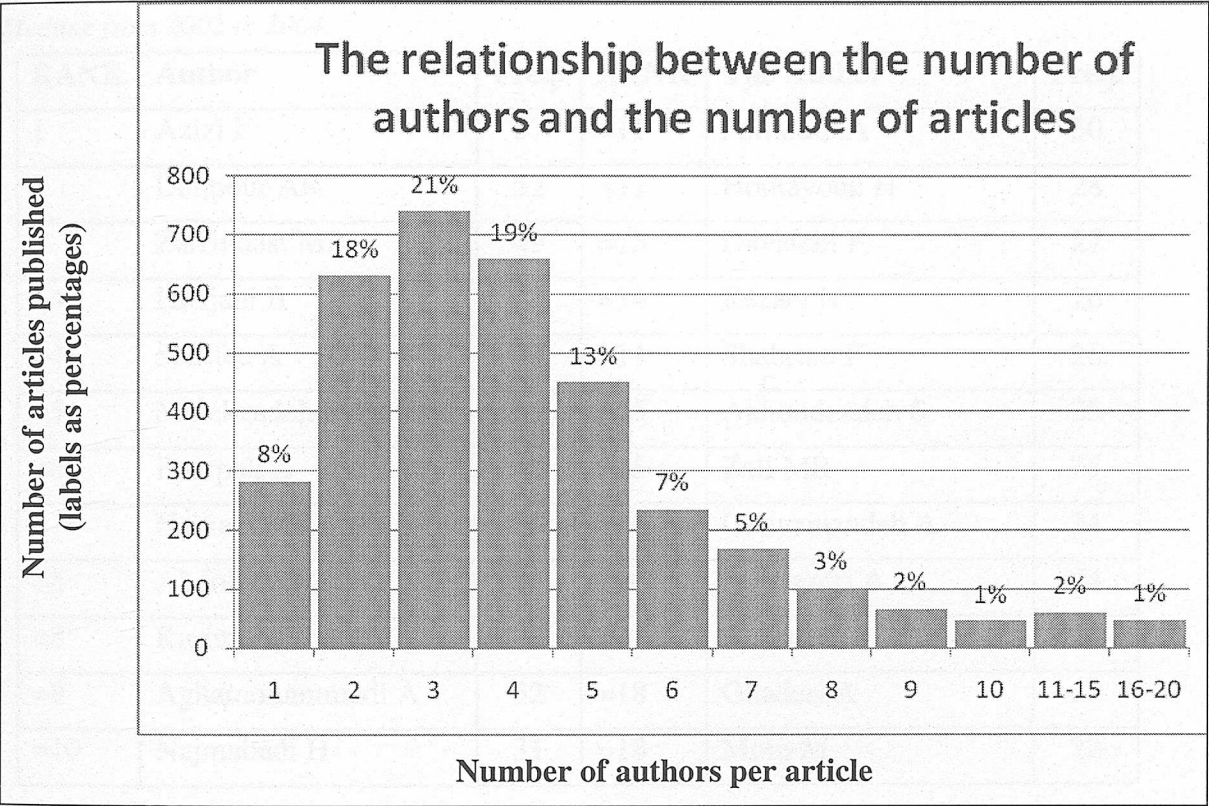
Although the trend is toward multi-authorship, the majority of items published by Iranian medical researchers have two, three and four authors. The average number of authors per item was about 4 persons. Of the 3435 items designated in this study, 281 articles (8%) were by single authors. The number of articles written by two authors, three authors, and four authors were 629 (18%), 738 (21%) and 658 (19%) respectively. Of the 3435 investigated items 105 articles have more than 11 authors. Further analysis of papers indexed in SCI with regard to the Iranians medical researchers' collaboration with other countries' researchers during three-year shows that the USA with 139 co-authored and England with 101 co-authored pares rank first and second, respectively. Collaboration with other counties was as follow: Canada 81; Australia 40; Japan 34; France 31 Germany 27 Sweden 15 and Netherlands 12.

The most prolific authors

The collected data allowed for author productivity to be measured on the basis of the number of articles published. The results are shown in the following table.

Table 5.2: The most prolific Iranian medical authors whose publications were indexed in ISI and Medline from 2002 to 2004.

RANK	Author	Freq.	RANK	The Author	Freq.
1	Azizi F	57	=11	Farhoudi A	30
2	Dehpour AR	52	=12	Homayoun H	28
3	Zarrindast MR	49	=13	Davatchi F	27
=4	Larijani B	43	=14	Rezaei N	26
=4	Shafiee A	43	=14	Shahram F	26
=5	Malekzadeh R	41	=15	Akhondzadeh S	25
=6	Pourpak Z	40	=15	Zali MR	25
=7	Namazi MR	35	=16	Ghavamzadeh A	24
=8	Abdollahi M	34	=16	Montazeri A	24
=8	Karimi M	34	=17	Mirmiran P	23
=9	Aghamohammadi A	32	=18	Ghaderi A	22
=10	Najmabadi H	31	=18	Moin M	22

10588 authors were responsible for 2508 articles indexed in SCI. In other words, the average number of authors per paper is 4.2 persons. The same analysis was made for the remaining articles indexed in PubMed that shows 3342 authors were responsible for 927 articles. Therefore the average number of authors is 3.6 persons.

Figure 5.4: Shows the percentage of authors' contribution in relation to the percentage of articles production.

93
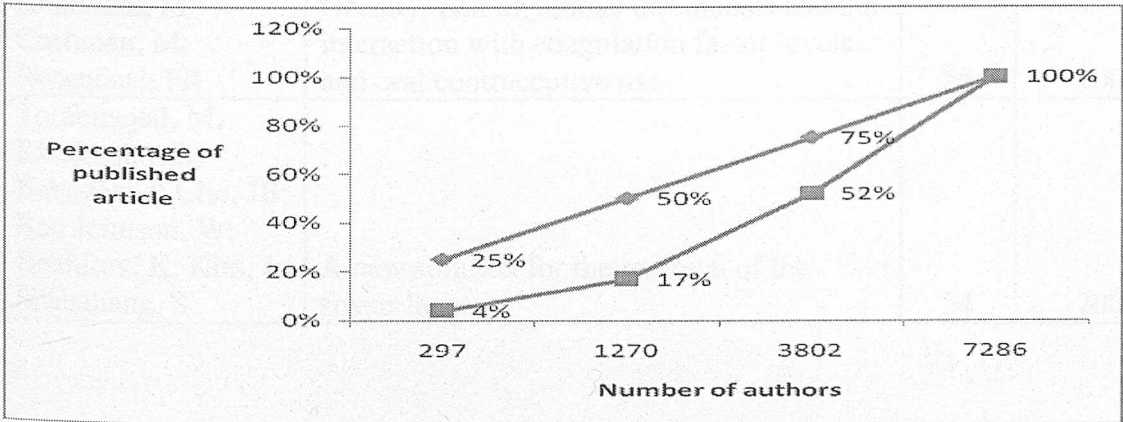
The figure 5.4 shows that 4 % (297) of authors were responsible for the 25% of articles production. 50% of articles had been published by 17% (1270) of authors and 75% of articles were produced by 52.8% (3802) of Iranian medical researchers. The average number of authors per article is about 4.

Most cited articles in SCI

The objective of the following analysis is to identify and list the articles that have influenced others the most as measured by citation count. An understanding of which research is viewed by the research community as most valuable to build upon may provide valuable insights into what research or even researcher to focus on now and in the future. Citation data being available for articles indexed in SCI shows that 2508 published articles received 10335 citations. In other words, the average number of citation per article is about 4.2. Among them 1021(40%) articles had not received any citations by the time of the analysis.

Considering citation as an indication of the influence of specific articles means that it is interesting to extract which articles are cited the most. Based on the analysis, a list of the 14 most cited articles during 2002 and 2004 is presented here.

Table 5.3: The 14 most cited articles of Iranian medical researchers in SCI from 2002 to 2004.

Authors	Tile	Time cited	Year of publication
Galati, G; Sabzevari, O; Wilson, JX; O'Brien, PJ	Prooxidant activity and cellular effects of the phenoxyl radicals of dietary flavonoids and other polyphenolics	95	2002
Azizi, F; Salehi, P; Etemadi, A; Zahedi-Asl, S	Prevalence of metabolic syndrome in an urban population: Tehran Lipid and Glucose Study	72	2003
Abdolmaleky, HM; Faraone, SV; Glatt, SJ; Tsuang, MT	Meta-analysis of association between the T102C polymorphism of the 5HT2a receptor gene and schizophrenia	55	2004
Abdollahi, M; Cushman, M; Rosendaal, FR	Obesity: risk of venous thrombosis and the interaction with coagulation factor levels and oral contraceptive use	55	2003
Torabinejad, M; Khademi, AA; Babagoli, J; Cho, JB; Ben Johnson, W; Bozhilov, K; Kim, J; Shabahang, S	A new solution for the removal of the smear layer	54	2003

Authors	Tile	Time cited	Year of publication
Abdolmaleky, HM; Smith, CL; Faraone, SV; Shafa, R; Stone, W; Glatt, SJ; Tsuang, MT	Methylomics in psychiatry: Modulation of gene-environment interactions may be through DNA methylation	49	2004
Kaviani, MJ; Hashemi, MR; Kazemifar, AR; Roozitalab, S; Mostaghni, AA; Merat, S; Alizadeh-Naini, M; Yarmohammadi, H	Effect of oral omeprazole in reducing re-bleeding in bleeding peptic ulcers: a prospective, double-blind, randomized, clinical trial	48	2003
Akhgari, M; Abdollahi, M; Kebryaeezadeh, A; Hosseini, R; Sabzevari, O	Biochemical evidence for free radical-induced lipid peroxidation as a mechanism for subchronic toxicity of malathion in blood and liver of rats	45	2003
Javanmardi, J; Stushnoff, C; Locke, E; Vivanco, JM	Antioxidant activity and total phenolic content of Iranian Ocimum accessions	44	2003
Ahmadian, G; Ju, W; Liu, LD; Wyszynski, M; Lee, SH; Dunah, AW; Taghibiglou, C; Wang, YS; Lu, J; Wong, TP; Sheng, M; Wang, YT	Tyrosine phosphorylation of GluR2 is required for insulin-stimulated AMPA receptor endocytosis and LTD	42	2004
Ghassemi, H; Harrison, G; Mohammad, K	An accelerated nutrition transition in Iran	41	2002
Ranjbar, A; Pasalar, P; Abdollahi, M	Induction of oxidative stress and acetylcholinesterase inhibition in organophosphorous pesticide manufacturing workers	41	2002
Knutson, MD; Vafa, MR; Haile, DJ; Wessling-Resnick, M	Iron loading and erythrophagocytosis increase ferroportin 1 (FPN1) expression in J774 macrophages	40	2003
Noorbakhsh, F; Vergnolle, N; Hollenberg, MD; Power, C	Proteinase-activated receptors in the nervous system	40	2003

The researcher have compiled a list of the top 25 most cited first authors, cited by at least 33 times. The full list of authors' names is shown below, together with the total number of citations received for number of papers indexed in SCI between 2002 and 2004.

Table 5.4: The 25 most cited first authors along with their number of citation and average number of citation per paper of Iranian medical researchers indexed in SCI from 2002 to 2004.

Rank	Author	Number of citation received	Citation per article	Number of papers that received citation
1	Azizi, F	283	13.48	21
2	Zarrindast, MR	262	9.70	27
3	Abdollahi, M	199	19.9	10
4	Homayoun, H	133	12.1	11
5	Galati, G	129	43	3
6	Jouyban, A	117	7.8	15
7	Abdolmaleky, HM	104	52	2
8	Torabinejad, M	86	43	2
9	Akhondzadeh, S	78	8.67	9
10	Namazi, MR	72	3.79	19
11	Foroumadi, A	59	9.83	6
12	Ghods, AJ	58	8.29	7
13	Mirmiran, P	57	7.13	8
14	Sharifi, AM	55	7.86	7
15	Karimi, M	54	5.4	10
16	Saadat, M	52	5.2	10
17	Nokhodchi, A	49	9.8	5
18	Ranjbar, A	48	24	2
19	Sayyah, M	46	5.75	8
20	Akhgari, M	45	45	1
21	Javanmardi, J	44	44	1
22	Ahmadian, G	42	42	1
23	Ghassemi, H	41	41	1
24	Noorbakhsh, F	40	40	1
25	Boskabady, MH	33	3.3	10

Journal Titles

Table 5.5 shows the top ranking journal titles in which Iranian authors published their papers from 2002 to 2004. In both sets of database the SCI and PubMed, Transplant Proc with 82 and Toxicol Appl Pharmacol with 65 papers were the first and second dominant journals, respectively. It is interesting to see that Iran J Allergy Asthma with 59 published papers was among the favorite sources for publications that publish articles in English.

Table 5.5: Distribution of articles' journal titles in SCI and Medline where Iranian medical researchers have published their articles from 2002-2004.

Journal title	Frequency
Transpl Ant Proc	82
Toxicol Appl Pharmacol	65
Anal Sci	62
Iran J Allergy Asthma Immunol	59
Urol J	59
East Mediterr Health J	58
Atheroscler Suppl	44
Int J Psychophysiol	42
Int J Cancer	36
Commun Agric Appl Biol Sci	34
Saudi Med J	32
Amer J Hum Genet	29
Eur J Human Genet	28
Int J Gynecol Obstet	28
Eur J Neurology	27
Ann Saudi Med	26
Eur J Pharmacol	24
Phys Rev E Stat Nonlin Soft Matter Phys	24
J Dent Res	24

Affiliations

The addresses of all authors were assessed to determine most productive Iranian- based universities or institutions. The results of top-ranked Iranian medical researcher's affiliations publications in journals covered by SCI and PubMed from 2002 to 2004 are shown in table 5.6.

Table 5.6: The top-ranked Iranian medical researcher's affiliations published in journals indexed in PubMed and SCI from 2002 to 2004

Institution	Frequency
Teheran Univ Med Sci	859
Shiraz Univ Med Sci	391
Shaheed Baheshti Univ Med Sci	352
Isfahan Univ Med Sci	180
Iran Univ Med Sci	167
Tarbiat Modarres Univ	159
Pasteur Institute of Iran	132
Mashhad Univ Med Sci	121
Tabriz Med Sci Univ	75
Kerman Univ Med Sci	75
Ahwaz Univ Med Sci	38

About 60% of articles have been published by the researchers working in Tehran, with a very small contribution from universities belonging to type 2 and 3. Tehran Medical Sciences University with 859 publications ranked first among Iranian medical universities followed by Shiraz Medical Science University and Shahid Beheshti University of Medical Sciences each with 391 and 352 publications, respectively.

Topics

The frequency of counts of Iranian medical researcher's papers indexed in the SCI database in different specialties is presented in the following table. These subject *categories of articles are the same as appeared in SCI database.*

Table 5.7: Distribution of subject categories of Iranian medical articles published in SCI journals from 2002-2004.

Topic	Frequency	Topic	Frequency
Pharmacology & Pharmacy	217	Public, Environmental & Occupational Health	57
Immunology	147	Hematology	55
Clinical Neurology	141	Dermatology	52
Biochemistry & Molecular Biology	123	Plant Sciences	48
Oncology	110	Neurosciences	48
Endocrinology & Metabolism	97	Ophthalmology	47
Gastroenterology & Hepatology	92	Cell Biology	46
Dentistry, Oral Surgery & Medicine	81	Psychology, Biological	46
Medicine, General & Internal	80	Chemistry, Analytical	45
Chemistry, Medicinal	71	Biochemical Research Methods	44
Obstetrics & Gynecology	70	Medicine, Research & Experimental	40
Genetics & Heredity	66	Urology & Nephrology	39
Peripheral Vascular Disease	66	Pediatrics	33

The table shows that the subfield of Pharmacology & Pharmacy with 217 articles took the first place followed by Immunology, Clinical Neurology and Biochemistry & Molecular Biology with 147,141 and 123 papers respectively. It seems that researchers working in basic medical sciences were more active than specialties in clinical medicine.

Type of Articles

An analysis of the types of published papers indexed in SCI was also carried out. The results are summarised in Table 5.8.

Table 5.8: Article analysis based on type of publication

Publication type	Year of Publication	2002	2003	2004	Total	Citations received	% Of received citation	Citation per paper
Article	Number	383	571	615	1569	9637	0.93	6.1
	Percent	24.41	36.39	39.2				
Review	Number	9	11	8	28	287	0.027	10.25
	Percent	32.14	39.29	28.57				
Correction	Number	1	2	3	6	0	0	0
	Percent	16.67	33.33	50				
Editorial material	Number	9	23	23	55	163	0.015	2.9
	Percent	0.57	1.47	1.47				
Letter	Number	19	45	37	101	216	0.021	2.1
	Percent	18.81	44.55	36.63				
Meeting abstract	Number	184	182	380	746	24	0.002	0.03
	Percent	24.66	24.4	50.94				

As the table 5.8 clearly shows, 62 % (1565 out of 2508) of the papers were original research articles. Of these, around 30% (746 out of 2508) are meeting abstracts, the rest being either letters or editorial materials or reviews. As has been mentioned, making some incentives such as supporting authors for the papers accepted to be presented in foreign conferences and seminars significantly affected the rate of publication in internationally published journals. Therefore it can be seen that the meeting abstract rate has grown considerably. It is very likely that the growth of original articles is partially due to the growth of number of meeting abstracts. However 746 meeting abstracts received just 24 citations.

Figures 5.5 show the distribution of citation within original articles indexed in SCI.

Figure 5.5: Distribution of 9499 citations within 1568 original articles which received citations.
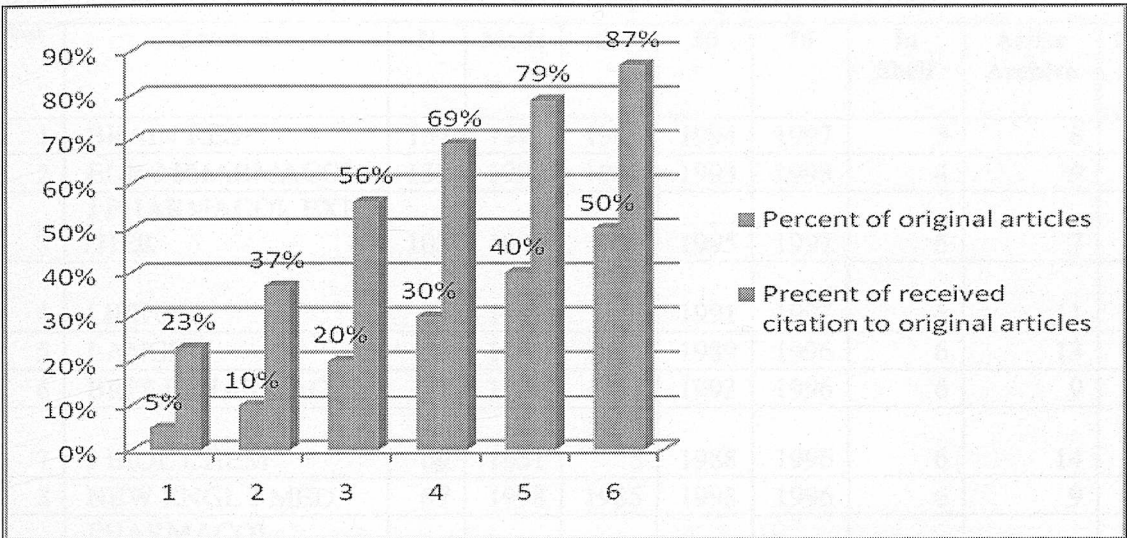
It is interesting to see that just 5% original articles which received citations account for 23 percent of total citations. 50 percent of original articles account for 87 percent of citation received by original articles. Of 1568 original articles 216 have not received any citation until the time of investigation (August 2008).

Although we could not able to represent the type of publication Indexed in PubMed, the number and proportion of original articles based on extracted data from SCI showed a steady increase of 14% (from 2002 to 2004) the following table illustrates this point.

Language

In terms of language, English was overwhelmingly dominant, with 3431 of the articles being in English, the others being two in German and two in French.

The internationally published leading scientific medical journals in Iranian medical researchers' papers

Tables' 5.9, 5.10 and 5.11 list the most cited foreign journals and their corresponding percentiles from 2002 to 2004. These might be served to categorise the three steps in weeding and archiving decisions. This threshold can be adjusted to meet the needs of individual universities, depending upon factors such as available space.

Over the course of the 3 years under investigations, 40803 citations representing 100 % of the total number of references of articles indexed in SCI have been analyzed and journals were grouped according to Bradford's Law of scattering to determine Zone 1 which consists of a few journals and have received the largest number of citations.

Table 5.9: The 20 most cited journals and their corresponding quartiles in 2002

*Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	BRAIN RES	154	1994	1987	1994	1997	5	8	15
2	EUR J PHARMACOL	139	1992	1987	1993	1998	4	9	15
3	J PHARMACOL EXP THER	103	1995	1982	1995	1997	5	7	20
4	LIFE SCI	81	1997	1983.5	1991	1997	5	11	18.5
5	LANCET	79	1997	1981	1989	1996	6	13	21
6	BRIT J PHARMACOL	77	1996	1986	1993	1996	6	9	16
7	J BIOL CHEM	69	1951	1969.5	1988	1996	6	14	32.5
8	NEW ENGL J MED	67	1998	1985	1993	1996	6	9	17
9	PHARMACOL BIOCHEM BE	65	1996	1991	1994	1997	5	8	11
10	PSYCHOPHARMACOLOGY	65	1992	1986	1992	1995	7	10	16
11	NATURE	62	1978	1978	1985.5	1992	10	16.5	24
12	SCIENCE	59	1991	1979	1988	1992	10	14	23
13	J PHARM SCI	59	1992	1978	1984	1992	10	18	24
14	INT J PHARM	57	1996	1988.5	1996	1998	4	6	13.5
15	BURNS	58	1998	1993.75	1996	1998	4	6	8.25
16	P NATL ACAD SCI USA	56	1993	1989	1993	1995.75	6.25	9	13
17	J CHROMATOGR	44	2000	1987	1995	2000	2	7	15
18	BRIT MED J	53	2000	1987.5	1992	1998	4	10	14.5
19	FERTIL STERIL	48	1997	1989.25	1995.5	1997	5	6.5	12.75
20	NEUROPHARMACOLOGY	48	1994	1983.25	1989.5	1994	8	12.5	18.75
21**									

*Ranked by number of citations.

** The remainder is shown in appendix Q.

Table 5.10: The 20 most cited journals and their corresponding quartiles in 2003

*Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	BRAIN RES	191	1997	1990	1994	1998	5	9	13
2	NEW ENGL J MED	146	1999	1986	1993	1998	5	10	17
3	LANCET	142	1992	1983	1992	1997	6	11	20
4	EUR J PHARMACOL	124	2002	1989	1995	1999	4	8	14
5	NATURE	113	1990	1979.5	1990	1996	7	13	23.5
6	P NATL ACAD SCI USA	97	1993	1988	1993	1997	6	10	15
7	J CHROMATOGR	92	2000	1987	1996	2000	3	7	16
8	J BIOL CHEM	89	1998	1991	1997	1999	4	6	12
9	PHARMACOL BIOCHEM BE	85	1996	1992.5	1996	1999.5	3.5	7	10.5
10	LIFE SCI	82	1993	1985	1993	1997	6	10	18
11	J PHARMACOL EXP THER	80	2000	1988	1994	1999	4	9	15
12	J CLIN ENDOCR METAB	79	1997	1982	1990	1997	6	13	21
13	BRIT MED J	75	2001	1977	1988	1999	4	15	26
14	INT J PHARM	74	2001	1990.75	1996	2000	3	7	12.25
15	J IMMUNOL	74	1994	1991	1994	1998	5	9	12
16	FERTIL STERIL	73	1993	1991	1994	1998.5	4.5	9	12
17	J CLIN MICROBIOL	72	2000	1991.25	1997	2000	3	6	11.75
18	BRIT J PHARMACOL	72	1994	1986	1992.5	1996	7	10.5	17
19	J NEUROSCI	67	1995	1994	1997	2000	3	6	9
20	KIDNEY INT	64	2000	1988	1996	1999.75	3.25	7	15
21**									

*Ranked by number of citations.

** The remainder is shown in appendix R.

Table 5.11: The 20 most cited journals and their corresponding quartiles in 2004

*Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	LANCET	148	1997	1989	1995	1998	6	9	15
2	NEW ENGL J MED	133	1998	1989	1994	1998	6	10	15
3	EUR J PHARMACOL	129	1995	1992.5	1996	2000	4	8	11.5
4	J BIOL CHEM	123	1999	1986	1993	2000	4	11	18
5	BRAIN RES	121	1997	1987	1994	1997.5	6.5	10	17
6	INT J PHARM	117	2002	1993	1998	2001	3	6	11
7	NATURE	117	1970	1976.5	1989	1996	8	15	27.5
8	J UROLOGY	116	1986	1986	1993.5	1998.75	5.25	10.5	18
9	P NATL ACAD SCI USA	112	1995	1990	1995	1999	5	9	14
10	J PHARMACOL EXP THER	100	2000	1986.25	1994	1999	5	10	17.75
11	SCIENCE	93	1988	1984.5	1992	1997	7	12	19.5
12	J NEUROSCI	82	1999	1996	1999	2001	3	5	8
13	JAMA-J AM MED ASSOC	79	1993	1989	1994	1998	6	10	15
14	PHYTOCHEMISTRY	78	1998	1987.75	1993.5	1999	5	10.5	16.25
15	J CLIN MICROBIOL	73	1999	1991	1997	1999	5	7	13
16	BIOCHEMISTRY-US	72	1993	1987	1993.5	1998.75	5.25	10.5	17
17	FERTIL STERIL	70	2001	1994	1999	2001	3	5	10
18	BLOOD	70	1999	1996	1998	1999	5	6	8
19	BRIT MED J	69	2000	1984	1991	1998	6	13	20
20	J CLIN ENDOCR METAB	69	1998	1991	1997	1999	5	7	13
21	PSYCHOPHARMACOLOGY	64	1990	1986	1990.5	1995	9	13.5	18

*Ranked by number of citations.

** The remainder is shown in appendix S.

In the above tables, the top most cited journals are ranked in descending order. The table also lists first, second and third quartiles of usage for each title. These journals were able to provide more than 33% of information needs of Iranian medical researchers from 2002 to 2004. These can be used for classification of the three chronological steps in weeding and archiving decisions. Again this threshold can be adjusted to meet the needs of individual universities, depending upon factors such as available space.

The "Brain Research" Journal was the most cited journal in 2002 and 2003 and took forth place in 2004, used a total of 466 times. The second most-used journal in 2002 was the European Journal of Pharmacology with 139 times of citation. This journal took forth place in 2003 and third place in 2004 with 124 and 129 times of citation respectively. Each of zone one1 journals were used more than 67 times during 2002-2004.

As may be expected, the specialized journals are ranked the highest, whereas journals covering a broad range of medical subjects such as Lancet, NEJM and Nature tend to be cited less frequently. This finding is slightly in contrast of the most cited internationally published journals presented in chapter 5 (Tables' 4.5, 4.6 and 4.7) where the results show journals with general coverage tend to be cited more.

It seems that the half-life of clinical journals is relatively lower than those belonging to the general medicine. The figure below shows cumulative percentage of journals usage over the time.

Figure 5.6: Shows the percentage of journals usage over the time.
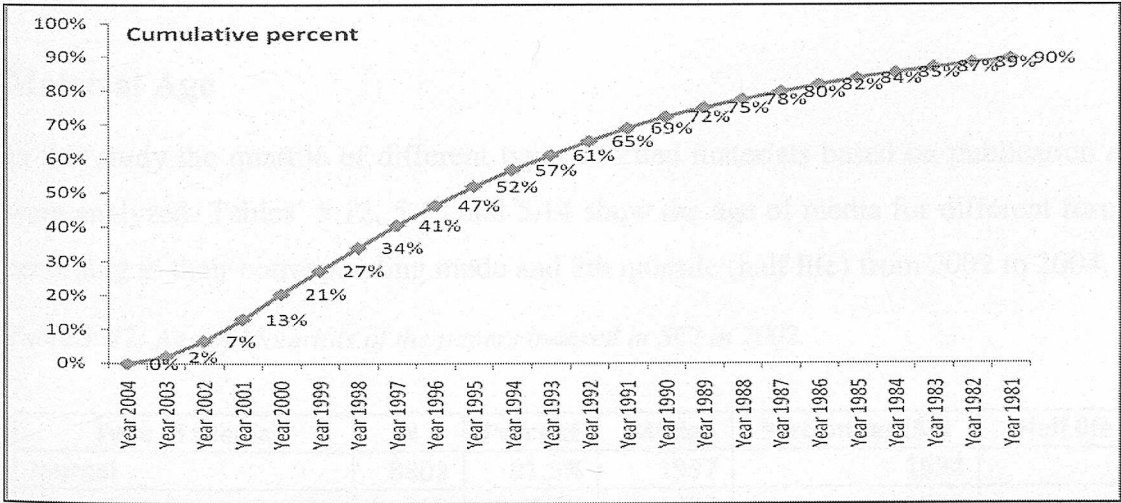
Usage of information resources by Iranian medical researchers

To investigate the types of information sources used by Iranian medical researchers and their preferred information formats several queries were written to extract relevant information. Figure 5.7 shows the number and percentage of each type of information sources, which were cited by Iranian medical researchers between 2002 and 2004 for the article indexed in SCI.

Figure 5.7: Shows different information sources usage over the time for the articles indexed in SCI between 2002 and 2004.

	Journal	Book	These	Congress & Seminar	Patent	Report
Year 2002	8803	700	27	64	16	15
year 2003	13201	868	32	42	19	7
Year 2004	14892	1392	41	94	27	31
Percent	91.6%	7.4%	0.2%	0.5%	0.2%	0.1%

Year 2002　　year 2003　　Year 2004　　Percent
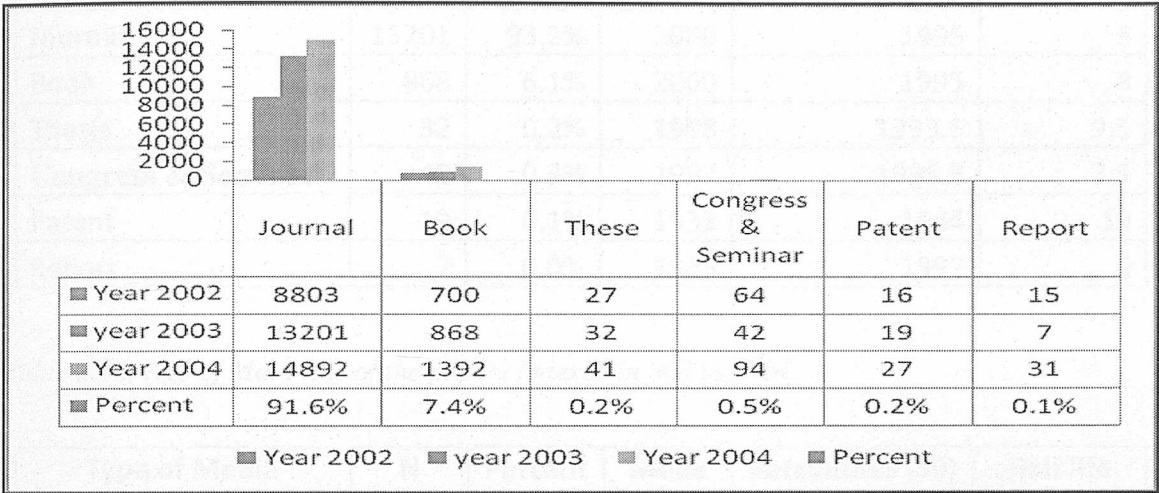
The above table shows that more than 91.5 percent of the total citations were to Journals, 704 percent to Books and 200 citations were made to conference papers. There was no citation to web resources.

Material Age

In this study the quartile of different types of cited materials based on publication date were analyzed. Tables' 5.12, 5.13 and 5.14 show the age of media for different formats according to their corresponding mode and 2th quartile (half life) from 2002 to 2004.

Table 5.12: Age of Materials of the papers indexed in SCI in 2002.

Type of Media	N	Percent	Mode	Percentiles (50)	Half life
Journal	8803	91.5%	1997	1994	8
Book	700	7.3%	1996	1993	9
Thesis	27	0.3%	1998	1995	7
Congress & Seminar	64	0.7%	1995	1994.5	7.5
Patent	16	0.2%	1985	1990	12
Report	15	0.2%	1985	1990	12

Table 5.13: Age of Materials of the papers indexed in SCI in 2003.

Type of Media	N	Percent	Mode	Percentiles (50)	Half life
Journal	13201	93.2%	2000	1995	8
Book	868	6.1%	2000	1995	8
Thesis	32	0.2%	1998	1993.5	9.5
Congress & Seminar	42	0.3%	1997	1995.5	7.5
Patent	19	0.1%	1933	1984	19
Report	7	0.0%	1985	1997	6

Table 5.14: Age of Materials of the papers indexed in SCI in 2004.

Type of Media	N	Percent	Mode	Percentiles (50)	Half life
Journal	14892	90.4%	2001	1996	8
Book	1392	8.4%	2001	1996	8
Thesis	41	0.2%	2000	1998	6
Congress & Seminar	94	0.6%	1997	1997	7
Patent	27	0.2%	1974	1977	27
Report	31	0.2%	1998	1996	8

The results show that the age of materials cited varied from one type to others.

One half of all references in journals articles were dated within the 8 years, whilst 50% of patents at least were cited within the previous 12 years. Half of the cited reports and thesis at least were published within the last 6 years.

Trends in the number of articles indexed in ISI journals since 1999

The data for medical research reported by Osareh and Wilson (2002) based on papers indexed in ISI were analysed in the present study (Table 5.15) to see whether or not the trend found could be extrapolated to predict later growth.

Table 5.15: Average number of Medical articles indexed in ISI, based on Osareh and Wilson (2002).

From	To	Mid point	Years	Total	Per annum
1985	1989	1987	5	275	55
1990	1994	1992	5	531	106
1995	1999	1997	5	1693	339

The number of articles expected to be published in 2002 to 2004 from this trend are shown in Table 5.16.

Table 5.16: Distribution of expected and observed articles published between 2002 and 2004.

Year	Expected	Observed
2002	669	606
2003	803	835
2004	962	1067

The suggested average number of publications, based on this trend between 2002 and 2004 is reasonably (~ 92%) close to that found by the present study.

However, more accurate predictions were obtained when the data from 2000 to 2006, obtained in this study, were used (see figure 5.8). The relationship between the number of articles indexed in SCI by Iranian Medical researchers (X) and the year of publication (Y) was found to fit an exponential model with the following formula:

$$Y = 1.446 \times 10^{0.3388x}$$

Figure 5.8: The average number of articles indexed in SCI by Iranian Medical researchers, based on data from 2000 to 2006 from this study.

108
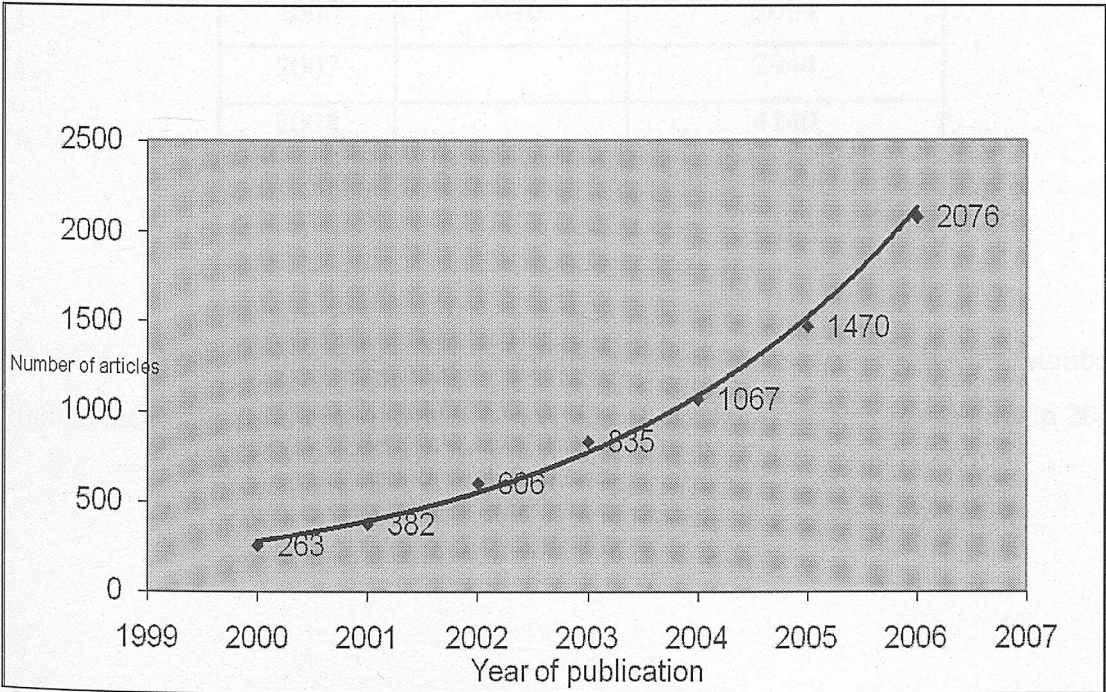
The correlation between the numbers of publications predicted by this model and actual the number observed is shown in the following figure:

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.998(a)	.996	.996	42.73061

The updated data fit an exponential model even more closely. This updated model has been used to construct table 5.17 showing the expected number of Iranian medical article publications over the next few years.

Table 5.17: Average number of Published Medical articles, based on SCI searches.

Mid point	Observed (per annum)	Predicted from Model (per annum)
2000	263	271
2001	382	381
2002	606	536
2003	835	753
2004	1067	1059
2005	1470	1489
2006	2076	2094
2007		2944
2008		4140
2009		5820
2010		8183

Based on observed data and applied model, it is anticipated that the total number of Iranian medical publication in Medline will exceed of 8000 articles per annum in 2010.

5.4 Conclusion

The rate of Publications indexed in recognized databases such as SCI and PubMed seems were more prevalent in recent years than earlier years, from 55 articles in 1987 to 1067 in 2004.

In general, it could be proposed that Iranian medical researchers' productivity is a function of many causes, and these might be grouped into two areas:

1) An author's personal characteristics, e.g. personality, achievement and expectations and

2) The author's environment or situation for example colleagues, availability of information, the problem under investigation and author's field or discipline.

The ascending trend of publication rate was somewhat owing to the rising number of scholars who engaged in the research and education in Iran after the end of the War between Iran and Iraq, the increased number of subscription to internationally published information sources, the annual international book fair, the ascending trend of attendance to forging conferences and seminars, the return of overseas student and the ease of communication in a technologically connected world.

On the other hand given that having publications in international journals acquire higher visibility than those in domestic ones, Iranian medical researchers attempt to increase their publication rate in journals indexed in well-known databases. Taking into account 10876 articles published in domestic journals between 2002 and 2004 with 3435 articles indexed in SCI and PubMed at the same time.

The articles Indexed in SCI had an average of 4.2 times of citation, while the average time of citation for articles punished in domestic journals was 0.07.

Therefore, it would be reasonable to assume that Iranian medical researchers tend to publish their valuable works in more international journals to more visibility.

Whilst PubMed cover more life sciences and biomedical journals than SCI, even it covers some Middle East and Iranian medical journals; Iranian medical researchers had a tendency to publish their finding in journals indexed in SCI (2508 articles) rather than in journals indexed in PubMed (2502 papers).

As described before the changes in policy during the successive 5-year economic development together with revisions in tenure and promotion requirement for college and university faculties after 2000 influenced the degree to which individuals produce manuscripts for publication in high impact journals.

The average number of authors per article was about 4 persons in both databases, comparable with the mode number of authors per article in clinical and life science in Croatia, Puljak et al. (2008). Of 13930 authors being responsible for the publication of 3435 articles in SCI and PubMed Azizi F, Dehpour AR, Zarrindast MR, Larijani B and Shafiee A were among the most productive authors in both databases.

The researchers who were working in Tehran have published about 60% of articles. Tehran Medical Sciences University with 859 publications in SCI and PubMed ranked first among Iranian medical universities and research centers. The majority (more than 90%) of cited items was foreign journal articles (36989 citations) and one half of all references in journals articles and books were dated within the 8 years, whilst 50% of patents on the average were cited within the previous 12 years. Half of the cited reports and thesis were published within the last 6 years. A comparison is made between the previously found trends (1987-1997) in the rate of international publication of Iranian medical researchers and subsequent growth from 2002 to 2004. The new trend matched with previously found trend to within 92%. The precision with which the proposed model predicts the number of internationally published articles enables accurate assessment of the possible effects of any changes in relevant policy in future.

Based on the results of this chapter a paper submitted in September 2008 for possible publication and following referees' comments, it has been revised and re-submitted. In addition, comments given by reviewers have been considered in the thesis. Information about this publication is presented in appendix Y.

Chapter 6

An Analysis of the
Cultural and Social Factors Influencing
Citation Behaviour of
Iranian Medical Scholars

6.1 Introduction (and literature review)

At a glance, one of the features that distinguish a scientific publication from a journalist's story or a novel is its footnotes, endnotes and citations. Citations or references are details of the sources, which were consulted in the course of a research or are cited or referred to in the text of a work. Scientists conscientiously cite colleagues whose publications they have used.

In this section the relationship between citation behavior and the personal and cultural traits that may influence such behavior is examined.

Citing behavior seems to vary according to personal traits and be affected by the scientific and social culture surrounding a community, Cronin (1982). It may be that citation conventions differ from discipline to discipline, not simply because of differences in personalities, traditions or modes of professional conduct, but, rather more basically, because of intrinsic differences in the nature of the disciplines themselves.

In the scientific communication, citation behavior reflects the practices, attitudes and prejudices of at least four cross-affecting groups; the users who take in and digest the scientific literature and draw on its ever-expanding network of citations; the instructors who educate in a discipline and conduct scientific investigation and who by implication, socialize traditions, behavior and ethics of their particular field or discipline; the authors who actively engaged in academic publishing, those whose citation behavior in a sense constitutes the established standard and the invigilators (journal editors and referees) who supervise and examine the publication of manuscripts and, by extension, the citations attached to them, Cronin (1982). In this study the Iranian medical academic members being involved in all above-mentioned areas were addressed to investigate citation behavior within the Iranian medical researchers.

Narin and Hamilton (1996) have compared citation behaviour in various disciplines. Their study has shown that in social sciences, an average of thirty works is cited in each article, whereas in engineering, the figure is ten and in mathematics, the average decreases to just five. In biochemistry and molecular biology articles are cited about five times as often as in pharmacy articles. The mathematician tends not to cite more than about ten publications, Narin and Hamilton (1996). The biomedical researcher and historian are not afraid to cite many articles. However, their approaches are different.

Citing cultures not only differ between specialties, they also vary between journals, not only in their "typographical format", but also the type and number of references, their positions in the text, etc, Narin and Hamilton (1996).

Bekavac and his colleagues (1994) found that when Croatian scientists publish in foreign journals, domestic literature is less cited, which they concluded was due to the size of the national contribution to world science in relation to the contribution by the rest of the world. However, when those same scientists publish in domestic journals, the share of domestic literature in their references is significantly higher (around 35%).

A study by Yang and Shi (2005) to identify and analyze the scientific level and quality of the articles published in Chinese Journal of Internal Medicine reveal that the percentage of cited papers in all the published articles was 47% from 2000-2004 and the average times of citation of an original article by other researchers is 4.3.

It may be that availability of information source both in print and online affect citation behavior and quantity of number of citation. Studies of (Montgomery and Sparks 2000; Rogers 2001) have documented that online sources have influenced citation behaviour, in particular the times of citation of print journals. This trend started with the availability of abstracts on CD-ROMs and increased following the availability of online resources.

A study by De Groote and Dorsch (2001) showed that print journals usage decreased following the availability of online journals regardless of whether a journal was available only in print or both in print and online. Studies of (De Groote and Dorsch, 2003 and De Groote Shutz and Doranski 2005) further examined citation habits of scholars and revealed that 73% of faculty members read print subscriptions and 67% read online subscription. Curties, Weller and Hurd (2001) reported that 85% of health sciences faculty went to the library to photocopy articles. However these findings mirror the change in retrieving journal due to remote access to full-text journals online, a study of Morse in 2000 showed that the percentage of usage of most popular titles was identical for both print and online lists. Sathe, Grady and Giuse (2002) investigating the reasons for online searching showed that the main reasons included journal browsing (39%), checking references (41%), printing articles (58%), and reading articles (16%). In studies to determine the impact of online journals on the citation patterns of medical

faculty, De Groote, Shutz and Doranski (2005) concluded that their results did not indicate researchers being more likely to cite online journals.

Taking into account the above findings, it can be concluded that online access has had positive impact on the number of articles researchers cite.

Citation to foreign sources in the Iranian medical articles are about 95 %, compared to the result of sources cited in Brazilian medical articles (86 %) which reveals Brazilian authors tend to select Brazilian sources Cunha-Melo, Santos and Andrade (2006). Another study conducted by Salomon, Sagasti and Sachs (1994) shows that third world scientists cite references essentially 78 % from mainstream scientific literature. He also found the rate of local languages sources usage in certain Asian countries, e.g. Indonesia, where more than half (52 %) of the published works of scientists appear in Indonesian languages, Thailand (28 % in Thai), and South Korea (18 %) in Korean. In Pakistan a bibliometric study of the Journal of Ayub Medical College conducted by Ullah, Farooq and Haroon (2008) showed that 78 % of the citations were from foreign journals.

Lancaster, Dilivio and Lee (1990) have looked at the question of whether or not the sources cited by scientists when they publish in their own national journals differ somewhat from the sources they cite when they publish outside their own country and it has been found that when researchers publish their work in their respective countries, the trend of cited materials is in favor of internal publication. Data derived from studies of Philippine scientists and Korean mathematicians do suggest that place of publication may exert some influence on citation behaviour. As with Croatian scientists, a Korean scientist is more likely to cite national sources when publishing in national journals than when publishing internationally.

Vinkler (1987) analyzed 484 references in 20 chemistry articles written by 20 selected authors at the Central Research Institute for Chemistry (CRIC) of the Hungarian Academy of Sciences. Vinkler reported that forty percent of the authors that he studied indicated that they have or will have a professional relationship with the cited author.

In this study, the results drawn from citation analysis of Iranian medical journals (see table 2.16 in chapter 2) indicate that the number of citations to domestic literature is relatively very low. It can be seen that the total number of published papers from 2002 to 2003 was 7026. The total number of citation received in 2004 for the papers published

from 2002 to 2003 was 481. In other words, the rate of citation per paper is 0.07, while according to Essential Science Indicators, among the 146 top-performing countries in all fields, Iran ranked 49th for citations, 42nd for papers, and 135th for citations per paper (around 3 citations per paper in medical sciences fields). The table 6.1 contains rankings of all fields in Iran.

Table 6.1:10-year country rankings for Iran

	Papers	Citations	Citations Per Paper
Rank for Iran among the 146 top performing countries:	42	49	135
Total for Iran:	21,661	63,519	2.93

Table 6.2: Iranian researchers' publication trend according to the subject of papers from 1996-2006

Rank by citation	Field	Papers published by Iranian researchers	Citations	Citations per paper
1	CHEMISTRY	6,609	27,639	4.18
2	PHYSICS	2,080	8,247	3.96
3	CLINICAL MEDICINE	2,188	6,248	2.86
4	ENGINEERING	3,236	6,052	1.87
5	PHARMACOLOGY & TOXICOLOGY	622	2,207	3.55
6	PLANT & ANIMAL SCIENCE	1,262	1,963	1.56
7	MATERIALS SCIENCE	1,073	1,885	1.76
8	BIOLOGY & BIOCHEMISTRY	610	1,578	2.59
9	NEUROSCIENCE & BEHAVIOR	308	1,209	3.93
10	AGRICULTURAL SCIENCES	469	998	2.13
11	GEOSCIENCES	471	879	1.87
12	MATHEMATICS	844	812	0.96
13	ENVIRONMENT/ECOLOGY	311	808	2.6

Source: Essential Science Indicators

Citations of articles published from 1999 to 2005 in the field of endocrinology and metabolism in different nations is shown in the following table.

Table 6.3: Some publication indicators of 14 countries between 1999 and 2005

Nations	Citations	Articles	Cit. /Art.
England	99,115	10,862	9.1
Italy	66,733	8,207	8.1
Sweden	41,055	3,972	10.3
Denmark	34,543	3,464	10
Finland	24,263	2,183	11.1
Belgium	22,039	2,367	9.3
Israel	12,187	1,533	7.9
Austria	9,575	1,355	7.1
Norway	6,114	747	8.2
Hungary	6,016	790	7.6
Turkey	5,906	1,654	3.6
Greece	5,223	1,002	5.2
Japan	81,245	10,618	7.7
China	10,147	1,89	5.4

Source:(lab-times online, n.d.)(reference 99).

The results of the tables' 6.1 and 6.2 show the average number of citations per paper for Iran in total and for 13-subject field for ten years. Focusing on medical subjects it can be seen that the average number of citations per article is about 3. This figure is near to what this study discovered. Identifying possible reasons of such a large gap between the average number of citations per paper in internationally published articles and those of published in domestic journals is the main focus of this chapter.

The findings of citation analysis lead us to investigate factors concerned with the over-reliance of Iranian researchers on citing foreigner's work in academic writing. A primary assumption derived from our citation analysis outputs is that Iranian researchers in the field of medical sciences tend to justify or substantiate their ideas to those of non-domestic publications while the size of national research publication is considerable. As a consequence, their writing appears to over-rely on foreign references, and to lack critical analysis and interpretation of domestic publications. This behavior may be interpreted as a manifestation of a cultural disposition. Hence our claim is that the cultural disposition is developed because of scholars' adherence to domestic cultural rhetorical conventions.

Given that citation analysis is a powerful informational, analytical and decision-making tool, in terms of both scientific and practical applications, it is important to investigate the reasons for the low rate of citation to domestic works and how it may be addressed. To this end, here, a survey is carried out through questionnaires in an attempt to ascertain some of the cultural and social factors that may influence citation behaviour.

The validity of citations as a measure of influence is one of the issues that consistently confront researchers when assessing scientific literature. Also author self-citation has been interpreted as a means for an author or group of authors to expand on previous hypotheses, refer to established study designs and methods and to justify further investigations on the basis of prior results. Taking into account this point of view, author self-citation may be an inevitable consequence of developing research by authors in a specific field.

On the other hand, repeated self-citation accentuates one's credibility or expertise and may serve to perpetuate authors' interpretations or opinions of specific research findings or general constructs Hyland (2003). Self-citations, when pervasive, might falsely validate the conclusions of an author or group and could even limit scientific discovery if other investigators do not challenge what might be perceived as developing or accepted concepts. To the extent that assessors of the importance of a publication rely on bibliometric indices based on citation counts (perhaps for lack of a better measure), author self citation may artificially inflate an article's importance to the general scientific community.

Here, the opportunity was taken to sound out Iranian researchers' perspectives on citation and self-citation.

6.2 Questionnaire Design

The scientific standard suggests that survey questions should always be pre-tested to assess whether they can " . . . be correctly understood by respondents and easily answered by them" Morgan (1990). Scientists recognize that pre-tests can improve the quality of a survey by increasing clarity and avoiding misunderstandings of survey questions Diamond (2000). Pre-testing is especially important in mail and web surveys because there are no interviewers to report problems in the questions and the survey instrument to the researcher. The purpose of the pre-test is to test both the questions and

the questionnaire Dillman (1978). He also recommends submitting the questionnaires to the scrutiny of three groups of persons: colleagues, prospective respondents, and users of the data. In this study samples from all groups has been selected. It is not of course being suggested that these four groups are separate; membership of one does not preclude simultaneous membership of another, and in certain cases members of one group may, after satisfactory apprenticeship, move to another, but it remains the case that an understanding of the social conventions of citation could possibly benefit from a practical exploration of beliefs and behavior within these four groups. In this research attention is focused on the producers to see what, if any, consensus exists. It seems not unreasonable to suppose that if the cultural and social convention of citing is meaningful, then its meaning will be best grasped and articulated by this elite group that in nature comprises the four above mentioned groups.

Initial Pilot Study (Identification of Potential Factors Influencing Citation Behaviour)

Aims

The answers of this pilot study were used to aid in the construction of the main questionnaire for evaluation of factors involved into the low rate of Iranian medical journals co-citation.

Methods

A series of open-ended questions were sent to academics along with the preliminary results of the citation analysis indicating the low citation rate amongst Iranian medical journals and inviting comments on the results.

Results

Of the fifty academics who were invited to comment, 30 responded with helpful comments.

The results of a pilot survey revealed that there might be a number of possible reasons for the paucity of citations to Iranian journals as itemized below.

Lack of information databases such as indexes and abstracts.

Greater value given by authors, editors and referees to citation of foreign articles.

Unavailability of Iranian journals.

Priority of other sources of information such as books, dissertations and proceedings.

Existence or availability of external articles with high quality among internationally published journals.

Deficit or deficiency of relevant articles due to the low rate of research in the same subject.

Lack of transfer of common knowledge to domestic scientific community.

Non-usefulness or lack of quality of articles published in Iranian Journals.

Personal characteristics such as: Snobbery.

Deliberate non-acknowledgement.

Plagiarism.

Jealousy.

Competition.

Unavailability of most Iranian journals article in the Internet.

Journal editors and referees pay greatest attention to the quantity of non-Persian references attached to submitted manuscripts.

These possible factors were incorporated into the main questionnaire survey to examine the extent to which each may influence the citation behavior of Iranian medical researchers.

Second Pilot Study (To test the effectiveness of the initial questionnaire)
Aims
Following the initial pilot study referred to above, where candidate factors influencing citation behavior were identified, a second pilot study based on these factors was evaluated.

Methods
A semi-structured questionnaire consisting of 43 questions was designed and sent to 50 Iranian researchers working in different fields within the medical sciences.

Results
The thirty responses received were analyzed and a discussion panel with 5 faculty members was established to determine whether they understood and conceptualised the questions in the same way. Following further discussions it was decided that a lower

number of questions would increase the rate of return and result in more considered responses. Therefore, the factors under investigation were reduced to ten and the number of questions was cut to twenty-one.

Postulated Hypotheses

An explanation of the reasons for the relatively low citation of internally published journals was the focus of this section of the study. Based on the results and feedback from the two pilot studies, the final questionnaire was primarily designed to test the following hypothesis:

Explanation: The reasons for the relatively few citations to Iranian journals.

In addition, the study was also seen as an opportunity to explore other factors related to citation behaviour and these are reflected in the following categories:

a. **Concept of Citation:** How Iranian researchers perceive and approach citation

b. **Concept of Referencing:** How Iranian researchers perceive the relationship between the number of references and the quality of an article

c. **Role of Reviewers:** Have reviewers ever pointed authors to relevant work that has not been cited in the submitted article?

Concept of Self-Citation: How do Iranian researchers perceive the value of self-citation?

In all of the above categories, differences in opinions between various sub-groups of respondents were also examined based on hypotheses designed to answer the following generalized questions:

In each category, are there any differences of opinion within the following groups?

Gender

Appointment

Publication record

Previous experience of peer reviewing

To test the internal consistency of the questionnaire, more than one question was set to test each of the hypotheses. However, since in the third pilot study (where there were

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more than 400 respondents), correlation analysis revealed a very strong relationship between some of the questions designed to test a single hypothesis, only one question was set in the final questionnaire to test that hypothesis. This was justified on the grounds that this would minimize the length of the questionnaire (which is known to affect both the rate of returns and the quality of responses) without compromising validity.

Methods

The methods employed here can be subdivided into three main sections. First, a questionnaire was devised based on the information received from the three pilot studies and the conventional criteria for questionnaire design as described above. Secondly, a sample population of recipients consisting of academic members of Iranian medical establishments was selected at random. The questionnaires (see appendix T) were then distributed by post and e-mail. Finally, the data were analyzed in Microsoft Excel and SPSS.

Design of Final Questionnaire

Category 1: Explanation

On the basis of the three pilot studies, questions in this category were designed to correspond to the hypotheses that the relatively few citations to Iranian journals are thought to be due to

Accessibility:	Questions testing the hypothesis that foreign sources are more accessible
	Foreign journals and articles are easier to find than Iranian ones
	Most of the articles published in domestic journals are not accessible via indices, databases and internet.
Personal Bias:	Questions testing the hypothesis that there is a practice of deliberate non-citation of Iranian articles (for personal reasons).
	The low rate of internal co citation may be the result of personal motivations among Iranian researchers.
	Probably, Iranian researchers tend to cite more foreign works to show that the researcher has conducted the research with good knowledge of the field.
	Some Iranian authors do not cite internal works to show that there is no precedence for the work in Iran.

Cultural Bias/Values:	Questions testing the hypothesis that there is a practice of deliberate non-citation of Iranian articles (for cultural reasons).
	Editors and referees of Iranian journals pay greater attention to the number of foreign works than internals ones.
	Probably, due to the use of specialist and impartial referees, articles published in foreign journals are of higher quality than those in Iranian journals.
	One of the main reasons of the low rate of internal citation among Iranian medical researchers is that often there is insufficient Iranian research in the field to cite.
	One of the main reasons of the low rate of internal citation among Iranian researchers may be that the content and data of articles published in domestic journals are not up to date.

One of the possible reasons of low citation among scientist might be the fact of omission of citation. The main reason for failing to cite, as Moravcsik (1989) indicates is more likely authors take common known information as their own.

Protocol:	Questions testing the hypothesis that Iranian medical researchers lack knowledge of correct citation protocol
	Any use of other persons' works (direct or indirect) needs to be cited.

The following questions were not in the two pilot studies. However, feedback from the second pilot study indicated that may prove to be informative indicators.

In the citing behavior studies, the percentages for the "affirmational type" [7]citations range from about 10 percent to 90 percent. As Cronin's study (1982) on psychology journal editors and editorial advisory board members indicated more than 80% of the participants believed that scientists frequently fail to cite all pertinent work and that authors tend to cite those whose views support their own.

Researchers may want to cite an author who is himself citing another source that he/she has not seen. The citing author must make it clear that he/she has not seen the original source her/himself, to avoid misleading the reader. This phenomenon may be occurring

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[7] Citations of 'affirmational type' includes citing work confirms cited work; citing work is supported by cited work; citing work depends on cited work; citing work agrees with ideas or findings of cited work and citing work is strongly influenced by cited work, Bornmann (2008).

in Iran as a result of inaccessibility to the full text of foreign or even domestic publication. Therefore the questions arising from this fact is that to what extent Iranian medical scholars assume researchers tend to cite works which views support their own or the tendency to cite works whose full text they have not read and only based on abstract of an article in an index or seeing it in the list of references of a paper it was cited.

Therefore, questions were included in the questionnaire as a preliminary measure to be expanded upon in future studies if the results warranted it.

	Questions testing the hypothesis that
Favoritism:	*Authors tend to cite those whose views support their own.*
Secondary referencing:	*Authors commonly cite works whose full text they have not read.*

Category 2: Concept of Citation

Although this study is based on the assumption that citation analysis is a valuable decision-making tool, results outlined in the previous chapters led to questions of how citation is perceived by Iranian medical researchers. Here, the opportunity was taken to sound out Iranian researchers' perspectives on citation and different type of information sources. The questions designed to test these two aspects of this category were as follows:

Questions testing the hypothesis that Iranian medical researchers perceive the number of citation in a paper be indicative of the quality of an article.	
Quality:	*Usually, articles with higher quality receive more citations.*
Influence:	*The more influential researchers in a given field are recognizable through the number of citations they receive.*
Credit:	*The more citations a researcher receives the more influential he or she is.*
Validity:	*Quality of an article is measurable through the number of citations it will receive.*

Questions testing the hypothesis that Iranian medical researchers perceive the relevance of different types of information sources differently.	
Articles:	*A greater number of citations of an article to research papers is indicative of a higher quality of that research.*
Books:	*In medical research, citations to books are not as valuable as citations to articles published in peer reviewed journals.*

Category 3: Concept of Referencing

The following hypothesis was based on the researcher's experiences of working with Iranian medical researchers and observation of their attitudes.

A question to test the hypothesis that a greater number of Iranian medical researchers perceive that there is not a relationship between the number of references and the quality of an article.	
List of References:	*A long list of references is an indicator of a research quality.*

Category 4: Role of Reviewers

Many studies lend considerable support to the idea that editors and referees could play a role in establishing and encouraging consistency in authors' citation practices. The following question was designed to ascertain the extent to which reviewers influence citation practice.

Questions to test the extent to which reviewers pointed authors to relevant work that has not been cited in the submitted article	
Referral:	*Have reviewers ever pointed to relevant work that has not been cited in your article?*
Type:	*If so, did it refer to Iranian or foreign research or both?*

Category 5: Concept of Self-Citation

Self-citation was another factor where cultural differences are expected. The respondents were asked to rate the function and significance of self citation.

A question to test the extent to which self-citation is perceived by Iranian medical researchers as being different from other types of citations.	
Value of Self-Citation:	*Self-citation is just as valuable as any other citation*

Sampling Scheme (Systematic)

To ensure that different types of academic appointments were adequately represented in the sample, the sampling frame was stratified by academic appointments. Each academic appointment is called a stratification factor. It means that before any selection takes place, the population is divided into a number of strata; then a random sample is selected within each stratum. This procedure is almost certain to be an improvement on a simple random because it makes sure that the different strata in the population are correctly represented in the sample. Thus stratified random sampling with a uniform sampling fraction tends to have somewhat greater precision than simple random sampling. Another advantage of stratified random sampling is that variation between strata does not enter into the standard error; because one ensures that this component of variation in the population is exactly reflected in the sample. Stratified sampling on the basis of academic position was used. 11440 academic members of medical science faculties were identified. These were classified into 4 groups according to their position (see table 6.4).

Using a computer program to calculate the sample size required for this population, it was found that for a 95 % Confidence Level and 4.3 Confidence Interval, a sample of about 500 is required. Assuming a non-response rate of 50 %, an initial target of 1000 was proposed. A random number was used to select the first sample member from the list and subsequent members were selected according to a fixed sample interval. This interval was calculated by dividing the total number on the list by the required sample size. For example to select 29 full-professors from 331 the sampling interval would be 11, and a random starting number was chosen between 1 and 11. This was 10, so the persons selected were those numbered 10, 21, 32…and so on.

Data Analysis

Different researchers analyse Likert_Scales on the basis of different assumptions. Both parametric and non-parametric tests appear in the literature (see e.g., Clason and Darmody (2001). If the probability of choosing adjacent choices on the scale is considered to be equal, then a normal distribution is assumed and parametric analytical techniques are justified. On the other hand, if normality cannot be assumed, then non-parametric statistical techniques are indicated.

Parametric tests, being more powerful, have a number of advantages. The primary advantage of parametric testing is that you get slightly more statistical power to detect

differences, but not much. On the other hand, if normality cannot be assumed, then the more limiting non-parametric alternatives need to be utilized.

It may be is argued that since non-parametric tests rely on analysis of ranks and since the latter is not affected when normality of distribution is assumed, then where the data are normally distributed, the results of parametric and non-parametric tests will be the same. On the other hand, if the data are not normally distributed, then the results may or may not be the same depending on the extent of the deviation from normality.

The mode was taken as the best measure of central tendency because it is not affected by the variance of the data. This idea is supported by Edwards (1957) who recommends that for non-parametric (esp. Likert-type) scales the mode be used.

Responses to a single Likert item are normally treated as ordinal data, because, especially when using only five levels, one cannot assume that respondents perceive the difference between adjacent levels as equidistant. Ordinal data have an inherent order or sequence, but one cannot assume that the respondent means that the difference between agreeing and strongly agreeing is the same as between agreeing and being undecided. When treated as ordinal data, Likert responses were analyzed using non-parametric tests. Once the influential factors have been determined, they are incorporated into a multiple regression analysis to establish the extent to which each of these factors affects citation behaviour.

In order to take into account the publication background of the respondents to understand whether or not having different number of publications in internal or external journals affect respondents' approach towards statements within the questionnaire, their publication record were extracted for comparison. The number of publications of authors was grouped into for quartiles. The mean ratings for each of the hypotheses being tested were the compared between the quartiles. The same approach was applied over their published books and translation records.

The reliability of the items within all 20 items of the questionnaire was tested using Cronbach's Alpha measure. A value of greater than 0.7 was taken to confirm the reliability of the questionnaire Cortina (1993), Miller (1995), Reuterberg and Gustafsson (1992), Zimmerman, Zumbo and Lalonde (1993) and Nunnaly (1978).

Similar analyses were carried out to test the internal reliability of the groups of items taken to test the same categories.

6.3 Results and Conclusions

Overview

Of the 1000 questionnaires distributed, 516 were received these are summarized 'Appointment' in table 6.4.

Table 6.4: The frequency and percentage of targets and respondents, categorized by 'Appointment'.

Appointment (group)	Total Population	Target Frequency (Stratified)	Frequency of Respondents		Percent Respondents
			Male	Female	
Full Professor	331	29	16	7	76
Associate Professor	889	78	35	9	56
Assistant Professor	6434	562	203	99	54
Tutor	3786	331	72	75	44
Total	11440	1000	326	190	51

Of 516 respondents who have identified their sex, 326 were male and 190 were female. The female proportion of those who identified their previous reviewing experience was 32 %. The table 6.5 serves to illustrate distribution of respondents according to their sex and reviewing experience.

Table 6.5: Output of the crosstab between sex of the respondents and who have had refereeing experience and those who have not.

Sex * referee Crosstabulation

		referee		Total
		referee background	without referee background	
sex	male	217	89	306
	female	105	59	164
Total		322	148	470

Questionnaire reliability

The result of a Cronbach's alpha value of 0.714, as summarized below, confirms the internal reliability of the questionnaire.

Table 6.6: Output of questionnaire Reliability Analysis

Case Processing Summary					Reliability Statistics	
		N	%		Cronbach's Alpha	N of Items
Cases	Valid	496	96.1		.714	20
	Excluded(a)	20	3.9			
	Total	516	100.0			

a Listwise deletion based on all variables in the procedure.

Factor Analysis

Factor analysis was used to determine the extent to which the 20 rated questions in the questionnaire fit into five broad categories that two previous pilot studies had indicated to be assessing the same concept. The results confirm the categories into which the questions were allocated.

In table 6.7 factors 1 to 5, correspond to the five hypotheses (for which there were more than one question in the 'Explanation' and 'Concept of Citation' categories. These hypotheses were,

Questions testing the hypothesis that Iranian medical researchers perceive the relevance of different aspects of citation differently.

Questions testing the hypothesis that there is a practice of deliberate non citation of Iranian articles (for personal reasons).

Questions testing the hypothesis that there is a practice of deliberate non citation of Iranian articles (for cultural reasons).

Questions testing the hypothesis that foreign sources are more accessible.

Questions testing the hypothesis that Iranian medical researchers perceive the relevance of different types of information sources differently.

Table 6.7: Factor Analysis of 14 questions related to five of the hypotheses

	Factor				
	1	2	3	4	5
Quality of an article is measurable trough the number of citations it will receive.	.663				
Usually, articles with higher quality receive more citations.	.646				
The more influential researchers in a given field are recognizable through the number of citations they receive.	.604				
The more citations a researcher receives the more influential he or she is.	.483				
Some Iranian authors do not cite internal works to show that there is no precedence for the work in Iran.		.692			
Probably, Iranian researchers tend to cite more foreign works to show that the researcher has conducted the research with good knowledge of the field.		.619			
The low rate of internal co citation may be the result of personal motivations among Iranian researchers.		.584			
One of the main reasons of the low rate of internal citation among Iranian medical researchers is that often there is insufficient Iranian research in the field to cite.			.705		
One of the main reasons of the low rate of internal citation among Iranian researchers may be that the content and data of articles published in domestic journals are not up to date.			.663		
Probably, due to the use of specialist and impartial referees, articles published in foreign journals are of higher quality than those in Iranian journals.			.581		
Foreign journals and articles are easier to find than Iranian ones.				.907	
Most of the articles published in domestic journals are not accessible via indices, databases and internet.				.594	
A greater number of citations of an article to research papers is indicative of a higher quality of that research.					.715
In medical research, citations to books are not as valuable as citations to articles published in peer reviewed journals.					.705

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

a Rotation converged in 5 iterations.

Hypothesis 1: Accessibility

Descriptive Statistics

Figure 6.1 summarises the responses to questions related to 'Accessibility' hypothesis.

Figure 6.1: Distribution of responses to the questions related to the 'Accessibility' hypothesis.
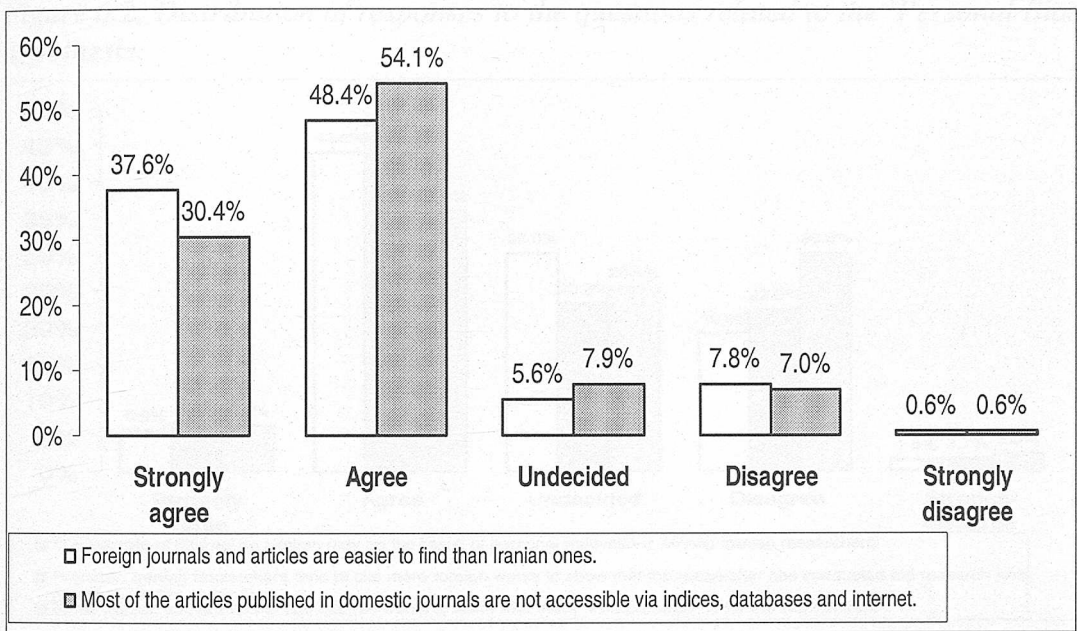
The assumption that both questions test the same hypothesis has already been supported by the results of the Factor analysis. However, this was further confirmed by Cronbach's Alpha coefficient indicating an acceptable reliability level, α (516, 2) = 0.706.

The modal average for both of the related questions is "Agree" (51.25 %). Overall, the responses indicate that accessibility to Iranian medical literature is a major concern (85.25 % being Agree or Strongly Agree versus 8% Disagree or Strongly Disagree). These results support the hypothesis that the relatively few citations to Iranian journals are thought by Iranian medical researchers to be partly due to foreign articles being more accessible.

Hypothesis 2: Personal Bias

Descriptive Statistics

Figure 6.2 summarises the responses to questions related to 'Personal Bias' hypothesis.

Figure 6.2: Distribution of responses to the questions related to the 'Personal Bias' hypothesis.
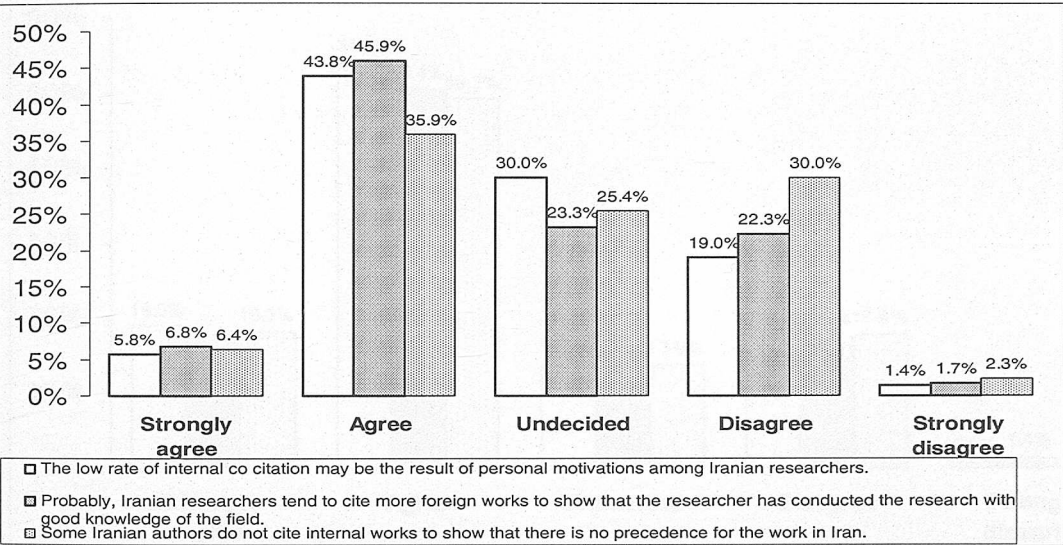
The assumptions that all three questions test the same hypothesis have already been supported by the results of the Factor analysis, however, this was further confirmed by Cronbach's Alpha coefficient indicating an acceptable reliability level, α (516, 3) = 0.708.

The modal average for the three of the related questions is "Agree" (41.86 %). Overall, the responses indicate that Iranian researchers claim that they do not cite many internal references as a result of the personal motivations (biases). (48.9 % Agree or Strongly Agree versus 25.46 % Disagree or Strongly Disagree).

Hypothesis 3a: Cultural Bias/Values (Authors):

Descriptive Statistics

Figure 6.3 summarises the responses to questions related to 'Cultural Bias/Values:' hypothesis.

Figure 6.3: Distribution of responses to the questions related to the 'Cultural Bias/Values:' hypothesis.
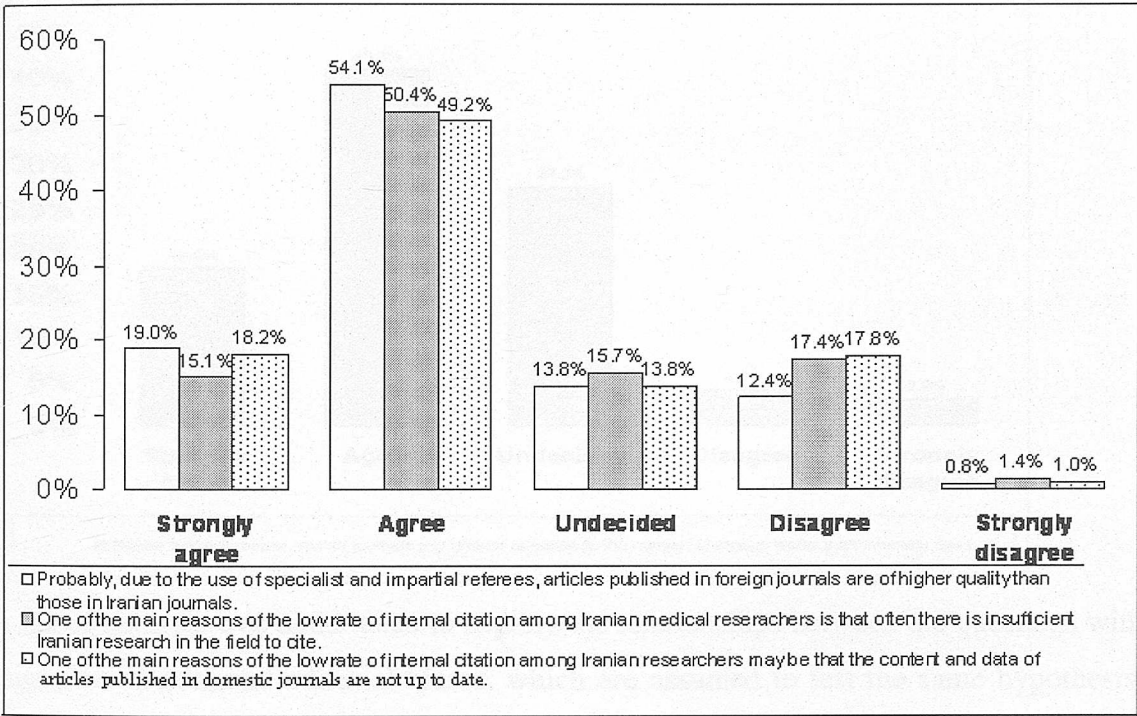
The assumption that all three questions test the same hypothesis has already been supported by the results of the Factor analysis, however, this was further confirmed by Cronbach's Alpha coefficient indicating an acceptable reliability level, α (516, 3) = 0.701.

Whilst the modal average for both of the related questions was "Agree" (51.23 %), the overall responses also support the hypothesis that Iranian researchers perceive that others do not cite all internal publications as a result of the Cultural Values (biases). (68.66 % Agree or Strongly Agree versus 16.92 % Disagree or Strongly Disagree).

Hypothesis 3b: Cultural Bias/Values :(Editors and Reviewers Biases)

Descriptive Statistics

Figure 6.4 summarises the responses to questions related to 'Editors and Reviewer Biases' hypothesis.

Figure 6.4: Distribution of responses to the questions related to the 'Editors and Reviewer Biases' hypothesis.

□ Editors and referees of Iranian journals pay greater attention to the number of foreign works than internals ones.
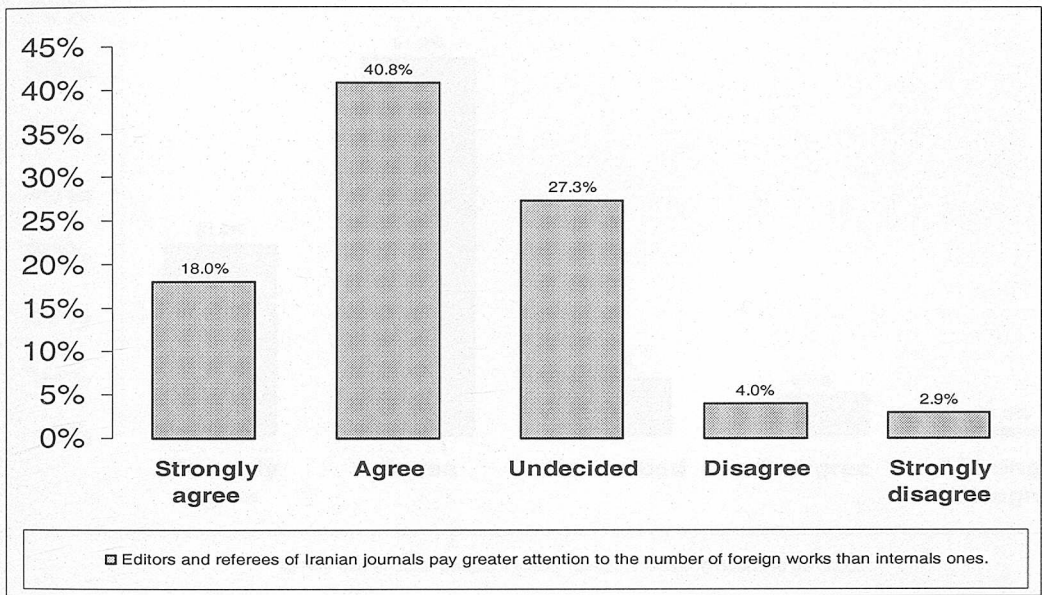
A factor analysis was undertaken to explore the relationships between the questions with regard to authors and editorial biases, which are assumed to test the same hypothesis, reveals that the question related to the Editorials and Reviewer Biases was not positively related to the author's biases. Therefore it was decided to test referees and editorials biases separately.

The modal average for the related questions is "Agree" (40.08 %).

Overall, the responses indicate that Iranian researchers do not cite more internal work as a result of Editorials and Reviewer biases toward foreign works. (88.08 % Agree or Strongly Agree versus 6.09 % Disagree or Strongly Disagree).

These results support the hypothesis that the relatively few citations to Iranian journals are thought by Iranian medical researchers to be partly due to the factors related to Editorials and Reviewer biases.

Hypothesis 4: Protocol

Descriptive Statistics

Figure 6.5 summarises the responses to questions related to 'Protocol' hypothesis.

Figure 6.5: Distribution of responses to the questions related to the 'Protocol' hypothesis.
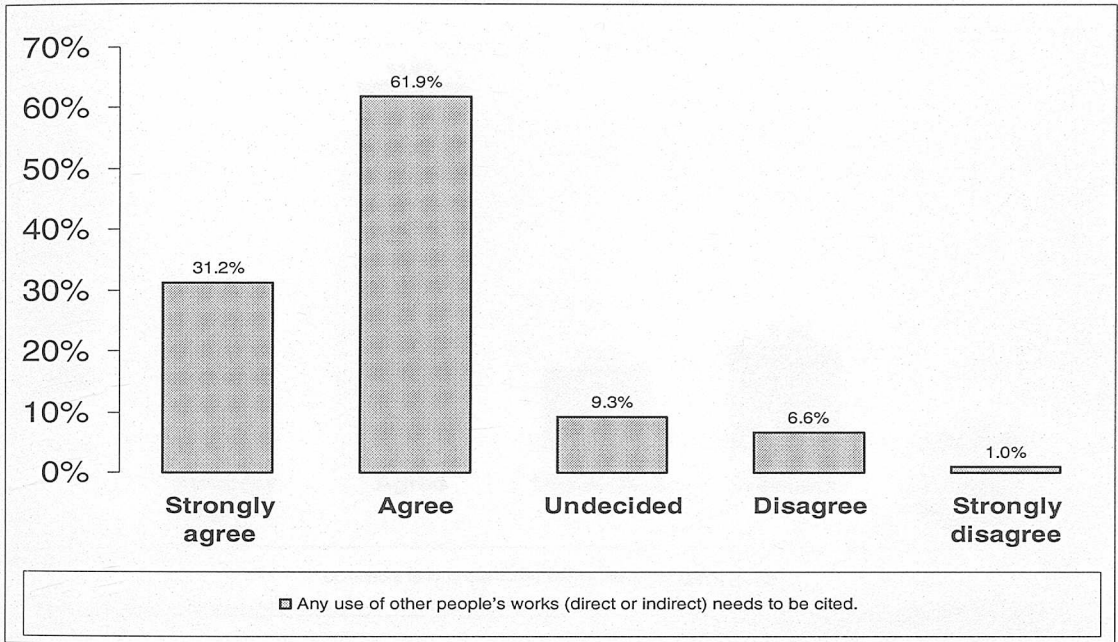
Since in the second pilot study correlation analysis revealed a very strong relationship between the two questions (1.If other person' work is not quoted exactly, it does not need to be cited and 2. Citations are required when providing any kind of information or idea) designed to test this hypothesis, only one question was set in the final questionnaire in consideration of minimizing the length of the questionnaire.

The results of this part of the study reject the hypothesis that the relatively few citations to Iranian journals are perceived to be due to Iranian researchers' lack of knowledge of correct citation protocol, with the modal average for the question being "Agree" (61.9 %). Overall, the responses indicate that Iranian researchers believe that their colleagues are aware of conventions and standards of scientific communication (93.1 % versus 7.6 %, with 9.3 % being neutral) although, this may not be reflected in their citation practice and behavior.

Hypothesis 5: Favouritism

Descriptive Statistics

Figure 6.6 summarises the responses to questions related to 'Favouritism' hypothesis.

Figure 6.6: Distribution of responses to the questions related to the 'favoritism' hypothesis.
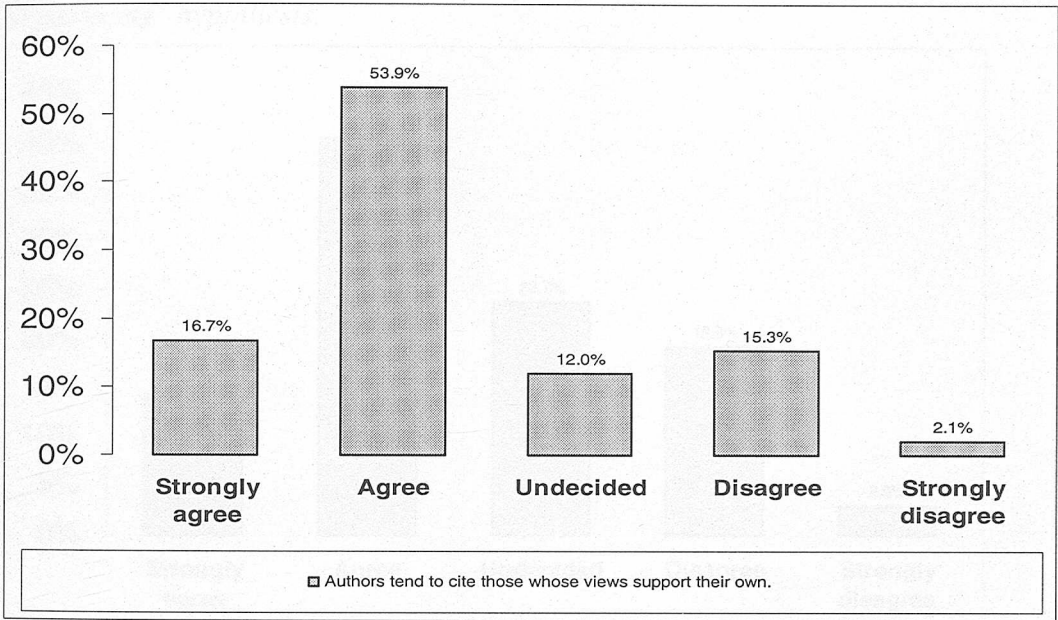
The results of this part of the study support the hypothesis that the authors tend to cite those whose views support their own.

With the modal average for the question is "Agree" (53.9 %). Overall, the responses being agree or strongly agree (70.6 % versus 17.4 %, with 12 % being neutral) affirm the assumption. Although this result appears to be convincing, to maintain consistency across all of the other questions and hypotheses more detailed quantitative tests have been conducted with the question.

Hypothesis 6: Secondary Referencing

Descriptive Statistics

Figure 6.7 summarises the responses to questions related to 'Secondary Referencing' hypothesis.

Figure 6.7: Distribution of responses to the questions related to the 'Secondary Referencing' hypothesis.
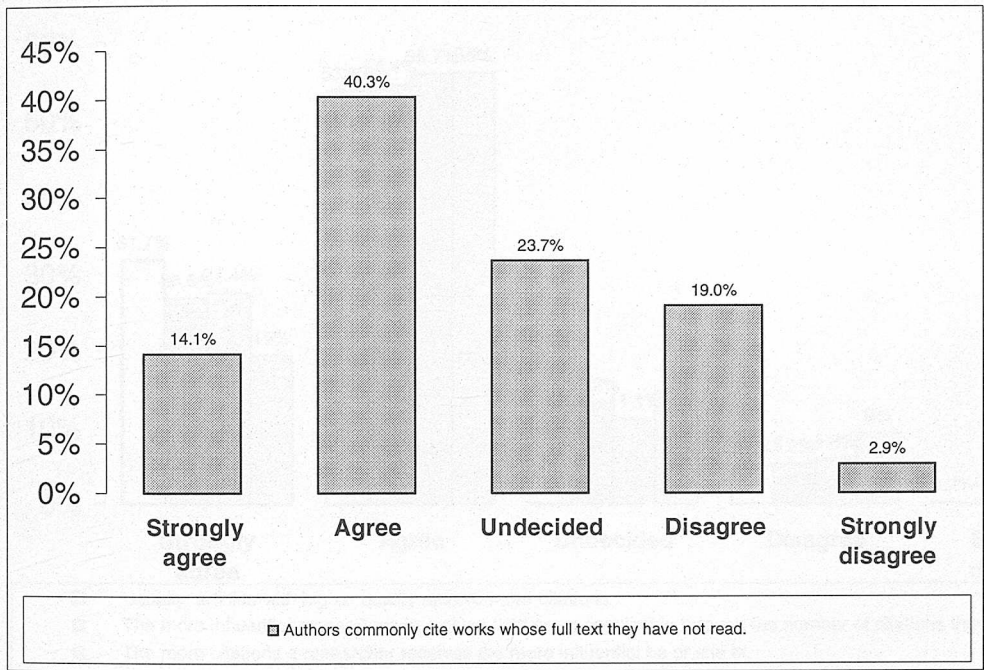
With respect to this hypothesis, only one question was asked. Overall, the responses indicate that Iranian medical scholars confirm their belief in the presence of such a behavior among Iranian medical scholars who have some kind of tendency to cite works whose full text have not read by them (54.4 % being agree or strongly agree, compared to 21.9 % disagree or strongly disagree).

Hypothesis 7: Concept of Citation

Descriptive Statistics

Figure 6.8 summarises the responses to questions related to 'Concept of Citation' hypothesis.

Figure 6.8: Distribution of responses to the questions related to the 'Concept of Citation' hypothesis.
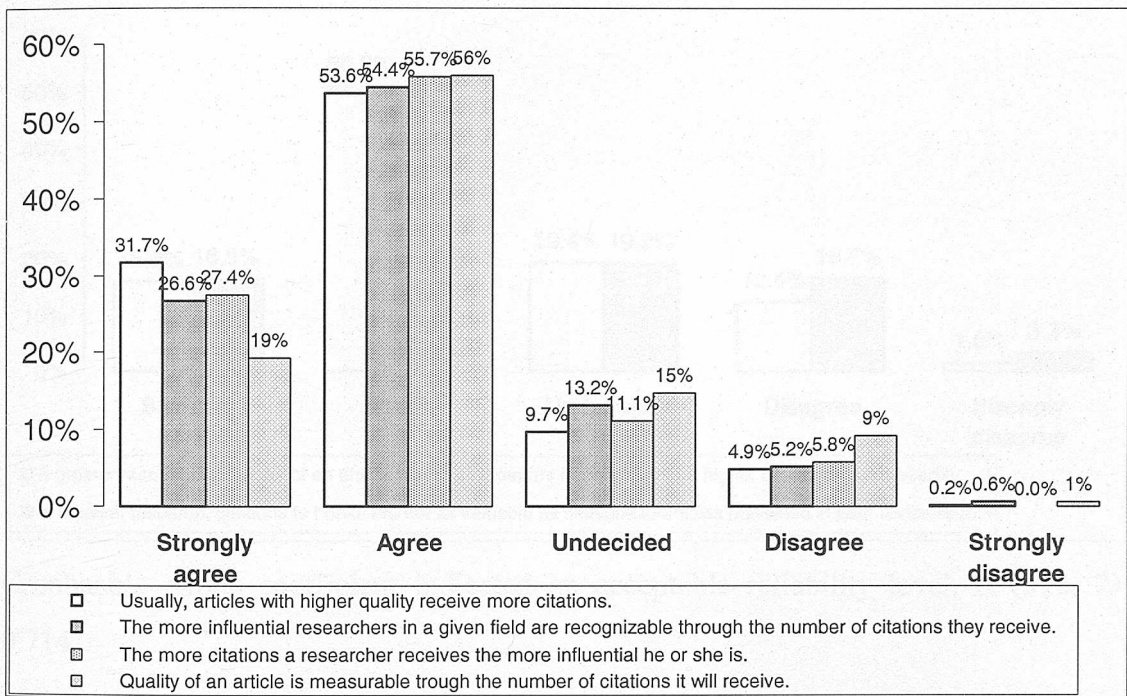
Cronbach's Alpha coefficient is indicated an acceptable reliability level, α (516, and 4) = 0.710. The results of this part of the study show how Iranian researchers perceive the concept of citation. The results derived from this part of the investigation suggest that citation is a valid indicator of the quality, influence or impact of published scientific knowledge in view of the Iranian medical researchers.

The investigation of Iranian medical researchers' approach to citation, with the modal average for four of the related questions being "Agree" (54.92 %), indicate that Iranian researchers consider citation to be a reliable criterion of the quality, influence or impact of published scientific publications. The overall responses (81.17 % Agree or Strongly Agree versus 6.65 % Disagree or Strongly Disagree) strongly support this conclusion.

Hypothesis 8: Concept of Citation to different type of information sources

Descriptive Statistics

Figure 6.9 summarises the responses to questions related to 'Concept of Citation to different type of information sources'hypothesis.

Figure: 6.9: Distribution of responses to the questions related to the 'Concept of Citation to different type of information sources' hypothesis.
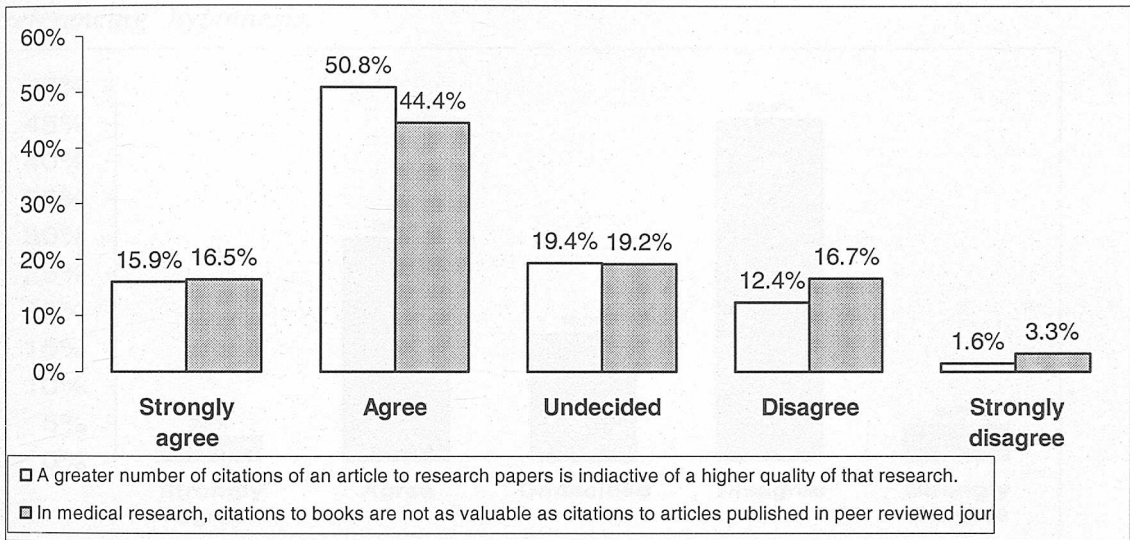
Cronbach's Alpha coefficient indicated an acceptable reliability level, α (516, 2) = 0.714.

The result of this part of the study support the hypothesis that that Iranian researchers perceive the relevance of different types of information sources differently, with the mode being "Agree" (47.6%). Overall, the responses indicate that Iranian researchers are more likely to refer research articles (65.8. % "Agree" or "Strongly Agree" versus 17% "Disagree" or "Strongly Disagree").

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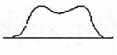
Hypothesis 9: Concept of referencing

Descriptive Statistics

Figure 6.10 summarises the responses to questions related to 'Concept of referencing' hypothesis.

Figure 6.10: Distribution of responses to the questions related to the 'Concept of referencing' hypothesis.
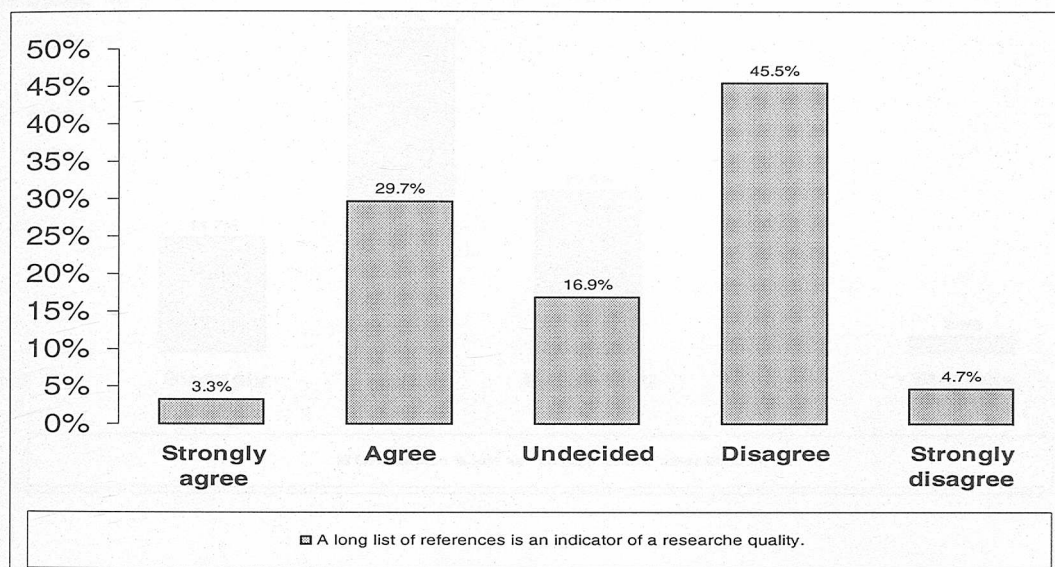
Whilst the results of this part of the study support the hypothesis that most Iranian researchers perceive there to be no relationship between the number of references and the quality of an article, with the mode being "Disagree" (45.5 %), unlike in the case of the other hypotheses, opinions with regards to this question appear to be polarized with the distribution being bimodal ( ). Overall, the responses indicate that Iranian researchers are less likely to equate the number of references with the quality of an article (50.2 % Disagree or Strongly Disagree versus 33 % Agree or Strongly Agree).

One of the intriguing questions arising from the citation analysis data (see chapter 4) was why articles by Iranian medical researchers contain fewer references than their international counterparts. The finding here could partly explain this discrepancy. If Iranian medical researchers do not relate the quality of an article to the number of references it contains, then this will not be a motive to include more citations.

Hypothesis 10: Concept of Self-Citation

Descriptive Statistics

Figure 6.11 summarises the responses to questions related to 'Concept of Self-Citation'hypothesis.

Figure 6.11: Distribution of responses to the questions related to the 'Concept of Self-Citation' hypothesis.
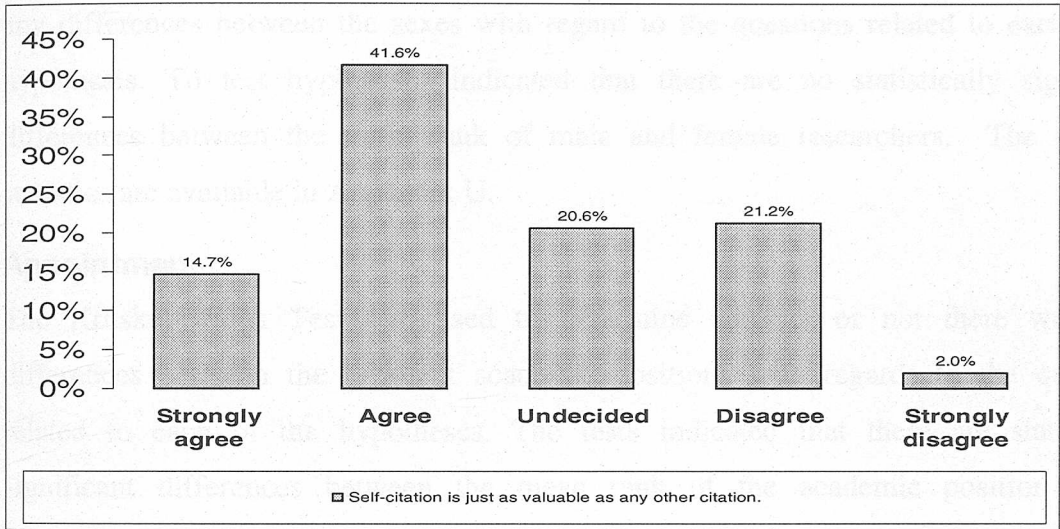
Cronbach's Alpha coefficient being 0.8.7 for the two corresponding questions at our pervious study, it was decided to ask only one question with regard to the value that researcher attach to the self-citation.

The results of this part of the study show how Iranian medical researchers perceive the value of self-citation. Overall, the responses indicate that Iranian researchers consider self- citation (citing one's previous publications in a new publication) as a natural practice in the process of scientific communication, with the mode being "Agree" (41.6 %). Overall, the responses (56.3 % being Agree or Strongly Agree) indicate that self-citation has been interpreted as a means for an author or group of authors to expand on previous hypotheses, refer to established study designs and methods and to justify further investigations on the basis of prior results. Taking into account the overall result, self-citation is perceived to be inevitable and just as valuable as any other citation from the point of view of Iranian medical researchers (both males and females).

In order to take into account the gender, different appointments, previous experience of reviewing and the publication background of respondents to understand whether or not

these factors affect respondents' approach towards statements within the questionnaire, the mean ratings for each of the hypotheses being tested. These factors have been described as follow:

Gender

The nonparametric Mann-Whitney Test was used to determine whether or not there were any differences between the sexes with regard to the questions related to each of the hypothesis. To test hypotheses indicated that there are no statistically significant differences between the mean rank of male and female researchers. The relevant statistics are available in Appendix U.

Appointment

The Kruskal-Wallis Test was used to determine whether or not there were any differences between the different academic positions with regards to the questions related to each of the hypotheses. The tests indicated that there are statistically significant differences between the mean rank of the academic position of the respondents and their perceptions of the role of 'Editorials and Reviewer Biases' in the low rate of internal citations in Iranian medical journals.

Comparison by different appointments was carried out to determine which two of the respondent groups' means are large enough to convince that the difference is meaningful. To do this, the LSD (Least Significant Difference) and Dunnett_T3 test were performed. The results are shown in table 6.8.

Table 6.8: (Appointment): Dunnett T3 and LSD test.

Multiple Comparisons							
Dependent Variable: Editors and referees of Iranian journals pay greater attention to the number of foreign works than internals ones.							
	(I) Appointment	(J) Appointment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
Dunnett T3	Assistant professor	Full professor	0.236	0.197	0.792	-0.325	0.796
		Associate_ professor	0.052	0.144	0.999	-0.338	0.442
		Tutor	0.325	0.100	0.007	0.061	0.588

*The mean difference is significant at the .05 level.

As table 6.8 indicates, multiple comparisons of mean differences between various types of academic appointments and question 2 of the questionnaire show there to be

differences in responses to questions 3 suggesting that, on average, Assistant-Professors are more likely to believe that the relatively few citations to Iranian journals are partly due to the fact that "Editors and Referees" of Iranian journals pay greater attention to the number of foreign works than internal ones. The statistics related to the non-significant differences for all of the other appointment-related hypotheses are available in Appendix V.

Previous experience of peer reviewing

T-tests were used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not, with regards to the questions related to each of the hypotheses indicate that there are statistically significant differences in relation to Accessibility, Personal bias, Author bias, Editorial and referees bias, Favoritism, Concept of citation and self citation and Concept of citation to different type of information sources.

The significant findings are shown below and the results of the analyses for the non-significant results are shown in Appendix W.

With regard to Accessibility, the T-tests were used to determine whether or not there were any differences between those authors who have had refereeing experience and those who have not, with regards to the questions related to 'Accessibility'. The results, as shown in the following output indicate that there is some evidence of a difference between the mean ranks of two groups (z=2.752; Sig.).

Mann−Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Accessibilit y	referee background	330	228.22	75314.00
	without referee background	148	264.64	39167.00
	Total	478		

Test Statistics (a)

	Accessibilit y
Mann-Whitney U	20699.000
Wilcoxon W	75314.000
Z	-2.752
Asymp. Sig. (2-tailed)	.006

a Grouping Variable: referee

The results suggest that those with reviewing experience consider 'Accessibility' to be more of a problem than those without.

These results also indicate that further research needs to be carried out in view of the reasons for foreign publications being more accessible than internal ones. For example, one such study could be to investigate the relationship between the extent to which an internal article is cited and the formats in which they are available.

The practical implication of this finding could be that different media formats need to be provided through which Iranian medical researchers can access literature.

With reference to Personal bias, the Mann-Whitney test was used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Personal Biases'.

Mann–Whitney Test
Ranks

	referee	N	Mean Rank	Sum of Ranks
Personal bias	referee background	330	264.13	87164.00
	without referee background	148	184.57	27317.00
	Total	478		

Test Statistics(a)

	Personal bias
Mann–Whitney U	16291.000
Wilcoxon W	27317.000
Z	-5.882
Asymp. Sig. (2–tailed)	.000

a Grouping Variable: referee

The results, indicate that there is a statistically significant difference between the mean rank of the two groups, z=5.882; Sig.

With regard to the Author bias, the Mann-Whitney Test was used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Cultural/Values or biases '.

Mann–Whitney Test
Ranks

	referee	N	Mean Rank	Sum of Ranks
Authors bias	referee background	330	251.40	82962.00
	without referee background	148	212.97	31519.00
	Total	478		

Test Statistics (a)

	Authors bias
Mann–Whitney U	20493.000
Wilcoxon W	31519.000
Z	-2.844
Asymp. Sig. (2-tailed)	.004

a Grouping Variable: referee

The results, as shown in the above output indicate that there is statistically significant difference between the mean rank of the two groups, z= 2.844; Sig.

With regard to Editorial and Referees biases, the Mann-Whitney Test was used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Editorial and Referees biases '.

Mann–Whitney Test
Ranks

	referee	N	Mean Rank	Sum of Ranks
Editorial and Referees' bias	referee background	328	256.44	84112.50
	without referee background	144	191.08	27515.50
	Total	472		

Test Statistics (a)

	Editorial and Referees' bias
Mann–Whitney U	17075.500
Wilcoxon W	27515.500
Z	-5.056
Asymp. Sig. (2-tailed)	.000

a Grouping Variable: referee

The results, as shown in the above output indicate that there is statistically significant difference between the mean rank of the two groups, z = 5.056; Sig.

The results suggest that those without reviewing experiences perceive editorial and referees biases to be a more important factor than those with reviewing experiences. One interpretation of this difference could be that those with reviewing experiences are less likely to express their opinion about the issue in which they are playing role.

A propos Favoritism, the Mann-Whitney Test was used to determine whether or not there were any differences between those authors who have had refereeing experience and those who have not with regards to the questions related to 'Favoritism'. The results, as shown in the following output indicate that there is statistically significant difference between the mean rank of the two groups, $z = 3.976$, Sig.

Mann-Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Favoritism	referee background	330	254.92	84122.50
	without referee background	148	205.13	30358.50
	Total	478		

Test Statistics (a)

	Favoritism
Mann-Whitney U	19332.500
Wilcoxon W	30358.500
Z	−3.976
Asymp. Sig. (2-tailed)	.000

a Grouping Variable: referee

The results suggest that those without reviewing experiences perceive less likely the tendency of authors towards commonly referencing those whose views support the submitted work.

In connection with Concept of Citation, the Mann-Whitney Test was used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Concept of Citation'.

Mann–Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Concept of Citation	referee background	328	247.69	81242.50
	without referee background	145	212.82	30858.50
	Total	473		

Test Statistics (a)

	Concept of Citation
Mann–Whitney U	20273.500
Wilcoxon W	30858.500
Z	−2.585
Asymp. Sig. (2–tailed)	.010

a Grouping Variable: referee

The results, as shown in the above output, indicate that there is statistically significant difference between the mean rank of the two groups, $z = 2.565$, $p < .05$

The practical implication of this finding could be that there is a consensus of opinion amongst Iranian medical researchers that citation indexes can be used as a means of not only appraising research performance surveyors in the field of medicine, assessing the research performance of individual authors and assessing the relative quality of papers and journals, but also decision makers could use it as a tool in promotion, tenure and making awards, Garfield (1962). One must keep in mind that citation data is only a criterion and it must be used along with other scales and measures to obtain a useful or meaningful assessment. The results suggest that those without reviewing experiences perceive more likely that citation is a valid indicator of the quality, influence or impact of published scientific knowledge in view of the Iranian medical researchers.

With regard to Concept of Citation to different type of information sources, the Mann-Whitney Test used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Concept of Citation to different type of information sources'.

Mann–Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Concept of Citation to different type of information sources	referee background	330	263.53	86966.00
	without referee background	148	185.91	27515.00
	Total	478		

Test Statistics (a)

	Concept of Citation to different type of information sources
Mann–Whitney U	16489.000
Wilcoxon W	27515.000
Z	−5.813
Asymp. Sig. (2–tailed)	.000

a Grouping Variable: referee

The results, as shown in the above output indicate that there is statistically significant difference between the two groups, z=. 5.813, p<0.0005.

These results may carry important policy implications for the use of citations to evaluate research performance and distribute resources in science and they represent new information on the role and impact of citations in scientific communication. The results suggest that those without reviewing experiences perceive more likely that citation to different type of information sources should be weighted differently.

With regard to Concept of self-citation, the Mann-Whitney Test was used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Concept of self citation'.

Mann–Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Concept of self citation	referee background	329	248.46	81742.00
	without referee background	144	210.83	30359.00
	Total	473		

Test Statistics (a)

	Concept of self citation
Mann–Whitney U	19919.000
Wilcoxon W	30359.000
Z	−2.898
Asymp. Sig. (2–tailed)	.004

a Grouping Variable: referee

The results, as shown in the above output indicate that there is statistically significant difference between the mean rank of the two groups, $z = 2.898$, $p<0.005$.

The practical implication of this finding could be that in citation analysis of Iranian medical literature self-citation should be given equal weight as any other citation.

Publication record

To see the differences between different groups by 'Publication Record' for each type of previous publication (as shown in the following table) the data was categorised into four or five intervals based on its percentiles. The significant findings are shown below and the results of the analyses for the non-significant results are shown in Appendix X.

		Internal	External	Books	Translation
N	Valid	476	370	240	217
	Missing	40	146	276	299
Percentiles	25	3.00	1.00	.00	1.00
	50	5.00	3.00	1.00	1.00
	75	10.00	7.00	2.00	2.00

The group intervals for each type of publication record are shown below

Quartile	Internal	External	Books	Translation
1	0-2	0	0	0
2	3-5	1-3	1	1
3	6-10	4-6	2	2
4	>10	>6	>2	>2

The output of the ANOVA tests based on different type of publication record showed no differences between the number of any publications and Iranian medical researchers' opinions regarding 'Accessibility' being a reason for the low relative citation to internal sources.

With regard to personal bias, the same analysis was undertaken. Given the result that there are significant differences between quartiles with regards to having an external publication record, post hoc tests were conducted to reveal the detail of the differences.

Post Hoc

External quartiles (I)	External quartiles (J)	Mean Difference (I-J)	Std. Error	Sig.
1.00	2.00	1.07	0.50	0.03
	3.00	0.58	0.54	0.28
	4.00	0.33	0.53	0.53
2.00	1.00	- 1.07	0.50	0.03
	3.00	- 0.50	0.30	0.10
	4.00	- 0.74	0.28	0.01
3.00	1.00	- 0.58	0.54	0.28
	2.00	0.50	0.30	0.10
	4.00	- 0.24	0.34	0.47
4.00	1.00	- 0.33	0.53	0.53
	2.00	0.74	0.28	0.01
	3.00	0.24	0.34	0.47

* The mean difference is significant at the .05 level.

These results can be interpreted at two levels. The first column in the following graph indicates that those respondents with no external publications agree less with the idea that personal biases are an important factor in the low citation of internal sources. However, although the largest difference was between those with no publications (first quartile) and those in the second quartile, there was a significant difference in the opposite direction between those in the second and fourth quartiles.

Figure 6.12: Mean of the Sum of the Ratings for the Three Questions Related Personal Bias.
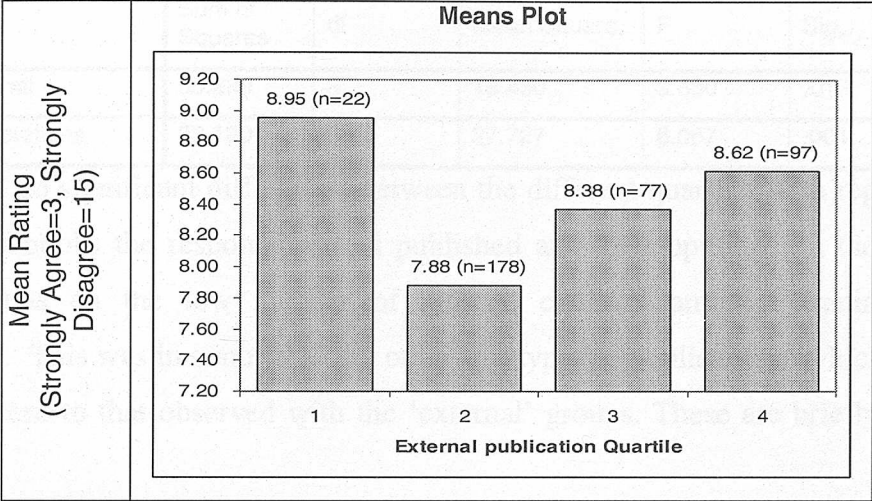
The results suggest that those with no external publication record perceive personal motivation to be a less important factor than those with a minimum of publications. One interpretation of this difference could be that those with low personal motivations are less likely to publish in external journals. Accordingly, they are also less concerned about the issue of personal motivations as indicated by their tendency to rate these questions as 'undecided' (average rating close to 9). On the other hand, those with a minimum of publications belong to the groups who are motivated to publish in external journals, but who have yet to build their publication record. As such, they are more motivated to use citation tactically in their own favour. The reverse trend as the number of external publications rise suggests that this bias is reduced as the person becomes more established in the field. The patterns were observed with regards to other publication types are summarized below.

Summary of the Means of responses

Quartile	Internal			Book			Translation		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
1	100	8.33	2.30	66	8.61	2.00	52	8.90	2.04
2	158	7.72	2.33	87	8.48	2.41	93	7.61	2.09
3	104	8.43	2.04	42	9.05	1.95	35	7.83	2.27
4	114	8.51	2.29	45	7.98	2.16	37	8.95	2.27

ANOVAs

	Sum of Squares	df	Mean Square	F	Sig.
Internal	55.289	3	18.430	3.630	.013
Translations	83.180	3	27.727	6.067	.001

There were no significant differences between the different quartiles with regards to the numbers of books the respondents had published and their opinions on the effects of Personal Bias on the low number of internal citations amongst Iranian medical researchers. This was in contrast to the other two types of publications, which showed a similar pattern to that observed with the 'external' groups. These are briefly discussed below.
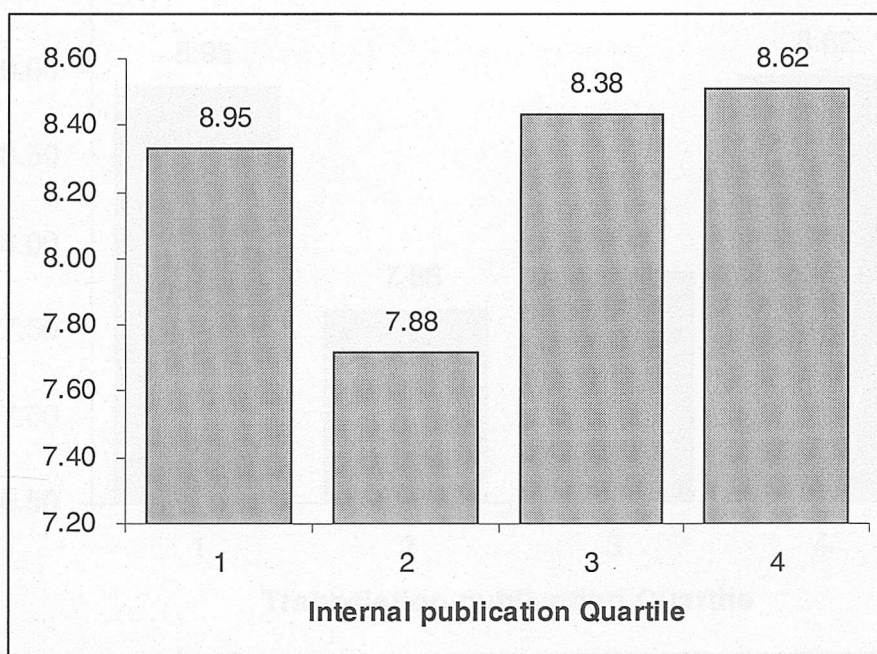
The results indicate that there are significant differences between the second quartile and quartiles 1, 2 and 3 (p<. 03, p<. 01, p<. 005 respectively).

The results suggest that those whose number of such publications falls within the second quartile (have 3 to 5 publications) consider personal motivations to be significantly more important in the low number of internal citations than the other groups.

This pattern can be interpreted in a similar way to that of the results of those with 'external' publications in that they suggest that those with few internal publications

perceive personal motivation to be a less important factor than those with a minimum of publications. One interpretation of this difference could be that those with low personal motivations are less likely to publish. Accordingly, they are also less concerned about the issue of personal motivations, although there is slightly greater tendency towards agreement than with the 'low external publications' group. On the other hand, those with a minimum of publications belong to the groups whose members are motivated to publish, but who have yet to build their publication record. As such, they are more motivated to use citation tactically in their own favour.

The reverse trend as the number of internal publications rise suggests that this bias is reduced as the person becomes more established in the field.
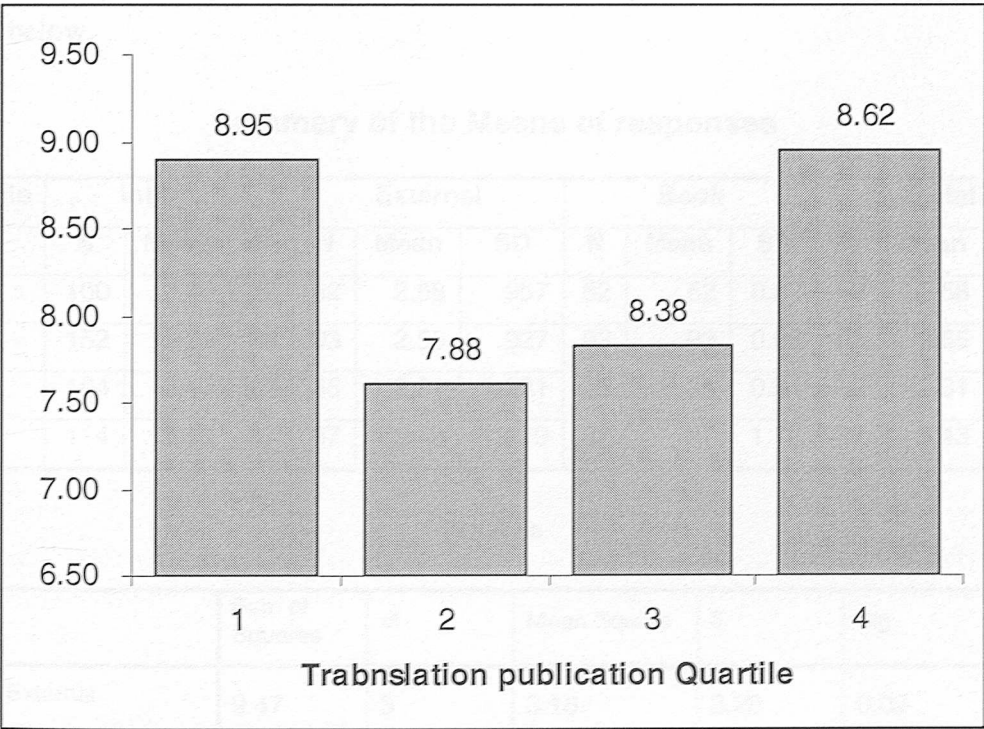
The results indicate that there are no significant differences between the middle two quartiles and also between the first and the last quartile. However, there are significant differences between all other quartiles ($p<0.03$ in all cases).

Similar arguments as those made for the rate of the 'Internal' and 'External' publications groups apply to these groups.

Overall, the trend in opinions between researchers with different publication records implies that personal biases are less likely to affect citation practice when researchers

have greater opportunities to publish their work. In addition, one of the limitations of this kind of analysis is that it does not take into account the fact that many of the respondents publish any combination works internally, externally, translated woks and books). This is supported by data from the results of the citation analysis, which indicates that the core of the researchers who publish internally is those who also publish in external journals.

With regard to the Editorial and Reviewer Biases, on the basis of percentiles for each type of previous publication (as shown in the following table) the data was categorised into four or five intervals based on its percentiles.

The outputs of the ANOVA tests based on different publication record grouping are shown below.

Summary of the Means of responses

Quartile	Internal		N	External			Book			Translation		
	N	Mean		N	Mean	SD	N	Mean	SD	N	Mean	SD
1	100	2.48	52	52	2.58	.957	52	52	0.83	52	2.58	0.96
2	152	2.22	93	93	2.55	.927	93	93	0.98	93	2.55	0.93
3	104	2.47	35	35	2.31	1.231	35	35	0.94	35	2.31	1.23
4	114	2.46	37	37	2.43	1.119	37	37	1.12	37	2.43	1.12

ANOVAs

	Sum of Squares	df	Mean Square	F	Sig.
External	9.47	3	3.16	3.29	0.02
Internal	6.53	3	2.18	2.23	0.08
Book	3.60	3	1.20	1.30	0.27
Translation	1.90	3	0.63	0.61	0.61

Given the above result that there are significant differences between the number of internal and external publication record and the idea that Editorial and Reviewer Biases are an important factor in the low citation of internal sources, post hoc tests were conducted to reveal the detail of the differences.

Post Hoc

External quartiles (I)	External quartiles (J)	Mean Difference (I-J)	Std. Error	Sig.
1.00	2	0.373	0.222	0.093
	3	0.091	0.237	0.701
	4	0.036	0.232	0.875
2.00	1	-0.373	0.222	0.093
	3	-0.282	0.134	**0.036**
	4	-0.337	0.125	**0.008**
3.00	1	-0.091	0.237	0.701
	2	0.282	0.134	0.036
	4	-0.055	0.150	0.717
4.00	1	-0.036	0.232	0.875
	2	0.337	0.125	0.008
	3	0.055	0.150	0.717

* The mean difference is significant at the .05 level.

Post Hoc

Internal quartiles (I)	Internal quartiles (J)	Mean Difference (I-J)	Std. Error	Sig.
1.00	2	.263(*)	.127	.039
	3	.009	.138	.949
	4	.024	.135	.860
2.00	1	-.263(*)	.127	.039
	3	-.254(*)	.126	.044
	4	-.239	.122	.051
3.00	1	-.009	.138	.949
	2	.254(*)	.126	.044
	4	.015	.134	.911
4.00	1	-.024	.135	.860
	2	.239	.122	.051
	3	-.015	.134	.911

* The mean difference is significant at the .05 level.

These results can be interpreted at two levels. The first column in the following graph indicates that those respondents with second quartile external publications agree more with the idea that Editorial and Reviewer Biases are an important factor in the low citation of internal sources. The largest difference was between those with 1-3

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publications (second quartile) and those in the third (4-6 publications) and forth quartile
(>6 publications) quartiles.

Figure 6.13: Mean of the Sum of the Ratings for the Questions Related to the editorial

nd referees biases based on different external and internal publication record quartiles
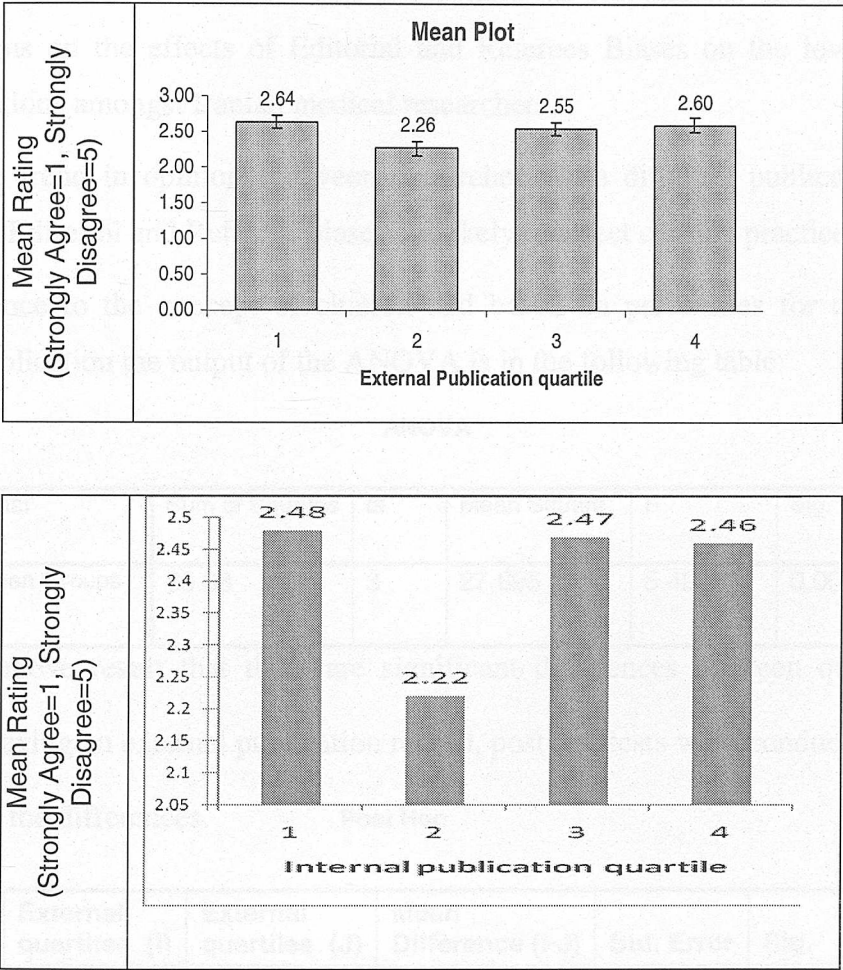
The results suggest that those with 1-3 external and internal publication record perceive
editorial and referees biases to be a more important factor than those with a minimum
and third and forth quartile of publications. One interpretation of this difference could
be that those with low publication are less likely to publish in external and external
journals. Accordingly, they are also more concerned about the issue of editorial and
referees biases as indicated by their tendency to rate the questions as 'Agree' (average
rating 2). On the other hand, those with more than four publications belong to the group
who are motivated to publish in external journal, has less concern to the Iranian editorial
or referees biases as they become more established in the field.

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The patterns were observed with regards to other publication types (Book and Translation) are summarized below.

There were no significant differences between the different quartiles with regards to the numbers of books or translated works publication the respondents had published and their opinions on the effects of Editorial and Referees Biases on the low number of internal citations amongst Iranian medical researchers.

Overall, the trend in opinions between researchers with different publication records implies that Editorial and Referees biases are likely to affect citation practice.

With reference to the concept of citation and based on percentiles for each type of previous publication the output of the ANOVA is in the following table:

ANOVA

External	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	83.08	3	27.695	5.428	0.001

Given the above result that there are significant differences between quartiles with regards to having an external publication record, post hoc tests were conducted to reveal the detail of the differences. **Post Hoc**

External quartiles (I)	External quartiles (J)	Mean Difference (I-J)	Std. Error	Sig.
1	2	1.495	0.511	0.022
	3	2.102	0.548	0.001
	4	1.230	0.534	0.131
* The mean difference is significant at the .05 level.				

These results can be interpreted at two levels. The second and third columns in the following graph indicate that those respondents agree more with the concept of citation. The largest difference was between those with non_ publications (first quartile) and those in the second (1-3 publications) especially in the third (4-6 publications) quartiles.

Figure 6.14: Mean of the Sum of the Ratings for the four Questions Related to the concept of citation.
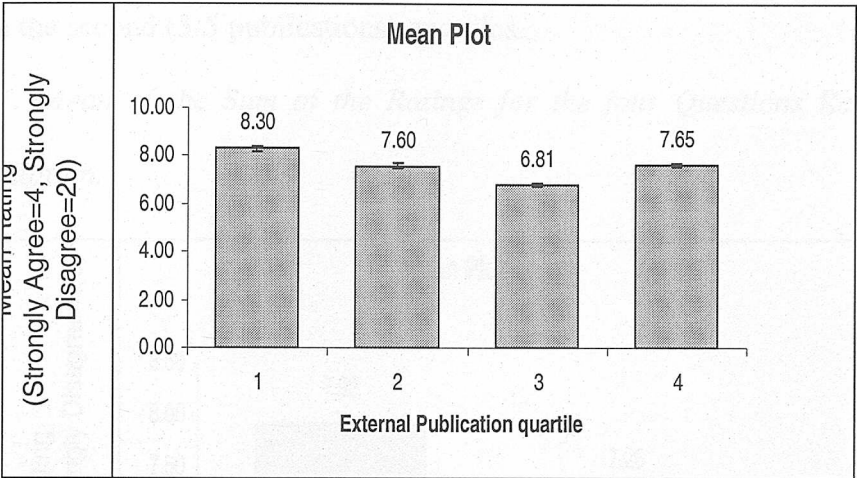
At the personal level, the results suggest that those with 1-6 external publication record perceive more citation as being an indicative of quality or influence than those with a minimum and fourth quartile of publications. One interpretation of this difference could be that those with low publication are less likely to publish in external journals. On the other hand, those with more than four publications belong to the group who are motivated to publish in external journal, have less concern with the citations that they receive from internal researchers.

The patterns that were observed with regards to other publication types are summarized below.

ANOVA

Internal	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	52.27	3	17.42	3.14	0.03

Given the above result that there are significant differences between quartiles with regards to having an external publication record, post hoc tests were conducted to reveal the detail of the differences.

Post Hoc

Internal quartiles (I)	Internal quartiles (J)	Mean Difference (I-J)	Std. Error	Sig.
1	2	0.834	0.303	0.037
* The mean difference is significant at the .05 level.				

These results can be interpreted at two levels. The second and third columns in the following graph indicate that those respondents agree more with the concept of citation. The largest difference was between those with less than 2 publications (first quartile) and those in the second (3-5 publications) quartiles.

Figure 6.15: Mean of the Sum of the Ratings for the four Questions Related to the concept of citation.
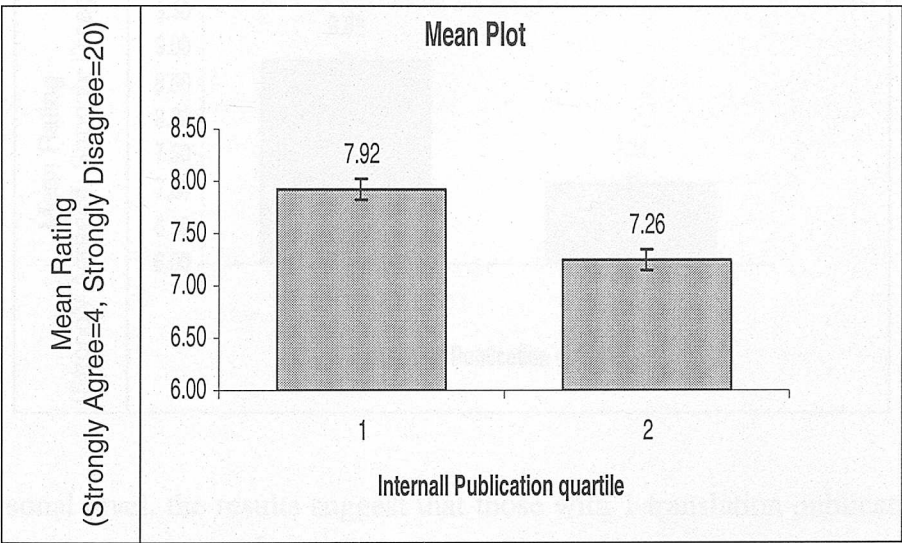
The results suggest that those with 3-5 Internal publication record perceive that more citation is an indicative of quality or influence than those with a minimum quartile (= or >2 publications). One interpretation of this difference could be that those with a low contribution due to the number of publication are less interested to the issues related to the research performance in internal journals.

The patterns that were observed with regards to Translation publication type is summarized below.

ANOVAs

	Sum of Squares	df	Mean Square	F	Sig.
Translation	64.38	3	21.46	3.78	0.01

Post Hoc

Translation quartiles (I)	Translation quartiles (J)	Mean Difference (I-J)	Std. Error	Sig.
1	4	1.716	0.516	0.006
* The mean difference is significant at the .05 level.				

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The results show that the respondents with Second quartile are agree more with the concept of citation than respondents with = or less than 2 publications (first quartile).

Figure 6.16: Mean of the Sum of the Ratings for the four Questions Related to the concept of citation.
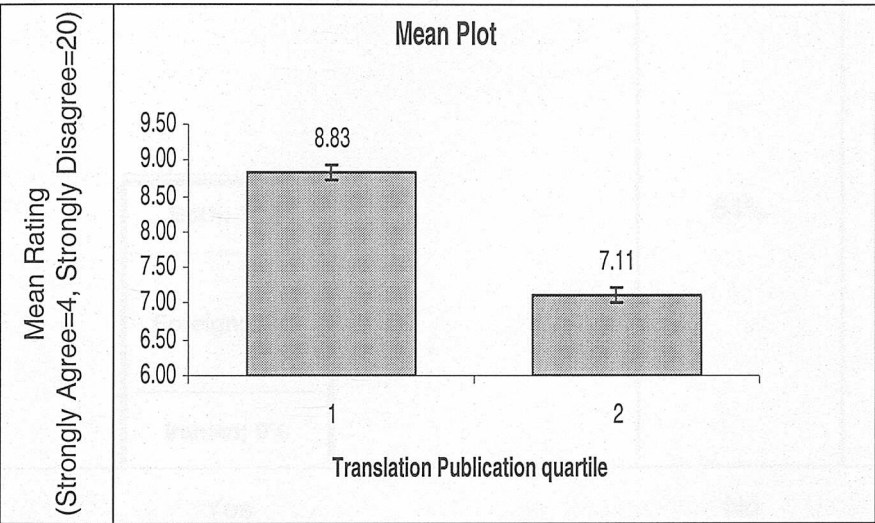
At the personal level, the results suggest that those with 1 translation publication record perceive more the relevance of citation being an indicative of quality or influence than those with a minimum of publications. One interpretation of this difference could be that those who have just started to translate foreign works are more concerned with the citations that they receive from internal researchers.

The patterns that were observed with regard to book publication type are summarized below.

	Sum of Squares	df	Mean Square	F	Sig.
Book	13.62	3	4.54	0.79	0.50

There were no significant differences between the different quartiles with regards to the numbers of books, and their opinions on the relevance of citation being an indicative of quality or influence.

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Hypothesis 11: Role of Reviewers

Figure 6.17: Summaries the responses to questions related to 'Role of Reviewers' question.
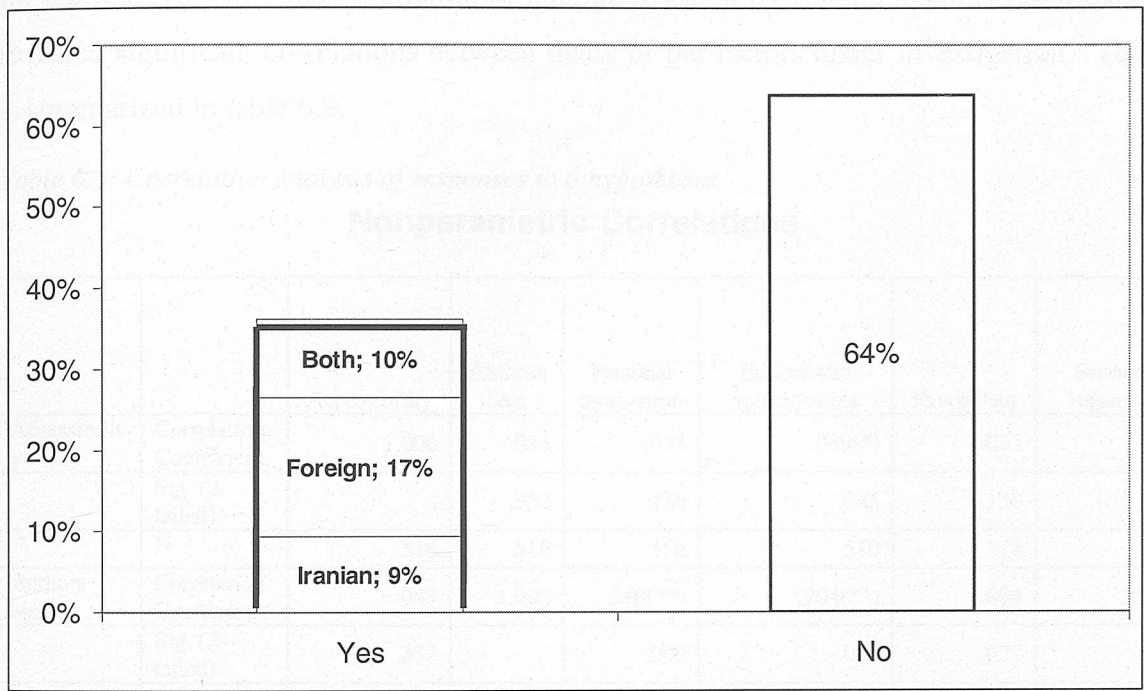
Responses to question 20 were used to ascertain the extent to which reviewers influence citation practice of Iranian medical researchers. The results show that referees influenced 36 % of the authors. Of this 36 %, 17 % of respondents were referred to foreign research compared to only 9 % reference to relevant Iranian articles. The results suggest that referees may also play a role in the observed discrepancy between foreign and internal citations.

Further Investigation of the Factors Affecting Internal Citation Rate in Iran

An analysis of the relationship between the factors considered in relation to the reasons for the relatively low rate of citation to internal research by Iranian medical researchers revealed significant correlations between many of the factors under investigation. This is summarized in table 6.9.

Table 6.9: Correlation analysis of responses to 6 hypotheses.

Nonparametric Correlations

		Accessibility	Authors bias	Personal motivation	Editors and referees bias	Favoritism	Secondary referencing
Accessibility	Correlation Coefficient	1.000	.043	-.053	.089(*)	.067	-.011
	Sig. (2-tailed)	.	.332	.230	.045	.130	.798
	N		516	516	510	516	511
Authors bias	Correlation Coefficient	.043	1.000	.240(**)	.204(**)	.084	.222(**)
	Sig. (2-tailed)	.332	.	.000	.000	.057	.000
	N	516		516	510	516	511
Personal motivation	Correlation Coefficient	-.053	.240(**)	1.000	.253(**)	.244(**)	.260(**)
	Sig. (2-tailed)	.230	.000	.	.000	.000	.000
	N	516	516		510	516	511
Editors and referees bias	Correlation Coefficient	.089(*)	.204(**)	.253(**)	1.000	.152(**)	.087
	Sig. (2-tailed)	.045	.000	.000	.	.001	.051
	N	510	510	510		510	505
Favoritism	Correlation Coefficient	.067	.084	.244(**)	.152(**)	1.000	.214(**)
	Sig. (2-tailed)	.130	.057	.000	.001	.	.000
	N	516	516	516	510		511
Secondary referencing	Correlation Coefficient	-.011	.222(**)	.260(**)	.087	.214(**)	1.000
	Sig. (2-tailed)	.798	.000	.000	.051	.000	.
	N	511	511	511	505	511	

* Correlation is significant at the 0.05 level (2–tailed).
** Correlation is significant at the 0.01 level (2–tailed).

The large number of significant correlations between personal motivation and four of the other factors suggested that personal motivation might be a function of the other 4 variables. Theoretically, this makes sense, since without personal motivation the pattern of citation would not be expected to differ significantly from those of other nations. For

example, it is possible that ease of accessibility to foreign journals may create a bias in the perception of researchers.

A multiple regression analysis was, therefore, carried out with 'personal motivation' as the dependent variable and the other hypothesized factors as independent variables. The results were revealing as outlined below.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.386(a)	.149	.142	2.103

a Predictors: (Constant), Favoritism, Authors bias, Editors and referees bias, Secondary referencing.

ANOVA (b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	386.538	4	96.635	21.843	.000(a)
	Residual	2212.044	500	4.424		
	Total	2598.582	504			

a Predictors: (Constant), favoritism, Authors bias, Editors and referees bias , secondary referencing.
b Dependent Variable: personal motivation

Table 6.10: Results of multiple linear regression analysis:

Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.565	.416		10.980	.000
	Authors bias	.104	.042	.105	2.444	.015
	Editors and referees bias.	.432	.096	.191	4.519	.000
	Secondary referencing	.360	.094	.164	3.811	.000
	Favoritism	.410	.097	.180	4.234	.000

a Dependent Variable: personal motivation

On the basis of table 6.10 the model indicates that 15% of the variation in personal motivations may be accounted for by the variation in the above variables.

The above findings opens the way to a) further research into the factors that may responsible for the other 85 % of the variation and b) future investigation of the possible reasons for the strong correlation between these factors and personal motivations.

Qualitative Results

The Survey Questionnaire consisted of a section allowing the respondents to make comments and observations on their views of the reasons for the low rate of internal citations amongst Iranian medical researchers. These have been translated from the original Farsi and have been categorised into themes. Some of the points raised were not included in the questionnaire, whilst others were emphasized by the respondents. The former group is set out in Table 6.11.

Table 6.11: Comments given by respondents of the survey analysis.

Comments	Frequency
Having relationship with editors and referees is very important in the articles' publication system in Iran	18
Articles are repetitive	14
Unawareness of other publications	12
Referees in the process of reviewing a submitted work base their approval on similar work published in foreign journals	12
Iranian researchers are not aware of the significance of referencing or citations	11
Iranian researchers books and articles are copied [plagiarized] from foreign publications	9
Articles' acceptances are mainly based on adding influential persons' names to the author list.	9
Iranian articles do not contain novel ideas	8
Competition is one of the main reasons of the low internal citation rate	8
Journals which are publishing in English don't accept more than 3 non-English references	7
Lack of trust in the data and results of the Iranian articles is a concern of the low rate of internal co citation	7
Most of Iranian articles are extracted from Masters students' dissertations [and published in the name of those other than the Masters student].	6
Journals are not dedicated to a field of medical sciences. Consequently they are a platform for publication of any paper, which reduces their quality.	6
Referees are not specialized in the subject of a submitted work	5
Some authors cite publications which do not exist	4
Iranian articles have low quality because of reviewing by non specialized persons	3

6.4 Discussion

The accessibility and personal motivation and the bias of Iranian researchers and referees' towards foreign-language articles had a significant effect on reasons for the paucity of citations to Iranian articles and journals. These four variables are interrelated, and correlation analysis (see table 6.9) shows that the personal motivation has the greatest influence in Iranian medical citation behaviour. The first reason is supported by the analysis of the type of Iranian medical article publication references, which shows a significant negative correlation between the use of articles and other type of resources and a significant positive correlation between non-articles sources. These two ideas are strongly supported by the comments given by the respondents in the supplementary comment section of the questionnaire which indicate foreign information sources are more accessible. The findings with regard to the accessibility of foreign information sources support the studies of Montgomery and Sparks (2000) and Rogers (2001) that online sources have influenced citation behaviour, in that one of the factors that have emerged from the findings related to the accessibility is that Iranian Medical researchers are more likely to cite non-Iranian articles because the latter are more accessible (presumably due to the availability of electronic access).

The Iranian medical researchers' bias is in contrast to some other countries, such as Croatia, Bekavac et al. (1994) and South Korea, Lancaster, Dilivio and Lee (1990), where it has been found that when researchers publish their work in international journals, more international references are cited whilst, when they publish in their respective countries, the trend is reversed. Further research is needed to elucidate the possible reasons for this trend, although some of the later findings in the current work may provide some clues (see sections related to Accessibility and Author and Referees' bias).

The relative value of self-citations compared with other citations is a controversial issue amongst bibliometricians. Some consider self-referencing to be the result of the "cumulative nature of individual research, others believe that the need for personal gratification is an important factor, whilst others argue that the value of self-citation is a rhetorical and tactical tool in the struggle for visibility and scientific authority", Fowler and Aksnes (2007). Journal self-citations, where authors cite their own works and journals cite their own articles, account for a significant portion of all citations. The

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results of citation analysis of Iranian medical articles show that of the total number of citations was 828,249 between 2002 and 2004; around 30% were journal self-citations and 399 (more than 48%) were author self citations.

6.5 Conclusion

The 20-item list in our survey study is not without its flaws, but it does cover a number of important issues. In some instances, citation behavior could be traced back to the educational system. However, for simplicity, any behavior that was a common to the population, whether or not it can be traced back directly to education, has been classified as a 'cultural' factor.

Although the interdependence of these factors is acknowledged, for the purpose of analysis the items have been clustered into some thematic groups, as outlined in section 6.2.

Despite some possible limitations, some clear conclusions can be drawn from the study. Given the current perception, it is worth noting that citation behaviour of Iranian medical researchers is to some extent affected by cultural and social factors.

With respect to the reason of relatively few citations to Iranian medical articles, accessibility is a major factor. The results also indicate that further research needs to be carried out in view of the reasons for foreign publications being more accessible than internal ones. For example, one such study could investigate the relationship between the extent to which an internal article is cited and the formats in which they are available.

The practical implication of this finding could be that different media formats need to be provided through which Iranian medical researchers can access literature.

Alongside "accessibility" Iranian researchers and referees' bias towards foreign-language articles seems to be a second variable that considerably influenced internal publication negatively. Deliberate non- citation (because of personal motivation) of Iranian medical articles is thought to be a factor; however we do not have strong evidence to conclude that this may heavily affect Iranian medical citation practice.

With respect to the hypothesis that proclaims that relatively few citations to Iranian medical articles are due to the relatively small number of internal publications, although

the results of the survey analysis support this assumption, the results of subject analysis of published articles in 2004 versus articles produced in 2002 and 2003 is in contrast to this of this result (See chapter 2).

In relation to the awareness of Iranian medical researchers of the protocol and standards of citation practice, the responses indicate that Iranian researchers believe that colleagues are aware of convention of scientific communication.

On the subject of the value given to non-journals and journal articles, the results indicate that respondents do give priority to journal sources. This notion in practice is supported based on the analysis of the distribution of different types of publication within Iranian medical articles, as the data shows that journal articles were the primary source of information cited by the Iranian medical researchers (more than 77 % in domestic journals and more than 90 percent in articles indexed in SCI).

The overall findings signify that Iranian medical researchers do not consider the number of references as an indication of the research quality. According to Iranian medical researchers, self-citation has the same value as citation to others and they confirm their view that citation count to be a reliable measure of the quality or impact of a research. Referees considered to be specialists in the subject of the article submitted could have a greater role in the quality and quantity of references attached to the manuscripts. Referees, being aware of related works that have been conducted in the subject of submitted work, could do more to ensure that the author has used all related and existing works. In cross-influencing process of citation practice, the data shows that Iranian reviewers' role was noticeable; although reviewers' bias toward foreign literature may be the same as that of authors.

Based on the results of this chapter a paper was submitted in November 2008 for possible publication and is awaiting editors' response. Information about this publication is presented in appendix Y.

Chapter 7:

Conclusions and Future Work

7.1 Overview

Prior to this study, no mechanism was available for coherent collection of bibliometric data for any type of publication in Iran. Consequently, no data was available for bibliometric analysis. To address the question of the lack of bibliometric databases for Iranian medical publications, the first task was to create a suitable database to allow for data entry and extraction of data for bibliometric analysis.

With no recourse to electronic versions, the data had to be gathered and entered manually using existing resources, such as hard copies in libraries and networks of friends. As the project progressed, ideas emerged for speeding up the data entry process. These included scanning and the use of Optical Character Recognition (OCR) software. Then, the data were transferred to Word for Windows™ format, where the text could be manipulated using the software's advanced features, such as macros, conversion to tables and exporting to various database- and spreadsheet-readable formats. The tabulated data from Word™ were transferred to Microsoft Excel™ where further text manipulation (through the use of advanced formulae) resulted in effective separation of the text into the required fields, suitable for importing into the Access™ database.

Preliminary results

The results of this aspect of the study indicated that the rate of co-citations of Iranian medical researchers in domestic publication is relatively low, even in comparison with the average number of citation per articles indexed in SCI by Iranian medical researchers in the same period (0.07 compared to 6). Self-citation plays an important role in scientific communication in the field of medicine in Iran. Qualitative and quantitative data from three sources suggest this conclusion. Survey analysis results indicate that the majority of Iranian medical researchers consider author self-citation to be equivalent to citation by other authors. This is supported by the findings of the bibliometric analysis which showed that over 30% of citations were author self-citations, and on average, over 40% of citations to journals were journal self-citations.

These results are relatively close of the findings of the study of Aksnes (2003) investigating the role of self-citation in the scientific production of Norway (1981-1996). Using a three-year citation window, he found that 36% of all citations represent author self-citations. However, this percentage decreases when citations are traced for longer periods.

Although significant differences in the number and age of citations between disciplines were found, overall, 9% of all author citations were self-citations Aksnes (2003). According to Snyder and Bonzi (1998), 15% of physical science citations were found to be self-citations, as opposed to 6% in the social sciences and 3% in the humanities. They suggest that the discrepancy "may be partly due to "the more incremental nature of research in the physical sciences". Yang and Shi (2005) found that the rate of self-citing in tropical medicine journals on average was 7.02 percent. However the reason for the high rate of author and journals self-citation in Iran may be because of the low number of specialized journals to serve a specific subfield and the low number of leading persons in different subject areas. Another reason for Iranian medical researchers' high rate self-citation may derive from their view that self-citation has the same value as the citation of others.

The average number of authors per article was about 3 persons. This is much lower compared to the findings of Puljak et al. (2008) where the mode number of authors per article of Croatian papers in clinical and life sciences was 6. The results obtained by Weeks et al. (2004) showed the average number of authors per article in 2000 across US medical journals is 6.9 and the same for NEGM and Lancet in 1991, Epstein (1993).

Of the 9952 items designated in this study, 1,233 articles (12%) were by single authors. The number of articles written by two authors, three authors, and four authors were 2658 (27%), 2,725 (27%) and 1,678 (17%) respectively.

The results show that the subfields of "endocrinology and diabetic disorders" were significantly more active areas of research in Iran than other subfields. Based on the derived journal impact factors the Iranian Journal of Endocrinology and Metabolism and the Iranian Journal of Diabetes and Lipid Disorders were always amongst those with the high impact factors (top 5 and top 10, respectively, in the 2002-2004 period investigated).

There may be a relationship between this finding and the finding that the more prolific authors and most cited authors are those active in the subfield of endocrinology and related matters. In addition, taking into account the immediacy index as the indication of recency of citation, it can be seen that the Iranian Journal of Endocrinology & Metabolism (IJEM) and the Iranian Journal of Diabetes & Lipid Disorders took first and fifth places respectively.

Covering all medical subjects, the Hakim Journal was one of the influential journals in Iranian medical communication as its received citations increased from 14 in 2002 to 54 in 2004. The impact factor reflected this change, as it ranked first in 2004 and took second place in 2002 and 2003.

Similarly high impact factor are observed in some International journals, such as NEJM, BMJ, JAMA and Lancet, which also cover a wide range of subjects within the medical field.

Focusing on behavioural subjects, another influential journal was the Journal of Andisheh Va Raftar which received 61 citations and ranked first place in 2002 and took 4th and 6th places in 2003 and 2004, respectively.

New perspective

Given the author's significant experience in the field of library management, the opportunities that the newly developed database presented were explored. Library managers' primary objective is to provide users with the best information systems at the lowest cost. As the users of libraries differ depending on the particular institution's disciplinary orientation, one of the decisions that library managers need to make is the extent to which they subscribe to journals covering general topics and those specializing in a particular subject. For example, a library serving the needs of specialists working within the field of Dermatology will need to decide which of the many dermatology journals to subscribe to. A particularly useful index would be one that allows the decision-makers to determine the extent to which different journals cover topics of interest to, in this example, dermatologists. A number of indices have been proposed to address these issues. However, these existing indices were found to be inadequate, either because they did not provide the required information, or they were too complicated for use in practice.

To address these shortcomings, two new measures (Indices) have been developed.

In this study the DSI (see chapter 4) has been developed an aid to decision-making with regards to the level of specialism of a journal within a particular discipline and serves to inform researchers in the field who wish to make individual subscription decisions.

Similarly, the DPI (see chapter 4) was developed and is being proposed as a decision-making tool for libraries as it indicates the proportion of all citations within a particular

discipline that had been received by a particular journal. The data required to calculate the values of these indices for each journal is readily available, making them easily accessible.

Whilst the DPI as applied to the Dermatology Journals example, appears to support Bradford's 20/80 rule (see chapter 5 section 5.3), through the use of DPI, it will be possible to determine which journals fall into the '20' category and which into the '80'. In other words, 80 percent of use comes from 20 percent of the journals. Librarians have to decide if the incremental costs of providing "the long tail" of the remaining 70 percent of the articles for the occasional user is worth it.

Both of the newly-developed/proposed indices have been applied to actual data for the Dermatology discipline from ISI. The results have confirmed the usefulness of each and the need for two separate indices. In addition, Spearman's Rank Correlation analysis has confirmed that each of these indices is measuring a different phenomenon and that they are both significantly different from GIF.

Other measures

In addition to the need to provide appropriate internally published resources for users, librarians also need to subscribe to international journals. This is particularly important for countries such as Iran, where, due to the exchange rates; the cost of such subscription can be very limiting. Again, appropriate measures need to be conceived to be used as decision-making tools. This idea was explored in chapter 4, where international journals were ranked by their rate of usage as measured by the number of citations they received in internal publications (see tables 45, 4.6 and 4.7). Using Bradford's (1984) criteria, all of the journals were assigned to one of 3 groups (zones) based on the frequency of citations they received. The top third most frequently cited journals (zone 1) were considered to be core journals. The analysis showed that these were the journals that received 100 or more citations within the period under investigation (2002-2004).

Interestingly, this number is in accordance with the findings that average number of subscription to international journals by 95% of mainstream medical libraries was in the range 105-180 (as obtained from the Iranian Ministry of Health and Medical Education). A list of the 195 most cited internationally published journals (zone 1), based on citation frequency, was extracted that might be served by Iranian medical libraries as a baseline for subscription along with their corresponding half life as a criteria for storage policy.

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The 195 titles had provided more than 33% of Iranian medical researchers information needs.

The Use of Half-Life

In this study, the half-life was used as a measure of the rate of depreciation of the usefulness of information sources (see section 5.4.1.1-5.4.1.3.and 5.4.2.1).

The results with regard to the age of different types of sources materials cited show significant differences between different sources; however there are no significant differences within each type of materials from, 2002 to 2004 except within web resources (see section 5.4).

The half-life of Foreign Journals is 8 years whilst 50% of Farsi Journals on average were cited within the last 5 years. Web resources had the shortest half-life, which showed an increasing trend from 2002-2004 ranging from 1-3 years. However further investigation might also determine the pattern of use of electronic resources, such as Internet sites or e-books.

Rates of Publication in International Journals

Iranian medical researchers' relationship with international journals was further considered by investigating the rate of publication of articles by these researchers in two different databases.

The expansion of the medical production based mainly on SCI provides additional evidence of the growth of medical research in Iran during the period under analysis. It seems that Iranian medical researchers have tendency to become more visible as they prefer to publish their publications in journals covered by the SCI despite of its restrictive coverage. Regarding the finding of Osareh and Wilson (2002) where Shiraz University of medical sciences ranked first for 1985-1999, our study shows that Tehran University of Medical Sciences has swapped place from second to first with Shiraz University of Medical Sciences. The rate of original articles and meeting abstracts continued to steady increase and doubled from 2002 and 2004, and it is expected the total number of Iranian medical publications in foreign journals indexed in SCI will reach more than 8000 in 2010. The authorship pattern in domestic publication and articles indexed in PubMed and SCI is slightly different as the average number of author in domestic publication is 3 and in those published in international journals is 4 persons. The intriguing result while comparing citation per article of domestic articles and those

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of published in international journals is clear, as the average is 0.07 and 4.2(in total and more than 6 for original articles), respectively. This difference supports the survey analysis result which indicates the low rate of internal citations is partially due to the cultural and personal biases.

A comparison is made between the previously found trends (1987-1997) in rate of international publication of Iranian medical researchers and subsequent growth from 2002 to 2004. The new trend found by this study matched with the previously found trend to within 92%.

A mathematical model is presented to predict the rate of growth of international article publishing by Iranian medical researchers (R^2 >0.99).

In addition to the number of internationally published articles, bibliometric indicators such as the most prolific authors, relative distribution of the field of study and various citation indices were extracted.

The significant growth of international publication of Iranian medical researchers over the past 20 years suggests changes in policy during that period have significantly influenced researchers' productivity.

The precision with which the proposed model predicts the number of internationally published articles enables accurate assessment of the possible effects of any changes in relevant policy.

The bibliometric indicators provided should enable decision makers to make informed policy or make decisions in the process of journal subscription.

Citation Behavior of Iranian Medical Researchers

In this study it was found that the rate of citations to Iranian publications in articles published in domestic medical journals is relatively low in contrast with the rate of citation in other non-English language communities/countries (see section 7.1). Hence a survey analysis was undertaken to find out possible reasons of the behavior and practice.

The findings strongly support the hypothesis that accessibility is a major factor. However, whilst Iranian medical researchers have, to some extent, been influenced by the remote access to the online journals as indicated by the results of the survey analysis (see references to 'Accessibility' in Chapter 6), the ongoing sanctions imposed on Iran for its nuclear program by the Western countries, which include subscriptions to

electronic information resources such as Science Direct, Ovid and Web of Sciences, along with the very low speed of Internet suggests that Iranian medical researchers are deprived of the benefits of online information sources. However, further research needs to be undertaken to evaluate the extent to which online resource have impacted Iranian researchers.

In addition, Iranian researchers and referees' bias towards non-Iranian articles and deliberate non- citation (because of personal motivation) of Iranian medical articles were found also important factors.

With respect to the hypothesis that proclaims that relatively few citations to Iranian medical articles are due to the relatively small number of internal publications, although the results of the survey analysis support this suggestion, citation results contradict the conclusion that the low rate of internal publications to be an important factor in the low rate of internal citations. The relationship between the number of internal citation and the number of internally published articles was investigated for 15 subjects and it was found that the average number of citations per article was approximately the same as that found for all internal publications.

7.2 Overall Summary

Practical Implications/Applications

This study led to the development of the following practically applicable solutions:

1. Methodology of data collection (chapter 2).

2. Tools of data entry (chapter 2).

3. A database consisting of all articles and their citations in Medical Research Publications in Iran between the years 2002-2004 (chapter 2 and appendix B).

4. 2 new methods of data analysis (the DSI and DPI indices for decision-making analysis (chapter 3).

5. A method for survey analysis of researchers' opinions (see chapter 6).

These new solutions can now be applied to a wide range of studies including comprehensive analysis of bibliometric data between other disciplines or other countries.

Furthermore, the data can be used to inform information policy and to help Iranian researchers to gain access to quality information.

In addition, if the database is kept up-to-date, it can provide useful information in research trends through the use of such indices as half-life.

Limitations and Recommendations

The main goal of this study was developing citation database to apply bibliometric indicators on scientific research of medical sciences in Iran. However the results related to citation analysis of Iranian medical journals can make a useful contribution to the field of scientometrics and informatics through providing new insight of citation patterns and practice in a peripheral country. Due to severe time limitations and financial barriers, it was only possible to apply two-year citation windows. It is recommended that if the Ministry of Health and Medical Education decides to apply bibliometric evaluations on a systematic basis in the future, our designed prototype database provide a strong foundation for development of Iranian's own comprehensive medical citation database.

If the Iranian Ministry of Health and Medical Education decide to take steps toward implementing this recommendation, two avenues are open for the undertaking of systematic evaluations: 1) the Ministry could train some of its personals to master the methodologies of evaluative bibliometrics and undertake the evaluations internally or, 2): it could contract out the evaluations and provide the chosen experts in evaluative bibliometrics with the database of publications, specifying the dimensions to be evaluated .

One of the indicators of research performance missing from this study is an evaluation of other non citation based indicators of Iranian medical scientific journals, such as a comprehensive usage study and peer ranking (see chapter 1) of Iranian medical scholars to see if of the non citation based correlate with the bibliometric indicators used in this study. If so, then the non-bibliometric indicators could serve to provide a degree of validation for the results of the bibliometric evaluation.

A co-citation analysis and cluster mapping of authors and articles related to medical research in Iran would be useful in understanding the growth patterns and relationships

between authors, topics, and publications within medical research in Iran. These techniques, in long term, could be used to provide additional insight into the field of medicine and in determining the major themes in medical research in Iran.

Given that accessibility was found to be a major concern amongst Iranian medical researchers, it is recommended that papers and other publications be made available online.

In the early stage of this project, major difficulties were encountered in both collection and organisation. The latter required a great deal of labour-intensive data manipulation in order to standardise the data into coherent datasets. One of the main problems was the varied formats of citations, different journals use different formats; even different articles in the same journal use different format (See Chapter 3). Due to the relatively constant referencing style in foreign journals, no such problem was found when handling data extracted from ISI or Medline databases. Another problem was the lack of skilled persons. After training hired staff to key in the Farsi citations data, they had difficulty in recognizing the components of a citation. Other problems were the incorrect or incomplete citations; in these cases the citations had to be checked using various online bibliographic services, even personal websites. This was time consuming and costly.

In order to maintain the consistency of the referencing style, the Ministry of Health and Medical Education should define and develop a unique style and software for referencing Farsi materials, and for English sources, recommend an internationally recognized style such as the Harvard[8] style of citing and referencing.

Content analysis of Iranian medical journals can reveal important issues from a contextual perspective in the field of medicine and unearth areas that receive inadequate coverage and may provide data for ranking them. To this end it is recommended a reliable method such as the "inter- rater" or "intercoder" reliability measure (see Tinsley and Weiss, 1975 and Cohen, 1960 cited by Oriogun, 2003) which can be undertaken to

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[8] Harvard referencing — also known as the Harvard system, author-date system, and parenthetical referencing — is a citation system used for writing and organizing the citation of source material. Harvard referencing is the preferred style of the British Standards Institution, the American Psychological Association, and the Modern Language Association (MLA). It is one of several systems recommended by the Council of Science Editors and the Chicago Manual of Style.

see the extent to which rankings based on citation analysis and content analysis correlate.

To further disseminate the finding, besides submitting articles to appropriate journals, further presentation of research findings in internal and international conferences will also be considered. Taking into account Iranian medical libraries' atmosphere, workshops are a very efficient way to disseminate the results of the research and to present the developed indices to the scientific community, particularly to librarians.

Since the researcher received a scholarship to conduct this study from Iranian Ministry of Health and Medical Education, some formal meetings with authorities to report the findings and how to put them into practice are also planned.

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Appendices

List of appendices

Appendix A: Ranking Law Reviews by Author Prominence by Jarvis and Coleman

Category of Contributor	Points
1. U.S. President	1,000.00
2. Leader—Major Foreign Nation	975
3. U.S. Supreme Court Justice	950
4. Major Celebrity	925
5. U.S. Vice President	900
6. U.S. Cabinet Secretary	875
7. U.S. Senator	850
8. Lawyer Celebrity	825
9. Leader—Minor Foreign Nation	800
10. Minor Celebrity	775
11. State Governor	750
12. U.S. Circuit Judge	725
13. U.S. District Judge	700
14. U.S. Representative	675
15. State Supreme Court Justice	650
16. Law Professor—Top 25 School (per U.S. News & World Report)	625
17. CEO—Fortune 500 Company	600
18. U.S. Government Official (ambassador, agency head, or equivalent) 575.00	600
19. Foreign Nation Supreme Court Justice	550
20. Partner—National Law Journal Top 250 Firm or General Counsel—Fortune 500 Company	525
21. U.S. Bankruptcy, Immigration, or Magistrate Judge (or equivalent)	500
22. Law Professor—Top 50 School (per U.S. News & World Report)	475
23. Foreign Nation Appellate Court Judge	450
24. State Appellate Court Judge or State Legislator	425
25. Law Professor—Top 100 School (per U.S. News & World Report)	400
26. Foreign Nation Trial Court Judge	375
27. State Trial Court Judge	350
28. Foreign Nation Government Official (agency head or equivalent)	325
29. State Government Official (agency head or equivalent)	300
30. Law Professor—Third Tier School (per U.S. News & World Report)	275
31. Local Government Official (mayor or equivalent)	250
32. Law Professor—Fourth Tier School (per U.S. News & World Report)	225
33. Non-Law School University Professor	200
34. Lawyer (not in any other category)	175
35. Non-Lawyer Professional (accountant, doctor, engineer, scientist, or equivalent)	150
36. Community College Professor	125
37. Ph.D. Student	100
38. J.D. Student	75
39. Paralegal	50
40. All Others	25

Appendix B: Development of Iranian Medical Journals Citation Database (IMJCDB)

Entities and Fields

In consideration of the desired outcomes of this study, the database was designed with entities and fields, as shown in the following table.

Five main tables

TBL_SOURCE	TBL_JOURNAL	TBL_AUTHOR	TBL_NONJOURNAL***	TBL_INSTITUTION
Source_ID	Journal_ID	Author_ID	Nonjournal_ID	Institution_ID
Journal_ID	ISSN	Author_surname	Title	Institution_name_english
Title	Title_English	Author_ forename	Publication_year	Instituion_name_farsi
Article_type	Title_Farsi	Gender	Publication Month	Number_of_academic_ staff
Publication_year	Institution_ID	Qualification	Edition	Category
Publication_month	Frequency	Current_academic _appointment*	Publisher	Year_established _shamsi
Volume_number	Current_Type_of_publication	Institution_ID	In_nonjournal_ID	Year_established
Issue_number	Previous_Type_of_publication	Discipline	URL	
Language	Category	Position**	No of Pages	
Pages				
Citation_type				
Discipline				
Edition				
Place_of_publication				
Publisher				
In				
URL				

*Faculties who currently hold an academic position such as full-professor and assistant professor.

** Some of the faculties hold an administrative appointment such as vice chancellor for research.

*** Other formats of publications such as books, reports and patents.

The Entity Relationship Diagram (ERD) in the above table are shown below

tbl_source_citation...
- citation_ID
- Source_ID

tbl_source_keyword...
- Source_ID
- Keyword

tbl_nonjournal
- Nonjournal_ID
- Title
- Publication_year
- Publication Month
- Edition
- Where_published
- Publisher
- In_nonjournal_ID
- URL
- Pages

tbl_source
- Source_ID
- Journal_ID
- Title
- Article_type
- Publication_year
- Publication_month
- Volume_number
- Issue_number
- Language
- Pages
- Citation_type
- Discipline
- Edition
- Place_of_publicataion
- Publisher
- In
- URL

tbl_source_author_link
- Source_ID
- Author_ID
- Rank

tbl_journal
- Journal_ID
- ISSN
- Title_English
- Title_Farsi
- Institution_ID
- Frequency
- Current_Type_of_publication
- Previous_Type_of_publication
- Category

tbl_author
- Author_ID
- Author_surname
- Autho_forename
- Gender
- Qualification
- Current_academic_appointment
- Institution_ID
- Discipline
- Position

tbl_institution
- Institution_ID
- Institution_name_english
- Instituion_name_farsi
- Number_of_academic_staff
- Category
- Year_established_shamsi
- Year_established

tbl_nonjournal_author_link
- Nonjournal_ID
- Author_ID
- Rank

Design of Data Entry Forms

To minimize the need for extensive training and supervision, the relevant data entry forms were painstakingly designed with particular attention paid to error capturing and handling systems, particularly in relation to language. A typical form is shown in following figure.

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Journal form figure

Testing and Implementation

Initially, data from several issues of Journals were entered to test for database integrity and the possibility of handling bilingual and bidirectional (Farsi script being right-to-left) data. Thus, the suitability of the database for the analyses in question was confirmed.

Summary

Following the design and testing of the database and the relevant data entry forms, many unforeseen problems were encountered. However, eventually, it was possible to find ways of collecting the data accurately and reliably for entry into the database and for subsequent analysis although inconsistencies in referencing styles within the articles had to be resolved manually.

Appendix C: Distribution of Iranian Medical Journals papers from 2002 to 2004.

Journal	No. of papers in 2002	No. of papers in 2003	No. of papers in 2004	Total
Journal of Iran University of Medical Sciences	100	120	130	350
Journal of The Faculty of Medicine	73	69	151	293
Journal of Research In Medical Sciences of Esfahan MSHJ	87	108	92	287
Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University	76	109	97	282
Journal of Shahid Sadoughi University of Medical Sciences & Health Services	92	97	69	258
Medical Journal of Tabriz University of Medical Sciences	51	94	76	221
Medical Journal of Mashhad University Of Medical Sciences	81	67	70	218
Journal of Veterinary Research	60	82	72	214
Shahid Beheshti MSUJ (Pajouhandeh)	64	80	61	205
The Journal of Gazvin University of Medical Sciences & Health Services	55	83	61	199
Daneshvar Medicine	59	61	59	179
Feyz	62	60	56	178
Journal of Babol University of Medical Sciences (JBIMS)	43	61	69	173
Bina Journal	51	49	69	169
Iranian Journal of Infectious Diseases & Tropical Medicine	57	53	56	166
Scientific Journal of Hamadan University of Medical Sciences & Health Services	48	69	47	164
Journal of Mazandaran University of Medical Sciences	47	54	62	163
Research In Medicine	52	51	53	156
Iranian Journal of Medical Education	91	29	28	148
Iranian Journal of Endocrinology & Metabolism (IJEM)	38	53	55	146
Journal of Medical Faculty Guilan University of Medical Sciences	46	47	49	142

Journal	No. of papers in 2002	No. of papers in 2003	No. of papers in 2004	Total
Journal of Military Medicine	46	49	46	141
Iranian Journal of Dermatology	38	41	59	138
Iranian Journal of Radiation Research (IJRR)	32	43	61	136
Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association	24	53	56	133
Journal of Dentistry of Tehran University of Medical Sciences	40	45	48	133
Kowsar Medical Journal	47	44	42	133
Yaft-e	48	44	41	133
Advances in Cognitive Science	35	59	36	130
Journal of Dentistry	34	37	58	129
Scientific Medical Journal	42	42	45	129
Journal of Medical Council of I.R.I.	43	42	44	129
Hakim	44	53	32	129
Journal of Esfahan Medical School (I.U.M.S)	30	44	53	127
Journal of Sabzevar School Of Medical Sciences	47	43	36	126
Teb Va Tazkieh	42	36	47	125
Journal of Andisheh Va Raftar	44	40	38	122
The Journal of Urmia University of Medical Sciences	40	41	40	121
Shahrekord University of Medical Sciences Journal	39	40	41	120
Acta Medica Iranica	53	52	15	120
Arch Razi Ins	49	38	28	115
Journal of Medicinal Plants	34	33	46	113
Medical Journal of Hormozgan University	32	39	42	113
Journal of Kerman University of Medical Sciences	36	38	37	111
Armaghaneh Danesh	33	35	40	108
Iranian Journal of Diabetes & Lipid Disorders	20	35	51	106

Journal	No. of papers in 2002	No. of papers in 2003	No. of papers in 2004	Total
Tabib-E-Shargh	31	35	40	106
Iranian Journal of Anaesthesiology & Intensive Care	36	28	41	105
Journal of Ardabil University of Medical Sciences (JAUMS)	32	32	40	104
Tanaffos	31	36	35	102
Iranian Journal of Fertility & Sterility	34	32	35	101
Ofogh-E-Danesh	26	34	40	100
Payesh	32	34	34	100
Scientific Journal of Kurdistan University of Medical Sciences	33	32	34	99
Iranian Journal of Basic Medical Sciences	28	37	34	99
Journal of Rafsanjan University of Medical Sciences & Health Services	34	29	35	98
Behboud	33	32	32	97
Journal of Zanjan University of Medical Sciences & Health Services	32	32	32	96
Journal of School of Public Health & Institute of Public Health	32	32	32	96
Journal of Gorgan University of Medical Sciences	24	33	38	95
Rahavard-E Danesh	31	32	32	95
Koomesh	22	35	37	94
Scientific Journal of Forensic Medicine	29	33	32	94
Journal of Mashhad Dental School	24	28	37	89
Journal of Rehabilitation	28	29	32	89
Iranian Journal of Obstetrics, Gyneocology & Infertility	27	28	29	84
Govaresh Journal	21	28	34	83
The Iranian Journal of Otorhinolaryngology	18	27	35	80
Iranian Journal of Orthopaedic Surgery	7	38	35	80
Yakhteh	24	24	32	80
Journal of Medical Research (JMR)	17	33	25	75

Journal	No. of papers in 2002	No. of papers in 2003	No. of papers in 2004	Total
Iranian Journal of Public Health	21	21	31	73
Iran J Med Sci	23	23	26	72
Journal of Iranian Anatomical Sciences	8	32	31	71
Journal of Birjand University of Medical Sciences	8	24	38	70
Daru (Journal of Pharmaceutical Faculty of Tehran Medical Sciences University	22	21	27	70
Iranian South Medical Journal	23	24	23	70
Archives of Iranian Medicine	19	24	23	66
Iranian Biomedical Journal	23	27	16	66
Iranian Journal of Pediatrics	14	26	25	65
Physiology And Pharmacology	24	19	21	64
Hayat	15	7	35	57
Journal of Dentistry (Shiraz University of Medical Sciences)	16	25	16	57
Tabriz Pharmacology Journal	10	21	25	56
Iranian Journal of Nuclear Medicine	27	14	13	54
Shiraz E Medical Journal	14	17	22	53
Modares Journal of Medical Sciences	16	12	23	51
Journal of Ilam University of Medical Sciences	16	16	16	48
Iranian Heart Journal (IHJ)	13	4	6	23
Audiology	2	9	7	18
Total	3305	3721	3850	10876

Appendix D: example of formula used for data manipulation.

After scanning references of each journal' articles and transferring them to Microsoft Word™, the first task was identification of different type of references and assigning them special symbol to facilitate categorizing the usage rate of each type of media during the next phases.

The symbols were as follow:

@ @=for journal' article

kkk=for book

rrr=for report

ppp=for thesis or dissertation

ttt=for research project

www=for online resource.

Since most of references were journal articles, the authors of each article were separated by inserting tab key.

The following examples serve to illustrate the above method.

Kuijpers D.I., Thissen M.R., Neumann M.H.,   Basal cell carcinoma: treatment options and prognosis a scientific approach to a common malignancy. @ @Am. J. Clin. Dermatol., 2002; 3(4): 247-59.

Janessen JH, Wellens HJ   What do medical student know about in hospital radiation hazards@ @ Angiol 1989 Jan;40(1):36-8

Zarghami M   The employment difficulties of higher education graduates: dilemmas, backgrounds and solutions @ @Research Quart 2000; 2: 83-9

Harden RM, Laidlaw JM   Effective continuing education: the CRISIS criteria@ @ Med Edu 1992; 26: 408-22

Oakland JS   Total oraganizational Excellence: Achieving world-class performance, oxford, UK, Butterworth-Heinemann Publisher Ltd, 1999(P50).kkk

WHO study group.   Tech Report Geneva: WHO; 1985. Report No: 727.rrr

Dezfullian A.R.,   Microscopical application of design based stereological methods in histopathology and toxic-pathology, Ph. D. thesis, the University of Liverpool: 1995.ppp

12-Ataollahi Z   Comparison of the effect of lecture-based and problem-based education methods on nursing students learning level Shahid Beheshti nursing and midwifery school, 1996.ttt

Bateman GR, Roberts HV   TQM for professors and students Internet: http://www weatherheadcwruedu/msmesb/1992Tennessee/ Robertshtm- downloaded in 22/08/2002.www

At the next step for example for journal articles we were able to separate different part of a references through tabulating it by Microsoft Word™ command which could be used to covert a text to a table

Kuijpers D.I., Thissen M.R., Neumann M.H.,	Basal cell carcinoma: treatment options and prognosis a scientific approach to a common malignancy.	Am. J. Clin. Dermatol., 2002; 3(4): 247-59.
Janessen JH, Wellens HJ	What do medical student knows about in hospital radiation hazards	Angiol 1989 Jan;40(1):36-8
Zarghami M	The employment difficulties of higher education graduates: dilemmas, backgrounds and solutions	Research Quart 2000; 2: 83-9
Harden RM, Laidlaw JM	Effective continuing education: the CRISIS criteria	Med Edu 1992; 26: 408-22

For extraction of publication date, we had to copy the file of each journal to Microsoft Excel™. In Microsoft Excel™ by the use of following command we were able to extract date of publication that we need for calculation of half life.

Razakaboay M, Maillefert JF, Wendling D, et al Bone metastases from a paraganglioma A review of five cases @@Rev Rhum Engl Ed 1999; 66: 86-91.	127	1999
Basal cell carcinoma: treatment options and prognosis a scientific approach to a common malignancy. @ @Am. J. Clin. Dermatol., 2002; 3(4): 247-59.	127	2002
What do medical student knows about in hospital radiation hazards@ @ Angiol 1989 Jan;40(1):36-8	76	1989
The employment difficulties of higher education graduates: dilemmas, backgrounds and solutions @ @Research Quart 2000; 2: 83-9	113	2000
Effective continuing education: the CRISIS criteria@ @ Med Edu 1992; 26: 408-22	63	1992

The formula used here for column two and three were as follow:

Column2=IF(ISERROR(SEARCH("19";I4;1));IF(ISERROR(SEARCH("20";I4;1));SEARCH("13";I4;1));SEARCH("20";I4;1));SEARCH("19";I4;1))

Column3=IF ((ISERROR (J5)); 0 ;(VALUE (MID (I5; J5; 4))))

For extraction of different type of references for example books from other references the following formula in Microsoft Excel™ was used:

=IF (ISERROR (FIND ("kkk"; I3; 1));""; I3)

	I	J	K	L	M	N	O	P	Q	R	S
1	References.	#VALUE!		0 book	thesis	conferenc	report	www	project	journal	patent
2	Walsh RM,	91	1997							Walsh	
3	Oakland JS Tota	129	1999	Oakland							
4	WHO study grou	43	1985				WHO				
5	Dezfullian A.R.,	165	1995		Dezfullia						
6	Ataollahi Z Com	172	1996						Ataollahi		
7	Bateman GR, Ro	103	1992				Batema				

Similar formula was applied with regards to the bibliographic information of each article.

The following example illustrates how title of a given article, authors, source, keywords and date of publication were extracted.

Appendix E: Examples of inconsistencies in syntactic styles and spelling errors.

FALSE	TRUE
J NEUROTICS METH	J Neurosci Methods
J NUROSURG	J Neurosurg
J NURS EDUCATOR	Nurse educator
J NUTR SCI VITAMIN	J Nutr Sci Vitaminol (Tokyo)
J OBS GYN	J Obstet Gynaecol
J OBSGYN	
JOURNAL OBSTETRICS AND GYNECOLOGY	
J OBSTETRICS AND GYNECOLOGY	
J OBSTETRICS GYNECOLOGY	
J ORAD IMPLANTOL	J Oral Implantol
J OSTEOPATHIC ASSOCIATION	J Am Osteopath Assoc
J ORTOP TRAUMA	J ORTHOP TRAUMA
J P N PHARMACOL	Jpn J Pharmacol
HEMOSTASE	HEMOSTASIS
HUM I KO TA HSUCH HSUEH PAO	HO NAY I KO TA HSUEH HSUEH PAO
J PEDIATR OPHLHALMOL STRAB	J Pediatr Ophthalmol Strabismus
PHISIOL BEH	Physiol Behav
PHRM BIOCH BEHAV	PHARMACOL BIOCHEM BEHAV
PHTYOCHEMISTRY	Phytochemistry
Phys Sportsmed	PHYSIC SPORTS MED
PHYSIOL AND MOLEC PLANT PATH	Physiol. Mol. Plant Pathol.
PHYSIOTHER RES LNT	PHYSIOTHER RES INT
PHYTOPATHOLOGICA	Phytopathology
PNEMNOLOGIE	Pneumologie
POATGRAD MED	Postgrad Med
POLISH OCCUP M	Pol J Occup Med
POLL PATHOL	Pol J Pathol
PRE HOSP DISAST MED	Prehosp Disaster Med
PROC JAP ACAD	Proc Jpn Acad
PROE EUR DIAL TRANSPLANT ASSOC	Proc Eur Dial Transplant Assoc
SEMIN NEUROPSYCHIATRY	Semin Clin Neuropsychiatry
ULUS TRAUMA DERG	Ulus Travma Derg
WLD REV NUTR DIE	World Rev Nutr Diet
Z URO	Z Urol

Appendix F: Frequency of citations, Self-Citations and Cited Articles for each 90 Iranian medical journals.

Rank *	Journal	2 to 2	3 to 3	4 to 4	3 to 2	4 to 2	4 to 3	TNCR	JSF	NCA
21	*Journal of Iran University of Medical Sciences*	2	1	2	5	1	2	13	2	12
22	Journal of Iranian Anatomical Sciences		3		2	2	6	13	10	6
23	Teb Va Tazkieh	2		1	2	7		12	0	5
24	Scientific Medical Journal	1			2	7	1	11	2	9
25	Scientific Journal of Forensic Medicine			1	5	4		10	7	8
26	Journal of School of Public Health & Institute of Public Health	1			2	6	1	10	1	7
27	Iranian Journal of Radiation Research (IJRR)		2	2			6	10	8	8
28	Iranian Heart Journal (IHJ)	1		2	2	3	2	10	0	7
29	Feyz					4	5	9	2	9
30	Govaresh Journal					4	5	9	1	8
31	Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University				1	3	5	9	6	8
32	Yakhteh		1		6	2		9	4	6
33	Journal of Shahid Sadoughi University of Medical Sciences & Health Services		1		4	3		8	1	6
34	Journal of The Faculty of Medicine		1		3	2	2	8	2	7
35	Payesh	1			1	5		7	1	7
36	Koomesh				3	3	1	7	4	5
37	Iranian Journal of Infectious Diseases & Tropical Medicine			1	2	3	1	7	1	6
38	Journal of Medical Faculty Guilan University of Medical Sciences				3	2	2	7	1	7
39	Journal of Rafsanjan University of Medical Sciences & Health Services				1	5	1	7	1	4
40	Scientific Journal of Hamadan University of Medical Sciences & Health Services	1			2	3	1	7	2	6

Rank *	Journal	2 to 2	3 to 3	4 to 4	3 to 2	4 to 2	4 to 3	TNCR	JSF	NCA
41	Iranian Journal of Dermatology			1		4	1	6	4	5
42	Advances in Cognitive Science	1	2		1	2		6	5	5
43	Journal of Babol University of Medical Sciences (JBUMS)			2	2		2	6	1	6
44	Daneshvar Medicine				2	4		6	0	4
45	Physiology And Pharmacology		1			3	2	6	0	6
46	Medical Journal of Hormozgan University				2	3	1	6	0	6
47	Tanaffos	1	3		1			5	5	5
48	Rahavard-E Danesh	1			1	3		5	1	3
49	Journal of Kerman University of Medical Sciences	1		1		2	1	5	1	5
50	Journal of Zanjan University of Medical Sciences & Health Services	1				3	1	5	1	3
51	Ofogh-E-Danesh	1			2	1		4	3	5
52	Daru (Journal of Pharmaceutical Faculty of Tehran Medical Sciences University				2		2	4	3	4
53	Iranian Journal of Anaesthesiology & Intensive Care				1	1	2	4	1	3
54	Medical Journal of Tabriz University of Medical Sciences		2			1	1	4	1	4
55	Journal of Isfahan Medical School (I.U.M.S)		1		1		2	4	1	3
56	Medical Journal of Mashhad University Of Medical Sciences					3	1	4	0	4
57	Journal of Dentistry of Tehran University of Medical Sciences	1				2	1	4	1	4
58	Iranian Journal of Basic Medical Sciences				4			4	1	2
59	Acta Medica Iranica				4			4	0	3
60	Arch Razi Ins				2	1	1	4	2	4

Rank*	Journal	2 to 2	3 to 3	4 to 4	3 to 2	4 to 2	4 to 3	TNCR	JSF	NCA
61	Armaghaneh Danesh					3		3	0	2
62	Journal of Sabzevar School Of Medical Sciences				1	1	1	3	1	3
63	Behboud					2	1	3	0	3
64	Shahid Beheshti MSUJ (Pajouhandeh)			1		1	1	3	0	3
65	Journal of Rehabilitation					2	1	3	2	3
66	Tabib-E-Shargh					3		3	2	3
67	The Journal of Urmia University of Medical Sciences					1	2	3	1	3
68	Journal of Medical Research (JMR)				3			3	0	3
69	Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association					2	1	3	1	3
70	Scientific Journal of Kurdistan University of Medical Sciences				2	1		3	2	3
71	Iranian Journal of Public Health				1	1	1	3	0	3
72	Journal of Ardabil University of Medical Sciences (JAUMS)				1	1		2	1	2
73	Iranian Journal of Nuclear Medicine					1	1	2	1	1
74	Journal of Mashhad Dental School				1		1	2	2	2
75	Yaft-e				1		1	2	0	2
76	Modares Journal of Medical Sciences		1					1	0	1
77	Iranian Journal of Pediatrics				1			1	0	1
78	Journal of Dentistry					1		1	1	1
79	Journal of Gorgan University of Medical Sciences					1		1	0	1
80	Journal of Ilam University of Medical Sciences		1					1	1	1
81	Journal of Birjand University of Medical Sciences						1	1	0	1

Rank *	Journal	2 to 2	3 to 3	4 to 4	3 to 2	4 to 2	4 to 3	TNCR	JSF	NCA
82	The Iranian Journal of Otorhinolaryngology					1		1	0	1
83	Shiraz E Medical Journal						1	1	1	1
84	Iranian Journal of Obstetrics, Gyneocology & Infertility							0	0	0
85	Audiology							0	0	0
86	Shahrekord University of Medical Sciences Journal							0	0	0
87	Journal of Dentistry (Shiraz University of Medical Sciences)							0	0	0
88	Hayat							0	0	0
89	Iranian Journal of Orthopaedic Surgery							0	0	0
90	Tabriz Pharmacology Journal							0	0	0
	Total	44	66	40	197	316	165	828	249	601

Appendix G: The immediacy index of Iranian medical journals from 2002 to 2004.

Rank*	Journal	Citation 02 to 02	Citation 03 to 03	Citation 04 to 04	Immediacy Freq.
21	Journal of Military Medicine	2		1	3
22	Journal of Medical Council of I.R.I.		2	1	3
23	Journal of Iranian Anatomical Sciences		3		3
24	Iranian Heart Journal (IHJ)	1		2	3
25	Journal of Babol University of Medical Sciences (Jbums)			2	2
26	Iranian Journal of Medical Education	2			2
27	Medical Journal of Tabriz University of Medical Sciences		2		2
28	Journal of Kerman University of Medical Sciences	1		1	2
29	Journal of Mazandaran University of Medical Sciences			2	2
30	Ofogh-E-Danesh	1			1
31	Iranian Journal of Dermatology			1	1
32	Payesh	1			1
33	Scientific Journal of Forensic Medicine			1	1
34	Shahid Beheshti Msuj (Pajouhandeh)			1	1
35	Journal of Shahid Sadoughi University of Medical Sciences & Health Services		1		1
36	Rahavard-E Danesh	1			1
37	Iranian South Medical Journal	1			1
38	Modares Journal of Medical Sciences		1		1
39	Physiology And Pharmacology		1		1
40	Iranian Journal of Infectious Diseases & Tropical Medicine			1	1
41	Journal of School of Public Health & Institute of Public Health	1			1
42	Journal of The Faculty of Medicine		1		1
43	Journal of Isfahan Medical School (I.U.M.S)		1		1
44	Journal of Dentistry of Tehran University of Medical Sciences	1			1
45	Scientific Medical Journal	1			1
46	Journal of Zanjan University of Medical Sciences & Health Services	1			1
47	Journal of Ilam University of Medical Sciences		1		1

Rank*	Journal	Citation 02 to 02	Citation 03 to 03	Citation 04 to 04	Immediacy Freq.
48	Scientific Journal of Hamadan University of Medical Sciences & Health Services	1			1
49	Yakhteh		1		1
50	Armaghaneh Danesh				0
51	Journal of Sabzevar School Of Medical Sciences				0
52	Behboud				0
53	Journal of Rehabilitation				0
54	Journal of Ardabil University of Medical Sciences (Jaums)				0
55	Daneshvar Medicine				0
56	Iranian Journal of Obstetrics, Gyneocology & Infertility				0
57	Audiology				0
58	Tabib-E-Shargh				0
59	Daru (Journal of Pharmaceutical Faculty of Tehran Medical Sciences University				0
60	Feyz				0
61	Koomesh				0
62	Govaresh Journal				0
63	Iranian Journal of Anaesthesiology & Intensive Care				0
64	Iranian Journal of Pediatrics				0
65	The Journal of Urmia University of Medical Sciences				0
66	Iranian Journal of Nuclear Medicine				0
67	Journal of Medical Research (JMR)				0
68	Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association				0
69	Journal of Medical Faculty Guilan University of Medical Sciences				0
70	Journal of Mashhad Dental School				0
71	Shahrekord University of Medical Sciences Journal				0
72	Medical Journal of Mashhad University Of Medical Sciences				0
73	Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University				0
74	Journal of Dentistry				0

Rank*	Journal	Citation 02 to 02	Citation 03 to 03	Citation 04 to 04	Immediacy Freq.
75	Scientific Journal of Kurdistan University of Medical Sciences				0
76	Journal of Gorgan University of Medical Sciences				0
77	Journal of Birjand University of Medical Sciences				0
78	Journal of Rafsanjan University of Medical Sciences & Health Services				0
79	Iranian Journal of Basic Medical Sciences				0
80	The Iranian Journal of Otorhinolaryngology				0
81	Yaft-e				0
82	Acta Medica Iranica				0
83	Arch Razi Ins				0
84	Iranian Journal of Public Health				0
85	Shiraz E Medical Journal				0
86	Journal of Dentistry (Shiraz University of Medical Sciences)				0
87	Hayat				0
88	Iranian Journal of Orthopaedic Surgery				0
89	Tabriz Pharmacology Journal				0
90	Medical Journal of Hormozgan University				0
Total	Total	44	66	40	150

*Ranked by immediacy index

Appendix H: Ranked list of Iranian medical journals according to their corresponding impact factor in 2002.

Rank*	Journal	No of Art. Published in 2000+2001	Cit. Received in 2002 for Articles published in 2000+2001	Impact Factor (2002)
16	Research In Medicine	80	7	0.088
17	Medical Journal of Hormozgan University	36	3	0.083
18	Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University	100	8	0.08
19	Bina Journal	89	7	0.079
20	Koomesh	54	4	0.074
21	Journal of Veterinary Research	162	12	0.074
22	Journal of Medical Faculty Guilan University of Medical Sciences	72	5	0.069
23	Journal of Zanjan University of Medical Sciences & Health Services	77	5	0.065
24	Medical Journal of Mashhad University Of Medical Sciences	176	11	0.063
25	Iranian Journal of Basic Medical Sciences	49	3	0.061
26	Scientific Journal of Forensic Medicine	66	4	0.061
27	Advances in Cognitive Science	33	2	0.061
28	Scientific Journal of Hamadan University of Medical Sciences & Health Services	99	6	0.061
29	Journal of Research In Medical Sciences of Esfahan MSUJ	192	11	0.057
30	Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association	37	2	0.054
31	Journal of Kerman University of Medical Sciences	75	4	0.053
32	Shahid Beheshti MSUJ (Pajouhandeh)	169	9	0.053
33	Daneshvar Medicine	134	7	0.052
34	Iranian Journal of Infectious Diseases & Tropical Medicine	41	2	0.049
35	Modares Journal of Medical Sciences	44	2	0.045
36	Journal of Dentistry of Tehran University of Medical Sciences	66	3	0.045
37	Iranian Journal of Dermatology	67	3	0.045
38	Scientific Journal of Kurdistan University of Medical Sciences	67	3	0.045
39	Journal of Iran University of Medical Sciences	138	6	0.043
40	Feyz	130	5	0.038
41	The Journal of Gazvin University of Medical Sciences & Health Services	114	4	0.035
42	The Journal of Urmia University of Medical Sciences	89	3	0.034
43	Rahavard-E Danesh	67	2	0.03
44	Journal of Dentistry	73	2	0.027
45	Journal of Babol University of Medical Sciences (JBUMS)	82	2	0.024
46	Journal of Gorgan University of Medical Sciences	43	1	0.023
47	Kowsar Medical Journal	87	2	0.023
48	Journal of Sabzevar School Of Medical Sciences	98	2	0.02
49	Tabib-E-Shargh	49	1	0.02
50	Journal of Isfahan Medical School (I.U.M.S)	116	2	0.017
51	Medical Journal of Tabriz University of Medical Sciences	122	1	0.008

*Ranked by Impact Factor

Appendix I: Ranked list of Iranian medical journals according to their corresponding impact factor in 2003.

Rank*	Journal	No of Art. Published in 2001+2002	Cit. Received in 2003 for Articles published in 2001+2002	Impact Factor (2003)
16	Journal of Rehabilitation	48	4	0.083
17	Scientific Journal of Forensic Medicine	65	5	0.077
18	Iranian South Medical Journal	136	10	0.074
19	Journal of Medical Faculty Guilan University of Medical Sciences	83	6	0.072
20	Journal of Shahid Sadoughi University of Medical Sciences & Health Services	186	13	0.07
21	Journal of Research In Medical Sciences of Esfahan Msuj	180	10	0.056
22	Kowsar Medical Journal	90	5	0.056
23	Advances in Cognitive Science	55	3	0.055
24	The Journal of Gazvin University of Medical Sciences & Health Services	112	6	0.054
25	Scientific Journal of Hamadan University of Medical Sciences & Health Services	94	5	0.053
26	Daru (Journal of Pharmaceutical Faculty of Tehran Medical Sciences University	40	2	0.05
27	Medical Journal of Hormozgan University	64	3	0.047
28	Journal of Babol University of Medical Sciences (JBUMS)	87	4	0.046
29	Physiology And Pharmacology	45	2	0.044
30	Ofogh-E-Danesh	46	2	0.043
31	Research In Medicine	92	4	0.043
32	Journal of Gorgan University of Medical Sciences	50	2	0.04
33	Daneshvar Medicine	126	5	0.04
34	Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University	129	5	0.039
35	Iranian Journal of Infectious Diseases & Tropical Medicine	82	3	0.037
36	Journal of Military Medicine	83	3	0.036
37	Armaghaneh Danesh	57	2	0.035
38	Journal of Medical Council of I.R.I.	88	3	0.034
39	Scientific Medical Journal	62	2	0.032
40	Rahavard-E Danesh	63	2	0.032
41	Journal of Iran University of Medical Sciences	189	6	0.032
42	Behboud	66	2	0.03

Rank*	Journal	No of Art. Published in 2001+2002	Cit. Received in 2003 for Articles published in 2001+2002	Impact Factor (2003)
43	Iranian Journal of Fertility & Sterility	68	2	0.029
44	Journal of The Faculty of Medicine	170	5	0.029
45	Journal of Veterinary Research	139	4	0.029
46	Iranian Journal of Dermatology	72	2	0.028
47	Journal of Zanjan University of Medical Sciences & Health Services	75	2	0.027
48	Iranian Journal of Nuclear Medicine	38	1	0.026
49	Medical Journal of Tabriz University of Medical Sciences	115	3	0.026
50	Journal of Kerman University of Medical Sciences	78	2	0.026
51	Payesh	40	1	0.025
52	Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association	40	1	0.025
53	Modares Journal of Medical Sciences	41	1	0.024
54	Shahid Beheshti MSUJ (Pajouhandeh)	167	4	0.024
55	Journal of Rafsanjan University of Medical Sciences & Health Services	42	1	0.024
56	Yaft-e	90	2	0.022
57	Journal of Sabzevar School Of Medical Sciences	94	2	0.021
58	Journal of Ardabil University of Medical Sciences (JAUMS)	48	1	0.021
59	Iranian Journal of Obstetrics, Gyneocology & Infertility	55	1	0.018
60	Iranian Journal of Anaesthesiology & Intensive Care	55	1	0.018
61	Medical Journal of Mashhad University Of Medical Sciences	175	3	0.017
62	Tabib-E-Shargh	63	1	0.016
63	Feyz	128	2	0.016
64	Journal of Dentistry	75	1	0.013
65	Journal of Isfahan Medical School (I.U.M.S)	76	1	0.013

*Ranked by Impact Factor

Appendix J: Ranked list of Iranian medical journals according to their corresponding impact factor in 2004.

Rank *	Journal	No of Art. Published in 2002+2003	Cit. Received in 2004 for Articles published in 2002+2003	Impact Factor (2004)
16	Journal of Military Medicine	95	16	0.168
17	Iranian Journal of Fertility & Sterility	78	13	0.167
18	Journal of School of Public Health & Institute of Public Health	62	10	0.161
19	Iran J Med Sci	87	14	0.161
20	Bina Journal	95	15	0.158
21	The Journal of Gazvin University of Medical Sciences & Health Services	138	21	0.152
22	Scientific Journal of Forensic Medicine	62	9	0.145
23	Teb va Tazkieh	78	11	0.141
24	Physiology And Pharmacology	43	6	0.14
25	Archives of Iranian Medicine	105	14	0.133
26	Scientific Medical Journal	84	11	0.131
27	Journal of Veterinary Research	142	18	0.127
28	Koomesh	57	7	0.123
29	Journal of Rafsanjan University of Medical Sciences & Health Services	63	7	0.111
30	Journal of Mazandaran University of Medical Sciences	101	11	0.109
31	Iranian Heart Journal (IHJ)	75	8	0.107
32	Payesh	66	7	0.106
33	Daru (Journal of Pharmaceutical Faculty of Tehran Medical Sciences University	43	4	0.093
34	Arch Razi Ins	43	4	0.093
35	Journal of Research In Medical Sciences of Esfahan Msuj	187	16	0.086
36	Medical Journal of Hormozgan University	71	6	0.085
37	Rahavard-E Danesh	63	5	0.079
38	Journal of Zanjan University of Medical Sciences & Health Services	65	5	0.077
39	Journal of Medical Faculty Guilan University of Medical Sciences	93	7	0.075
40	Tanaffos	67	5	0.075
41	Feyz	122	9	0.074
42	Iranian Journal of Public Health	42	3	0.071

Rank *	Journal	No of Art. Published in 2002+2003	Cit. Received in 2004 for Articles published in 2002+2003	Impact Factor (2004)
43	Ofogh-E-Danesh	60	4	0.067
44	Iranian Journal of Dermatology	79	5	0.063
45	Advances in Cognitive Science	95	6	0.063
46	Iranian Journal of Anaesthesiology & Intensive Care	65	4	0.062
47	Iranian Journal of Basic Medical Sciences	65	4	0.062
48	Journal of Medical Research (JMR)	50	3	0.06
49	Scientific Journal of Hamadan University of Medical Sciences & Health Services	117	7	0.06
50	Journal of The Faculty of Medicine	143	8	0.056
51	Iranian Journal of Infectious Diseases & Tropical Medicine	110	6	0.055
52	Journal of Isfahan Medical School (I.U.M.S)	74	4	0.054
53	Journal of Kerman University of Medical Sciences	75	4	0.053
54	Journal of Rehabilitation	57	3	0.053
55	Daneshvar Medicine	120	6	0.05
56	Journal of Iran University of Medical Sciences	220	11	0.05
57	Iranian Journal of Nuclear Medicine	41	2	0.049
58	Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University	185	9	0.049
59	Journal of Dentistry of Tehran University of Medical Sciences	85	4	0.047
60	Behboud	65	3	0.046
61	Scientific Journal of Kurdistan University of Medical Sciences	65	3	0.046
62	Armaghaneh Danesh	68	3	0.044
63	Tabib-E-Shargh	68	3	0.044
64	Journal of Shahid Sadoughi University of Medical Sciences & Health Services	190	8	0.042
65	Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association	77	3	0.039
66	Journal of Babol University of Medical Sciences (JBUMS)	104	4	0.038
67	Journal of Mashhad Dental School	52	2	0.038
68	The Journal of Urmia University of Medical Sciences	81	3	0.037

Rank *	Journal	No of Art. Published in 2002+2003	Cit. Received in 2004 for Articles published in 2002+2003	Impact Factor (2004)
69	Modares Journal of Medical Sciences	28	1	0.036
70	Acta Medica Iranica	112	4	0.036
71	Journal of Sabzevar School Of Medical Sciences	90	3	0.033
72	Shiraz E Medical Journal	31	1	0.032
73	Journal of Ardabil University of Medical Sciences (JAUMS)	64	2	0.031
74	Journal of Ilam University of Medical Sciences	32	1	0.031
75	Journal of Birjand University of Medical Sciences	32	1	0.031
76	Medical Journal of Tabriz University of Medical Sciences	145	4	0.028
77	Medical Journal of Mashhad University Of Medical Sciences	148	4	0.027
78	The Iranian Journal of Otorhinolaryngology	45	1	0.022
79	Yaft-e	92	2	0.022
80	Iranian Journal of Pediatrics	52	1	0.019
81	Journal of Gorgan University of Medical Sciences	57	1	0.018
82	Journal of Dentistry	71	1	0.014
83	Shahid Beheshti MSUJ (Pajouhandeh)	144	2	0.014
84	Iranian Journal of Obstetrics, Gyneocology & Infertility	55	0	0
85	Audiology	17	0	0
86	Shahrekord University of Medical Sciences Journal	79	0	0
87	Journal of Dentistry (Shiraz University of Medical Sciences)	39	0	0
88	Hayat	22	0	0
89	Iranian Journal of Orthopedic Surgery	38	0	0
90	Tabriz Pharmacology Journal	31	0	0

*Ranked by Impact Factor

Appendix K: Number of input citations of Iranian medical journals from 2002-2004

Rank*	Journal	Input citations
16	Journal of Gorgan University of Medical Sciences	15
17	Research In Medicine	14
18	Journal of Iran University of Medical Sciences	14
19	Shahrekord University of Medical Sciences Journal	14
20	Journal of The Faculty of Medicine	13
21	Armaghaneh Danesh	13
22	Journal of Andisheh Va Raftar	12
23	Scientific Journal of Forensic Medicine	12
24	Journal of Rafsanjan University of Medical Sciences & Health Services	12
25	Iranian Journal of Public Health	12
26	Advances in Cognitive Science	11
27	Journal of Birjand University of Medical Sciences	11
28	Iranian South Medical Journal	10
29	Daru (Journal of Pharmaceutical Faculty of Tehran Medical Sciences University	10
30	Journal of Medicinal Plants	10
31	Iranian Journal of Pediatrics	10
32	Journal of Veterinary Research	10
33	Iranian Journal of Obstetrics, Gyneocology & Infertility	9
34	Journal of School of Public Health & Institute of Public Health	9
35	Scientific Journal of Kurdistan University of Medical Sciences	9
36	Tanaffos	8
37	Hakim	8
38	Journal of Ardabil University of Medical Sciences (JAUMS)	8
39	The Journal of Urmia University of Medical Sciences	8
40	Kowsar Medical Journal	8
41	Scientific Medical Journal	8
42	Archives of Iranian Medicine	8
43	Iranian Journal of Radiation Research (IJRR)	8
44	Ofogh-E-Danesh	7
45	Journal of Kerman University of Medical Sciences	7
46	Journal of Dentistry Faculty of Shahid Beheshti Medical Sciences University	7
47	Journal of Zanjan University of Medical Sciences & Health Services	7
48	Scientific Journal of Hamadan University of Medical Sciences & Health Services	7
49	Iran J Med Sci	7
50	Journal of Sabzevar School of Medical Sciences	6
51	Journal of Rehabilitation	6

Rank*	Journal	Input citations
52	Rahavard-E Danesh	6
53	Yakhteh	6
54	Medical Journal of Hormozgan University	6
55	Shahid Beheshti MSUJ (Pajouhandeh)	5
56	Daneshvar Medicine	5
57	Feyz	5
58	Journal of Medical Faculty Guilan University of Medical Sciences	5
59	Journal of Dentistry	5
60	Iranian Journal of Basic Medical Sciences	5
61	Arch Razi Ins	5
62	Iranian Journal of Dermatology	4
63	Physiology And Pharmacology	4
64	Govaresh Journal	4
65	Iranian Journal of Infectious Diseases & Tropical Medicine	4
66	Medical Journal of Tabriz University of Medical Sciences	4
67	Journal of Isfahan Medical School (I.U.M.S)	4
68	Journal of Mashhad Dental School	3
69	Journal of Medical Council of I.R.I.	3
70	Yaft-e	3
71	Iranian Biomedical Journal	3
72	Journal of Research In Medical Sciences of Esfahan Msuj	2
73	Iranian Journal of Ophthalmology of Iranian Ophthalmologists Association	2
74	Journal of Ilam University of Medical Sciences	2
75	Iranian Journal of Anaesthesiology & Intensive Care	1
76	Iranian Journal of Nuclear Medicine	1
77	Journal of Medical Research (JMR)	1
78	Medical Journal of Mashhad University of Medical Sciences	1
79	Journal of Dentistry of Tehran University of Medical Sciences	1
80	Acta Medica Iranica	1
81	Shiraz E Medical Journal	1
82	Audiology	0
83	Teb Va Tazkieh	0
84	Modares Journal of Medical Sciences	0
85	The Iranian Journal of Otorhinolaryngology	0
86	Iranian Heart Journal (IHJ)	0
87	Journal of Dentistry (Shiraz University of Medical Sciences)	0
88	Hayat	0
89	Iranian Journal of Orthopaedic Surgery	0
90	Tabriz Pharmacology Journal	0

*Ranked by number of input citations.

Appendix L: The 102 most cited journals in 2002 and their corresponding half-life are listed in the following table.

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	NEGM	362	1999	1985.75	1992	1997	5	10	16.25
2	LANCET	300	1999	1984	1991	1997	5	11	18
3	BMJ	219	2000	1985	1993	1998	4	9	17
4	FERTIL STERIL	187	1991	1988	1993	1998	4	9	14
5	JAMA	186	1995	1984	1993	1997	5	9	18
6	AM J OBSTET GYNECOL	175	1995	1987	1994	1998	4	8	15
7	OBSTET GYNECOL	158	1997	1991	1996	1998	4	6	11
8	PEDIATR	151	1992	1986	1992	1998	4	10	16
9	AM J CLIN NUTR	146	2000	1988	1994.5	1998	4	7.5	14
10	CIRCULATION	143	1998	1985	1994	1998	4	8	17
11	DIABET CARE	141	1997	1993.5	1997	1998	4	5	8.5
12	ANN INTERN MED	118	1992	1985	1991	1995	7	11	17
13	CANCER	113	1996	1976.5	1987	1996	6	15	25.5
14	J PEDIATR	112	1994	1983	1992	1996.75	5.25	10	19
15	J CLIN ENDOCRINOL METAB	104	1984(a)	1983	1989	1994.75	7.25	13	19
16	ARCH INTERN MEDL	101	1998	1985.5	1992	1997	5	10	16.5
17	HUM REPROD	99	1998	1994	1997	1998	4	5	8
18	CHEST	98	1988	1988	1992	1995.25	6.75	10	14
19	BRAIN RES	90	1995	1985.75	1991.5	1995	7	10.5	16.25
20	J BONE AND J OINT SURG	87	1988(a)	1976	1988	1994	8	14	26
21	J CLIN MICROBIOL	87	1996	1988	1994	1997	5	8	14
22	ANESTHESIOLOGY	86	1992	1988	1992	1996.25	5.75	10	14
23	J INFECT DIS	83	1998	1986	1992	1998	4	10	16
24	NATURE	81	1984	1970	1984	1992.5	9.5	18	32
25	J UROL	80	1994	1987.25	1994	1997	5	8	14.75
26	ANESTH ANALG	80	1992	1987.25	1992	1996	6	10	14.75
27	ARCH DIS CHILD	79	1994	1978	1989	1994	8	13	24
28	AM J EPIDEMIOL	77	1999	1985	1993	1998.5	3.5	9	17
29	J ADV NURS	77	1998	1994	1997	1999	3	5	8
30	NEUROLOGY	75	1998	1988	1994	1997	5	8	14
31	AM J MED	73	1993	1980	1989	1993	9	13	22
32	AM J PHYSIOL	68	1996	1988.25	1995	1997	5	7	13.75

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
33	GASTROENTROLOGY	67	1992	1987	1992	1997	5	10	15
34	PAIN	67	1995(a)	1988	1992	1997	5	10	14
35	ANN THORAC SURG	66	1995(a)	1991.75	1995	1998.25	3.75	7	10.25
36	RADIOLOGY	65	1992(a)	1987	1992	1997	5	10	15
37	AM J TROP MED HYG	65	1995(a)	1982	1993	1997	5	9	20
38	PEDIATR INFECT DIS J	62	2000	1991	1995.5	2000	2	6.5	11
39	AM J SURG	62	1996	1986.75	1993	1996	6	9	15.25
40	SCIENCE	61	1992	1977.5	1985	1994	8	17	24.5
41	Am J Psychiatry	61	1991	1989	1991	1996	6	11	13
42	BR J ANESTH	61	1993(a)	1986.5	1993	1998	4	9	15.5
43	AM J CARDIOL	60	1987	1986	1990	1997	5	12	16
44	BR JOBSTET GYNECOL	60	1999	1985.5	1996	1999	3	6	16.5
45	PROC NATL ACAD SCI USA	57	1990(a)	1986	1991	1996	6	11	16
46	INFECT IMMUN	56	1984	1984.25	1991.5	1996	6	10.5	17.75
47	J BIOL CHEM	56	1993(a)	1972.5	1983.5	1993.75	8.25	18.5	29.5
48	STROKE	52	1999	1992.5	1997	1999	3	5	9.5
49	J TRAUMA	52	1995	1984	1991.5	1997	5	10.5	18
50	AM J PUBLIC HEALTH	52	1998	1991	1994.5	1998	4	7.5	11
51	ACTAPEDIATR	51	1999	1994	1997	1999	3	5	8
52	CLIN CHEM	51	1972	1976	1987	1993	9	15	26
53	BLOOD	50	1992	1990	1993	1998	4	9	12
54	J NEUROSURG	50	1991	1983	1989.5	1994	8	12.5	19
55	VACCINE	50	2000	1994	1998	2000	2	4	8
56	TRANSACTIONS THE ROYAL SOCIETY TROPICAL MEDICINE AND HYGIENE	50	1995	1983.5	1994	1997	5	8	18.5
57	CLIN ENDOCRINOL	50	1995	1983.75	1993	1995	7	9	18.25
58	Planta_Med	50	1994	1983.5	1991	1995	7	11	18.5
59	CLIN ORTOP	48	1975(a)	1981	1985.5	1991	11	16.5	21
60	ORAL SURG ORAL MED ORAL PATHOL	47	1992	1985	1991	1992	10	11	17
61	AM J GASTROENTROLOGY	45	1999	1991	1995	1999	3	7	11
62	LARYNGOSCOPE	45	2000	1989	1995	1998	4	7	13
63	J ETHNOPHARMACOL	45	2000	1991	1995	1999	3	7	11

Rank		Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
64		DIABETES	44	1991(a)	1979	1986	1991	11	16	23
65		SPINE	44	1994	1988.25	1992.5	1995	7	9.5	13.75
66		AM REV RESP DIS	44	1989(a)	1983.25	1989	1992	10	13	18.75
67		Thorax	44	2000	1991	1995.5	2000	2	6.5	11
68		Contraception	44	1995.00(a)	1994	1997	2000	2	5	8
69		Avian_Dis	44	1995	1988	1993.5	1997	5	8.5	14
70		TRANSPLANTATION	43	1997	1992	1997	1998	4	5	10
71		Antimicrob_Agent_Che mother	43	1995	1985	1991	1996	6	11	17
72		OPHTHALMOL	42	1999	1989.75	1996	1999	3	6	12.25
73		J CLIN INVEST	41	1985	1984	1991	1996.5	5.5	11	18
74		BRJPSYCHIATRY	41	1996	1986	1992	1996	6	10	16
75		J RHEUMATOL	41	1994(a)	1992	1995	1998.5	3.5	7	10
76		J IMMUNOL	40	1997(a)	1987	1995.5	1998.75	3.25	6.5	15
77		CLIN INFECT DIS	40	1997	1995	1997	1997.75	4.25	5	7
78		OSTEOPOROSISINT	40	2001	1994.25	1998	2000	2	4	7.75
79		EUR J PHARMACOL	40	1996	1985.25	1994	1998	4	8	16.75
80		J THORAC CARDIOVASC SURG	40	1992	1982	1989	1995	7	13	20
81		AM HEART J	40	1986(a)	1987	1991	1998.75	3.25	11	15
82		J EXP MED	39	1992(a)	1985	1992	1997	5	10	17
83		Arthritis_Rheum	39	1996	1989	1994	1997	5	8	13
84		KIDNEY INT	38	1980(a)	1983.75	1992	1996	6	10	18.25
85		BR_J_DERMATOL	38	1998	1990.5	1994.5	1998	4	7.5	11.5
86		Mutat_Res	38	1995.00(a)	1989.75	1993	1995.25	6.75	9	12.25
87		J ENDODON	37	1992(a)	1986.5	1992	1996	6	10	15.5
88		BURNS	37	1998	1991.5	1997	1999.5	2.5	5	10.5
89		ATHEROSCLEROSIS	37	1995	1987.5	1991	1996	6	11	14.5
90		J Periodontol	36	1978(a)	1978.25	1984	1992.75	9.25	18	23.75
91		Neurosugery	36	1992	1988	1992	1995.75	6.25	10	14
92		Drugs	36	1998	1990	1996.5	1998	4	5.5	12
93		GUT	35	1986	1988	1996	1999	3	6	14
94		CANCER RES	35	1998	1983	1990	1994	8	12	19

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
95	ARCH GEN PSYCHIATR	35	1994	1976	1989	1994	8	13	26
96	ANNNYACADSCI	35	1998(a)	1990	1996	1999	3	6	12
97	ACTA OBSTET GYNECOL SCAND	35	1998	1993	1997	1999	3	5	9
98	Postgrad_Med_J	34	1992.00(a)	1987	1992	1997	5	10	15
99	J_Hand_Surg	33	1990	1985	1989	1993	9	13	17
100	J AM COLL CARDIOL	32	1998	1988.5	1995	1998	4	7	13.5
101	J PHARMACOL EXP THER	32	1990	1989.25	1993.5	1997.75	4.25	8.5	12.75
102	HEPATOLOGY	32	1994	1991.75	1995	1997	5	7	10.25

*Ranked by number of citations.

Appendix M: The 98 most cited journals in 2003 and their corresponding half-life are listed in the following table

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	NEGM	438	1995	1987	1993.5	1997	6	9.5	16
2	LANCET	383	1997	1985	1992	1997	6	11	18
3	HUM REPROD	275	2000	1995	1997	2000	3	6	8
4	FERTIL STERIL	273	1997	1990	1996	1999	4	7	13
5	BMJ	245	1998	1982.5	1993	1998	5	10	20.5
6	JAMA	236	1999	1987	1993	1998	5	10	16
7	J CLIN ENDOCRINOL METAB	233	1998	1988	1996	1999	4	7	15
8	AM J OBSTET GYNECOL	224	1997	1986	1993.5	1998	5	9.5	17
9	ARCH INTERN MEDL	215	1994	1991	1994	1998	5	9	12
10	OBSTET GYNECOL	202	2000	1988.75	1995	1999	4	8	14.25
11	DIABET CARE	185	1998	1995	1998	2000	3	5	8
12	PEDIATR	182	1996	1985	1994	1998.25	4.75	9	18
13	CIRCULATION	181	1999	1992	1996	1999	4	7	11
14	J BONE AND JOINT SURG	178	1990	1975	1986	1994	9	17	28
15	GASTROENTROLOGY	163	1997	1991	1996	1998	5	7	12
16	AM J CLIN NUTR	160	2000	1988	1994	1998	5	9	15
17	CANCER	158	1989	1982.75	1990	1996	7	13	20.25
18	PROC NATL ACAD SCI USA	157	1996	1990	1995	1998	5	8	13
19	ANN INTERN MED	150	1992	1985	1992	1997	6	11	18
20	J UROL	148	1992	1987	1993	1998	5	10	16
21	J PEDIATR	146	1998	1985	1991	1998	5	12	18
22	NATURE	146	1981	1974.75	1985	1993	10	18	28.25
23	J BIOL CHEM	139	2002	1985	1994	1999	4	9	18
24	CHEST	133	1997	1989	1994	1999	4	9	14
25	SCIENCE	129	1998	1981	1988	1994	9	15	22
26	CLIN ORTOP	128	1996	1982	1990	1996	7	13	21
27	AM J MED	126	1983	1982	1990	1997.25	5.75	13	21
28	ANESTH ANALG	123	1994	1991	1995	1999	4	8	12
29	AM J GASTROENTROLOGY	116	1999	1993	1997	2000	3	6	10
30	SPINE	113	1994	1988	1993	1997	6	10	15
31	J PROSTHET DENT	112	1985	1981.25	1986	1991.75	11.25	17	21.75
32	J CLIN MICROBIOL	110	2000	1992	1996	1999	4	7	11
33	AM J PHYSIOL	108	1997	1985	1992	1997	6	11	18
34	KIDNEY INT	108	1999	1990	1994	1998	5	9	13
35	BRAIN RES	105	1994	1985.5	1993	1998	5	10	17.5
36	J INFECT DIS	100	1998	1989	1995	1999	4	8	14

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
37	ANN THORAC SURG	97	1996	1990	1994	1998	5	9	13
38	GUT	96	1999	1991	1995	1999	4	8	12
39	RADIOLOGY	94	1993	1983	1990	1995.25	7.75	13	20
40	DIABETES	93	2000	1985.5	1992	1998	5	11	17.5
41	BLOOD	91	1990	1990	1994	1997	6	9	13
42	BR JOBSTET GYNECOL	90	1998	1987.75	1993	1999	4	10	15.25
43	J IMMUNOL	89	2000	1989	1996	1998.5	4.5	7	14
44	ARCH DIS CHILD	84	1994	1985	1991.5	1997	6	11.5	18
45	J AM COLL CARDIOL	82	1998	1994.75	1998	2000	3	5	8.25
46	AM J CARDIOL	80	1999	1989	1996	1999	4	7	14
47	J NEUROSURG	80	2002	1984.25	1995	2001	2	8	18.75
48	AM J TROP MED HYG	80	1999	1979.25	1991	1996.75	6.25	12	23.75
49	STROKE	80	1997	1989	1997	2000	3	6	14
50	ORAL SURG ORAL MED ORAL PATHOL	79	1994	1983	1989	1994	9	14	20
51	ANESTHESIOLOGY	78	1992	1984.75	1992	1995	8	11	18.25
52	CLIN INFECT DIS	78	1997	1994	1997	1999.25	3.75	6	9
53	Neurosugery	77	2003	1992	1997	2002	1	6	11
54	J CLIN INVEST	76	1993	1984	1991	1995.75	7.25	12	19
55	CANCER RES	76	1990	1988	1991	1996	7	12	15
56	AM J EPIDEMIOL	73	1990	1983	1990	1997	6	13	20
57	LARYNGOSCOPE	73	2002	1982.5	1991	1998.5	4.5	12	20.5
58	TRANSACTIONS THE ROYAL SOCIETY TROPICAL MEDICINE AND HYGIENE	73	1998	1985	1991	1997	6	12	18
59	INFECT IMMUN	72	1989	1989	1994	1998.75	4.25	9	14
60	CLIN CHEM	71	1972	1981	1987	1993	10	16	22
61	ARCH PHYS MED REHAB	71	1998	1983	1992	1998	5	11	20
62	J NUTR	69	2000	1989	1997	2000	3	6	14
63	Scand_J_Gastroenterol	68	1991	1990.25	1994	1997	6	9	12.75
64	J TRAUMA	67	1993	1984	1992	1996	7	11	19
65	ARCH SURG	66	1999	1985.75	1992.5	1998.25	4.75	10.5	17.25
66	J AM ACAD DERMATOL	65	1999	1990.5	1995	1998.5	4.5	8	12.5
67	Biol_Reprod	65	1996	1992	1996	1999	4	7	11
68	BR J ANESTH	63	1992	1991	1994	1999	4	9	12
69	VACCINE	63	1999	1995	1998	2000	3	5	8
70	AJR	63	1995	1984	1993	1997	6	10	19
71	Int_J_Pharm	63	1991	1991	1995	1998	5	8	12

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
72	EUR J PHARMACOL	62	1994	1990	1995	2000	3	8	13
73	Am_J_Orthod	62	1977	1972	1978	1988.25	14.75	25	31
74	J_Clin_Oncol	62	1993	1991.75	1995	1998.25	4.75	8	11.25
75	HEPATOLOGY	61	1997	1994	1997	1999.5	3.5	6	9
76	AM REV RESP DIS	61	1978	1978	1985	1990.5	12.5	18	25
77	NEUROLOGY	60	1993	1989.25	1995	1998	5	8	13.75
78	J PHARMACOL EXP THER	60	1990	1983.25	1990	1996	7	13	19.75
79	CLIN ENDOCRINOL	60	1994	1992.25	1996	1999	4	7	10.75
80	AM J SURG	59	1980	1982	1990	1996	7	13	21
81	BR J SURG	59	1990	1982	1990	1996	7	13	21
82	Pediatr_Nephrol	59	1996	1995	1997	1999	4	6	8
83	INT J PHARM	58	1991	1991	1995.5	1998.25	4.75	7.5	12
84	ENDOCRINOLOGY	58	1982	1984	1990	1996.25	6.75	13	19
85	ANN SURG	57	1998	1977	1988	1997	6	15	26
86	Soc_Sci_Med	57	1994	1994	1995	1998	5	8	9
87	Surgery	56	1990	1980	1989	1994.75	8.25	14	23
88	METABOLISM	55	1994	1984	1994	1998	5	9	19
89	Planta_Med	55	1986	1983	1992	1997	6	11	20
90	LIFE SCI	53	1990	1987.5	1992	1998.5	4.5	11	15.5
91	ATHEROSCLEROSIS	53	1991	1992	1997	1999	4	6	11
92	J THORAC CARDIOVASC SURG	52	1995	1983	1991	1995	8	12	20
93	J_Chromatogr	52	1990	1987.25	1991	1994.75	8.25	12	15.75
94	Teratology	52	1989	1984.25	1990	1994	9	13	18.75
95	OPHTHALMOL	51	1995	1989	1995	2000	3	8	14
96	ACTA OBSTET GYNECOL SCAND	51	2001	1991	1997	2001	2	6	12
97	Bull_WHO	51	1997	1989	1997	1999	4	6	14
98	Cell	51	1997	1990	1994	1997	6	9	13

*Ranked by number of citations.

Appendix N: The 110 most cited journals in 2004 and their corresponding half-life are listed in the following table

Rank	Journal	N	Mode	25	50	75	In shelf	Active archive	Passive archive
1	NEGM	617	1998	1989	1994	1998	6	10	15
2	LANCET	478	1999	1986.75	1993	1998	6	11	17.25
3	JAMA	371	1999	1988	1995	1999	5	9	16
4	AM J CLIN NUTR	308	1999	1989	1997	2000	4	7	15
5	J UROL	287	1997	1989	1994	1998	6	10	15
6	BMJ	280	1994	1986	1994	1998.75	5.25	10	18
7	CIRCULATION	265	1997	1990	1996	1999	5	8	14
8	OBSTET GYNECOL	264	1998	1990	1996	2000	4	8	14
9	AM J OBSTET GYNECOL	258	1998	1987	1995	1998.25	5.75	9	17
10	FERTIL STERIL	254	2001	1990	1997	2000	4	7	14
11	J CLIN ENDOCRINOL METAB	231	2000	1990	1996	2000	4	8	14
12	DIABET CARE	227	1998	1994	1998	2001	3	6	10
13	HUM REPROD	212	2001	1996	1998	2000	4	6	8
14	ANN INTERN MED	186	1998	1984	1992	1997	7	12	20
15	OSTEOPOROSISINT	184	1998(a)	1997	1999	2001	3	5	7
16	PEDIATR	183	2001	1989	1996	2000	4	8	15
17	J CLIN MICROBIOL	178	1998	1992	1997	1999.25	4.75	7	12
18	J PEDIATR	165	1995(a)	1984.5	1995	1999	5	9	19.5
19	AM J MED	158	1991	1988	1993	1999	5	11	16
20	AM J CARDIOL	157	1998	1989.5	1995	1998	6	9	14.5
21	ARCH INTERN MEDL	155	1997	1988	1995	1999	5	9	16
22	AM J EPIDEMIOL	154	1993(a)	1988.75	1993	1998.25	5.75	11	15.25
23	GASTROENTROLOGY	153	1998	1992	1997	2000	4	7	12
24	J ENDODON	153	1992	1986	1992	1998	6	12	18
25	ANN THORAC SURG	151	1993	1991	1995	1998	6	9	13
26	PROC NATL ACAD SCI USA	149	1999	1986.5	1993	1998	6	11	17.5
27	CANCER	146	1993	1983	1992	1997	7	12	21
28	INFECT IMMUN	145	1995(a)	1988	1994	1998	6	10	16
29	NATURE	144	1970	1979	1988	1996	8	16	25
30	CHEST	141	1997	1988	1995	1999	5	9	16
31	BRAIN RES	141	1993	1989	1993	1998	6	11	15
32	ANESTH ANALG	140	1999	1990	1994.5	1999	5	9.5	14
33	J BONE AND J OINT SURG	139	2001	1974	1985	1996	8	19	30
34	TRANSPLANTATION	136	2000	1994	1998	2000.75	3.25	6	10
35	BLOOD	124	2002	1992	1996	2000	4	8	12
36	J IMMUNOL	123	1998	1988	1996	2000	4	8	16
37	AM J GASTROENTROLOGY	122	1999	1995	1999	2001	3	5	9
38	RADIOLOGY	120	1991	1985.25	1991	1996	8	13	18.75

Rank	Journal	N	Mode	25	50	75	In shelf	Active archive	Passive archive
39	EUR J PHARMACOL	119	1999	1990	1997	2000	4	7	14
40	SCIENCE	118	1997	1986.75	1992	1997	7	12	17.25
41	ANESTHESIOLOGY	114	1997	1985	1992	1997	7	12	19
42	KIDNEY INT	114	1997(a)	1992	1996	1999	5	8	12
43	PAIN	112	1992	1989	1992	1996.75	7.25	12	15
44	J NUTR	111	2000	1995	1999	2001	3	5	9
45	DIABETES	110	1991	1986.75	1991	1996	8	13	17.25
46	J CLIN INVEST	108	1992	1983.25	1991	1996	8	13	20.75
47	Eur_J_Pharmacol	108	1999	1988	1995	1999	5	9	16
48	Am J Psychiatry	107	1978	1982	1992	1998	6	12	22
49	ARCH DIS CHILD	106	2002	1987.75	1995	1999.25	4.75	9	16.25
50	GUT	106	2002	1992	1996	2001	3	8	12
51	CLIN INFECT DIS	103	1997	1994	1997	2000	4	7	10
52	HEPATOLOGY	102	2001	1997	1999	2001	3	5	7
53	CLIN ORTOP	101	1982	1982.5	1990	1995.5	8.5	14	21.5
54	J BIOL CHEM	101	2000	1984	1993	1998	6	11	20
55	J INFECT DIS	97	1995	1988	1994	1997	7	10	16
56	BR JOBSTET GYNECOL	96	1997(a)	1989	1996	1999	5	8	15
57	J AM COLL CARDIOL	95	2000	1993	1996	2000	4	8	11
58	J Periodontol	94	1992	1984	1992	1996	8	12	20
59	J NEUROSURG	93	1987	1983	1990	1998	6	14	21
60	LARYNGOSCOPE	93	2001(a)	1985.5	1995	2000	4	9	18.5
61	CLIN CHEM	93	1995	1981.5	1992	1997	7	12	22.5
62	NEPHROL DIAL TRANSPLANT	92	1999	1995	1998	2000	4	6	9
63	Int_J_Pharm	91	1995	1994	1997	2001	3	7	10
64	AM J PHYSIOL	90	1992	1988.75	1993	1997	7	11	15.25
65	J_Bone_Miner_Res	90	1997	1994	1997	1999	5	7	10
66	INT J PHARM	89	1995	1994.5	1997	2001	3	7	9.5
67	DIABETOLOGIA	88	2000	1989.25	1994.5	1998.75	5.25	9.5	14.75
68	VACCINE	87	2001	1995	1998	2001	3	6	9
69	AM J SURG	87	2002	1983	1996	2000	4	8	21
70	SPINE	86	1993(a)	1991	1995	1998	6	9	13
71	J THORAC CARDIOVASC SURG	86	1998	1984	1993	1997	7	11	20
72	CLIN ENDOCRINOL	85	1997	1990	1994	1997	7	10	14
73	J_Dent_Res	84	1997	1975.5	1986.5	1994.75	9.25	17.5	28.5
74	J ETHNOPHARMACOL	83	2001	1991	1998	2001	3	6	13
75	AM J PUBLIC HEALTH	81	1996	1987	1995	1997	7	9	17
76	AM_J_Kidney_Dis	81	2001	1994	1998	2001	3	6	10
77	ARCH GEN PSYCHIATR	80	1994	1987.25	1994	1997.75	6.25	10	16.75
78	LIFE SCI	79	1995(a)	1984	1994	1999	5	10	20

Rank	Journal	N	Mode	25	50	75	In shelf	Active archive	Passive archive
79	UROLOGY	79	2002	1990	1997	2000	4	7	14
80	J PEDIATRSURG	77	2001	1989	1998	2001	3	6	15
81	J PHARMACOL EXP THER	76	1988(a)	1983.5	1992	1997	7	12	20.5
82	Indian_Pediatr	76	2000	1993.25	1998.5	2001	3	5.5	10.75
83	STROKE	75	1999	1990	1995	1999	5	9	14
84	BURNS	74	1998(a)	1995	1998	2001	3	6	9
85	J PROSTHETDENT	73	1992	1985	1991	1996.5	7.5	13	19
86	ORAL SURG ORAL MED ORAL PATHOL	73	1981	1982	1989	1997	7	15	22
87	J_Prosthel_Dent	73	1992	1985	1991	1996.5	7.5	13	19
88	METABOLISM	72	1998	1990.5	1996	1998	6	8	13.5
89	CANCER RES	71	1992(a)	1985	1993	1999	5	11	19
90	BR J PSYCHIATRY	71	1990	1988	1991	1997	7	13	16
91	AM J TROP MED HYG	70	1995(a)	1986.75	1994	1998	6	10	17.25
92	ATHEROSCLEROSIS	70	2000	1991.75	1996	2000	4	8	12.25
93	Transplant_Proc	69	2001	1995	1997	2001	3	7	9
94	J TRAUMA	68	1997	1987	1995	1998.75	5.25	9	17
95	J_Chromatogr	68	2000	1989	1997	2000	4	7	15
96	J ADV NURS	67	1999	1995	1998	2000	4	6	9
97	J RHEUMATOL	66	1997	1988.75	1994	1997	7	10	15.25
98	NEUROLOGY	65	1996	1990	1995	1998.5	5.5	9	14
99	PEDIATR INFECT DIS J	65	2001	1992.5	1996	2000	4	8	11.5
100	AM HEART J	65	2000	1991	1995	2000	4	9	13
101	ENDOCRINOLOGY	65	1996(a)	1985.5	1995	1999.5	4.5	9	18.5
102	J_Exp_Med	65	1990	1987	1992	1998	6	12	17
103	Thyroid	64	1999	1996.25	1999	1999	5	5	7.75
104	Appl_Environ_Microbial	64	1999(a)	1990.25	1995	1999.75	4.25	9	13.75
105	Transfusion	63	2002	1991	1997	2000	4	7	13
106	BR J SURG	62	1992	1981.5	1991.5	1996	8	12.5	22.5
107	J EXP MED	62	1990	1987.5	1992	1997	7	12	16.5
108	ANN SURG	61	1995	1972	1988	1997	7	16	32
109	BR J ANESTH	59	2001	1984	1992	1998	6	12	20
110	DIABET MED	58	1998	1996	1998	2001	3	6	8

Appendix O: The concluding list of most cited journals

Rank	Journal	Cited time
1	NEGM	1763
2	LANCET	1530
3	ANN INTERN MED	1017
4	JAMA	987
5	BMJ	941
6	FERTIL STERIL	905
7	BRAIN RES	802
8	AM J CLIN NUTR	760
9	J CLIN ENDOCR METAB	754
10	AM J OBSTET GYNECOL	747
11	J UROL	736
12	EUR J PHARMACOL	721
13	OBSTET GYNECOL	720
14	CIRCULATION	710
15	HUM REPROD	710
16	NATURE	663
17	J BIOL CHEM	577
18	J CLIN MICROBIOL	559
19	PEDIATR	557
20	DIABET CARE	553
21	INT J PHARM	549
22	CANCER	524
23	GASTROENTEROLOGY	519
24	SCIENCE	516
25	J PEDIATR	492
26	J PHARMACOL EXP THER	451
27	J BONE AND J OINT SURG	434
28	CHEST	427
29	J IMMUNOL	416
30	BLOOD	396
31	AM J MED	390
32	J INFECT DIS	374
33	PROC NATL ACAD SCI USA	363
34	AM J GASTROENTEROL	359
35	INFECT IMMUN	353
36	KIDNEY INT	353
37	ANESTH ANALG	343
38	LIFE SCI	339
39	AM J TROP MED HYG	337

Rank	Journal	Cited time
40	AM J CARDIOL	325
41	SPINE	325
42	AM J PHYSIOL	324
43	J CLIN INVEST	321
44	ANN THORAC SURG	314
45	J NEUROSURG	311
46	AM J EPIDEMIOL	304
47	PAIN	300
48	CLIN CHEM	290
49	RADIOLOGY	279
50	ANESTHESIOLOGY	278
51	CLIN ORTOP	277
52	NEUROLOGY	273
53	P NATL ACAD SCI USA	270
54	ARCH DIS CHILD	269
55	GUT	268
56	J ETHNOPHARMACOL	267
57	BURNS	256
58	CLIN INFECT DIS	251
59	DIABETES	247
60	BR J OBSTET GYNECOL	246
61	J ENDODON	239
62	TRANSPLANTATION	237
63	VACCINE	232
64	CANCER RES	225
65	HEPATOLOGY	224
66	OSTEOPOROSISINT	224
67	J TRAUMA	221
68	J PROSTHET DENT	290
69	J CHROMATOGR	214
70	LARYNGOSCOPE	211
71	J AM COLL CARDIOL	209
72	TRANSACTIONS THE ROYAL SOCIETY TROPICAL MEDICINE AND HYGIENE	209
73	AM J SURG	208
74	STROKE	207
75	BRIT J PHARMACOL	206
76	TRANSPLANT P	204
77	ORAL SURG ORAL MED ORAL PATHOL	199
78	OPHTHALMOL	198
79	CLIN ENDOCRINOL	195

Rank	Journal	Cited time
80	PHARMACOL BIOCHEM BE	195
81	J EXP MED	194
82	PSYCHOPHARMACOLOGY	192
83	BR J ANESTH	183
84	J NUTR	180
85	J NEUROSCI	179
86	J THORAC CARDIOVASC SURG	178
87	ENDOCRINOLOGY	175
88	PLANTA MED	173
89	Am J Psychiatry	168
90	NEPHROL DIAL TRANSPL	168
91	ATHEROSCLEROSIS	160
92	J PERIODONTOL	157
93	J PHARM SCI	153
94	J ADV NURS	144
95	AM REV RESP DIS	137
96	AM J PUBLIC HEALTH	133
97	BIOCHEM PHARMACOL	133
98	PHYTOCHEMISTRY	131
99	METABOLISM	127
100	PEDIATR INFECT DIS J	127
101	BIOCHEMISTRY-US	122
102	BR J SURG	121
103	J Chromatogr	120
104	NEUROSCI LETT	119
105	ANN SURG	118
106	ARCH GEN PSYCHIATR	115
107	NEUROSCIENCE	115
108	J DENT RES	114
109	Neurosugery	113
110	BR J PSYCHIATRY	112
111	ANAL CHEM	110
112	UROLOGY	108
113	J AM ACAD DERMATOL	107
114	J RHEUMATOL	107
115	AM HEART J	105
116	J PHARM PHARMACOL	93
117	J Bone Miner Res	90
118	J MED CHEM	90
119	DIABETOLOGIA	88
120	ACTA OBSTET GYNECOL SCAND	86

Rank	Journal	Cited time
121	NEUROPHARMACOLOGY	85
122	ANAL CHIM ACTA	83
123	AM J Kidney Dis	81
124	ARCH OPHTHALMOL-CHIC	77
125	J PEDIATR SURG	77
126	AM J OPHTHALMOL	76
127	Indian Pediatr	76
128	ARCH PHYS MED REHAB	71
129	ANN NY ACAD SCI	69
130	Antimicrob Agent Chemother	69
131	Scand J Gastroenterol	68
132	J NEUROCHEM	67
133	ARCH SURG	66
134	BEHAV BRAIN RES	66
135	Biol Reprod	65
136	Appl Environ Microbial	64
137	Thyroid	64
138	AJR	63
139	Transfusion	63
140	Am J Orthod	62
141	DIABETES CARE	62
142	J Clin Oncol	62
143	J INVEST DERMATOL	59
144	Pediatr Nephrol	59
145	DIABET MED	58
146	Soc Sci Med	57
147	Surgery	56
148	BIOCHEM J	52
149	Teratology	52
150	ACTAPEDIATR	51
151	Bull WHO	51
152	Cell	51
153	Avian Dis	44
154	Contraception	44
155	Thorax	44
156	EUR J CLIN PHARMACOL	42
157	CLIN PHARMACOL THER	41
158	HYPERTENSION	40
159	Arthritis Rheum	39
160	AM J MED ET	38
161	BR J DERMATOL	38

Rank	Journal	Cited time
162	Mutat Res	38
163	ARCH DERMATOL	37
164	BIOCHEM BIOPH RES CO	36
165	Drugs	36
166	INT J CANCER	36
167	PROG NEUROBIOL	36
168	BRIT J DERMATOL	35
169	BRIT J HAEMATOL	35
170	J ALLERGY CLIN IMMUN	35
171	J HYPERTENS	34
172	Postgrad Med J	34
173	EPILEPSIA	33
174	J Hand Surg	33
175	ALIMENT PHARM THERAP	32
176	AM J ORTHOD DENTOFAC	32
177	BRIT J OPHTHALMOL	32
178	FLAVOUR FRAG J	32
179	J ESSENT OIL RES	32
180	J PHARMACEUT BIOMED	32
181	AM J RESP CRIT CARE	31
182	FEBS LETT	31
183	J NATL CANCER I	31
184	PLAST RECONSTR SURG	30
185	INT J CARDIOL	29
186	J CONTROL RELEASE	29
187	TRENDS PHARMACOL SCI	29
188	METHOD ENZYMOL	28
189	DRUG DEV IND PHARM	27
190	J CHEM ENG DATA	26
191	CHEM PHARM BULL	25
192	ACTA CYTOL	25
193	NEUROREPORT	25
194	AM J HUM GENET	23
195	BIOCHIM BIOPHYS ACTA	22

Appendix P: The most cited journals on 25 subject categories

Subject categories:Obstetrics and Gynecology	Cited time
1.FERTIL STERIL	905
2.AM J OBSTET GYNECOL	747
3.OBSTET GYNECOL	720
4.HUM REPROD	710
Pharmacology	
1.EUR J PHARMACOL	721
2.INT J PHARM	549
3.J PHARMACOL EXP THER	451
Endocrinology and Metabolism	
1.J CLIN ENDOCR METAB	754
2.DIABET CARE	553
3.DIABETES	247
Pediatrics	
1.PEDIATR	557
2.J PEDIATR	492
3.PEDIATR INFECT DIS J	127
Neurology	
1.BRAIN RES	802
2.J NEUROSURG	311
3.NEUROLOGY	273
4.STROKE	207
Dentistry	
1.J PROSTHET DENT	290
2.J ENDODON	239
3.J DENT RES	114
Urology	
1.J UROL	736
2.KIDNEY INT	353
3.UROLOGY	108
Nutrition	
1.AM J CLIN NUTR	760
2.J NUTR	180
Chemistry	
1.BIOL	
2.CLIN CHEM	290
3.PHARMACOL BIOCHEM BE	195
Oncology	
1.CANCER	524
2.CANCER RES	225
3.HEPATOLOGY	224

Subject categories:	Cited time
Cardiology	
1.AM J CARDIOL	325
2.J AM COLL CARDIOL	209
3.J THORAC CARDIOVASC SURG	178
4.AM HEART J	105
Gastroenterology	
1.GASTROENTEROLOGY	519
2.AM J GASTROENTEROL	359
3.GUT	268
Dermatology	
1.BURNS	256
2.J AM ACAD DERMATOL	107
3.J INVEST DERMATOL	59
4.BR J DERMATOL	38
Infectious Disease	
1.J INFECT DIS	374
2.INFECT IMMUN	353
3.CLIN INFECT DIS	251
4.PEDIATR INFECT DIS J	127
Public health	
1.AM J TROP MED HYG	337
2.TRANSACTIONS THE ROYAL SOCIETY 3.TROPICAL MEDICINE AND HYGIENE	209
4.AM J PUBLIC HEALTH	133
Radiology	
1.RADIOLOGY	279
Ophthalmology	
1.OPHTHALMOL	198
2.ARCH OPHTHALMOL-CHIC	77
3.AM J OPHTHALMOL	76
Internal Medicine	
1.ANN INTERN MED	1017
Surgery	
1.AM J SURG	121
2.BR J SURG	118
3.ANN SURG	
Orthopedics	
1.J BONE AND J OINT SURG	434
2.J BONE MINER RES	90
3.CLIN ORTOP	277

Subject categories:	Cited time
Thoracic	
1.CHEST	427
2.ANN THORAC SURG	314
3.J THORAC CARDIOVASC SURG	178
Psychiatry	
1.AM J PSYCHIATRY	168
2.ARCH GEN PSYCHIATR	115
3.BR J PSYCHIATRY	112
Anesthesiology	
1.ANESTH ANALG	343
2.ANESTHESIOLOGY	278
3.BR J ANESTH	183
Nursing	
1.J ADV NURS	144
Rheumatology	
1.J RHEUMATOL	107
2.ARTHRITIS RHEUM	39

Appendix Q: The most cited journals and their corresponding quartiles in 2002.

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	BRAIN RES	154	1994	1987	1994	1997	5	8	15
2	EUR J PHARMACOL	139	1992	1987	1993	1998	4	9	15
3	J PHARMACOL EXP THER	103	1995	1982	1995	1997	5	7	20
4	LIFE SCI	81	1997	1983.5	1991	1997	5	11	18.5
5	LANCET	79	1997	1981	1989	1996	6	13	21
6	BRIT J PHARMACOL	77	1996	1986	1993	1996	6	9	16
7	J BIOL CHEM	69	1951	1969.5	1988	1996	6	14	32.5
8	NEW ENGL J MED	67	1998	1985	1993	1996	6	9	17
9	PHARMACOL BIOCHEM BE	65	1996	1991	1994	1997	5	8	11
10	PSYCHOPHARMACOLOGY	65	1992	1986	1992	1995	7	10	16
11	NATURE	62	1978	1978	1985.5	1992	10	16.5	24
12	SCIENCE	59	1991	1979	1988	1992	10	14	23
13	J PHARM SCI	59	1992	1978	1984	1992	10	18	24
14	INT J PHARM	57	1996	1988.5	1996	1998	4	6	13.5
15	BURNS	58	1998	1993.75	1996	1998	4	6	8.25
16	P NATL ACAD SCI USA	56	1993	1989	1993	1995.75	6.25	9	13
17	J CHROMATOGR	44	2000	1987	1995	2000	2	7	15
18	BRIT MED J	53	2000	1987.5	1992	1998	4	10	14.5
19	FERTIL STERIL	48	1997	1989.25	1995.5	1997	5	6.5	12.75
20	NEUROPHARMACOLOGY	48	1994	1983.25	1989.5	1994	8	12.5	18.75
21	J UROLOGY	45	1990	1988.5	1992	1998	4	10	13.5
22	SPINE	43	1985	1986	1992	1997	5	10	16
23	PAIN	41	1992	1990	1993	1996	6	9	12
24	HUM REPROD	40	1998	1996	1997	1998	4	5	6
25	NEUROSCI LETT	40	1997	1989.25	1993	1997	5	9	12.75
26	J CLIN MICROBIOL	39	1992	1990	1993	1998	4	9	12
27	INFECT IMMUN	38	1993	1993	1996	1998.25	3.75	6	9
28	J CLIN ENDOCR METAB	38	1997	1980.75	1985	1995	7	17	21.25
29	T ROY SOC TROP MED H	43	1995	1982	1989	1995	7	13	20
30	J MED CHEM	35	1992	1988	1994	1998	4	8	14
31	AM J TROP MED HYG	35	1995	1987	1995	1998	4	7	15

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
32	AM J ORTHOD DENTOFAC	32	1991	1988	1991	1996	6	11	14
33	BEHAV BRAIN RES	32	1997	1993	1996	1997	5	6	9
34	AM J RESP CRIT CARE	31	1998	1996	1998	2000	2	4	6
35	BIOCHEM PHARMACOL	31	1988	1983	1989	1993	9	13	19
36	J IMMUNOL	30	2000	1989	1995	1999	3	7	13
37	J DENT RES	30	1982	1978.5	1983	1987.5	14.5	19	23.5
38	J NEUROSCI	30	1994	1990.75	1994	1998	4	8	11.25
39	ANAL CHEM	30	2000	1987.75	1994	2000	2	8	14.25
40	AM J CLIN NUTR	30	1999	1980.5	1988	1994	8	14	21.5
41	TRANSPLANT P	30	1997	1997	1997.5	1998.25	3.75	4.5	5
42	TRENDS PHARMACOL SCI	29	1992	1990.5	1992	1997.5	4.5	10	11.5
43	INT J CARDIOL	29	1996	1996	1996	1998	4	6	6
44	J INVEST DERMATOL	28	1967	1969.25	1982.5	1993.75	8.25	19.5	32.75
45	JAMA-J AM MED ASSOC	27	1984	1984	1991	1996	6	11	18
46	J PERIODONTOL	27	1993	1978	1986	1993	9	16	24
47	DRUG DEV IND PHARM	27	1994	1992	1995	1998	4	7	10
48	NEUROSCIENCE	26	1997	1989.75	1995	1997	5	7	12.25
49	J CHEM ENG DATA	26	1995	1994.75	1996.5	1999	3	5.5	7.25
50	ANTIMICROB AGENTS CH	26	2000	1994.75	1999	2000	2	3	7.25
51	GASTROENTEROLOGY	26	1992	1985	1992	1997	5	10	17
52	ACTA CYTOL	25	1989	1983	1989	1993	9	13	19
53	CHEM PHARM BULL	25	1979	1979.5	1987	1996	6	15	22.5
54	NEUROREPORT	25	1997	1994	1996	1997.5	4.5	6	8
55	PHYTOCHEMISTRY	25	1985	1984.5	1988	1995	7	14	17.5
56	CHEST	24	2000	1991	1997	1999.75	2.25	5	11
57	ANAL CHIM ACTA	24	2000	1987.25	1995	1999	3	7	14.75
58	CIRCULATION	24	1995	1979	1993	1997.5	4.5	9	23
59	AM J HUM GENET	23	1996	1993	1996	1999	3	6	9
60	CANCER	23	1992	1977	1992	1996	6	10	25
61	NEPHROL DIAL TRANSPL	23	1999	1995	1998	1999	3	4	7
62	ENDOCRINOLOGY	23	1957	1971	1988	1997	5	14	31
63	AM J EPIDEMIOL	23	1987	1981	1989	1996	6	13	21

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
64	J PHARM PHARMACOL	23	1994	1980	1994	1998	4	8	22
65	BIOCHEM J	23	1971	1973	1987	1995	7	15	29
66	J ETHNOPHARMACOL	22	2000	1996.5	1999	2000	2	3	5.5
67	J NEUROCHEM	22	1996	1990.5	1995	1997	5	7	11.5
68	BIOCHIM BIOPHYS ACTA	22	1991	1969.75	1984	1990.25	11.75	18	32.25
69	PHYS THER	21	1998	1986.5	1992	1997	5	10	15.5
70	BIOCHEMISTRY-US	21	1973	1977.5	1986	1994.5	7.5	16	24.5
71	ANN INTERN MED	21	1994	1983.5	1992	1994.5	7.5	10	18.5

Appendix R: The most cited journals and their corresponding quartiles in 2003.

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	BRAIN RES	191	1997	1990	1994	1998	5	9	13
2	NEW ENGL J MED	146	1999	1986	1993	1998	5	10	17
3	LANCET	142	1992	1983	1992	1997	6	11	20
4	EUR J PHARMACOL	124	2002	1989	1995	1999	4	8	14
5	NATURE	113	1990	1979.5	1990	1996	7	13	23.5
6	P NATL ACAD SCI USA	97	1993	1988	1993	1997	6	10	15
7	J CHROMATOGR	92	2000	1987	1996	2000	3	7	16
8	J BIOL CHEM	89	1998	1991	1997	1999	4	6	12
9	PHARMACOL BIOCHEM BE	85	1996	1992.5	1996	1999.5	3.5	7	10.5
10	LIFE SCI	82	1993	1985	1993	1997	6	10	18
11	J PHARMACOL EXP THER	80	2000	1988	1994	1999	4	9	15
12	J CLIN ENDOCR METAB	79	1997	1982	1990	1997	6	13	21
13	BRIT MED J	75	2001	1977	1988	1999	4	15	26
14	INT J PHARM	74	2001	1990.75	1996	2000	3	7	12.25
15	J IMMUNOL	74	1994	1991	1994	1998	5	9	12
16	FERTIL STERIL	73	1993	1991	1994	1998.5	4.5	9	12
17	J CLIN MICROBIOL	72	2000	1991.25	1997	2000	3	6	11.75
18	BRIT J PHARMACOL	72	1994	1986	1992.5	1996	7	10.5	17
19	J NEUROSCI	67	1995	1994	1997	2000	3	6	9
20	KIDNEY INT	64	2000	1988	1996	1999.75	3.25	7	15
21	PSYCHOPHARMACOLOGY	63	1991	1989	1992	1995	8	11	14
22	J ETHNOPHARMACOL	62	2000	1994	1999	2000	3	4	9
23	AM J CLIN NUTR	62	1993	1988.75	1993	1997.25	5.75	10	14.25
24	JAMA-J AM MED ASSOC	61	1993	1989	1993	1998	5	10	14
25	BLOOD	61	2001	1991	1997	2000	3	6	12
26	OPHTHALMOLOGY	60	1986	1985	1991	1997	6	12	18
27	TRANSPLANT P	60	1999	1993.5	1997	1999	4	6	9.5
28	J UROLOGY	60	1992	1986	1992	1995.75	7.25	11	17
29	J NEUROSURG	60	1992	1971.75	1984	1991.5	11.5	19	31.25
30	TRANSPLANTATION	58	1995	1995	1997	2000	3	6	8

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
31	SCIENCE	56	1996	1981.25	1989.5	1996	7	13.5	21.75
32	BIOCHEM PHARMACOL	56	1988	1982	1988	1991.75	11.25	15	21
33	GASTROENTEROLOGY	54	1999	1991.75	1996	1999	4	7	11.25
34	NEPHROL DIAL TRANSPL	53	1999	1995	1998	2000	3	5	8
35	J INFECT DIS	51	2000	1989	1995	2000	3	8	14
36	J ENDODONT	49	2000	1992.5	1997	2000	3	6	10.5
37	BURNS	49	1998	1994	1998	1998.5	4.5	5	9
38	ARCH OPHTHALMOL-CHIC	49	1991	1984	1988	1992.5	10.5	15	19
39	AM J GASTROENTEROL	48	1999	1994.25	1997	2000	3	6	8.75
40	NEUROSCIENCE	47	1998	1991	1996	1998	5	7	12
41	J PHARM SCI	47	1994	1980	1987	1996	7	16	23
42	AM J OBSTET GYNECOL	46	1995	1983.75	1992	1997	6	11	19.25
43	NEUROSCI LETT	46	1995	1990.75	1994	1996	7	9	12.25
44	J CLIN INVEST	46	1991	1983.75	1991	1995	8	12	19.25
45	CIRCULATION	46	1994	1986	1992	1995.25	7.75	11	17
46	J NEUROCHEM	45	1996	1993	1996	1999	4	7	10
47	T ROY SOC TROP MED H	43	1985	1983	1992	1998	5	11	20
48	EUR J CLIN PHARMACOL	42	1983	1983	1988	1996.25	6.75	15	20
49	OBSTET GYNECOL	42	1993	1986.75	1992.5	1996	7	10.5	16.25
50	CANCER	42	1985	1981	1986.5	1995	8	16.5	22
51	AM J EPIDEMIOL	41	1990	1984.5	1991	1997	6	12	18.5
52	CLIN PHARMACOL THER	41	1988	1986.5	1992	1997.5	5.5	11	16.5
53	SPINE	39	1995	1991	1995	1999	4	8	12
54	J PHARM PHARMACOL	38	1999	1988.75	1996	1999	4	7	14.25
55	AM J TROP MED HYG	38	1999	1986.25	1993.5	1999	4	9.5	16.75
56	ANAL CHEM	37	1990	1981.5	1993	1997	6	10	21.5
57	PROG NEUROBIOL	36	1998	1993.25	1998	1998.75	4.25	5	9.75
58	ANN INTERN MED	36	1997	1979.75	1989	1997	6	14	23.25
59	BRIT J HAEMATOL	35	2000	1989	1997	2000	3	6	14
60	NEUROLOGY	35	2002	1984	1993	2000	3	10	19

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
61	ARCH INTERN MED	35	1990	1990	1993	1998	5	10	13
62	J HYPERTENS	34	1988	1988	1991.5	1994.25	8.75	11.5	15
63	J TRAUMA	34	1992	1988.75	1994.5	1998.25	4.75	8.5	14.25
64	AM J MED	33	1980	1976.5	1983	1996	7	20	26.5
65	EPILEPSIA	33	2000	1986.5	1995	2000.5	2.5	8	16.5
66	ALIMENT PHARM THERAP	32	2000	1997	1999.5	2000.75	2.25	3.5	6
67	CLIN CHEM	31	1972	1974	1983	1994	9	20	29
68	AM J OPHTHALMOL	31	1988	1982	1991	1996	7	12	21
69	PAIN	31	1992	1987	1992	1993	10	11	16
70	AM J PHYSIOL	30	1989	1984.25	1988	1992	11	15	18.75
71	J PEDIATR	30	1996	1984	1993.5	1997	6	9.5	19
72	PLAST RECONSTR SURG	30	1991	1983.75	1991	1996.25	6.75	12	19.25
73	DIABETES CARE	29	1996	1990.5	1995	1998.5	4.5	8	12.5
74	HUM REPROD	29	1990	1991	1993	1998	5	10	12
75	BIOCHEMISTRY-US	29	1989	1983	1989	1995.5	7.5	14	20
76	ANAL CHIM ACTA	29	1997	1983	1991	1997	6	12	20
77	PHYTOCHEMISTRY	28	1987	1985.25	1989	1993.75	9.25	14	17.75
78	PLANTA MED	28	1994	1989.75	1995	1999	4	8	13.25

Appendix S: The most cited journals and their corresponding quartiles in 2004.

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
1	LANCET	148	1997	1989	1995	1998	6	9	15
2	NEW ENGL J MED	133	1998	1989	1994	1998	6	10	15
3	EUR J PHARMACOL	129	1995	1992.5	1996	2000	4	8	11.5
4	J BIOL CHEM	123	1999	1986	1993	2000	4	11	18
5	BRAIN RES	121	1997	1987	1994	1997.5	6.5	10	17
6	INT J PHARM	117	2002	1993	1998	2001	3	6	11
7	NATURE	117	1970	1976.5	1989	1996	8	15	27.5
8	J UROLOGY	116	1986	1986	1993.5	1998.75	5.25	10.5	18
9	P NATL ACAD SCI USA	112	1995	1990	1995	1999	5	9	14
10	J PHARMACOL EXP THER	100	2000	1986.25	1994	1999	5	10	17.75
11	SCIENCE	93	1988	1984.5	1992	1997	7	12	19.5
12	J NEUROSCI	82	1999	1996	1999	2001	3	5	8
13	JAMA-J AM MED ASSOC	79	1993	1989	1994	1998	6	10	15
14	PHYTOCHEMISTRY	78	1998	1987.75	1993.5	1999	5	10.5	16.25
15	J CLIN MICROBIOL	73	1999	1991	1997	1999	5	7	13
16	BIOCHEMISTRY-US	72	1993	1987	1993.5	1998.75	5.25	10.5	17
17	FERTIL STERIL	70	2001	1994	1999	2001	3	5	10
18	BLOOD	70	1999	1996	1998	1999	5	6	8
19	BRIT MED J	69	2000	1984	1991	1998	6	13	20
20	J CLIN ENDOCR METAB	69	1998	1991	1997	1999	5	7	13
21	PSYCHOPHARMACOLOGY	64	1990	1986	1990.5	1995	9	13.5	18
22	J IMMUNOL	60	1993	1988	1995	1998	6	9	16
23	BRIT J PHARMACOL	57	1996	1989	1996	2000	4	8	15
24	GASTROENTEROLOGY	56	2001	1992	1997	2001	3	7	12
25	J ETHNOPHARMACOL	55	2000	1991	1999	2001	3	5	13
26	J MED CHEM	55	1995	1986	1994	1999	5	10	18
27	HUM REPROD	55	1998	1996	1998	2000	4	6	8
28	OBSTET GYNECOL	54	1991	1990.75	1995	1999.25	4.75	9	13.25
29	AM J CLIN NUTR	54	2000	1991	1995.5	2000	4	8.5	13
30	CIRCULATION	51	1996	1990	1995	1999	5	9	14
31	J CLIN INVEST	50	1997	1987.75	1992	1997	7	12	16.25
32	J CHROMATOGR	50	2000	1984.75	1995	2001	3	9	19.25
33	PAIN	49	1977	1987	1992	1996	8	12	17

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
34	AM J TROP MED HYG	49	1992	1988.5	1995	1998	6	9	15.5
35	J PHARM SCI	47	1984	1974	1984	1995	9	20	30
36	BIOCHEM PHARMACOL	46	1961	1984.75	1992.5	2000	4	11.5	19.25
37	PHARMACOL BIOCHEM BE	45	1993	1990.5	1995	2000	4	9	13.5
38	OPHTHALMOLOGY	45	2001	1992.5	1998	2001	3	6	11.5
39	AM J OPHTHALMOL	45	2000	1981.5	1992	1999	5	12	22.5
40	TRANSPLANT P	45	2001	2000	2001	2003	1	3	4
41	LIFE SCI	44	1996	1986	1995	1999.75	4.25	9	18
42	CLIN CHEM	44	1972	1976.75	1987.5	1997	7	16.5	27.25
43	AM J OBSTET GYNECOL	44	1992	1980.25	1992	1997.75	6.25	12	23.75
44	ANAL CHEM	43	1997	1989	1996	1999	5	8	15
45	CANCER RES	43	1994	1988	1994	1999	5	10	16
46	NEUROSCIENCE	43	1995	1993	1996	1999	5	8	11
47	J INFECT DIS	43	1983	1990	1994	1997	7	10	14
48	J AM ACAD DERMATOL	42	1991	1989.75	1995	2000	4	9	14.25
49	INFECT IMMUN	42	1995	1993	1995.5	1998.25	5.75	8.5	11
50	CANCER	42	1994	1982	1992.5	1997	7	11.5	22
51	PEDIATRICS	41	1992	1986.5	1992	1996.5	7.5	12	17.5
52	PLANTA MED	40	1995	1986	1995	1999	5	9	18
53	HYPERTENSION	40	1997	1990	1994.5	1998	6	9.5	14
54	J PEDIATR	39	1995	1980	1990	1996	8	14	24
55	AM J MED GENET	38	1998	1993	1998	2001	3	6	11
56	BURNS	38	2002	1994.75	1998	2001	3	6	9.25
57	NEUROLOGY	38	2002	1994.75	1998	2001	3	6	9.25
58	ARCH DERMATOL	37	1996	1977.5	1990	1997	7	14	26.5
59	NEUROPHARMACOLOGY	37	1994	1986.5	1993	1996.5	7.5	11	17.5
60	BIOCHEM BIOPH RES CO	36	1990	1990	1994.5	1999.5	4.5	9.5	14
61	INT J CANCER	36	2003	1993	1998	2001	3	6	11
62	BRIT J DERMATOL	35	2000	1989	1995	1999	5	9	15
63	J ALLERGY CLIN IMMUN	35	1999	1988	1997	1999	5	7	16
64	ANN NY ACAD SCI	34	1998	1991.75	1996	1999	5	8	12.25
65	BEHAV BRAIN RES	34	1999	1995	1999	2000	3.75	5	9
66	DIABETES CARE	33	1996	1994.5	1997	1999.5	4.5	7	9.5

Rank	Journal	N	Mode	25	50	75	In Shelf	Active Archive	Passive Archive
67	NEUROSCI LETT	33	1999	1990	1994	1999	5	10	14
68	AM REV RESPIR DIS	32	1988	1983	1987.5	1990.75	13.25	16.5	21
69	FLAVOUR FRAG J	32	2002	1997	2000	2002	2	4	7
70	VACCINE	32	2002	1992	1999	2001	3	5	12
71	J ESSENT OIL RES	32	2000	1997.5	2000	2002	2	4	6.5
72	J PHARM PHARMACOL	32	1997	1987.25	1997	2000	4	7	16.75
73	J PHARMACEUT BIOMED	32	2002	1998.25	2001	2002	2	3	5.75
74	BRIT J OPHTHALMOL	32	2002	1997	2000	2002	2	4	7
75	J PROSTHET DENT	32	1990	1995	1998.5	2001	3	5.5	9
76	GUT	31	2000	1992	1997	2000	4	7	12
77	J NATL CANCER I	31	2001	1987	1994	2001	3	10	17
78	J INVEST DERMATOL	31	1990	1989	1992	1996	8	12	15
79	CHEST	31	1997	1991	1996	1999	5	8	13
80	FEBS LETT	31	1996	1990	1994	1996	8	10	14
81	J BONE JOINT SURG AM	30	1997	1983.5	1993.5	1999.25	4.75	10.5	20.5
82	CLIN INFECT DIS	30	1995	1993	1995	1997.25	6.75	9	11
83	ANAL CHIM ACTA	30	2000	1992.75	2000	2001.25	2.75	4	11.25
84	HEPATOLOGY	29	1997	1997	1998	2000	4	6	7
85	KIDNEY INT	29	1996	1994.5	1997	2000	4	7	9.5
86	ENDOCRINOLOGY	29	1992	1988.5	1995	2000	4	9	15.5
87	BIOCHEM J	29	1994	1991	1994	1998.5	5.5	10	13
88	UROLOGY	29	1997	1985	1994	2000	4	10	19
89	J CONTROL RELEASE	29	1999	1989.5	1998	2000	4	6	14.5
90	AM J PHYSIOL	28	1993	1987.25	1991	1993	11	13	16.75
91	ARCH OPHTHALMOL-CHIC	28	1989	1978.25	1991.5	1997.5	6.5	12.5	25.75
92	J EXP MED	28	1998	1987.75	1996.5	1999	5	7.5	16.25
93	J NEUROSURG	28	2001	1976	1989	2001	3	15	28
94	J CHROMATOGR B	28	1997	1997	1998	2001	3	6	7
95	AM J CARDIOL	28	1997	1989.25	1996	2000.75	3.25	8	14.75
96	AM J GASTROENTEROL	28	1989	1992.25	1998	2001	3	6	11.75
97	METHOD ENZYMOL	28	1955	1978	1988.5	1994	10	15.5	26

Appendix T: Survey questionnaire.

The following questionnaire is related to the second phase of my PhD research where I am investigating the factors, which may influence co-citation practice among Iranian medical researchers.

As you may be aware, currently, around 90 scientific medical journals are published by Iranian medical universities and research centres. All of these journals benefit from a peer review evaluation policy in the course of the valuation process prior to publication of submitted work. This policy, as many studies have shown, helps to improve around 80% of submitted works.

The first phase of the study entitled "citation analysis of Iranian medical journals from 2002 -2004" revealed that then number of citations per paper is around 0.07, which is too low in comparison to other courtiers.

Considering the determinant role of research in medical sciences, taking into account your understanding of the quantity and the quality of scientific research activities, along with your scientific communication with Iranian medial journal editors and reviewers, as well as your familiarities with the problems and cultural atmosphere of the scientific environment, I would greatly appreciate your assistance in helping the researcher to find out possible reasons for the paucity of citation of Iranian medical researchers to papers published in domestic journals by completing the following questionnaire.[9]

I acknowledge your valuable time and attention in advance.

All your information will be kept confidential.

In this research the word *citation* means the act of citing a work; that is, providing a reference to the work in the form of a bibliographic citation.

Yours sincerely,

Ali Rashidi

PhD student at London Metropolitan University in UK

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[9] This is a direct translation of the original text in Farsi. Although the verbose nature of the introduction would not have been appropriate for the European or American audience, this style is commonplace in such requests in Iran.

Email: a.rashidi@londonmet.ac.uk

Number of published article in Iranian medical journals ☐ Foreign Journals ☐

Number of published Books ☐ Translated Books ☐

Have you pervious experience of reviewing. Yes ☐ No ☐

If you are interested to receive the result of this study please indicate you email address.

Please indicate your agreement or disagreement by choosing one of the following options.

Question	SA	A	U	D	SD
Any use of other persons' works (direct or indirect) needs to be cited.					
Foreign journals and articles are easier to find than Iranian ones.					
Most of the articles published in domestic journals are not accessible via indices, databases and internet.					
The low rate of internal co citation may be the result of personal motivations among Iranian researchers.					
Probably, Iranian researchers tend to cite more foreign works to show that the researcher has conducted the research with good knowledge of the field.					
Some Iranian authors do not cite internal works to show that there is no precedence for the work in Iran.					
Authors commonly cite works whose full text they have not read.					
Authors tend to cite those whose views support their own.					
Editors and referees of Iranian journals pay greater attention to the number of foreign works than internals ones.					
Quality of an article is measurable trough the number of citations it will receive.					
Probably, due to the use of specialist and impartial referees, articles published in foreign journals are of higher quality than those in Iranian journals.					
One of the main reasons of the low rate of internal citation among Iranian medical researchers is that often there is insufficient Iranian research in the field to cite.					
One of the main reasons of the low rate of internal citation among Iranian researchers may be that the content and data of articles published in domestic journals are not up to date.					
A greater number of citations of an article to research papers is indicative of a higher quality of that research.					
In medical research, citations to books are not as valuable as citations to articles published in peer reviewed journals.					
The more influential researchers in a given field are recognizable through the number of citations they receive.					
The more citations a researcher receives the more influential					

he or she is.					
Usually, articles with higher quality receive more citations.					
Self-citation is just as valuable as any other citation.					
A long list of references is an indicator of a research quality.					
Have reviewers ever pointed to relevant work that has not been cited in your article?	Yes	No			
If so, did it refer to Iranian or foreign research?	Iranian	Foreign	Both		
Other comments: 1: 2: 3:					

Appendix U: Mann-Whitney Test results to determine whether or not there were any differences between the sexes with regards to the Hypotheses.

Hypothesis 1: Accessibility (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
accessibility	male	321	250.20	80315.50
	female	177	248.22	43935.50
	Total	498		

Test Statistics(a)

	Accessibility
Mann–Whitney U	28182.500
Wilcoxon W	43935.500
Z	−.152
Asymp. Sig. (2–tailed)	.879

a Grouping Variable: sex

Hypothesis 2: Personal Bias: (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Personal bias	male	321	248.00	79607.00
	female	177	252.23	44644.00
	Total	498		

Test Statistics (a)

	Personal bias
Mann–Whitney U	27926.000
Wilcoxon W	79607.000
Z	−.317
Asymp. Sig. (2–tailed)	.751

a Grouping Variable: sex

Hypothesis 3a: Cultural Bias/Values (Authors) :(Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Authors bias	male	321	252.64	81097.00
	female	177	243.81	43154.00
	Total	498		

Test Statistics (a)

	Authors bias
Mann–Whitney U	27401.000
Wilcoxon W	43154.000
Z	−.663
Asymp. Sig. (2–tailed)	.507

a Grouping Variable: sex

Hypothesis 3b: Cultural Bias/Values :(Editors and Reviewers Biases) (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Editorials and Reviewer Biases	male	315	253.73	79925.00
	female	177	233.63	41353.00
	Total	492		

Test Statistics (a)

	Editorials and Reviewer Biases
Mann–Whitney U	25600.000
Wilcoxon W	41353.000
Z	−1.585
Asymp. Sig. (2–tailed)	.113

a Grouping Variable: sex

Hypothesis 4: Protocol :(Gender Differences)

Ranks

	sex	N	Mean Rank	Sum of Ranks
Protocol	male	321	252.44	81033.00
	female	177	244.17	43218.00
	Total	498		

	Protocol
Mann–Whitney U	27465.000
Wilcoxon W	43218.000
Z	−.676
Asymp. Sig. (2–tailed)	.499

a Grouping Variable: sex

Hypothesis 5: Favouritism (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Favoritism	male	321	253.70	81436.50
	female	177	241.89	42814.50
	Total	498		

Test Statistics (a)

	Favoritism
Mann–Whitney U	27061.500
Wilcoxon W	42814.500
Z	−.959
Asymp. Sig. (2–tailed)	.337

a Grouping Variable: sex

Hypothesis 6: Secondary Referencing (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Secondary Referencing	male	318	245.61	78105.00
	female	176	250.91	44160.00
	Total	494		

Test Statistics (a)

	Secondary Referencing
Mann–Whitney U	27384.000
Wilcoxon W	78105.000
Z	−.414
Asymp. Sig. (2–tailed)	.679

a Grouping Variable: sex

Hypothesis 7: Concept of Citation (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Concept of Citation	male	318	247.70	78767.50
	female	175	245.73	43003.50
	Total	493		

Test Statistics (a)

	Concept of Citation
Mann–Whitney U	27603.500
Wilcoxon W	43003.500
Z	−.148
Asymp. Sig. (2–tailed)	.882

a Grouping Variable: sex

Hypothesis 8: Concept of Citation to different type of information sources (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Concept of Citation to different type of information sources	male	321	252.30	80987.00
	female	177	244.43	43264.00
	Total	498		

Test Statistics (a)

	Concept of Citation to different type of information sources
Mann–Whitney U	27511.000
Wilcoxon W	43264.000
Z	−.598
Asymp. Sig. (2–tailed)	.550

a Grouping Variable: sex

Hypothesis 9: Concept of referencing (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Concept of referencing	male	321	249.83	80195.50
	female	177	248.90	44055.50
	Total	498		

Test Statistics (a)

	Concept of referencing
Mann–Whitney U	28302.500
Wilcoxon W	44055.500
Z	−.074
Asymp. Sig. (2–tailed)	.941

a Grouping Variable: sex

Hypothesis 10: Concept of Self-Citation (Gender Differences)

Mann–Whitney Test

Ranks

	sex	N	Mean Rank	Sum of Ranks
Concept of self citation	male	319	251.13	80110.50
	female	174	239.43	41660.50
	Total	493		

Test Statistics(a)

	Concept of self citation
Mann–Whitney U	26435.500
Wilcoxon W	41660.500
Z	−.917
Asymp. Sig. (2–tailed)	.359

a Grouping Variable: sex

Appendix V: Kruskal-Wallis Test results to determine whether or not there were any differences between groups by Appointment with regards to the Hypotheses. Hypothesis1: Accessibility (Differences between groups by Appointment)

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Accessibility	516	3.78	1.516	2	10
Appointment	516	3.11	.730	1	4

Kruskal–Wallis Test

Ranks

	Appointment	N	Mean Rank
Accessibility	Full_professor	22	196.80
	Associate_ professor	46	244.63
	Assistant_professor	301	266.12
	Tutor	147	256.47
	Total	516	

Test Statistics(a,b)

	Accessibility
Chi–Square	5.300
df	3
Asymp. Sig.	.151

a Kruskal Wallis Test

b Grouping Variable: Appointment

Hypothesis 2: Personal Bias (Differences between groups by Appointment)

The Kruskal-Wallis Test was used to determine whether or not there were any differences between the Academic Appointments with regards to the questions related to 'Personal Bias'. The results are shown in the following output.

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Personal bias	Full_professor	22	267.20
	Associate_ professor	46	267.82
	Assistant_professor	301	255.37
	Tutor	147	260.70
	Total	516	

Test Statistics(a,b)

	Personal bias
Chi–Square	.428
df	3
Asymp. Sig.	.934

a Kruskal Wallis Test

b Grouping Variable: appoint

Hypothesis 3a: Cultural Bias/Values (Authors) :(Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
personal	Full_professor	22	267.20
	Associate_ professor	46	267.82
	Assistant_professor	301	255.37
	Tutor	147	260.70
	Total	516	

Test Statistics(a,b)

	personal
Chi–Square	.428
df	3
Asymp. Sig.	.934

a Kruskal Wallis Test

b Grouping Variable: appoin

Hypothesis 3b: Cultural Bias/Values :(Editors and Reviewers Biases) (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Editors and referees' bias	Full_professor	22	236.66
	Associate_ professor	46	271.02
	Assistant_professor	295	270.07
	Tutor	147	224.23
	Total	510	

Test Statistics (a, b)

	Editors and referees' bias
Chi–Square	11.465
df	3
Asymp. Sig.	.009

a Kruskal Wallis Test

b Grouping Variable: appoin

Hypothesis 4: Protocol :(Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Protocol	Full_professor	22	266.36
	Associate_ professor	46	253.59
	Assistant_professor	301	258.47
	Tutor	147	258.93
	Total	516	

Test Statistics (a, b)

	Protocol
Chi–Square	.136
df	3
Asymp. Sig.	.987

a Kruskal Wallis Test

b Grouping Variable: appoint

Hypothesis 5: Favouritism (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Favoritism	Full_professor	22	272.91
	Associate_ professor	46	281.03
	Assistant_professor	301	255.94
	Tutor	147	254.53
	Total	516	

Test Statistics (a, b)

	Favoritism
Chi–Square	1.738
df	3
Asymp. Sig.	.629

a Kruskal Wallis Test

b Grouping Variable: appoin

Hypothesis 6: Secondary Referencing (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Secondary Referencing	Full_professor	22	241.89
	Associate_ professor	46	267.79
	Assistant_professor	298	249.79
	Tutor	145	267.17
	Total	511	

Test Statistics(a,b)

	Secondary Referencing
Chi–Square	2.030
df	3
Asymp. Sig.	.566

a Kruskal Wallis Test

b Grouping Variable: appoint

Hypothesis 7: Concept of Citation (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Concept of Citation	Full_professor	22	281.98
	Associate_ professor	46	248.66
	Assistant_professor	296	249.43
	Tutor	147	267.63
	Total	511	

Test Statistics (a, b)

	Concept of Citation
Chi–Square	2.338
df	3
Asymp. Sig.	.505

a Kruskal Wallis Test

b Grouping Variable: appoint

Hypothesis 8: Concept of Citation to different type of information sources (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Concept of Citation to different type of information sources	Full_professor	22	261.57
	Associate_ professor	46	276.33
	Assistant_professor	301	248.27
	Tutor	147	273.41
	Total	516	

Test Statistics (a,b)

	Concept of Citation to different type of information sources
Chi–Square	3.730
df	3
Asymp. Sig.	.292

a Kruskal Wallis Test

b Grouping Variable: appoint

Hypothesis 9: Concept of referencing (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Concept of referencing	Full_professor	22	207.25
	Associate_ professor	46	225.80
	Assistant_professor	301	266.25
	Tutor	147	260.53
	Total	516	

Test Statistics (a, b)

	Concept of referencing
Chi–Square	6.463
df	3
Asymp. Sig.	.091

a Kruskal Wallis Test

b Grouping Variable: appoint

Hypothesis 10: Concept of Self-Citation (Differences between groups by Appointment)

Kruskal–Wallis Test

Ranks

	appoin	N	Mean Rank
Concept of self citation	Full_professor	22	271.91
	Associate_ professor	46	249.09
	Assistant_professor	296	256.67
	Tutor	146	252.68
	Total	510	

Test Statistics (a, b)

	Concept of self citation
Chi–Square	.476
df	3
Asymp. Sig.	.924

a Kruskal Wallis Test

b Grouping Variable: appoint

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Appendix W: Mann-Whitney Test results to determine whether or not there were any differences between groups by Previous Reviewing Experience with regards to the Hypotheses.

Hypothesis 4: Protocol (Differences between groups by 'Previous Reviewing Experience)

Mann–Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Protocol	referee background	330	230.08	75926.50
	without referee background	148	260.50	38554.50
	Total	478		

Test Statistics (a)

	Protocol
Mann–Whitney U	21311.500
Wilcoxon W	75926.500
Z	−2.457
Asymp. Sig. (2–tailed)	.014

a Grouping Variable: referee

The results, as shown in the following output indicate that there is not statistically significant difference between the two groups, $z = 2.457$, NS. The practical implication of this finding could be that it is not necessary to educate researchers with regards to citation protocol; rather, it is important to make them aware of the value of correct citation in practice.

Hypothesis 6: Secondary Referencing (Differences between groups by 'Previous Reviewing Experience)

The results, as shown in the following output indicate that there is statistically significant difference between the two groups, $z = 1.801$; NS.

Mann–Whitney Test
Ranks

	referee	N	Mean Rank	Sum of Ranks
Secondary Referencing	referee background	327	244.76	80037.50
	without referee background	147	221.34	32537.50
	Total	474		

Test Statistics (a)

	Secondary Referencing
Mann–Whitney U	21659.500
Wilcoxon W	32537.500
Z	−1.801
Asymp. Sig. (2–tailed)	.072

a Grouping Variable: referee

Hypothesis 9: Concept of referencing (Differences between groups by 'Previous Reviewing Experience)

Mann–Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Concept of referencing	referee background	330	236.12	77919.50
	without referee background	148	247.04	36561.50
	Total	478		

Test Statistics (a)

	Concept of referencing
Mann–Whitney U	23304.500
Wilcoxon W	77919.500
Z	−.853
Asymp. Sig. (2–tailed)	.393

a Grouping Variable: referee

The results, as shown in the above output indicate that there is not statistically significant difference between the mean rank of the two groups, $z = -.853$; NS.

These results may carry important policy implications for the use of citations to evaluate research performance and distribute resources in science and they represent new information on the role and impact of citations in scientific communication.

Appendix X: ANOVA Test results to determine whether or not there were any differences between differences groups by Publication Record with regards to the Hypotheses.

Hypothesis 1: Accessibility (Differences between groups by Publication Record)

The output of the ANOVA tests based on the 'External' grouping is shown below.

External

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min	Max
Quartile					Lower Bound	Upper Bound		
1	22	3.59	1.563	.333	2.90	4.28	2	8
2	176	3.81	1.506	.114	3.59	4.04	2	10
3	77	3.62	1.433	.163	3.30	3.95	2	8
4	95	3.68	1.482	.152	3.38	3.99	2	8
Total	370	3.73	1.485	.077	3.58	3.88	2	10

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.695	3	.898	.406	.749
Within Groups	810.735	366	2.215		
Total	813.430	369			

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Translation	10.550	3	3.517	1.621	.185
Books	9.907	3	3.302	1.188	.315
Internal	2.759	3	.920	.407	.748

Hypothesis 3a: Cultural Bias/Values (Authors) (Differences between groups by Publication Record)

On the basis of percentiles for each type of previous publication the output of the ANOVA tests based on the each grouping is in the following table:

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
External	10.39	3	3.46	0.65	0.58
Internal	20.45	3	6.82	1.27	0.28
Books	9.04	3	3.01	0.53	0.66
Translations	7.81	3	2.60	0.51	0.68

Given the above result there are no significant differences between quartiles with regards to having any kind of publication record.

Overall, all researchers with different publication records affirm that Cultural/Values or biases affect citation practice of Iranian medical researchers while referencing works published in domestic journals.

Hypothesis 4: Protocol (Differences between groups by Publication Record)

On the basis of percentiles for each type of previous publication (as shown in the following table) the data was categorised into four or five intervals based on its percentiles.

		Internal	External	Books	Translation
N	Valid	476	370	240	217
	Missing	40	146	276	299
Percentiles	25	3.00	1.00	.00	1.00
	50	5.00	3.00	1.00	1.00
	75	10.00	7.00	2.00	2.00

The group intervals for each type of publication record are shown below

Quartile	Internal	External	Books	Translation
1	0-2	0	0	0
2	3-5	1-3	1	1
3	6-10	4-6	2	2
4	>10	>6	>2	>2

The output of the ANOVA tests results based on the 'different publication records' grouping are shown below.

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
External	3.43	3	1.14	1.55	0.20
Internal	1.68	3.00	0.56	0.78	0.50
Books	0.95	3	0.32	0.409493	0.75
Translations	2.64	3	0.88	1.20	0.31

The results indicate that there are no differences between the number of any kind of publications and Iranian medical researchers' opinions regarding lack knowledge of

correct citation protocol in the low rate of internal citations being a reason for the low relative citation to internal sources.

Hypothesis 5: Favouritism (Differences between groups by Publication Record)

On the basis of percentiles for each type of previous publication (as shown in the following table) the data was categorised into four or five intervals based on its percentiles.

		Internal	External	Books	Translation
N	Valid	476	370	240	217
	Missing	40	146	276	299
Percentiles	25	3.00	1.00	.00	1.00
	50	5.00	3.00	1.00	1.00
	75	10.00	7.00	2.00	2.00

The group intervals for each type of publication record are shown below

Quartile	Internal	External	Books	Translation
1	0-2	0	0	0
2	3-5	1-3	1	1
3	6-10	4-6	2	2
4	>10	>6	>2	>2

The output of the ANOVA tests results based on the 'different publication records' grouping is shown below.

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
External	4.003	3	1.334	1.448	0.229
Internal	6.992	3	2.331	2.402	0.067
Books	3.575	3	1.192	1.149	0.330
Translations	3.557	3	1.186	1.301	0.275

The results indicate that there are no differences between the number of any kind of publications and Iranian medical researchers' opinions regarding the question that authors tend to cite those whose views support their own.

Hypothesis 6: Secondary Referencing (Differences between groups by Publication Record)

On the basis of percentiles for each type of previous publication (as shown in the following table) the data was categorised into four or five intervals based on its percentiles.

		Internal	External	Books	Translation
N	Valid	476	370	240	217
	Missing	40	146	276	299
Percentiles	25	3.00	1.00	.00	1.00
	50	5.00	3.00	1.00	1.00
	75	10.00	7.00	2.00	2.00

The group intervals for each type of publication record are shown below

Quartile	Internal	External	Books	Translation
1	0-2	0	0	0
2	3-5	1-3	1	1
3	6-10	4-6	2	2
4	>10	>6	>2	>2

The output of the ANOVA tests results based on the 'different publication records' grouping are shown below.

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
External	4.19	3	1.40	1.31	0.27
Internal	7.72	3	2.57	2.41	0.07
Books	5.54	3	1.85	1.95	0.12
Translations	0.76	3	0.25	0.27	0.85

The results indicate that there are no differences between the number of any kind of publications and Iranian medical researchers' opinions regarding the question that authors commonly cite works whose full text authors have not read.

Hypothesis 8: Concept of Citation to different type of information sources (Differences between groups by Publication Record)

The output of the ANOVA tests results based on the 'different publication records' grouping are shown below.

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
External	23.053	3	7.684	2.475	0.06
Internal	18.038	3	6.013	1.994	0.114
Books	17.12	3	5.708	2.067	0.11
Translations	37.802	13	2.908	1.032	0.424

The results indicate that there are no differences between the number of any kind of publications and Iranian medical researchers' opinions regarding the question that Iranian medical researchers perceive the relevance of different types of information sources differently.

Hypothesis 9: Concept of referencing (Differences between groups by Publication Record)

The Mann-Whitney Test was used to determine whether or not there were any differences between those authors who have had reviewing experience and those who have not with regards to the questions related to 'Concept of Citation to different type of information sources'.

Mann-Whitney Test

Ranks

	referee	N	Mean Rank	Sum of Ranks
Concept of referencing	referee background	330	236.12	77919.50
	without referee background	148	247.04	36561.50
	Total	478		

Test Statistics (a)

	Concept of referencing
Mann-Whitney U	23304.500
Wilcoxon W	77919.500
Z	−.853
Asymp. Sig. (2-tailed)	.393

a Grouping Variable: referee

The results, as shown in the above output indicate that there is not statistically significant difference between the mean rank of the two groups, z = -.853; NS.

These results may carry important policy implications for the use of citations to evaluate research performance and distribute resources in science and they represent new information on the role and impact of citations in scientific communication.

Hypothesis 10: Concept of Self-Citation (Differences between groups by Publication Record)

The output of the ANOVA tests results based on the 'different publication records' grouping are shown below.   ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
External	4.174	3	1.391	1.326	0.265
Internal	0.132	3	0.044	0.042	0.989
Books	1.799	3	0.600	0.627	0.598
Translations	2.138	3	0.713	0.679	0.566

The results indicate that there are no differences between the number of any kind of publications and Iranian medical researchers 'opinions regarding that self-citation is just as valuable as any other citations.

Appendix Y: list of publications

1. Iranian Medical Journals Citation Database: Its construction and Preliminary Findings (Re-submitted following referees' comments).

2. An Investigation of International Journal usage by Iranian Medical Researchers (Published in September 2008 in LIBRS).

3. An Analysis of the International Scientific Publications of Iranian Medical Researchers in Science Citation Index and PubMed (2002-2004) (Re-submitted following referees' comments).

4. An Analysis of the Cultural and Social Factors Influencing Citation Behaviour of Iranian Medical Scholars (Submitted, awaiting referees' comments).

5. A new look at the role of disciplines in citation analysis (Re-submitted following editor's comments).

6. The construction of Iranian Medical Science Citation Index (IMSCI). Presented at the Third Regional Conference on Medical Journals in the Eastern Mediterranean Region, 27-29 January 2006, Shiraz, Iran.

7. Bibliometric analysis of Iranian medical researchers on oncology and hematology areas from 1973-2008. Presented at the 8th Iranian Congress of Hematology and Oncology. 9-11 October 2008, Urmia, Iran.

Appendix Z: Glossary of Terms Used

Most of the concepts and definitions used in the present study have been introduced in this appendix.

Immediacy index: The immediacy index of a journal indicates how quickly articles in a journal are cited.

Impact factor: It can be viewed as the average number of citations in a year given to those papers in a journal that were published during the two preceding years.

Cited Half-life: The cited half-life calculation finds the number of publication years from the current year that account for 50% of citations received by the journal.

Bradford law of scattering: Bradford proposed a formula that described this phenomenon: on any one subject, a few group of core journals will provide 1/3 of the articles on that subject, a medium number of less-core journals will provide another 1/3 of the articles on that subject, and a large number peripheral journals will provide the final 1/3 of the articles on that subject.

Co citation: Co citation analysis has been used to map the topical relatedness of clusters of authors, journals or articles.

Bibliographic coupling: Bibliographic coupling occurs when two works reference a common third work in their bibliographies.

Author self-citation: A self-citation is a reference an author provide in a document to other documents written by him self.

Journal self-citation: If an article cites any of the articles published in the same journal before then it is termed as a case of journal self citation.

Discipline Proportion (Share) Index (DPI): indicates the proportion of all citations within a particular discipline that had been received by a particular journal.

Discipline Specialism Index (DSI): is defined as the proportion of the total citations to a particular Journal which relate to articles in a particular discipline

Citation window: The period of the citing documents used in the citation analysis study, For example, a citation window specified as year M to year N. means that all the citing documents used in the citation analysis study were published between years M to year N inclusive.

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