

Developing Research Information System in Health Sector: a Delphi Study

¹Nahid Ramezan Ghorbani, ²Maryam Ahamdi, ²Farahnaz Sadoughi, ³Alireza Abadi, ⁴Mostafa Ghanei

¹PhD.student of Health Information Management, School of Health Management and Information Sciences, Tehran University of Medical Sciences, Iran.

²Associated of professor, Ph.D. in Health Information Management, School of Health Management and Information Sciences, Tehran University of Medical Sciences, Tehran, Iran.

²Associated of professor, Ph.D. in Health Information Management, School of Health Management and Information Sciences, Tehran University of Medical Sciences, Tehran, Iran.

³Associated of professor, Ph.D. in Biostatistics, School of Allied Medical Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

⁴Professor and sub-specialist in pulmonary diseases, Deputy for Research and Technology, Ministry of Health Iran.

Abstract: In recent decades, in low-income developing countries, management has been faced with serious challenges due to deficient information. An increasing number of dispersed data, concepts, observation of poor outputs, separate and egocentric software applications aggravated the situation too. In order to promote and balance the research environment in the field of health, developing a platform for appropriate interactions in the field of health research is essential. Thus, the basic question is what kind of model is suitable for research information system in the field of health in Iran? The present study is a descriptive –comparative qualitative approach conducted in Iran in the years 2010-2011. Based on collected data, the preliminary model was designed and it was assessed through questionnaire and Delphi Technique. In case the questionnaire gets the approval of less than 50% from the respondents, items in the proposed model will be excluded whereas if the questionnaire gets the approval of more than 75% from the respondents, items will be implemented on the model. If the questionnaire gets the approval between 50-74% from the respondents, the model will be re-evaluated and modified. The modified questionnaire will be given to the respondents again and, in case that it will get the approval of more than 75% or more, the items will be implemented and the model will be finalized. The proposed model for the country is based on the following central axes: structure, content, methods of gathering information, services and capabilities and methods of disseminating information and as well as two minor axes namely; search services and portal which were approved by the respondents. The major strength of this model includes: presentation of effective and useful services, provide an environment for research marketing, maintenance of ownership rights for the researchers. The most important weakness of this model is that it does not address to protocols, standards and technical issues. In order to achieve this national system, it is important that there should be a common serious determination for its development, change in attitude and culture of the researcher's society in the domain of health and also improvement in the country's ICT infrastructure. In this regard, perhaps the most important role of policymakers in formulating policies and programs relevant to research in a medium term period, is the implementation of the proposed model.

Key words: National Research Information System, Health, Information System, Iran, Management Information Research

INTRODUCTION

With an increase in scientific research centers and academia, researchers have been confronted with voluminous information and on the other hand the fragmentation and lack of order and control of information have resulted to the researchers' lack of easy access to information (Mojiri *et al.* 2006). Also, present studies showed that 2% of GDP in developed countries such as United States, Great Britain and France and 4% of GDP in Sweden, Finland and Japan are spent on health related researches. However, in developing countries and average of 0.05 of GDP is spent on health related researches (Rezaian 2010). Avoidable deficits in the health sector can be accounted to inaccessible data, information and knowledge or poor quality data. Research centers in the domain of health lack the ability to share critical information quickly and therefore are confronted with significant problems in analyzing data and in making decisions (Koo and LaVenture 2001). Moreover, information in the repositories and information systems are released from variety of sources and in different formats and in different qualities (sometimes contradictory) (Hogenaar *et al.* 2010).

Corresponding Author: Maryam Ahamdi, School of Health Management and Information Sciences, Tehran University of Medical Sciences, Tehran, Iran, Postal Cod: 1996713883.
E-mail Address: m-ahmadi@tums.ac.ir

In considering today's competitive society, having the right information in order to acquire investment opportunities is vital for the scientists (Huntington 2000). Today's society is faced with important problems which can be partially solved and improved through the use research data as an operational guide (Jeffery and Asserson 2010). Therefore, obstacles to public access of knowledge in a broad and general manner must be broken (Hermans 2001). Information systems provide an opportunity for groups of users in order to gain access to outputs. This system allows the possibility to evaluate results of analysis, and also reuse data and the possibility to combine results in order to produce new insights cutting the costs for repeated experimentations (Matthews and Wilson 2002). In recent years, drawbacks on some research information integration are not usually seen regularly (Parinov 2010). Currently in Iran, different internet databases are used in collecting scientific information (Khoshro 2007).

Also, in considering the terms of development based on knowledge, the government's requirement to prepare a comprehensive program on science and technology for the purpose extracting comprehensive information and ensuring the public of a safe, inexpensive and wide access to needed information and to make use of regional communication opportunities (paragraph 44) and set up a comprehensive system of research and technology (paragraph 46) has been established. The necessity of establishing an integrated and comprehensive research information system especially in the domain of health has become apparent (Expediency Council 2009). Therefore, in this study, an attempt to compare the national research information systems of selected countries and also review the current status of Iran's comprehensive model for health research information system has been conducted.

MATERIALS AND METHODS

The present study is a descriptive- comparative with a qualitative approach conducted in Iran in the year 2010-2011 comprising of 3 phases:

Phase I: Comparative Study:

In selecting the countries under study, the first step initiated was to make an assessment on countries having a national research information system in the domain of health as well as the extent of coverage of information resources and also ease of accessibility to documents (in the English language). From the 4 continents such as (United States of America, Australia, Europe and Asia) countries were randomly selected. Therefore, national information research systems in the domain of health on countries like United States, Australia, Holland and Japan and the existing health research information system in Iran were investigated. It is important to note that special features of the health research information systems of the above countries were compared based on five axes:

- Structure of the national health information system
- Content
- Methods of gathering information
- Services and capabilities and
- Methods of disseminating information

Phase II: Designing Preliminary Model:

In order to design a preliminary model, initially, assessment and comparisons were made on the selected countries based on the gathered data on the 5 axes mentioned above. The basis for selecting components for the proposed model was done in a way that common items were only included once on the table while items that are different were taken into consideration. In addition, those cases that seem to be useful to the proposed model will be given further consideration for an inclusion in the Iranian National Research System.

Phase III: Testing the Reliability of the Questionnaire and Validity of the Proposed Model:

For the purpose of acquiring validity on the proposed model, all components were distributed to the experts in the form of a questionnaire followed by the Delphi technique. A section of this test was conducted among the panel of experts in order to get their votes. Initially, questionnaire was designed based on the 5 axes of the proposed model and answer to every question were based on the 3 point Likert scale (agree, no comment, disagree). The questionnaire includes 4 open ended questions and these were specially intended to the experts in order that they can give their opinions regarding strengths, weaknesses, threats and opportunities of the proposed model.

In order to gain scientific validity, the second questionnaire was designed based on the model proposed by the panel of experts then the questionnaires were distributed to 5 members of the panel for assessment. Their opinions were taken into consideration in order to improve the questionnaire and to increase its validity. Reliability of the questionnaire was measured using Cronbach's with 94% result and in considering the high suitability of Cronbach's alpha (0.7) of the scientific community; these results indicate highly on the validity of the questionnaire.

After determining the questionnaire's validity and reliability on the proposed six axes model, the questionnaire was sent to the pre-determined 30 experts (individuals who have written books, article or have done researches on this field and or those who have 10 years or more of experience in the field of research). Questionnaires were distributed either personally and or through e-mail.

Data were analyzed using descriptive statistics. In the Delphi technique, those items or components that have earned less than 50% of approval from the experts were excluded from the proposed model while those that gained more than 75% of experts' approval were included in the proposed model. Components which were rated between 50-75% were recommended by experts and the open-ended questions in the second stage of Delphi were again reviewed until the final consensus was attained.

In the second round of Delphi test, the questionnaire was presented in a meeting held on June 25, 2012 in the Deputy of Research and Technology with the presence of 7 experts. Before the start of the meeting, consent was taken from all participants then they were notified that the session will be tape recorded and transcribed by the note-taker. Also, in this meeting, the presence of a person proficient in qualitative research to control the process and accuracy of the meeting has been strictly observed. Results of the meeting was analyzed with strict observance on its integrity then was approved by the group. Immediately after each meeting, analysis of the results was implemented.

Data analysis at this stage was done with the use of simultaneous content analysis. Interviews were analyzed manually, meaning that text were read and reread for the purpose of "open coding". Words and concepts were then extracted and coded. In the next stage, codes that were conceptually similar were classified then finally axial coding was carried out.

Simultaneous with the extraction and comparison of comments, suggestions and new ideas were also recorded. Codes and categories that were developed initially in the open coding were also included and compared then similar codes were then integrated. Categories that were related to each other were placed on common axis. In this study, in order to ensure the accuracy and reliability of obtained results, codes were extracted by each of the researchers who have sufficient experience and scientific ability having continuous involvement with data and observations. Data were separately read several times and finally, extracted codes were reviewed and evaluated by the researchers for correlation.

In order to attain consistency of the findings, another researcher who is not part of the project was asked to play the role as a foreign inspector and in considering the possibility of similar results, correlations were also approved and the final results were presented.

Results:

Results related to reliability of the model includes the following:

Participants' Profile:

Based on the findings on stage I, 38.5% of the participants are employees of the Ministry of Health and Medical Education, 30.8% are employed in the Ministry of Science, 23.1% faculty members of medical universities and 7.7% are employees of private companies. 76.9% are males with 50% having PhD degree, 30.8% having master's degree and 19.2% have bachelor's degree. Majority of the participants were graduates of Medical and Information Technology and Computer Science. Mean age of participants was 50.11 years with a SD of 6.27. Also, the average years of participants working experience is 19.57 with a SD of 5.08. Majority of the participants' years of experience is between 15-20 years and about 69.2% had managerial position.

Findings of the second stage showed that 42.9% of the experts are employed in the Ministry of Health and Medical Education, 42.9% are employed in the Ministry of Science and from this number 57.1% are males of which 71.4% are having PhD degree, 28.6 % have master's degree. Mean age of participants was 50.43 years with an SD of 5.35. Average years of participants' working experience were 22.67 with an SD of 4.92. Majority of participants have managerial positions.

Results of the Overall Panel: Axes of the Proposed Model:

Majority of the experts believed that this system be implemented in partnerships with the Ministry of Health and Medical Education and the Ministry of Science with an indirect cooperation of private sectors. In the first round of Delphi, it was agreed that the subject of coverage of the National Health Research Information System must be in the domain of medical sciences, basic sciences and humanities. The subject in the domain of engineering was approved in the second round. All participants have agreed to inclusion of articles (journals, work article, and conferences), books, theses (master's, doctoral, general and specialties) in this proposed model (Table1). Contents of the draft and educational materials, pamphlets, monographs and audiovisual materials were items that did not get the approval of the participants.

Table 1: Experts' point of view regarding the Health Research Information System's Content

Items that were accepted in the first round of Delphi	Per	No
Articles (magazines, conferences, business)	100	26
Books	100	26
Thesis (MS, PhD, the PhD)	100	26
Research project	92/3	24
Researchers and faculty members	96/2	25
Workshops	100	26
Patents	92/3	24
Speeches	76/9	20
Organizations and universities	92/3	24
Databases	96/2	25
Items that were accepted in the second round of Delphi		
Computer Products	61/5	16
Technical Report	53/8	14
Seminars and conferences	61/5	16
Magazines	69/2	18
Awards and prizes	69/2	18
Dataset	61.5	16
Indexed	61/5	16

Majority of the experts specially on the methods concerning collection of data for the National Health Research Information System have agreed to the following structural design; a centralized architecture (hierarchical), open archive, open harvesting protocols, direct data collection and recording from the web and collection of abstracts on information resources. Full text collection was not approved for the reason of the complexity of the system and undermining copyrights. Also, sending data through e-mail, CD, FTP were not approved due to the fact that offline style and in the form of batches and the avoidance of repeating this procedure is not feasible.

In terms of the Health Research Information System's services and capabilities, 23 services in the first stage and 20 services in the second stage were approved by the experts (Table 2). Inclusion of the following services to the proposed model such as insertion of components in sending data via CD, FTP, e-Learning, Web hosting, electronic archives, microfilm and microfiche, blogs and transition of information into blogs were not approved by these experts.

Table 2: Experts' point of view regarding the Health Research Information System's Services and Capabilities.

Items that were accepted in the first round of Delphi	Per	No
World News broadcast on the Internet	92/3	24
Bibliographic database	96/2	26
Data Publication	84/6	22
Service Provider reports	84/6	22
Search	96/2	25
Meta data registries	84/6	22
Statistical Services	96/2	25
Relation of Repositories	92/3	24
Indexes / collections	84/6	22
Portal users and programs applications	92/3	24
Templates to export data	88/5	23
Citation information	73/1	19
Twitter	76/9	20
Tube	88/5	23
Online Thesaurus	92/3	24
Subject classification	92/3	24
Personalize	80/8	21
End note	76/9	20
National distribution of Google Scholar	88/5	23
Bilingual	84/6	22
Translation	92/3	24
Multimedia	84/6	22
Citation information	73/1	19
Mash up	73/1	19
Items that were accepted in the second round of Delphi		
Distribution and entities management	65/4	17
Carry out all on line orders	69/2	18
Anonymous	69/2	18
Warning	57/7	15
Receipt and billing	65/4	17
Management of fax and e-mail distribution	53/8	14
Access policies and access rights	61/5	16
Quality Assurance Services	57/7	15

Electronic Library	69/2	18
Internal electronic resources.	69/2	18
External electronic resources	65/4	17
Databases	69/2	18
Cataloguing System	69/2	18
RSS	61/5	16
Webometrics analysis	57/7	15

Majority of experts have agreed to the list of search services to be included as components on the proposed model (Table 3). But the search components for the web site did not gain the necessary approval from experts due to the reason that its architectural structure is hierarchical and centralized and the components to show the results were in the form of twenties which is time consuming for the users to scroll the pages up and down to see results (score > 50).

Table 3: Features of Search Services for the National Health Research Information System from the experts' point of view.

Items that were accepted in the first round of Delphi	Per	No
Simple Search	88/5	23
Advance Search	96/2	25
And	100/0	26
Or	100/0	26
*	100/0	26
?	88/5	23
Not	88/5	23
Title	100/0	26
Author	100/0	26
Abstract	100/0	26
Keywords	100/0	26
No of product	100/0	26
Ownership	100/0	26
Subject classification	84/6	22
Type of data	84/6	22
Name of manufacturer	100/0	26
Time restriction	100/0	26
Subject highlighted	96/2	25
Sort by time	92/3	24
Sort by title	96/2	25
Sort ascending and descending	100/0	26
Sort relevance	96/2	25
Search result 50-100	96/2	25
Help of research	100/0	26
Mash up	73/1	19

Majority of the experts have agreed to the inclusion of the proposed features in the section on the methods of information distribution in the proposed model of RIS in health. Components for the proposed system such as; portal, statistical reports and new case reports received the highest votes. Online ordering system did not get the needed votes to gain inclusion in the first round of Delphi Technique (Table 4).

Table 4: Methods of information distribution of the national health research information system from the experts' point of view

Items that were accepted in the first round of Delphi	Per	No
Production and delivery of documents online	92/3	24
Portal	96/2	25
Statistical reporting	96/2	25
Reporting of new cases that are added to the system	96/2	25
Information on seminars, research opportunities, workshops, and other research priorities	92/3	24
News Provider and What's New	92/3	24
Items that were accepted in the second round of Delphi		
Online ordering system	65/4	17

All experts have agreed to the inclusion of the following features to the portal system: F & Q, index and subject lists, dashboard indicators, statistical reporting and ranking service, databases of articles, books, dissertation and workshops. Also, majority of the experts have agreed to the inclusion of the following features to the portal of RIS in health: home page, about us, registration, simple search, advance search, help, general

rules for online use (copyright, responsibility), methods of requesting data information, contact, comments, news, news reports, Twitter, list of local partner organizations, list of foreign partners, the national disease coding system, Codes of related diagnostic groups, the National Library, the list of repositories, drug enforcement administration database, records and documents, bilingual, help desk, resource ordering, cataloging systems, relation of repositories, data export formats, customizable, databases of research projects, researchers and faculty members, journals, patents, lectures, organizations and universities database for data set respectively. But features such as; Mash up, RSS, methods of payment (credit cards, banking accounts, cash, checks), and reference services, database computer products, technical reports database, and databases for conferences, seminars and awards and honors were approved in the second round Delphi.

In order to optimize the proposed model, experts have suggested to the addition of the following features in the portal of proposed model in the first round of Delphi: maps, customs information especially on drugs related to health, display research results in reporting format, knowledge translation as well as information about companies and individuals who can cooperate in research works. Also, majority of the experts have expressed that proposed model must be implemented based on the status of the country's broadband and ICT infrastructure and the complexity of the system, also they expressed that the proposed model can be largely implemented while a small percentage (14.4%) have expressed that the proposed model can be completely implemented.

Discussion:

Structure:

Results of the present study showed that the structure of the proposed model has placed emphasis on government sector and the subjects of coverage are in the field of medical sciences, humanities, engineering, social sciences and other fields. Studies on the NTIS system in the United States, ANDS in Australia, NII in Japan and NARCIS in Netherlands are in line with this study (The Australia National Data Service 2011; BUSINESS PLAN 2011/12; U.S. Department of Commerce National Technical Information Service Organization Chart 2012; Akiyama and Naito 2000; Dijk *et al.* 2006; Hitotsubashi 2007; National Technical Information Service 2005).

In Italy, national organizations with the cooperation of the Ministry of Science and Research and the support from universities and research centers has made a move of creating an integration between the repositories of scientific publications management systems, in such manner that, in the implementation of this system organizations involved will be responsible for executing any confirmation. This finding is consistent with our present study (Middaugh 2001).

Content:

Majority of the experts' have place emphasizes the following items to be given priority in the proposed model: article database (journals, work article, conferences) books, theses (bachelor's, master's, doctoral and professional), workshops, research projects, resumes of researchers and faculty members, inventions, lectures, universities and organizations, databases, computer products, technical reports, seminars and conferences, journals, honors and awards, data set, indexes and maps. Results of the comparative study have shown that in majority of cases, the countries under study have also placed emphasis on these matters. But in NII's Japan, contents of drafts on training materials, and again in NII's Japan and ANDS Australia, contents of handouts and monographs and NTIS in America, audiovisual materials have been approved (The Australia National Data Service 2011; Akiyama and Naito 2000; National Technical Information Service 2005; National Academic Research and Collaborations Information System 2011; Adema and Rutten 2010) whereas in our proposed model, for the reason of the system's complexity in the first phase of the implementation process, these components were not approved but they were again proposed in the second phase of implementation. This finding is inconsistent with our present study. Also, the present study in comparison to the core of the research information systems in Karlsruhe Institute of Technology that includes journals, research merit, research projects, patents and technologies (Scholze and Maier 2012) and Norwegian research documentation system (Frida) that consisted of the following 5 modules: ideas, technical reports, publications, patents, prototypes, products and technologies (Lingjoerde and Sjørgren 2010) are in most cases consistent with our study.

Methods of Gathering Information:

In the proposed model, centralized hierarchical approach was approved by experts, in this manner the concentration of information will be reduced and control and monitoring of received information will be consistent with the administrative system of research organizations thus provide more flexibility.

Oh *et.al.*, in 2006, have designed a successful comprehensive system having the ability for integration and concentration of the system was designed in a way that while possessing all the necessary information, the load of the central system is at the same time reduced. The NTIS system in the United States, has utilized the centralized architecture(Oh *et al.* 2006). In a study conducted by Chelsam and colleagues in 2011, they have

designed a clinical research information system with the use of XML model and archiving and open harvesting protocols (Chelsom *et al.* 2011).

Services:

In this present study, in identifying the most common services used, 38 services in this proposed model were emphasized. Liao in the study conducted in 2011, has regarded the use resource sharing, reference news, resources for researchers and scientific research managers to providing conditions for the control of information and improvement in the concepts, accuracy and timeliness of information. Also, in the present study, these 2 services were taken into consideration in the proposed model (Liao *et al.* 2011). Also, in the study conducted on the following systems; NTIS, NII, ANDS and NARCIS, results showed that these systems possess majority of the services that were defined in our proposed model (National Technical Information Service 2011; Jippes *et al.* 2010; Sharon *et al.* 2007; The ANDS Technical Working Group 2007).

In a study conducted by Joint in 2008 (Joint 2008) and Scholze *et al.*, in 2012 showed the possibility of issuing and automated entry of data and expressed the relationships of repositories as a big advantage to the research information systems (Scholze and Maier 2012). These findings are consistent with the findings in our study. Nadkarni and associates in their study conducted in 2011 showed that the possibility of transporting biological shipments and interactive web services in clinical research information system is of utmost importance (Nadkarni *et al.* 2011). This finding is inconsistent with the results of our study.

Search service: The following are the experts' views concerning search service of the proposed model; use of transactions, Boolean logic, restrictions, methods of presenting results and types of sorting results and display of geographic data. Notess in a comparative study conducted in 2007 on 6 search engines have found that features such as; possibility of search result restriction based on language, date and subject, sorting of search results based on relevance and date are necessary for a search engine (Notess 2007).

Methods of Disseminating Information:

The method of information dissemination on our proposed model in comparison to the method of information dissemination in the systems of NII, ANDS, NTIS and NARCIS were largely consistent (The Australia National Data Service 2011; National Academic Research and Collaborations Information System 2011; Adachim 2011; Rhys 2007).

In addition to the existing methods in the proposed model, other methods such as reports of new cases, dissemination of information regarding conferences, study opportunities, workshops, research priorities and knowledge translations were also approved by the experts to be added to the proposed model. Also, a study conducted by Leskosek in 2008 has propounded the possibility of distance dissemination of clinical research information online together with user-friendly interface and security issues (Leskosek 2008). This study is not consistent with our study due to the fact that, in the security issues were not considered in the proposed model.

Experts' opinions especially on the strengths of the proposed model for the national health research information system are as follows: promote knowledge and education of the country through research information management, create an integrated and centralized research information system, fast and easy access to information resources, provide effective and useful research and educational services, create a conducive environment for research marketing, web metrics and references and citations, ability to communicate with other research centers and universities in order to exchange scientific information, provide a conducive environment of communication for stakeholders for knowledge production, identifying researchers in different fields, protect researchers' ownership rights, provide a model for other countries in the region and optimizing decision making process in the domain of health. With regards to the weaknesses of the proposed model, the following items were expressed by the experts': the need for a technical team possessing a strong ability and technical knowledge in order to develop and implement the proposed system, the lack of sufficient attention to standards of storage, retrieval, transfer, exchange, and chain verification and registration system, lack of attention to the workflow of information, lack of clear priorities for implementation of system components and the evasion of security protocols and technical issues.

Conclusions:

In recent decades, in low-income developing countries, management has been faced with serious challenges due to deficient information (Rani *et al.* 2011). In the present situation, majority of government scholars have acknowledged this problem and in order to balance and promote the research environment in the domain of health, creating an environment conducive for interactions in the field of health research, having emphasis on the country's comprehensive map must be supported.

Undoubtedly, utilization of the following proposed strategies can be instrumental in setting up a national health research system:

- Strategic planning, development and implementation of the national research system based on the proposed model taking into consideration to its priorities.

- Developing and application of rules and regulations for the purpose of optimizing research registration system.
- Strengthening IT infrastructure through cooperative agreement
- Business process implementation and standardization on the processes of entry and export of information
- Organizing information to form a spatial network
- Collect, manage and provide information in the field of health research marketing
- Formulate an agreement with other regional countries and to link with international networks and establish communication with other networks
- Allocation of financial resources for training and recruiting skilled and efficient workforce
- Draw the trust and support of public authorities and the private sector and benefit from technical knowledge and develop necessary protocols for setting up the system.

Ethical Considerations:

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors.

Financial Support:

This study was part of a PhD. Thesis supported by Tehran University of Medical Sciences. The authors declare that there is no conflict of interests.

ACKNOWLEDGEMENTS

The authors would like to express their thanks the informatics experts of Deputy for Research and Technology at the Ministry of Health and Medical Education for their cooperation and support in the completion of this project.

REFERENCES

- Adachim, J., 2011. *Open Access in Japan: Update 2011*, in *Open Access Korea Conference*, Seoul, Korea.
- ADEMA, J. and P. RUTTEN, 2010. *Report on User Needs: Digital Monographs in the Humanities and Social Sciences*, in *OAPEN report*.
- Akiyama, K. and E. Naito, 2000. *Scholarly Databases at the National Institute of Informatics (NII) (formerly NACSIS)*. BUSINESS PLAN, 2011/12. Australian National Data Service (ANDS), pp: 6-81.
- Chelsom, J.J., et al., 2011. *Ontology-driven development of a clinical research information system*, in *24th International Symposium on Computer-Based Medical Systems, CBMS 2011*: Bristol.
- Dijk, E., et al., 2006. *NARCIS: The Gateway to Dutch Scientific Information*, in *Paper presented at ELPUB Conference 2006, Bansko*, Bansko, Editor: Bulgaria.
- Expediency Council, 2009. *Vision 20 years Documentation of country*. Expediency Council: Tehran.
- Hermans LMLHA, 2001. *ICT for Better Access to Education, Culture and Science (speech)*. in *The Global Research Village II*, Amsterdam.
- Hitotsubashi, C.K., 2007. *National Institute of Informatics (NII), 2-1-2*, National Institute of Informatics: Tokyo, JAPAN.
- Hogenaar, A., M.V. Meel and E. Dijk, 2010. *What are your information needs? Three user studies about research information in the Netherlands, with an emphasis on the NARCIS portal Netherland Research Information*. in *10th International Conference on Current Research Information Systems*. Denmark: AALBORG UNIVERSITY.
- Huntington, W., 2000. *Research Partnerships in the Internet Age*. in *Community of Science*.
- Jeffery, K.G. and A. Asserson, 2010. *CRIS and DataSpaces by Epitaxial Growth*. in *Connecting science with society Proceedings CRIS2010 Conference*: AALBORG University Press.
- Jippes, A., W. Steinhoff and E. Dijk., 2010. *NARCIS: research information services on a national scale*, in *The 5th International Conference on Open Repositories (OR2010)*: Madrid, Spain.
- Joint, N., 2008. *Current research information systems, open access repositories and libraries (Review)* Library Review, 57(8): 570-575.
- Koo, D., P. O'Carroll and M. LaVenture, 2001. *Public health 101 for informaticians*. J Am Med Inform Assoc., 8: 585-597.
- Khosro, M.J., 2007. *Research and Information Management Systems Technology of Country*. Ministry of Science and Information Technology: Tehran.
- Leskosek, B.L., 2008. *A clinical research information system: an example of prospective observational study in oncology*. AMIA Annu Symp Proc., 6: 1021.

- Liao, R.A., H.A. Zhou and Y.B. Zhao, 2011. *Service self-aware and data adaptive-allocation for scientific research information system*, in *International Conference on Management and Service Science, MASS 2011: Wuhan*.
- Lingjoerde, G.C. and A. Sjørgren, 2010. *Remodelling Frida – from institutional registration to common registration and responsibility across member institutions*. in *CRIS*, Denmark: AALBORG University Press.
- Matthews, B.M. and M.D. Wilson, 2002. *Accessing the Outputs of Scientific Projects*. in *6 International Conference on Current Research Information Systems*, Germany: Kassel University Press.
- Middaugh, M.F., 2001. *Understanding Faculty Productivity: Standards and Benchmarks for Colleges and Universities*, San Francisco: Jossey-Bass Publishers. 1.
- Mojiri shahin, et al., 2006. *Needs of collaboration of information and librarian shipe in approved Res earches in Esfahan medical science university*. *Management of health and treatment information Jouranl*, 4: 11-16.
- Nadkarni, P.M., R. Kemp and C.R. Parikh, 2011. *Leveraging a clinical research information system to assist biospecimen data and workflow management: a hybrid approach*. *Journal of clinical bioinformatics*, 1: 22.
- National Academic Research and Collaborations Information System*, 2011; Available from: <http://www.narcis.nl/>.
- National Technical Information Service (NTIS),2005. *The NTIS Database search guide, U.S. Department of Commerce: USA*, pp: 3-4.
- National Technical Information Service (NTIS)*. 2011; Available from: <http://www.ntis.gov/>.
- Sharon, D., et al., 2007. *Interlibrary Loan and Document Delivery Between Japan and US*, Japanese ILL Committee: TOKYO.
- Notess, R. Greg, 2007. *Search Engine Showdown Reviews*.
- Oh William K, et al., 2006. *Development of an integrated Prostate Cancer Research Information System CLINICAL GENITOURINARY CANCER*, 5(1): 61-66.
- Parinov, S., 2010. *A CRIS driven by research community: benefits and perspectives Connecting science with society*. in *10th International Conference on Current Research Inforamtion Systems*. Denmark: AALBORG UNIVERSITY.
- Rani, M., H. Bekedam and B.S. Buckley, 2011. *Improving health research governance and management in the Western Pacific: A WHO Expert Consultation*. *Journal of Evidence-Based Medicine*, 4: 204-213.
- Rezaian Mohsen, 2010. *The reasons for the health-related research in the developing countries and the ways to overcome them*. *Tabib shargh journal*, 12(2): 1-7.
- Rhys, F., 2007. *Australian Perspective: Opportunities and Responsibilities for Research Data*, in *3rd International Digital Curation Conference*: Washington DC.
- Scholze, F. and J. Maier, 2012. *Establishing a research information system as part of an integrated approach to information management: Best practice at the Karlsruhe Institute of Technology (KIT)*. *LIBER Quarterly*, 21(2): 201-212.
- The ANDS Technical Working Group, 2007. *Towards the Australian Data Commons: A proposal for an Australian National Data Service*.
- The Australia National Data Service*, 2011. Available from: <http://ands.org.au/guides/>.
- U.S. Department of Commerce National Technical Information Service Organization Chart*, 2012. available from: <http://www.commerce.gov/department-commerce-organizational-chart-pdf>.