Research Article

Data Collection Patterns in Hospitals of Tabriz

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Abstract

Purpose: Considering the importance of information in hospitals, this study assessed the common pattern of data collection in Tabriz hospitals and the reasons explaing them.

Methods: The study had a descriptive cross-sectional design and all the hospitals in Tabriz city were studied (census). The questionnaire was developed by the researchers consisting of two parts (information about the HIS and indicators for hospital data collection). The content validity of the questionnaire was verified by a panel of experts.

Results: Out of the 20 participating hospitals, 19 hospitals were equipped with HIS. In eligible hospitals, the data used to be recorded as 48% manually, 28% by computer, 15% through both methods, and in 9% the indicators were not recorded. Indicators of demographic information entry and their modification; list of prepared medicines for inpatients in hospital pharmacy; and entry of the number of free beds in the wards had the highest rates of computerized data entry upto a proportion of 80%. Indicators of patients' clinical information as well as the safety and data regarding complaints had the highest manual recording rate among the studied hospitals with a proportion of upto 90%. The reasons that the staff didn't use the HIS included; unnecessary complexity; unfriendliness of the software; poor quality of the used hardware and shortage of options on the software; laws and regulations; fearand personnel's viewpoints, and finally the hospital approach or policy.

Conclusion: Despite spending much cost and time to implement and maintain the HIS, still almost half of the data entry was being done manually. It requires the policies of using the HIS systems to be revised.

Introduction

Hospitals have a significant role in promoting the health and providing health services, therefore, administration of these organizations is of importance. Management of these organizations needs timely collection and correct classification of data, and then putting information available for the administrators [1].

A major part of care giving processes is focused on information. They produce large volumes of data in daily work to the extent that the money spent to collect, retrieve and store the information is estimated to be approximately 30% of the health budget [2]. Effective methods for information management are necessary to provide safe services with high quality [2].

The hospital managers for an accurate decision making are dependent on two principal activities: data collection and data analysis [3]. According to the volume of generated data, providing quality health services requires a comprehensive information system [4]. Nowadays Hospital Information Systems (HISs), are one of the most common computer systems that are designed to support health care services and have become powerful tools for providing high quality health services [5].

The system is also a useful tool for increasing the quality of nursing information [6], reducing costs, providing more time for staff to care the patients [7], time saving and easy access to patients' information [8].

Recently, regarding to the deployment of the hospital accreditation program in Iran, and devoting specific points for the HIS in it, the role of the HIS has become more important [9]. By this program, the recorded data in the HIS will be used to extract data to calculate the performance indicators of the

hospitals. Thus if hospitals do not have a comprehensive information system, extracting data from paper records will be with errors, time and cost consuming [10].

Considering the importance of information in health care systems and the spread of using HISs, the correct data collection in hospitals is an essential. Therefore, the present study has been designed with the aim of depicting hospital performance in data collection.

Methods

In this descriptive cross-sectional study, all 21 hospitals of Tabriz city (including Teaching, Social Security, Private and Military hospitals) were investigated. Sampling was not done and all of the hospitals included in the study (census), except for one hospital that did not participate. The city is the center of East Azerbaijan province and also largest city of north-west of Iran.

The required data were gathered by a researcher-designed questionnaire consisting of two parts. The validity of the questionnaire was assessed and verified by a panel of experts. The first part of the questionnaire was related to the data collection method (manually or computerized), HIS implementation time, the number of computers linked to the internal network and IT department personnel (including the personnel that are employed for startup and maintenance of the HIS).

The second part was consisting of 30 indicators for assessment of hospital data collection process. The indicators were extracted and designed by literature review and checklists of Ministry of Health and Medical Education for evaluation and accreditation of hospitals.

The Delphi technique was used to assess the validity of the indicators. Using this technique, 14 members of the expert panel were scored each indicator in two aspects of importance and practicability with grading 1-9. The indicators with the scores of 1-3 were eliminated and those with the scores of 7-9 were finalized. Then the median scores of each of the indicators were calculated and finally, the mean of the 30 median scores was calculated.

The aspects of importance and practicability of the indicators obtained scores of 8.51 and 7.53, respectively, in a 1-9 scale. This shows the importance and yet practicability of the indicators in the field. To assess the reliability of the indicators and solve executive problems in the field, they were piloted in one hospital. The finalized indicators were included how the demographic, clinical, managerial, safety, medical equipment, social work and financial data are collected. These data are currently collected in the country's hospitals for routine.

Next, the data on the indicators were gathered in the hospitals with cooperation of the related personnel; such as head of the medical records department, and officer of Infection Control, Nursing Director, Quality Improvement, medical equipment department's representative, officer of social work and complaints.

The data entries were divided into four categories: manually, computerized, both manually and computerized and none of them. **Manually**, refers to the data entries in paper-based medical record or daybooks. **Computerized**, refers to the ones entered into the HIS. The **both manually and computerized** means that the data were recorded simultaneously in daybooks and HIS or other computer programs (separate software or computer files). If the answer "**None**" is given, it means that the specified data are not recorded anywhere.

The descriptive statistics was used to report the results. To evaluate the hypothesis, according which there is a relationship between the frequency of indicators that are recorded by computer and the number of IT staff, the Kruskal-Wallis test was used. The test also was performed for the number of computers. Tests were done at a 0.05 significance level. All statistical works were done using SPSS 22 software.

Results

This cross-sectional study was performed during the summer in 2013 through which 20 hospitals of Tabriz city were studied and one refused to participate. Out of the 20 participating hospitals, 19 were equipped with HIS and one was through implementing it. Ownership of the studied hospitals were public or university (9 hospitals), private or charity (7 hospitals), military (2 hospitals) and Social Security (2 hospitals).

The computerized information systems were implemented and used in the studied hospitals for 7 years and one month in average. One hospital used the HIS for 17 years, 5 for 9-12 years, 8 for 6-8 years, 4 for about 3 years and one hospital for less than one year. Average number of computers connected to the intra-net in the studied hospitals was 40. The median, minimum and maximum numbers of personnel of the IT departments were 2, 1 and 4, respectively.

Indicators relating to clinical information (nursing works, physicians' orders, progress of disease and the patients' history, with 90, 90, 90 and 95 percent, respectively), safety information (medication errors, errors caused by invasive and non-invasive medical techniques with 100, 80 and 80 percent, respectively) and patients' complaints information with 95 percent accounted for the highest level of manually data entry in the hospitals (manual mode only).

The data entry routine for the studied indicators in the hospitals were: only manually (48%), computerized (28%), both (manually and computerized) (15%) and none (9%). Figure 1 shows the data entry routine of the study indicators for each hospital separately.

Table 1 represents the data entry method for 30 indicators separately. For example, the first indicator is recorded manually in 2 hospitals, by computer in 16 and by both methods in 2 hospitals.

Table 2 shows the method of data entry in the hospitals, divided by their ownership.

Results of the Kruskal-Wallis test showed that the method of data entry correlate neither with the number of IT staff (P= 1) nor with the number of computers (P=1).
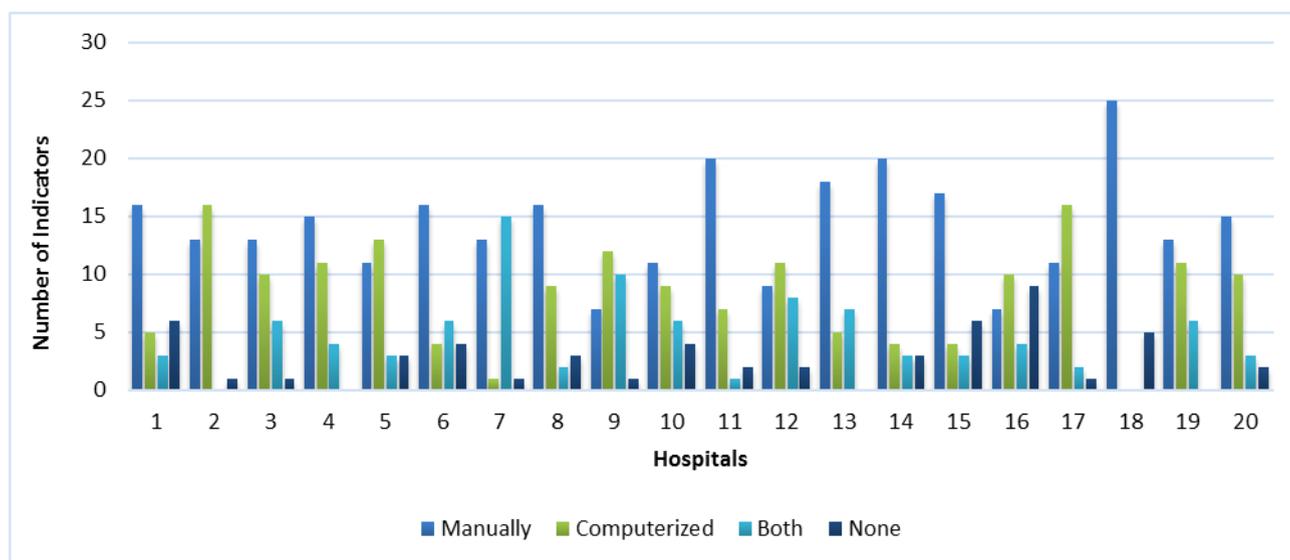
Figure 1. Method of data entry for the indicators in the hospitals.

Discussion

In this study the method of data collection was investigated in Tabriz hospitals. The use of information is considered as one of the important pillars of clinical governance, and it includes the collection, storage, retrieval, analysis and use of the information. The accuracy of data, and accurately generating and interpreting them are necessary for success in the program of clinical governance [11]. The method of data collection in the hospitals depends on the type and options of the HIS program that is used, the policy of hospital, and information needs of the managers and users. The findings from this study showed that the hospitals which had adopted the accreditation and clinical governance programs, considering the importance of information in these programs, had encouraged the accurate recording of the data. So the personnel have had sufficient incentive for that.

Instant access to information has great importance for decision making and planning. But still in the studied hospitals the computerized recording of data such as medical and medication errors, complaints, and clinical information of the patients does not exist. Despite the software facilities, most of the clinical data such as nursing works, physicians' orders, progress of disease and the patients' history are not punched in the hospital information system. The study results showed that despite

spending huge costs on implementing and maintaining HISs, still 50% of the data entries are manually. If this trend continues, the hospitals will be prevented from reaching HIS benefits.

The reasons of no data entry into computer and continuing to manually record keeping in under studied hospitals can be divided into the following categories: 1) Unnecessary complexity of the HIS software 2) lack of user-friendliness of the software, 3) insufficient facilities (hardware and software), 4) laws and regulations 5) fear, 6) personnel's viewpoint and 7) hospital's policy or approach.

1) Unnecessary complexity of the HIS: Based on the study results, in designing hospital information systems, weakness is one of the reasons for the lack of clinical information in the HIS. Medical orders and nursing reports are not entered into the HIS, because of lack of attention to ease of data entry and the personnel workload (doctors and nurses). The possibility of punching data such as the errors and nosocomial infections does not exist in most HISs that are used in the hospitals. Previous studies considered the lack of officials' attention to ease of use of the HIS, lack of software for keeping care data, inability of programmers in designing the systems, and complicacy of hospital's infrastructure for HIS designers, as the reasons of failure of the HISs [12-15].

Table 1. Method of data recording related to each indicator in the study hospitals.

The indicators	manually	Computerized	Both	None
Documenting demographic information and modifying them	2	16	2	0
Documenting referred patients from other hospitals	9	6	4	1
Documenting nursing works	18	1	1	0
Documenting Physicians' orders	18	0	2	0
Documenting the patients' history	18	0	1	1
Documenting progress of disease	19	0	1	0
Logging patient displacement inside the ward	4	7	7	2
Logging patient transmission between the wards	4	7	8	1
Logging empty beds of the wards	1	16	3	0
Logging the number of Extra beds	1	13	2	4
Logging bed mobility between the wards and damage or loss of beds	6	5	3	6
Documenting the number of prescriptions provided for outpatient	2	15	1	2
Documenting the number of prescription provided for inpatients	4	16	0	0
Documenting drugs of the drugstore	3	11	5	1
Logging the expiration date of the drugs	6	9	1	4
Documenting nosocomial infection rates	15	0	4	1
Logging actions and consumed accessories in Central Sterilization Room (CSR) department	9	4	4	3
Documenting the faulty Packs	14	0	0	6

Documenting medication errors	20	0	0	0
Documenting errors caused by invasive methods	16	0	2	2
Documenting errors caused by non-invasive methods	16	0	2	2
Documenting patient discharges separately	5	8	6	1
Documenting deaths in the first 24 hour	8	3	9	0
Documenting deaths after 24 hours	7	3	9	1
Documenting schedule of the shifts' personnel	8	6	5	1
Documenting complaints from the hospital	19	0	1	0
Documenting poor patients	5	4	2	9
Documenting status of the equipment	13	4	2	1
Documenting equipment failure	16	1	2	1
Logging individuals' access to patients' medical records	0	13	3	4

2) Lack of user-friendliness of software environment: The gap between the abilities of the purchased HIS and the needs of users, caused them that despite the possibility of punching data on HIS, record the data in manual way or both manually and computerized. This incoherence in user needs and the abilities of the HISs is in spite of spending very much on starting up and maintaining the HIS. One of the studied hospitals, in order to resolve this problem have redesigned the HIS according to information needs of the users, especially the management. Studies are shown that ignoring user satisfaction is the reason for not using the computerized information system and therefore its failure. On the other hand using the system and its accordance with the expectations of the users, demonstrates the success of the system [12]. Using the system by its users indicates its success and also the return on investment [16-18].

3) Lack of facilities (hardware and software): Despite the efforts of hospitals to provide its staff with new and up-to-date computers and despite spending a lot on this, still many clinical wards are facing with the shortage of hardware and thus lack of clinical data on the HIS. Currently, the hospitals are trying to quantitatively develop the HIS network, while training the personnel, resolving hardware shortages and technical faults by investment, and managerial support for HIS implementation and usage could be helpful for hospitals to achieve one of the main advantages of HIS which is creating an integrated information system [19].

4) Laws and regulations: Lack of legal support from electronic records and having no legal value, especially in case of physician order and nursing report sheets, resulted in keeping the records in manual way after all the efforts to computerize them. Some external organizations related to hospitals, such as insurance companies are requesting full paper-based records for paying the hospitals. Thus according to this and findings from previous studies punching clinical data into the HIS seems a redundant and time-consuming work [20].

5) Fears: Another reason for lack of computerized data entry is the personnel's fears. Recording the infection rates and clinical errors are important in programs such as clinical governance,

but they are not correctly recorded in the studied hospitals. One of the studied hospitals, in which the infection and errors rate were zero, expressed that this zero rates are due to inappropriate behavior of management with personnel or wards that report either an error or infection. Other studies stated that fear from consequences is an obstacle for reporting and the nameless error-reporting system as a factor for increasing the reports. Another type of fear is fear from losing the recorded information in HIS in case of computer crash or software failures which leads to lack of users' trust to the HIS and continuing to record the data manually [20].

6) Personnel's viewpoints: The actual importance of personnel's viewpoint seems when in manual data recording, the data is in the monopoly of one particular person and he/she assumes himself/herself as the owner of the data. But when the data is recorded in the HIS, it is possible for all authorized persons to access it using his/her user name and password. So there is no monopoly in access to data and by editing the user account the level of access can be determined. The personnel also should be trained about the advantages of the HIS. The hospitals in which the personnel have understood the importance of the information systems and it was supported by the managers, the data were collected carefully. In the case of no tendency of the users to punch the data in the HIS, the process of data collection will cut off and the existence of HIS would have no impact. Similar study has proved positive correlations between management supports and reaching the benefits of the HIS [17].

7) The approach or policy of the hospital: Considering the merely financial approach of the studied hospitals, most of them have had more attention to develop the financial parts of the HIS. So the data such as demographic and admission information which are required to prepare the reports for being paid from the insurances have the highest percentage of computerized recording. This is confirmed by results of other studies which showed that the possibility of punching financing and accounting data (lab, pharmacy and imaging) exists in most of the HISs [12-14].

Table 2. Data entry method separated by hospitals' ownership.

Hospital ownership	Data entry method (%)				
	Manually	Computerized	Both (Manually and computerized)	None	Total
Public or Teaching	38.88	35.56	16.30	9.26	100
Private or Charity	54.76	22.38	14.76	8.10	100
Military	58.33	15	16.67	10	100
Social Security	51.67	26.67	11.66	10	100

According to the results of the study it seems that in the studied hospitals recording of the data simultaneously in both manually and computerized manner are done for some reasons including: 1) unreliable reports of the HIS (no compliance with manual

reports), 2) software programs offered by external organizations, and 3) impossibility of extracting some managerial reports.

1) Unreliable reports of the HIS (no compliance with manual

reports): Lack of compliance between extracted reports of HIS and manual method has different reasons. For example on the indicator of "deaths in the first and second 24 hours after admission" because of change in the admission process at the night work shift in some hospitals (integration of emergency department and inpatient admissions), it is impossible to separate the deaths that occurred in the first and second 24 hours except by separately recording them in the notebook.

Double registration of occupied and available beds is because of errors in the bed occupancy rate which is calculated by the HIS. This error is due to changes in the number of active beds of hospital wards and also adding the extra beds to them. Most hospitals gave the basic information such as the number of approved and active beds into the HIS when implementing it and are unable to change these numbers. Thus the HIS calculates the occupancy rate according to the unrealistic numbers of the beds. Keeping records in both methods also indicates that the personnel do not trust the HIS reports. Another study have mentioned that some external organizations do not have confidence in HIS reports and this issue have reduced the efficiency of these systems [21].

2) Programs offered by external organizations: In some cases although the data are not entered into the HIS, but the hospitals have stated both the manual and computerized recording of them. Some external organizations force the hospitals to punch some data into the softwares apart from the HIS; such as the Nosocomial Infections from the Ministry of Health and the Nurses Work Overtime from the pertaining university. The point is that the hospitals do not have access to their own data on such softwares and cannot get reports; and considering the absence of the possibility for punching these data into the HIS, they have to record them manually. Ahmadi et al. stated that there is no possibility for recording the personnel information, such as number of staff, personnel working hours and professional training, in most HISs used in Iran [14].

3) Impossibility of extracting some managerial reports: Another factor that causes the hospitals to continue recording some data in manual way beside the computerized method is the impossibility of extracting some managerial reports. Some of the HISs used in the studied hospitals show the number of non-occupied beds in every particular day, just in the same day, but they do not have the ability of extracting the trend of bed occupation in a period of time. So they have to keep these data in notebooks.

The present study delineated that some of the data which is generated in the hospitals are not recorded in any method. The reasons for lack of recording these data can be divided into: a) lack of persuasion and b) no necessity is felt (deficiency of the HIS).

a) Lack of persuasion: In the present study it was found that some of the data which exist in the hospitals are not recorded because the authorities do not persuade the personnel or request them to do so. The examples of such data are the number of damaged packs in the CSR (despite its importance in patient safety and infection control), the complaints and the results of them (despite its importance in clinical governance and increasing customer satisfaction).

b) No necessity is felt (deficiency of the HIS): The second reason that some data are not recorded in the hospitals is that no necessity is felt for them and the used HISs do not have the capability of recording some details. In nine out of nineteen hospitals the data on the poor patients are not recorded, because the social work unit does not exist in the organizational chart of them. In these hospitals in case of discount for the patients the hospital administrator him/herself decides about it and no data is kept in these instances. However, in the hospitals that have the social work unit in case of discounts the reason of discount is not recorded on the HIS because there is not a specified place for it on the HIS.

Despite the long experience of the hospitals in using HISs, currently only one third (1/3) of the data are automatically available. To access the rest of the data that are recorded in both methods, you need to extract them from paper notebooks, separate software or Personal Computer (PC) of particular staff. Other studies also have stated that still very little amount of the data are available with just one mouse click, and a large part of them are required to be extracted from PCs or paper-based medical records and the manually data collection is needed to complete the calculation of the performance indicator [10].

Conclusion

Considering the advancement of the information technology and the increased production of data in the hospitals, data collection in manual way is one of the challenges that the healthcare systems are faced with. This study showed that despite spending so much time and money for implementing, developing and maintaining the hospital information system, in most hospitals still about half of the data are recorded manually. In order to reduce the obsession on manual data collection it seems that the HISs should work on their user friendliness, the information needs of the users should be reviewed and the HIS should be revised to match the needs, and the separate programs of the Ministry of Health should be integrated into the hospital information system.

References

1. Safdarian N, Ashiri M: Hospital Information System. *Journal of Biomedical Engineering* 2010,4(13): 13 [In Persian]
2. Health Information and Quality Authority: *Guidance on Developing Key Performance Indicators and Minimum Data Sets to Monitor Healthcare Quality*; 2010. [www.hiqa.ie]
3. Monitoring and Evaluation and Management Information Systems (MIS): pathfinder international. [www.pathfinder.org/.../Strengthening-You-Orga.]
4. Ahmadi M, Shahmoradi L, Barabadi M, Hoseini F: Usability Evaluation of Hospital Information Systems based on IsoMetric 9241. *Hakim Research Journal* 2011,13(4):226-33. [In Persian]
5. Farzandipour M, Sadoughi F, Meidani Z: Hospital Information Systems User Needs Analysis: A Vendor Survey. *Journal of Health Informatics in Developing Countries* 2011,5(1):147-54.
6. Ammenwerth E, Rauchegger F, Ehlers F, Hirsch B, Schaubmayr C: Effect of a nursing information system on the quality of information processing in nursing: An evaluation study using the HIS-monitor instrument. *International Journal of Medical Informatics* 2011,80:25-38 . doi:10.1016/j.ijmedinf.2010.10.010.
7. Malliarou M, Zyga S: Advantages of Information Systems in Health Services. *SMIJ* 2009,5(2):43-53. doi: 10.4127/ch.2009.0040.
8. Imani E, Khademi Z, Yusefi P, Bahrami Z, Naghizadeh F: Experiences of nursing managers about hospital information system: a qualitative study

Bimonthly. *Journal of Hormozgan University of Medical Sciences* 2012,16(3):223-32. [In Persian]

9. Vahid Dastjerdi M, Emami Razavi H, Razavi S: *The guide to assess hospital accreditation standards in information technology department.* Tehran: Ministry of Health and Medical Education, Department of Accreditation and Monitoring; 2012.

10. Anema H, Kievit J, Fischer C, Steyerberg E, Klazinga N: Influences of hospital information systems, indicator data collection and computation on reported Dutch hospital performance indicator scores. *BMC Health Services Research* 2013,13:212. doi:10.1186/1472-6963-13-212.

11. Delkhorushan A, Dehqani M, Raqebi S, Farhadian A: *Clinical governance.* Birjand: Birjand University of Medical Sciences; 2011. [http://www.bums.ac.ir/shares/darman/darman/clinicalgovernance/ktabe%20hakemiyate%20balini.pdf.]

Hospitals Affiliated with Mashhad University of Medical Sciences, Iran. *Health Information Management* 2012,9(3):310-7. [In Persian]

17. Yaghmaei F, Shirazi M: Assessment of Users' Intention to Use Hospital Information Systems Based on Diffusion of Innovation Theory in Razi Hospital of Ahvaz. *Journal of Health Administration* 2012,14(46):11-20. [In Persian]

18. Alipour J, Hoseini S, Hayavi Haghighi MH, Feghhi Z, Sharifi R, Kohkan A: Perspectives on hospital information system in medical practice. *Hormozgan Medical Journal* 2010,14(2):140-7. [In Persian]

19. Nematollahi M, Sharifian R, Parvin S: Evaluating the Hospital Information System at Nemazee Hospital,

12. Asadi F, Moghaddasi H, Hosseini A, Maserrat E: A survey on Pharmacy Information System at Hospitals Affiliated to Shahid Beheshti University of Medical Sciences; 2009. *Journal of Health Administration* 2010,13(41):31-40. [In Persian]

13. Sharifian R, Saiedi M: Check the status of softwares utilization of medical records at Archive hospital admission Tehran University of Medical Sciences. *Payavard Salamat* 2007, 1: 45-51. [In Persian]

14. Ahmadi M, Habibi Koolaee M: Nursing Information Systems in Iran. *Hakim Research Journal* 2010,13(3):185-91. [In Persian]

15. Simon S, Kaushal R, Cleary P, Jenter C, Volk L, Poon E, et al: Correlates of electronic health record adoption in office practices: a statewide survey. *J Am Med Inform Assoc* 2007,14(1):110-7. doi: 10.1197/jamia.M2187.

16. Sadoughi F, Khoshkam M, Farahi S: Usability Evaluation of Hospital Information Systems in Shiraz, from the Users' Viewpoints. *Media* 2012,3(2):2-9. [In Persian]

20. Ebadi Azar F, Kahooei M, Soleimani M, Ghazavi S, Ghods A, Alaei S, et al: The impact of hospital information computerized network on clinical departments curative services personnel (Semnan University of Medical Sciences-Amir Al-Momenin hospital). *Journal of Health Administration* 2009,11(31):7-16. [In Persian]

21. Mokhtaripoor M, Siadat S. Information Technology in the hospitals of Isfahan: suggesting a model. *Health Information Management* 2008,5(1).[In Persian]