Original Article

Impact of a Computerized Hospital Information System on the Staff workload in an Iranian Hospital Medical Records Department

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Abstract:
Introduction: A hospital information system (HIS) is a comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital. As an area of medical informatics, the introduction of a HIS into a hospital was purported to reduce the time spent on administrative and clinical activities by electronic data processing. However, adoption has been slow, and a key concern has been that staffs will require more time to complete their work using HIS. And also Most of available HIS have lots of deficiencies in data gathering, so hospital managers decided to keep their paper records and same time use HIS. Most previous studies addressing this issue have been done with concentration on clinical staff activities.
Methods: Comparative observational of the impact of a HIS on Medical Records Department time in four units: Admission Discharge and Transfer/ADT, Medical Filing and Retrieval, Medical coding/billing, and Medical Statistics. Measurements: We used a time-motion method to measure staff time spent in predefined activities. Medical Records staff monitored while using HIS and paper based system. 15 clerical medical records staff were observed treating 300 documents while still using paper-based records, and same persons were observed treating 400 patients' records with HIS.
Results: Following HIS implementation, the use of the computerized system decreased the average total workload by 61.35% (from 66.41 to 23.93 m).
Conclusion: Hospital Information System (HIS) reduces three nonclinical activities time noticeably which is vital to decision making and plays a crucial role in the success of the organization.

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1. Introduction

The use of computers in Iranian hospitals has increased rapidly over the last decade, while nearly all hospitals in Iran keep and update their paper records besides keeping information in HIS(1). This fact has been accepted that paper based records will not have efficiency in modern facilities (2). The computerized Hospital information systems used in Hospitals aimed to meet the administrative purposes. Medical record department plays the most important role in developing and keeping administrative information in hospitals besides patients and medical information (3). Although many hospitals currently have established HIS, the scope of their applications is often limited to outpatient and inpatient billing, or in some hospitals, the mere replacement of the abacus or calculator (4). Medical Records activities may be categorized into four types. The first is admission-discharge and

transmission system (ADT) that is replaced traditional paper booking and scheduling system and master patient index. The second is an electronic Filing and Retrieval which replaces traditional filling system and Filing and Retrieval. The third is a computerized coding system which helps medical coders with providing list alphabetical list of diagnoses and codes (ICD-10, ICD-9 CM). And the fourth is electronic medical statistics system (5). All the four categories have been integrated into the HIS. However, the Medical Records subsystem function in the HIS has the following limitations: (i) not having the all functions of paper records; (ii) in Coding subsystem only the English language can be used for diagnoses while almost all the diagnoses were written in national language; and (iii) the system does not meet the specific needs of each department, such as statistical support due to late entry of information by nurses in the departments. Although HIS was implemented in our hospital, hospital managers decided to keep their paper records along to the HIS, this cause duplication in the tasks of Medical Records staffs (1, 6).

During the past 10 years, the validity of computerized information systems for several departments has been widely reported: the impact of electronic medical record systems on primary care, pediatrics, intensive care units and radiation oncology have been analyzed (7-10), and the effects of a HIS on Medical Records department staff was undeniable (11). However, the reported studies have focused on the qualitative change in staff work, rather than the quantitative measurement of efficacy of electronic systems. A comprehensive analysis of the efficiency of a hospital information system in Medical Records department, and the resultant change to the department staff workload, has not yet been performed. Therefore, we analyzed and quantified the change in the Medical Records department staff workload for their major task after the introduction of the HIS. This study will measure the time staff spent for completing predefined tasks in each two systems. Our results will be relevant to clarify the change of staff workload after introducing a HIS into Medical records departments.

2. Material and Methods

The study was conducted in 2010 at a 300 bedded trauma center hospital, which Computerized and Paper based system were undergoing simultaneously. The Medical Records Department of the hospital was studied for assessing the impact of Hospital Information System in comparison to paper based system on staff workload. The target population consisted of the records in the four medical records department units, which: 100 trauma case resulted to surgery were studied in each unit within different systems: (Admission and Discharge, Medical coding and billing, Medical Filing and Retrieval and Statistics units). The data were collected from a sample of 700, consisting of 100 HIS ADT, 107 Medical Coding HIS, 94 Medical coding paper based, also 100 Electronic Filing and Retrieval, and 93 traditional Filing and Retrieval, and 100 Electronic medical statistics to 103 manual statistics selected by the disproportionate stratified sampling technique. The inclusion criteria for selecting the sample were the cases who involved in trauma and surgery.

The tool used to collect the data was four standard time study forms. The forms were reconstructed with emphasis on the workflow. A pilot study was conducted for the HIS, to check the validity and feasibility of the study. The tool was administered to subjects, for ascertaining the reliability. The reliability calculated by using split method r = 0.73, 0.86 and 0.76, for coding, Medical Filing and Retrieval and the medical statistics respectively, which was high and satisfactory.

The effect of the electronic chart system on the staff workload was evaluated for four different clerical groups of staff: ADT staff, Medical coding and billing staff, Medical Filing and Retrieval staff, and Medical statistics staff. The average processing time per document was measured for two different methods, Computerized Information system and paper based system, and the results were compared through T test. For that purpose, two record groups, each composed of 400 surgical traumas, were selected.

Staffs evaluated all the necessary procedures in completing tasks in both Computerized Hospital Information System and paper based system. Any items that can be processed by only one method, such registering new inpatients in the CHIS, were excluded in the evaluation.

A sheet of paper was given to the staffs, which contained the list of all procedures for each task, which were required to record the time. The list of procedures given to each group of staff is summarized in Table 1. In cases where all procedures are performed consecutively, the times of starting and finishing whole procedures were recorded and the total elapsed time was calculated. When all procedures were not consecutive, the time taken for each step of the procedures was measured and the total elapsed time was computed. The workload evaluation by the ADT staff group focused on tasks required for admitting new patient, such as recording and entering patient's information, and scheduling appointments. Medical Coding staffs recorded the time required for coding the diagnoses, procedures and external causes. Medical Filing and Retrieval staff group measured the time taken to respond to the document request from inside or outside the hospital. And the medical statistics staff recorded the required time to calculate daily statistics regarding to the patients.

The staffs recorded the time taken to complete each patient record task, i.e. the time from the moment of opening the patient's paper record or electronic chart to the moment of completing predefined task. Finally, the total workloads measured in the two groups were compared. Paired t-test was performed to evaluate the statistically significant differences.

Table 1. Summary of procedures whose elapsed time were recorded

Staff group	Procedures
ADT	New patient registration
	Making new chart (paper or electronic)
	Entering patient information
	Selecting primary physician
	Recording all information necessary before hospitalization
	Scheduling an appointment
	Finding/opening the patients chart
Medical Filing and Retrieval	receiving the file requests
	detecting file number
	retrive the files
	confirming file and send to the request site
	Recording (or entering) ID on the chart
Medical Coding	detecting diagnoses, procedures and external causes
	look-up the codes
	registering the codes
Medical statistics and information	gathering data from inpatient and outpatient units
	calculating the indexes

3. Results

The average workload for four groups of staff is summarized in Table 2. As shown in the table, the use of the computerized system decreased the average total workload by 61.35% (from 66.41 to 23.93 m). The HIS decreased the workload for two groups of staff noticeably. The largest decrease of average workload was observed in the Medical Statistics staff group, which was a 90.2% decrease (from 25.85to 2.55 m). The average workloads of medical Filing and Retrieval, and ADT staff decreased by 59.7% (from 30.87 to 12.45 m) and 11.8% (from 4.5 to 3.97 m) respectively. However, the average workload of the medical coding/billing staff group also decreased by 4.5% (from 5.19 to 4.96 m). This negligible decrease was due to the extra time necessary to enter the required parameters such as insurance/phone number parameters into HIS.

The introduction of the computerized system into medical records departments has increased the accuracy of required data for hospital administration by reducing random errors. According to the independent sample t-test in ADT unit, comparison of two systems shows statistically significant differences. Which means HIS system reduce time and workload of the ADT staff ($p<0.001$). In the second unit, filing and retrieval, there is more significant and noticeable change. Qualified records which were studied in filing and retrieval in HIS were 107 and paper based system 94 documents. Average of time needed to complete filing tasks in paper based system was 2.4 times greater than HIS. Comparison of the means by sample t test has shown that there is a statistically significant difference between HIS and paper based system averages ($p<0.001$).

In medical coding and billing unit the coding process in traditional system takes 0.23 minutes more times than HIS. T test for average shows that there is NO significant statistically differences between the systems. ($p=0.36$) In the fourth and final unit, Medical statistics unit, with application of HIS, staffs experienced 10 times less needed time to do statistics procedures rather than traditional system. Testing the averages of two systems show that there are statistically significant differences ($p=0.36$).

Table 2. Comparison of the average workload of Medical records department staff

Staff group	Average workloads (range) (m)		Average workload reduction (%)	P-value
	Paper based	HIS		
ADT	4.5	3.97	11.80%	<0.01
Filing and Retrieval	30.87	12.45	59.70%	<0.01
Medical Coding	5.19	4.96	4.50%	0.36
Statistics	25.85	2.55	90.20%	<0.01
Total	66.41	23.93	61.35	<0.01

4. Discussions

The introduction of Hospital Information Systems has many advantages, as mentioned above, In summary, we quantitatively analyzed the efficacy of the HIS system for four different groups of staff and proved that this system decreased the total workload of These four groups of staff by almost 61%, and thereby improved the efficiency of hospital management. In Coding section, the system lagged from code indexes. The HIS coding does not consist of coding manuals, natural language or computerized coding assistant, and also not the alphabetical index, there are lots of vague field for coding in this system. Also the nurses' notes or physician orders are not entered to this system, this causes medical coders and medical statistics clerks enter data in medical record department in to the patient's records. One of the biggest challenges of HIS systems in Iran is still workflow. The workflow of the HIS systems are derived from traditional paper system, which is not suitable for computerized system.

The introduction of the Computerizes Hospital Information System (C.HIS) into medical records departments has decreased the time of patient admission by reducing work process. Hodge et al. reported the admission time for each patient was decreased to 5 minutes by using a Computerized Hospital Information System over 1 year (12). Moradi et al. studied the time spent for admission in HIS and paper based medical record system illustrated that some stages of admission process was increased. But total time of patient admission had 12% reduction in comparison with paper based system. The total time was 12 minutes which 5 minutes was taken for data entry (13). According to their data, it can be concluded that Shohada HIS had more accordance with work process and better performance.

For medical filing and retrieval unit, findings show that about 50% of total medical records time was consumed by staffs in this unit. In paper based system from the total time of 61.91 minutes, 30.78 minutes were spent in paper based medical filing and retrieval unit. By using HIS this time will decrease to 12,45 minutes which is equal to 59,7% time saving. Braden et al. in a report entitled Health information management department: reengineering file management at Texas University mentioned 99,3 % increase in accessibility and in 80% of cases decreased to 15 minutes(14).Mona Osman from Lebanese Institute of medicine depict the biggest problem of paper based filing and retrieval system that 27% of staff time would only be used to retrieval of the records(15).Young et al. in a survey of advantages and disadvantages of CPR wrote: medical retrieval time in HIS system is nearly zero (16). Zareie at Electronic archive of medical records versus paper based archive wrote: manual and traditional system of archiving records in Iranian hospitals resulted in facing lots of problems in filing and retrieval records. In his survey the time of retrieval and filing reduces to 5 minutes from 30. The highest rate of reduction was related to retrieval (17).

In medical coding unit, the results show that only 10% of total time was used by this unit staffs. Hannah Dennymarie in a study of average time for medical coding wrote, coding in a general hospital take less than one minute, and in a specialized hospital around 3 minutes for each record in electronic based system. Didear et al. in CPR successful stories reports that computerized assisted coding systems reduces more than 50% of staff time (18).

In summary, we quantitatively analyzed the efficacy of the Computerized Hospital Information system for four different groups of non clinical activities and proved that this system decreased the total workload of three groups of staff by _61%, and thereby improved the efficiency of patient management.

5. Conclusion

In summary, Hospital Information System (HIS) reduces three nonclinical activities time noticeably which is vital to decision making and plays a crucial role in the success of the organization.

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