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Use of Health Information Technology in Patient Care Management: a Mixed Method Study in Iran

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Abstract

Introduction: New computerized system, including health information technologies (HITs), plays an important role in the efficacy of management and nursing care services.

Objective: This study was aimed to determine the use of HIT in patient care management, in a case study in Iran.

Methods: This mixed method study was conducted in 2018 at the Kowsar Hospital of Semnan, Iran. Data collection was performed, using an observational checklist, and a questionnaire, including two main parts, one demographic and other assessment of information technology (IT) application in the care management of inpatients. The researcher prepared the questionnaire and its validity was verified. The data were organized and analyzed in the form of a descriptive analytic report. In the process of data collection 10 participants, including nurses, head nurses, physicians, radiology experts and IT managers were interviewed, and data analysis was performed, using conventional content analysis.

Results: Nurses were satisfied with the computerized system and believed it can expedite the job. From the nurse's viewpoint, the most common use of the HIT was to have access (observation) to patient admission and discharge information (100%), providing medicine and equipment, and transfer of patients (92.3%). The least use of IT was the retrieval of evidence in the care process (0%), and judgment and analysis related to radiological diagnostic procedures (0%). The potential of electronic record is still not applicable.

Conclusion: Use of modern information and communication technology in hospitals facilitates access and transfer of information, and also accelerates patient's admission and discharge process, relation between hospital units, simplifying the administration of current affairs and providing the necessary medical supplies and diagnostic procedures. However, modifying organizational policies improves the infrastructure, and enhances nurses' motivation in documentation of nursing reports, which can be effective in increasing the impact of IT in care management processes, especially in electronic record and nurse's clinical judgment and evidence-based care.

Key words: Hospital Units; Information Technology; Iran; Medical Informatics; Nursing, Supervisory

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INTRODUCTION

The world is progressing by development of technology and communication, along with changes in policies, economics, demographic and socio-environmental variables, which influence on health care delivery systems (1). Nowadays, the use of information technology (IT) becomes a routine activity for many organizations (2). In fact, the term informatics means the use of computerized information systems to answer questions, solve problems and make decisions (3). Based on the results of past studies, when informatics is applied in nursing tasks and procedures, such as financial, clinical, and other administrative transactions, it can help to reduce costs and the time required to complete the process (4). Therefore, one of the areas where informatics can be used is the nursing field. Different definitions are presented for nursing informatics. One is the use of IT, in relation to any practice within the nursing area, and it is indicated by nurses such as patient care, management, education and research (5). Computer and hospital

information system (HIS) can be used for collecting, storing, processing and modifying related data, which can facilitate the provision of nursing services, resource management and nursing care (6).

Application of informatics in nursing is expanding (2, 7). Some studies indicate that nurses use informatics in all their activities, and evidence suggests that with the development of the use of IT, even it could help the client to increase their participation in the care process (8, 9). Therefore, many studies have been done on the compliance and the use of IT in the field of health. For example, informatics reduces medical and drug errors, improves the quality of care, increases patient safety, clinical warnings and reminders, improves the quality of nursing documentation, nurses' access to medical documentation, and prevention services, increases patient satisfaction, and reduces health care costs (10-19). However, other studies indicate that the use of this technology is slow, or even somewhat dissatisfied with its application (20).

Currently, in Iran, due to the widespread use of IT in other areas, it was slowly developed in the health sector. Meanwhile, the use of these technologies will bring more health goals, provides better services and access information in the shortest time, increases patient satisfaction and system efficiency, and reduce costs. As a result, using these technologies in the field of health will accelerate the transition towards a better future, and health care organizations should be prepared to comply with these systems and to escape the challenges posed by their use. In spite of the importance of informatics in nursing, there has not been a specific study on the status of informatics use in care management, and studies have generally focused on the provision of services (21). Clarifying and determining the status, and finding defects and possible barriers can provide the basis for the redesign and improvement of the quality of care management, and nursing services. Therefore, the researcher aims to investigate the status of informatics use by nurses in the patient processing and care management. In other word, this study aimed to determine the influence of health information technology (HIT) on patient care management.

METHODS

Study design and setting

This research is a mixed method study, conducted in one of the university-affiliated hospitals in Iran. All hospital inpatient wards and also emergency ward were considered as research environments.

Data gathering and statistical analysis

Data collection was performed, using an observational checklist, consisting of 5 questions related to the use of IT (informatics) in patient care management, which was designed by the researcher. Checklist answers were ranked at three level score, use of a computer to quickly access and observe the information as score 1, transferring information score 2, and analysis of information was scored 3.

Furthermore, a questionnaire, including 5 demographic and 8 main questions was designed by a researcher, and used for data collection. The questionnaire answers were ranked with a 5-point Likert scale; from completely agree to completely disagree. The reliability of the questionnaire was confirmed by Cronbach's alpha score of 0.87. The validity of the questionnaire was confirmed by face and content validity. Entering the research environment and data collection were done by coordination and permission of hospital managers. Meanwhile, research process was explained to the participants, and they were assured about the confidentiality and use of data solely for the research purpose. The study was performed in three steps as follows:

In the first step, the use of the informatics system in the care management process, including admission, inpatient period, and finally discharge, was evaluated based on the checklist. Unclear points were resolved with the help of users and their explanations. The data from the observation checklist were organized by the researcher in the form of a descriptive analytic report. In the second step, at least 2 nurses completed the questionnaire on the use of IT in care management in each hospital ward. Data from the quantitative section were organized and analyzed, using SPSS 16 software, and appropriate statistical methods.

In the last step, some of these hospital staff and clients were also interviewed by researchers' due to perception of users' deep experience (Table1). The main participants were the nurses with at least 1-year work experience with HIS, who had a willingness to cooperate with the researcher, and selected by purposive sampling. Based on data analysis and guidance, nurses, physicians, radiology experts and IT managers were selected and interviewed. The sampling procedure continued until data saturation was reached and no new data were obtained. Qualitative data analysis was performed, using Graneheim and Lundman conventional content analysis method (22). Researcher repeatedly perused the collected data,

Table 1: Participants' characteristics (interviewees) in the research process

Participant (N)	Individual/ Organizational Character	Age	Sex	Work experience/care services (year)
1	Nurse	34	male	12
2	Hospital ward secretary	36	female	5
3	Nurse	52	male	27
4	Head Nurse	48	female	26
5	Head Nurse	41	male	17
6	Physician	51	male	24
7	Staff in radiology unit	39	female	16
8	Staff in informatics unit	41	male	14
9	Instructor	48	female	27
10	Client	50	male	7 (intermittent)

in order to obtain a general understanding of the subject. The obtained data were analyzed in the following steps: manifestation of the latent content, unit of analysis, definition of the unit, condensation, abstraction, content area code, category and theme.

Results

There were 24 computers in the 5 general inpatient wards, 4 intensive and 2 emergency wards, evaluated based on the observation checklist. In addition, 10 participants were interviewed. Meanwhile in this process, the research questionnaire was completed by 26 nurses, 21 of whom were female, and the rest were male, with an average age of 36.8 years (24–52), and average 13 years (1–29 years) of work experience. About, 92% of nurses had a BS degree, and the rest had a master's degree. Approximately, 80% of the nurses had passed at least one formal training program from the 7th ICDL skills. Only, 58% of nurses participated in the HIS training course, and 40% of whom believed that ICDL had a low influence on the HIS-related skills.

The findings from the observational section showed that there were generally 3 computers, and at least 2 computers in each hospital ward. In addition to the HIS system, internet connectivity and the possibility for use of flash drive and compact disk (CD), head nurse computers were equipped with automation program. Another computer, which also had internet connectivity, mostly was used for daily affairs, providing support services and the relationship between wards, based on the HIS, and the third computer was sometimes used for HIS, but mainly for retrieval of the computed tomography (CT) scan and radiographies.

The results of observations and participants' experiences showed that nurses used the HIS system in their daily work. The HIS system used to interact with other units, especially pharmacy, laboratory and radiology. Physicians, residents and medical students used a computer system to receive and review the radiology and CT scan. Hospital ward secretaries also used computers based on the HIS system for work affairs. The secretary's use was in fact complementary to the head nurse and nurse activity. In addition to the exchange of organizational and administrative information, head nurses also requested the general medical equipment in this format. However, it was not possible to view daily, weekly, or monthly queries.

From nurses' viewpoint, the most commonly used computer system is for patient admission and discharge, and providing medicines and equipment (100%), and the least common is for retrieving evidence in the care process (0%), and the analysis of radiological diagnostic judgment (0%) (Table 2). The medical equipment, such as syringes and drugs, were specifically requested for each patient and sent to the pharmacy. These orders can be made by nurses and head-nurses. Medical equipment for hospital wards, such as serum, iodine, etc., are ordered on a daily or weekly basis by head-nurse.

Regarding the use, the internet and intranets available, for improvement of the quality of information on disease or treatment associated with or about patients' previous hospitalization history, only 23.1% of the nurses believed computer systems help them in this regard (retrieval of evidence in the care process). Despite the limited amount of internet traffic for the hospital nurses (almost 20 hours, monthly), 46% of the respondents did not know enough about it, and 28% of nurses, despite being aware, did not use it.

In general, the findings indicate that the most common use of the computer in the care management process is the admission and discharge of the patient, as well as support in the provision of drugs and equipment, and the least was related to the recovery of evidence in the care process.

The qualitative data derived from the interview

Table 2: Adoption of computers in care management from nurses' viewpoints

Computer user domains	Usage type in care management	Completely agree (5)	Relatively agree (4)	No Idea (3)	Relatively disagree (2)	Completely disagree (1)
Patients Admission	Quick access and observation (1)	26 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Transfer of information (2)	20 (76.9)	6 (23.1)	0 (0.0)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	4 (15.4)	4 (15.4)	2 (7.7)	12 (46.1)	4 (15.4)
Retrieving evidence in the care process	Quick access and observation (1)	6 (23.1)	4 (15.4)	6 (23.1)	8 (30.8)	2 (7.7)
	Transfer of information (2)	3 (11.5)	4 (15.4)	6 (23.1)	7 (26.9)	6 (23.1)
	Organization and analysis (3)	0 (0.0)	2 (7.7)	4 (15.4)	14 (53.8)	6 (23.1)
Receive support in the provision of medicines and equipment	Quick access and observation (1)	24 (92 .3)	2 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
	Transfer of information (2)	26 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	2 (7.7)	6 (23.1)	4 (15.4)	10 (38.5)	4 (15.4)
Get support for providing patients' nutrition	Quick access and observation (1)	3 (11.5)	0 (0.0)	23 (88.5)	0 (0.0)	0 (0.0)
	Transfer of information (2)	24 (92.3)	2 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	2 (7.7)	6 (23.1)	4 (15.4)	8 (30.8)	4 (15.4)
Laboratory diagnostic procedures	Quick access and observation (1)	4 (15.4)	1 (3.8)	1 (3.8)	22 (76.9)	0 (0.0)
	Transfer of information (2)	20 (76.9)	4 (15.4)	2 (7.7)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	1 (3.8)	1 (3.8)	3 (11.5)	10 (38.5)	11 (43.1)
Radiological diagnostic procedures	Quick access and observation (1)	2 (7.7)	1 (3.8)	1 (3.8)	12 (46.2)	10 (38.5)
	Transfer of information (2)	22 (84.6)	2 (7.7)	2 (7.7)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	0 (0.0)	4 (15.4)	2 (7.7)	14 (53.8)	6 (23.1)
Transfer to other hospital wards	Quick access and observation (1)	26 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Transfer of information (2)	22 (84.6)	4 (15.4)	0 (0.0)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	6 (23.1)	4 (15.4)	4 (15.4)	8 (30.8)	4 (15.4)
Discharge or transfer to other Hospitals	Quick access and observation (1)	26 (100)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Transfer of information (2)	24 (92.3)	2 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
	Organization and analysis (3)	8 (30.8)	4 (15.4)	4 (15.4)	8 (30.8)	2 (7.7)

with the participants, included three main categories (themes): Positive attitude to use IT in the service support, utilizing IT in accelerating cross-sectoral interactions, and Expediency prevention to expand IT,s evidence-based utility, which is described in table 3.

In general, most of the participants agreed with the speed and convenience of working with the computers in service support, and considered that as a facilitator, which speeds up access to the necessary equipment and resources, the experience of one of the nurses was expressed as follows:

"Most of the time, shortly after the computer request is made, the necessary medical supplies become available"(P1, nurse)

The dominant approach in designing and using IT, especially HIS, was that nurses used it in public affairs to facilitate interactions with para-clinic units, and the participants were satisfied with the

Table 3: Qualitative data derived from the interview with the participants

Main Category	Sub-category
Positive attitude to use IT in service support	Satisfaction with the facilitation of send requests by HIS
	Satisfaction with the speed reception of consumables medical supplies
The use of IT to accelerate cross-sectoral interactions	Facilitating interactions with inter-wards and para clinic units
	The use of HIS for patients in hospital transfers
Expediency prevention to expand IT,s evidence-based utility	Nursing documentation focusing on paper records
	Concerned about time-consuming electronic recording
	Low tendency to retrieve and extract care evidences

ease of transferring requests, and receive of responses (diagnostic tests). However, in the case of laboratory test results, they refer to the computer when necessary to view the results of the tests. One of the nurses' tricks is as follows:

"We usually receive diagnostic tests results in paper form and keep it in the patient paper-based chart, but sometimes we are in a hurry or paper form is not available, then we refer to the computer (P3, nurse).

For the CT scan and patients' imaging results, nurses rarely use computers. However, medical students and physicians frequently use it, based on HIS or by CD. Most of the nurses complained about a simultaneous request of patients' imaging results in paper and electronic form. However, removing a paper form of patients' imaging results, and complete replacement with the electronic form, increased durability and access of images, and these were a positive change in view of physicians and nurses. According to the radiology staffs, nurses and even patients, focusing on code rather than patient personal information can be considered as one of the focal points of increased error. One patient experience stated: unfortunately, my brain CT scan was misplaced with another patients' CT scan, and even the doctor prescribed me a medication based on the wrong CT scan, but fortunately, the problem was resolved immediately." (P10, client).

The findings from the direct observation and evaluation of the researcher indicated that HIS generally was used to establish the daily work interactions, and the researcher rarely encountered the icons and specified cases of classified information. Participants' experience shows that some organized data usually are sent to the nursing office monthly through the Department of Statistics and Information Technology that may be sent to the relevant ward nursing office. The experience of one of the supervisors is as follows:

"We do not need much summarized and categorized information. Some important information, such as the monthly number of discharge, is forwarded to us by the hospital nursing office. Sometimes, even if we need we ask about necessary categorized information directly from the Department of Statistics and Information Technology "(P4, head nurse).

The use of IT generally focuses on cross-linking and receiving support services, and in spite of relative strengthened infrastructure, nurses are reluctant to expand it in the care process. Typically, nurses and even nursing managers have little interest in retrieving disease-related evidence, as well as documentation reports in electronic form.

"Even though computers are connected to the internet, in fact, we do not have enough time to resolve ambiguity or problem by use of computer or internet; it is time-consuming for us. Sometimes we are free, but the computers are busy, because other nurses are using it (P3, nurse).

Discussion

This study was conducted with the aim of surveying computer and IT application in managing hospital wards by head nurses. The findings of this study indicated that IT application is increasing, but now, the most use of IT is in daily routine official relations, accessing guidelines and laws, presenting reports and exchanging information. In general, the findings of the present study indicate that although the use of the IT system in care management is expanding, nurses mainly use IT for receiving support services and facilitating inter-ward relations. In other word, electronic recording of care processes and evidence-based judgments are not established properly.

According to the findings of the research, one of the missing loops in the health care delivery system is the lack of use of software systems such as Computerized Physician Order Entry (CPOE) and Clinical Decision Support System (CDSS), along with hospital information systems for prescribing drugs electronically, or computer-based orders. As

a result, it reduces patient safety management and the lack of use of these systems causes medical errors by nurses and doctors. Perhaps, the reason for not using these software systems with HIS is that at present, these computer systems are not exactly designed to match with nurses' work processes. In fact, in order to meet the nurse's needs, system designers must involve nurses and physicians in designing and development of HIS. In addition, the lack of compliance of nurses and physicians with these systems is another reason for slow expansion of HIS. The results of Piscotty et al. in 2015, were similar to those of the present study (23).

Contrary to some previous studies in health system, which indicate dissatisfaction with IT and computer networks (24), in the current study, nurses were confident with the use of technology in the hospital sector, and the associated support and management application.

However, the study by Cohen et al. (2016), on the analysis of the performance and importance of hospital information systems from nurses' viewpoint, in one of the developing countries showed that nurses were dissatisfied with the low number of computer systems in the department. Consistent with the current study, computer systems in the hospital wards are sometime occupied during the day (25). Therefore, proper training of nurses and suitable coordination can help to increase their ability to guide and optimize information availability (9).

The study of Guard et al. (2005) illustrates the use of informatics in all nursing activities (8), and the widespread use of IT in facilitating communication, coordination with other care providers even outside hospitals (26), and development of partnerships with health care providers between patients and their families (27, 28). However, in the current study, evidence-based care approach is not established by nurses. For example, contrary to physician and medical students, nurses have little tendency to electronic nursing documentation, and use of IT for nursing diagnosis. The results of a study conducted in Singapore show that inadequate ability of elderly nurses to use computers, is one of the nurses' challenges (29). Electronic documentation of nursing reports is useful in improving the interpersonal communication and facilitating communication with other health care providers (30, 31). In fact, nursing or hospital software systems are not designed based on nurses' workflow and the nursing process. Therefore, in addition to organizational policies, the poor design of these systems may cause dissatisfaction and increased workload for nurses (23).

According to the results of the current study, nurses are not interested in the retrieval of evidence and application in the care process.

As the physician orders, nursing reports, and patient care process are not recorded in any of the computer. Therefore, care providers cannot properly use evidence-based care, and this is one of the main shortcomings in the documentation of all medical records in the HIS. The findings of the study also show that despite the good progress in the use of IT, there are some limitations, including inadequate communication between information elements, repeat and increase of workload. Some studies have reported on the increasing success of the relationship between information elements, the development of the information network and the associated benefits (9). However, the expansion of the use of IT and its efficacy in supporting services and access to diagnostic results can indirectly help to accelerate the treatment and care process, and finally reduce the workload of nurses. Poon *et al.* study (2006) showed that clinical staffs had sufficient access to the results of patient tests and therapies, as well as integrated information systems (32).

One of the positive points of this study was the use of various information collection methods, as well as the participation of the main stakeholders and the use of their experiences, but the limitation here, is conducting the study in only one hospital. Therefore, it is recommended to expand the study, involving more hospitals and even focus on the use, outside of hospitals and between the health networks.

Conclusions

According to the results of the study, it can be said that computer systems apply for support and access to the parental information. In addition, the findings of the study have been taken into account that less attention has been paid to clinical information, clinical judgment and evidence-based care. In fact, one of the missing loops in the care management is the lack of use of CDSS systems in nursing care processes. By using these suitable informatics systems, the health care quality can be improved in clinics, and on the other hand, therapeutic errors and health care cost can be reduced. In other words, managers and policy-makers in the health sector should pay particular attention to the upgrade of systems in the care management processes and re-engaging organizational culture.

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AUTHORS' CONTRIBUTION

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

CONFLICT OF INTEREST

None declared.

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