Health Information Technology in the Knowledge Management of Health Care Organizations

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Background: The complexity of clinical decisions in health care organizations (HCOs) increases the information-processing demands, and the benefits of a Health Information Technology (HIT)-based Knowledge Management (KM). Therefore, since 1995, the health sector of Iran has gradually introduced and utilized hospital information systems, the internet, and office automation in HCOs to increase the efficiency of health care services. Studies show that the status of information management and knowledge in HCOs of Iran is inappropriate.
Objectives: The current study evaluated whether the current status of HIT and its application in the HCOs are in line with KM goals.
Patients and Methods: The study was performed on 550 staff members of hospitals affiliated to Semnan university of medical sciences in 2014. A researcher made questionnaire was developed. All medical and non-medical staff members were included in this study.
Results: According to the obtained results 15% of the subjects highly used clinical information systems for information exchange inside their institution, 35.5% somewhat used electronic reports, and in some subjects significant relationship was found between demographic background and attitude (P < 0.05).
Conclusions: It was concluded that HCOs need an HIT clearly designed with KM and they have to recognize where knowledge is resided, when designing strategies to warrant that knowledge is being created and transferred in the best way and to the right persons. Otherwise, the HCOs do not use an efficiency-oriented HIT.

Keywords: Health Information Technology; Knowledge Management; Efficiency

1. Background

In recent decades, organizations have shifted their main focus from capital and manpower to technology, and the current trend in organizational assessment has moved toward a focus on knowledge. Today, it is an undeniable fact that knowledge is considered a critical asset in organizations, and many institutions try to manage knowledge in order to maintain a competitive advantage (1, 2). Knowledge Management (KM) is a process by which organizations gain the ability to transform data into information and information into knowledge. They will also be able to apply and utilize the obtained knowledge in their decisions significantly (3). An important point of KM is to pay special attention to the role of information and communication technology as an effective and essential tool to achieve the goals of KM in organizations. Technology, especially health information technology (HIT), is one of the factors underlying the link between the different parts of an organization that pave the way for knowledge transfer (4).HIT can provide two major KM applications. First, by revealing

knowledge, it can create an expert or support system for decision making. Second, HIT helps various individuals with specific expertise to be informed about their different activities, and provides quick links between them (5, 6). Apart from hardware prerequisites such as infrastructures and the necessary tools, HIT needs software. The software presents itself as an information system in an organization (7).

To increase the efficiency, effectiveness, and quality of services and to generate client satisfaction in the health care sector, It is inevitable to use effective information systems (8). The information system of a hospital, data are simultaneously stored in a database available to the authorized users, wherever and whenever needed, with a structure compatible with their specific needs (9). Such an advantageous system not only reduces mistakes and increases speed and accuracy in providing medical services to the patients, but also can reduce costs via coordinating services and improving the quality of care (10).

Computer literacy of employees is vital in the new era in which organizations are equipped with computer networks such as the internet, office automation systems, and so on. Providing appropriate and high quality training for the staff is one of the best strategies to develop and retain them. Therefore, many employees working in health care organizations (HCOs) have passed training courses such as computer skills and application of information systems. Because of the changes in HCOs, successful organizations strongly feel the need to benefit from KM. Hence, the evaluation of HIT and its use in HCOs are of great importance. As a result, Long and Lai conducted a study to assess the role of KM in health care centers in China, and they put an emphasis on the role of IT and the development of KM systems in organizations (11). According to Dwivedi et al. telehealth is a dynamic technology to transfer medical information that can provide several opportunities to utilize KM in HCOs. They also believe that the integration of KM with HIT in organizational processes can help HCOs gain a deeper understanding of how to use the clinical data (12).

Given that the KM information system manages an organization's knowledge, HIT and related equipment also play a major role in this system. IT enables and facilitates the creation, collection, and storage of information and knowledge in an organization. Further, it helps the retrieval and sharing of knowledge among the organization staff, and above all facilitates the application of knowledge within the organization (13).

The complexity of clinical decisions in HCOs increases the information-processing demands and the benefits of an HIT-based KM effort (14). Therefore, since 1995, Iran health sector has gradually introduced and utilized hospital information systems, the internet, and office automation in HCOs to increase the efficiency of health care services. Accordingly, all medical and non-medical staff has passed computer skills training in order to take advantage of HIT.

Several studies are performed on the impact of information systems in clinical settings in Iran (15, 16). The studies indicated that health information technology had little role in clinical governance and health care organizations should develop standardized data sets, reporting forms, and mechanisms for data analysis.

Despite the occurred changes in HCOs, such as the introduction of a variety of clinical and administrative information systems and the emergence of related training courses, studies show that the status of information and knowledge management in Iran HCOs is inappropriate (17, 18). The Identification of HIT strengths and weaknesses leads to strengthening the knowledge management, the governance of IT in the health field.

2. Objectives

The current study aimed to evaluate the status of HIT and its application in the HCOs of a developing country based on KM goals.

3. Patients and Methods

First, ethical approval was obtained from the ethical committee of Semnan university of medical sciences. Then, a cover letter was prepared to describe the study purposes. The letter explained that responding to the questionnaire indicated the participants' consent to take part in the research. It also assured the participants regarding the confidentiality of the responses.

3.1. Subjects and Settings

The current descriptive study was performed in two hospitals (Amir-al-Momenin and Kosar) affiliated to Semnan university of medical sciences, Iran. The hospitals were selected because they had clinical and administration information systems and were connected to the internet from 2008. The research was performed from September to October 2014. All medical and non-medical staff (n = 550) were included in the study.

3.2. Data Gathering

An anonymous self-administered questionnaire was developed. First, a 16-item questionnaire was developed after reviewing KM literatures. It was divided into two areas: 1) Demographics, such as gender, age, job, education, and job experience; 2) HIT status and its use, such as using the internet, e-mail, information systems and electronic reports, information exchange inside and outside the HCOs, management support, the investment in HIT, the repetition of HIT training course, the use of updated applications, and the accountability of information systems to meet users' needs. The attitudes were graded as very low = 1, low = 2, partly = 3, high = 4, and very high = 5. Then, the primary questionnaire was reviewed for content validity by checking the suitability and accuracy of the questions with a group of experts in the management and HIT areas. Next, the questionnaire was rewritten and became more focused as a result of the experts' suggestions. Then pilot study of the questionnaire was conducted on thirty administrative and health care practitioners randomly selected from the two hospitals. Participants in the pilot study were excluded from the study. Internal consistency was expressed as Cronbach's alpha 0.753 for the second section of the questionnaire. Next, further revisions were made and some statements were rephrased. Lastly, the final version of the anonymous questionnaire was distributed among administrative and health care practitioners working in the hospitals and they were asked to complete the questionnaire. The questionnaire was returned maximum in 72 hours.

3.3. Data Analysis

To determine the distributions of responses, SPSS was

used to perform descriptive statistics. The mean and standard deviation for each item was reported. Mann-Whitney U and Kruskal-Wallis tests were used to compare the means. The significance level was set at $P < 0.05$.

4. Results

The total response rate of the questionnaire was 60%. In total, 325 out of 550 questionnaires were returned. The results indicated that 77.8% of the subjects were female, 60.3% were clinical staff, 68.7% of the participants were holding at least a bachelor's degree, 39.2% were 30 - 40 years old, and 31.7% had work experience of less than five years (Table 1). In the current study, 9.3% highly used the internet at work, 15% highly used the clinical information systems for information exchange inside their institution, 35.5% somewhat used electronic reports, 36.3% were slightly encouraged by managers to use information systems, 61.5% reported that their organization invested a little to update applications, 5.8% reported that HIT training courses were frequently held, 5.1% highly applied information systems for data exchange with other hospitals, and 20.2% reported that their needs were highly met by information systems (Table 2). Significant differences were observed between some of the subjects' demographic background and their attitudes such as gender ($P = 0.000$) and job ($P = 0.00$) (Table 3).

Table 1. Demographic Characteristics of the Participants [a]

Demographic Variable	Values
Gender	
Male	71 (22.2)
Female	249 (77.8)
Job	
Medical staff	191 (60.3)
Non-medical staff	126 (39.7)
Education	
Diploma	56 (17.6)
Bachelor's degree	219 (68.7)
Master's degree	15 (4.7)
PhD	29 (9.0)
Age, y	
< 30	9.7 (34.3)
30 - 40	111 (39.2)
40 - 50	68 (24.0)
> 50	7 (2.5)
Work history, y	
< 5	88 (31.7)
5 - 10	75 (27.0)
10 - 15	40 (14.4)
15 - 20	22 (7.9)
> 20	53 (19.0)

[a] Data are presented as No. (%)

Table 2. The Staff's Attitudes Towards the Use of Information Technology and its Status in Hospitals [a]

Attitudes Towards the Information Technology Usage Status	Very Little	Little	Somewhat	High	Very High	Mean ± SD
Information system helps to the use of internet in the working area	135 (41.6)	43 (13.3)	108 (33.3)	30 (9.3)	8 (2.5)	2.18 ± 1.1
Information system helps to the use of e-mail in the working area	214 (66.0)	52 (16.0)	43 (13.3)	11 (3.4)	4 (1.3)	1.58 ± 0.9
Information system helps to data exchange inside the organization	82 (25.7)	55 (17.2)	112 (35.2)	48 (15)	22 (6.9)	2.60 ± 1.2
Office automation system is used to exchange information	120 (37.3)	48 (14.9)	62 (19.3)	60 (18.6)	32 (9.9)	2.49 ± 1.4
Information system helps to make decisions	21 (6.6)	45 (14.2)	170 (53.6)	71 (22.4)	10 (3.2)	3.01 ± 0.8
Computerized records are used instead of paper records	89 (27.7)	44 (13.7)	114 (35.5)	60 (18.7)	14 (4.4)	2.58 ± 1.1
Manager encourages the use of information systems	116 (36.3)	72 (22.5)	106 (33.1)	22 (6.9)	4 (1.2)	2.14 ± 1.0
The institution invests on providing updated applications	195 (61.5)	59 (18.6)	50 (15.8)	12 (3.8)	1 (0.3)	1.63 ± 0.9
IT training is frequently held	105 (32.3)	75 (23.2)	123 (37.8)	19 (5.8)	3 (0.9)	2.20 ± 0.9
The system provides information exchange among hospitals	202 (64.1)	40 (12.7)	53 (16.8)	16 (5.1)	4 (1.3)	1.67 ± 1.0
Information system meets work needs	51 (16.1)	58 (18.3)	125 (39.4)	64 (20.2)	19 (6)	2.82 ± 1.1

[a] Data are presented as No. (%).

Table 3. The Difference of Attitudes Between the Groups

Demographic Variable	Mean ± SD	P Value
Gender		0.000
Male	2.55 ± 0.7	
Female	2.09 ± 0.6	
Job		0.000
Clinical staff	2.00 ± 0.5	
Non clinical staff	2.41 ± 0.6	
Education		0.187
Diploma	2.16 ± 0.5	
Bachelor's degree	2.17 ± 0.6	
Master's degree	2.60 ± 0.7	
PhD	2.32 ± 0.6	
Age, y		0.531
< 30	2.14 ± 0.6	
30 - 40	2.18 ± 0.6	
40 - 50	2.20 ± 0.5	
> 50	2.39 ± 0.6	
Work history, y		0.601
< 5	2.08 ± 0.6	
5 - 10	2.08 ± 0.6	
10 - 15	2.26 ± 0.7	
15 - 20	2.29 ± 0.5	
> 20	2.33 ± 0.6	

5. Discussion

The current study aimed to assess the contribution of HIT in knowledge management in health care organizations, and the results showed that the internet and e-mail were trivially used in the work scope of the employees. Other studies showed that the staff working in HCOs increasingly used the internet and email for decision making and service delivery (19, 20). Further, Ajuwon found that physicians increasingly used the internet to obtain health information to take care of patients (21). The difference in results indicated that lack of institutionalizing the culture of using the internet as a value to the organization leads to creating an environment in which the medical and non-medical staff cannot find opportunities to share their complementary knowledge via the internet, and the internet cannot be used as a KM tool to improve the quality of decisions with the help of other sources of information.

The results of the current study indicated a lack of support for HIT by health care managers and a lack of investment to update applications in HCOs that lead to the lack of a clearer picture of the status of knowledge resources. It prevents HIT from integrating explicit knowledge to support problem-solving and decision-making and cannot create an appropriate knowledge-based organization.

The results showed that the HCOs did not make enough investment to routinely train their employees in HIT. Lee's study indicates same findings. He evaluated nurses' experiences in the early stage of implementing a clinical information system. He found that nurses had insufficient training and experienced poor interdisciplinary cooperation (22). It suggests a lack of attention to organizational learning, and medical and non-medical staff cannot create, search, share, and use knowledge in their daily work.

The findings of the study indicated that computer reports did not completely replace paper reports. Kahouei et al. found that despite the introduction of clinical information systems in the hospitals, most of the employees were using paper records (23). The results showed a lack of alignment between the application of knowledge and organizational strategies, operations, and functions. Therefore the information systems cannot successfully integrate the generated data (13); HCOs fail to integrate their fragmented knowledge via information systems and cannot utilize them to deliver services (24, 25).

The findings of the current study revealed that information systems were not able to properly transfer information. The study by Kripalani et al. indicated the same findings. They examined communication and information transfer between hospital-based and primary care physicians. They found that communication among physicians occurred infrequently and access to patient reports after discharge was low, which impacted the quality of care (26). These results showed the lack of a knowledge transfer strategy focusing on rapidly disseminating knowledge. It leads to an inadequate transfer of a considerable amount of explicit knowledge in HCOs (5) and on the other hand, HCOs incur large expenditures to gain the knowledge that they could acquire internally through a robust exchange of information.

The study results showed that information systems are not understood as a critical component of the KM infrastructure and the HCOs are not recognized where knowledge is resided when designing strategies; and knowledge is not necessarily created and transferred in the best way and to the right persons. This condition caused the change of strategy to lead to minor variations in functions.

5.1. Limitations of the Study

The findings of the study should be interpreted with caution because it was performed using self-administered questionnaires. Potential problems such as poor understanding of the questions and possible answer bias can threaten the results, but the reliability and validity of the questionnaire may mitigate the possible negative impact on the results.

5.2. Implications

The results of the study had some implications. First,

the findings showed that HCOs should reconfigure their knowledge sources. It includes the use of existing sources and the ones that the HCOs may acquire. Combining these sources in new and various ways increases the efficiency of HCOs and helps them attain a better and more appropriate communication with the current external environment (5).

Second, the study showed that IT in HCOs should be accompanied by a global, cultural change toward knowledge. HCOs need an HIT clearly designed with KM.

Third, the study findings indicated that the impact of HIT on an HCO's efficiency depends on the organization's strategy. Earlier literature identified the importance of mutually aligning strategy and HIT (27, 28).

Fourth, the study indicates information system managers have no experience in efficiency-oriented HIT. It prevents HCOs with a high desire for efficiency from using HIT to utilize and share knowledge. Employing managers experienced in implementing efficiency-oriented HIT solutions will provide the chance to recognize and deploy IT solutions that support knowledge utilization (14).

Fifth, the study indicated the importance of accommodating HIT with a change strategy and the connection between the change and KM strategies in HCOs. These conditions allow HIT to prepare opportunities to create and experiment new knowledge that can be utilized to develop new services (15).

Sixth, organizational factors can have an impact on the use of efficiency-oriented HIT. For example, the strategic importance of information management in HCOs can affect the hospital managers' decision to invest in HIT. Additionally, the position of chief information officer (CIO) is very crucial in an HCO. When the CIO directly reports to the chief executive officer (CEO), and is one of the top level executives in the organization, it may place the CIO in a better position to affect the strategy of organization.

In HCOs with a high emphasis on efficiency, employing IT-based knowledge efforts are very useful and provide the largest efficiency improvements. However, the findings showed that the IT of HCOs was not conducive to knowledge usage, sharing, and creation. In other words, the HCOs do not use an efficiency-oriented HIT. The current study indicated that HCOs continue to work with the knowledge they formerly possessed and the means of knowledge transfer have not changed much. These conditions prevent HIT departments from providing significant value to the HCOs. The current study results indicated that, considering the current state of HIT in HCOs and the way it is used, these organizations are unlikely to provide an opportunity for meritocracy among their employees. The results showed that health care institutions failed to use their existing infrastructure to transform themselves into learning organizations. They have not been able to develop the existing HIT and leverage the existing knowledge to benefit directly from knowledge-based structures and knowledge-oriented employees. If HIT efforts are properly matched with the change strat-

egy of HCOs, they can introduce HIT governance in the field of health, and enhance quality improvements in health care services in the community.

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Authors' Contributions

Mehdi Kahouei: preparing grant submissions; Zohreh Molanoroozi: planning, preparation and approval of the original questionnaire; Mina Habibiyan and Sorayya Sedghi: the questionnaire conduction and data collection. All authors contributed to the writing of the article, and read and approved the final manuscript.

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