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Success factors of hospital information system implementation

Hadi Alizadeh-Siuki [1], Mostafa Sheykhotayefeh[2*]

[1] Department of Public Health, School of Health, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran
[2] Department of Health Information Technology, School of Allied Medical Sciences, Torbat Heydariyeh University of Medical Sciences, Torbat Heydariyeh, Iran

*** Corresponding author email: sheykhotayefeh@gmail.com**
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Abstract

Hospital Information Systems (HIS) implementation is a complex process which is critical for modernizing healthcare delivery. This study aims to investigate, analyze, and present a suitable model for HIS implementation adaptable to the social and working culture of hospital personnel.
This applied research employs a narrative review method. Library texts and internet sources were used to gather data on HIS implementation. Available literature was studied and analyzed to select and present a suitable model, which was domesticated based on the hospital needs and expert opinions.
The study revealed several challenges in HIS implementation, including lack of comprehensive planning, insufficient user engagement (especially medical doctors), unclear value for users, parallel manual and computerized systems, and undefined user roles. However, some cases demonstrated well-defined elementary training and system accessibility for users. Successful HIS implementation requires meticulous planning for time, cost, and human resources. Hospital managers' financial support and involvement in decision-making are crucial. User cooperation can be enhanced through training and demonstration of system capabilities. The proposed model addresses these issues, potentially solving implementation challenges. Key factors for success include stakeholder engagement, comprehensive planning, gradual implementation, continuous training, and ongoing evaluation.

Key words: Information System, Hospital Information System, Implementation, Hospital

Introduction

Due to the high amount of clinical data in hospitals which is the result of high number of patients who refer to the hospitals, and also the importance of accessibility of the data for users, manual systems have created a lot of problems for the hospital managements (1), to the extent that in many cases, accessibility to general or specific information in management, research and clinical areas is impossible and has forced the managers of medical records to have a repetitive job and feel an emptiness which results in inefficiency and not being responsive (2). On the other hand, users of the information derived from the medical document files such as managers, medical doctors and researchers have greater expectations about the accessibility of complete and fast information day after day (3, 4). This condition and legal request has made the managers of hospital medical records section disappointed and less efficient. Improvement of technology and expansion of computer usage by different users and also the capability of managers of medical document sections have led the hospitals to use hospital information system (HIS) in order to respond well to the information management via computers (5). It should be kept in mind that implementation and performance of a computer system in a hospital requires a comprehensive and a quite long term plan as if this plan isn't done by a full awareness of the needs of different users and a suitable method of the culture and working style of the hospital, there is a high possibility of the plan's failure and consequently a waste of time and money (6). An important point in the implementation of computerized systems is the capability of the heath centers management board to make users do things on time and create probable changes in working methods (7). For instance if the visits, in implemented computerized system, are supposed to end at 10 a.m., it must be done on time. Otherwise there will be problems in implementation. Thus the manager of the health center must guarantee that these changes in the working system of the forces will be performed and he must accept the consequences of performing these changes in the working method of the forces. Applying these changes in occupational therapy activities (esp. medical doctors) is not easy and requires creating a new working culture in form of systematic performance of a reformation paradigm. In other words a computerized system should be implemented in a hospital where its health staff are well aware of the capabilities of the system in solving patients' and hospital's problems. So, by realizing the need for a system like this, they do their best to help the implementation action (8).

Implementation of a computerized system in a health center or any other place brings a new culture with it. Creating the culture and accepting it by users, requires enough time, money and professional activities. If a computer system doesn't fulfill expectations and ultimate goals of its users, it will defeat and the users will not apply it anymore (6, 8). In this regard, this study aimed to investigate the success factors of hospital information system implementation.

Methods

This study is an applied one which is done in a narrative review method and has applied internet and library sources (including PubMed, Scopus, and Google scholar). The applied keywords were related to hospital information systems (radiology information system, laboratory information system, nursing information system, pharmacy information system, etc.), implementing (implementation, launching, and installation) and status (success, failure, challenges, and barriers). Different methods in investigations have been applied to implement hospital's information systems and by evaluating and analyzing them a suitable model for implementing hospital's information system was selected which was based on users' needs and social and working values.

Results

The developed HIS is comprised of subsystems include: computerized physician order entry (CPOE), Electronic Medical Record (EMR), Clinical decision support system (CDSS), billing, insurance claims, admission discharge transfer (ADT), Picture archiving and communication system (PACS) , and Customer

Relations Management (CRM). These systems also can be developed by the web-based approach (16).

Yaseen A. et al. (9) in an article entitled "expansion of applying doctors' awareness and knowledge about HIS" mention that expansion of applying doctors' awareness and knowledge about HIS systems plays an important role in its implementation. They implemented the HIS in 2003 in a hospital in Jordan and handed out a questionnaire including 38 questions among doctors and asked about their ideas of the system. The results showed that doctors used it to find the information they need and knew nothing about what the whole features of the system were and also there weren't enough IT employees during the implementation. In analyzing this article it's necessary to say that although doctors are important users of the system, there are other users as well and if they don't have a good function, the system will face problems. Besides, in this article, doctors' ideas were analyzed after the system was implemented and because primary trainings of these users weren't done, after analysis, a general educational plan was considered necessary while these users must have been trained earlier than the implementation in order to introduce the capabilities of the system to users and keep them pleased. We believe that the medical team is the strongest group in a hospital and if they are asked for their ideas before the implementation, they will be pleased with it and in different implementation levels, they can be good help for the implementation manager.

Ash J.S et al. (10) in their study titled "factors effecting implementation of health electronic files" believes that although general viewpoints present that doctors resist towards information systems and using computers, this resistance can be neutralized by participating them in investigations (17), analysis, and providing and installing hospital's system. According to the findings of the above study, and analyzing "investigations, analysis, and providing and installing hospital's system" which were mentioned in the present research, we should remember that these levels are prior to implementation of a computer system and researchers in this article aim at attracting the attention of the medical doctors in system implementation. They want to include medical doctors in each level even initial levels like providing and analyzing the system, so that their ideas will be applied and also their cooperation in implementation will be guaranteed.

Faraja T. in an article entitled "designing and implementing hospital's information systems in developing countries" mentions that all needs of the users should be found in designing the level of the plan and they must be included in order to involve the users in implementation level. Also the flexible nature of the software is a plus for users, so that it helps them use information at every level. What's more, it is necessary to use the system correctly, teach using it continuously for better adaptation and learning of the system (11).

Researchers and writers of this article by realizing the needs of users and including them in the system, mean that all users of the system must be asked for their opinions in designing level, in other words the system must provide working needs of its users to guarantee their cooperation in implementation level. That is, if we want the cooperation of all user groups of the hospital, it's necessary to ask about their ideas even in primary levels of the HIS system so that the users can see their working added value in HIS system and compare it to the manual system.

Aniza et al. (12) in an article titled "implementation of HIS in third grade hospitals of the health system in Malaysia" believe that investing on human forces, supporting the system, enough training for the users and user friendliness of the software have direct effects on implementation of the system. The most important factor in the success of the HIS system, is providing a well-designed system which covers all issues perfectly. A good plan and an accurate management assure us of a successful and acceptable system implementation by the users.

In this article as well as our suggested model, providing a general plan for system implementation and its details such as the required human force, the manager's support of

the system, and user friendliness and users training are considered essential and taking care of these details in implementation leads to a successful implementation. Implementing HIS system must be done gradually at different levels. Then the system is divided into some subsystems and the implementation is done level by level. The causes of presenting this kind of implementation are: continual referring to the system and also the close relationship of users with the system to minimize the disagreement of users by means of giving time to them to adapt to the new system (13)

If the HIS system is provided in different levels in planning and programming of the software, it is probably a system containing patients' reception, admission, discharge, and transfer (ADT), doctors' orders and result management, pharmacies and labs and so on.

Because implementation of HIS system is difficult and time consuming, it helps if above levels along with manual ones, be implemented in the process of patient's treatment. So the system is divided into subsystems and users are evaluated in every level. As well, the efficient management helps the implementation level realize new needs of the users and can fulfill them as much as possible (14).

Kimiafar Kh. in an article titled "The quality of information in viewpoint of hospital's information system's users" mentions that: in fact decreasing the costs of healthcare, increasing its quality and expanding health services are required and also applying hospital's information system and implementing and expanding these systems have a competitive advantage and are justified too. Computerized programs will be successful if they provide consultancy in professional levels and also if they can easily take care of the doctors' and other users' routines. This article, too, emphasizes the accurate evaluation of users' needs and in some other research this issue has been emphasized as well (15).

Hospital's software includes all clinical and executive systems. Systems like HIS or even Electronic Health Record (EHR) aren't typically single-user software, but they are managing packages including hospital's multi-systems which are involved in collecting patients' general information. Thus it is suitable for a hospital that is presenting the HIS system to compare 400-600 different software's. Keeping in mind that all capabilities of HIS must be considered while selecting the system, we shouldn't forget that selecting and implementing levels of software are closely related. If the system is stronger, user-friendlier and better in providing what users' need, it will certainly make fewer mistakes (16).

In another article titled "Implementation of Consolidated HIS: Improving Quality and Efficiency of Healthcare" that J. Choi has conducted in 2010, security and safety considerations for accessibility to patients' files and also entering data into information system in implementing the HIS are of high importance. Considering the security while entering the data and using a system, make users trust and use the system and this brings about a more successful performance of an information system. Providing a secure HIS system and making the users trust it are necessary features of software that would make users cooperate in implementation and expansion of the system (17).

Ron Borzekowski in an article titled "Measuring the cost impact of hospital information system" believes that it is necessary to train the users, domesticate the software and apply the modern information technology for implementing the HIS. Training the users as well as selecting the software and domesticating it are important factors in the success of implementing software which we emphasize it as well (18).

Jeffery McCullough in his article titled "

The adoption of hospital information system" states that the extent to which the implementation of a hospital's system is successful, differs according to the kind of management and ownership of different health centers. He mentions that implementing clinical information systems in private and for-profit hospitals is more successful than state and academic hospitals(19).

Also, the successes in performing these information management systems in for-profit centers have been more successful than other centers. Our experience proves that these 2

results, because of observing management principles in private centers and being more motivated for implementation, are more successful in implementation. That's why in our investigations, we emphasize on performing a plan for implementation (20).

Discussion

This narrative review aimed to investigate the success factors of hospital information system (HIS) implementation. The main findings reveal that successful HIS implementation is a complex, multifaceted process that depends on several key factors. These include: comprehensive planning with clear timelines and resource allocation; active engagement of all stakeholders, particularly clinical staff, from the early stages; continuous and thorough user training; gradual, phased implementation; strong support from hospital leadership; system flexibility and user-friendliness; robust security measures; and ongoing evaluation and improvement. The study found that while technological aspects are important, organizational, cultural, and human factors play equally critical roles in the success of HIS implementation. Addressing these factors in an integrated manner can significantly enhance the likelihood of successful HIS implementation, leading to improved healthcare delivery, increased efficiency, and better patient outcomes. These findings underscore the need for a holistic approach to HIS implementation that goes beyond mere technical considerations and embraces the broader context of healthcare organization dynamics. Generally, there are two methods of performing and implementing a hospital information system (HIS):

First method: Providing software's that perform different works separately

In this method, each person or supervisor of ward, according his awareness, recognition and need to computer, ignoring professional issues of informing such as the effect of clinical or Para clinical issues on treatment process and the necessity for unity of patients' information in hospital, uses stand-alone software. In this method, the result of every action on computer isn't transferred to the system which the next action is done in patients' treatment process; and this process is done much faster than the manual system and because of the scattered information of the patients in systems of different wards, the problem of manual systems will still exists. Besides, if identity information of a patient must repeatedly enter different systems, the information of patient's diagnosis and treatment is created in a different system so in this way, goals of the managing experts of health information and international sanitation and treatment system won't be reached and the important principle of the unity of each patient's information and its accessibility will not be answered. So it won't be possible to send and exchange patient's general information between wards or other health centers via computer. In this method, the hospital will be equipped with computers in every ward or unit, that according to their needs, the software with the suitable features is selected. These software's differ and do not adapt in format, operating system and programming language, and are possibly designed and provided in different time periods by different people ignoring the essential relationship between them. They are not even adaptable to the applied hardware. So there is no possibility of relation and electronic exchange of information between them.

Second method: Implementing general hospital information system

In this method, computer does the whole treatment, management and financial work of the patient using general software which includes different parts. So the start and finish time of all actions, are specific in the system and the delay in the first method won't happen here. And finally patient's treatment is done much faster with more relation between working stops of the patient's treatment and treatment factors. The output of this system is the decrease in time period of treatment by finding out the hidden parts of the treatment process. This decrease in time results in a decrease in patient's treatment, country's treatment's cost and an increase in quality of treatment services and patient's satisfaction. Also in such a system, every single action which is done by one person for treatment of a

patient, are specific and controllable, so the issues like controlling and supervising health centers can be easily possible for managers. Providing treatment and sanitation information management standards in this method will be possible using technological capabilities. Because all information provided by different sessions of patient's reception in a hospital is gathered in a unit, it will be available using computers. By creating telecommunication connection between hospitals and coordination in structure of HIS software's in different hospitals, relation, sending and exchanging information between hospitals will be easily done.

In this study, the key factors in successful HIS implementation identified include: 1) comprehensive planning: a well-designed implementation plan that addresses time, cost, and human resource requirements is crucial; 2) stakeholder engagement: involving all user groups, especially physicians and other clinical staff, from the early stages of system design through implementation, is vital for system acceptance and utilization; 3) user training: continuous, comprehensive training programs are essential to ensure proper system usage and to maximize its benefits; 4) gradual implementation: a phased approach to implementation, starting with core functionalities and progressively adding more complex features, can facilitate user adaptation and system integration; 5) management support: strong backing from hospital leadership, including financial support and active participation in decision-making processes, is critical; 6) system flexibility and user-friendliness: the HIS should be adaptable to the specific needs of the hospital and be intuitive for users to operate; 7) security and data integrity: ensuring data security and accuracy is crucial for building user trust and meeting regulatory requirements; 8) continuous evaluation and improvement: regular assessment of the system's performance and user satisfaction can guide ongoing refinements and enhancements. These factors are inter-dependent and should be considered holistically throughout the implementation process (6, 21-24).

Conclusion

This narrative review highlight several critical success factors for the implementation of Hospital Information Systems. The findings underscore the complexity of HIS implementation and the multifaceted approach required to ensure success. The success of HIS implementation relies not only on technological aspects but also on organizational, cultural, and human factors. Future research should focus on developing standardized metrics for evaluating HIS implementation success and exploring the long-term impacts of successful implementations on healthcare quality, efficiency, and patient outcomes. Additionally, as healthcare technology continues to evolve, studies examining the integration of emerging technologies (e.g., artificial intelligence and Blockchain) into existing HIS frameworks will be valuable. In conclusion, while HIS implementation presents significant challenges, adherence to these success factors can greatly enhance the likelihood of a successful implementation, ultimately leading to improved healthcare delivery and patient care.

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