doi: 10.5455/aim.2014.22.398-401
ACTA INFORM MED. 2014 DEC 22(6): 398-401
Received: 11 September 2014 • Accepted: 05 December 2014

Published online: 19/12/2014
Published print: 12/2014

ORIGINAL PAPER

Development of Hospital Information Systems: User Participation and Factors Affecting It

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ABSTRACT

Introduction: Given the large volume of data generated in hospitals, in order to efficiently management them; using hospital information system (HIS) is critical. User participation is one of the major factors in the success of HIS that in turn leads Information needs and processes to be correctly predicted and also their commitment to the development of HIS to be augmented. The purpose of this study is to investigate the participation rate of users in different stages of HIS development as well as to identify the factors affecting it. ***Method and materials***: This is a descriptive–cross sectional study which was inducted in 2014.The study population consists of 140 HIS users (from different types of job including physicians, nurses, laboratory, radiology and HIM staffs) from Teaching Hospitals Affiliated to Urmia University of Medical Sciences. Data were collected using a self-structured questionnaire which was estimated as both reliable and valid.The data were analyzed by SPSS software descriptive statistics and analytical statistics (t-test and chi-square). ***Results***: The highest participation rate of users in the four-stage development of the HIS was related to the implementation phase (2.88) and the lowest participation rate was related to analysis (1.23).The test results showed that the rate of user participation was not satisfactory in none of the stages of development (P< 0.05).The most important factors in increasing user participation include established teamwork from end-users and the support of top managers from HIS development. ***Conclusion***: According to the results obtained from the study, it seems that health care administrators must have a detailed plan for user participation prior to the development and purchase of HIS so that they identify the real needs as well as increase their commitment and motivations to develop, maintain and upgrade the system, and in this way, the success of the system will be assured.

Key words: Hospital information systems, development, user participation, design, analysis, implementation, evaluation

1. INTRODUCTION

As one of the most important social organizations, hospitals play a major role in improving the health status of the country as well as in providing health–treatment services that given the large volume of collected data, using Information Technology (IT) is essential in order to efficiently manage them (1, 2). Hospital Information System (HIS) is one of the IT tools covering all functions and operations that are done in the process of patient's care in various wards of hospital (3-5). Research all over the world have shown that on one hand, using HIS leads to provide qualitative, customer-oriented and cost-effective care services and on the other hand, the system can provide timely access to complete and accurate information (4-6).But, it is clear that despite potential benefits of HIS, its development in health care organizations is a complex and difficult task and its success and efficiency are dependent on several factors (7).In a study, Beuscart-Zephir et al showed that the role of human factors in implementing and applying HIS can increase the efficiency of these systems(8). Bellazer also considers the participation of users in selecting HIS system critical (9).The results of the study to Medical Records Institute (2005) showed that the most important factor affecting successful implementation of information systems is the user participation in HIS development (10). Based on users' needs and their current activities, health care managers should deeply analyze and then, choose the system (11).Other studies have also shown that users have effective ideas in designing and developing HIS and accept decisions on which they participate better (12-16).Among from them, users'participation and their insight and understanding to HIS cause to properly predict information and process needs and also increase their commitment to the development of HIS (13).The current policy of the Ministry of Health and emphasis by officials on more utilization of IT has augmented the acceleration of purchase and development of HIS in hospitals (14).Given that development of HIS is done in four stages of analysis, design, implementation and evaluation and the users' participation in each of these steps is to guarantee the success of these systems (15). This study aims to investigate the level of users' participation in the development of HIS in Teaching Hospitals Affiliated to Urmia University of Medical Sciences and also, identifying its effective factors.

2. METHODOLOGY

This is a descriptive- analysis study conducted cross-sectional in 2014.The studied population consisted of all HIS users in the Teaching Hospitals of Urmia University of Medical Sciences that among from them, by the method of multi-

stage cluster sampling, 140 individuals in various job (medicine, nursing, paraclinical, health information management, pharmacy and accounting staffs) were selected. Data were collected through a self-structured questionnaire and through visiting centers. The first part of the questionnaire is dedicated to the respondents' demographic information including sex, age, educational level, occupation, work experience and level of computer skills and using it.Its second part also includes the participation rate of users in developing hospital information systems that using available literature and conducted researches, it is in four main stages: of analysis (4 questions), design (5 questions), implementation (6 questions) and evaluation (4 questions).The participation rate of the users was considered through Likert standard and in 5 choice types (very low = 1, low = 2, medium = 3, high = 4 and very much = 5) that given the response to the samples, by calculating the mean obtained total score (1 to 5), the participation rate of the usersis determined and finally, factors affecting augmentation in participation rate is also specified. The validity of the instrument was determined based on concepts in the valid scientific texts and comments of experts (including health information management professionals, medical informatics and health services management).The reliability of the questionnaire was also assessed through calculating the internal consistency.In so doing, the designed questionnaire was given to15 cases of the research population and after collecting data, the value of Cronbach's alpha was estimated as 0.82.It was analyzed using SPSS software.

Four-fold stage	Related cases	Mean	SD
	Identifying problems of the previous information system	1.44	0.94
Analysis	Providing strategy and suggestion for development of HIS	1.28	0.74
	Need assessment of development of HIS	1.06	0.88
	Feasibility of development of HIS	1.15	0.84
	Determining hardware properties of HIS	2.25	0.77
	Determining software properties of HIS	1.64	0.94
Design	Determining data elements (informational needs) of HIS	2.44	0.68
	Determining the workflow and exchange of information in HIS	2.32	0.75
	consulting with designers of HIS system	2.08	0.69
	Purchasing and selecting HIS system	2.24	0.57
	Determining educational needs to development of HIS	3.53	0.69
Implementation	Participating in educational courses to development of HIS	3.92	0.42
	Experimental implementation of HIS system	3.66	0.65
	Determining the capability of using and the rate of being useful HIS	3.38	0.54
Evaluation	Converting to the new HIS system	3.44	0.48
	Evaluating the performance of HIS system	2.88	0.68
	Determining errors and problems of HIS system	3.32	0.74
	Proposing the necessary modifications in HIS system	2.46	0.77
	Monitoring and updating HIS system	2.25	0.65

Table 1. *Cases for rate of user participation in four-fold stages of developing hospital information systems (range of changes 1-5)*

3. FINDINGS

Out of 140 distributed questionnaires, 120 ones (87.5%) were collected. 64.2% of respondents were female and their mean age and work experience were 34.3 and 9.4 years, respectively and most respondents' educational degree (58.6%) was bachelor.The mean computer skill was 3.46 and its using rate at home and workplace were 3.18 and 2.66, respectively.

Based on the above diagram, in terms of job ranking, the maximum rate was related to nursing (30 %) and medicine (22 %) and the minimum rate was related to pharmacy staffs (6%).

According to the table above, at the stage of analysis, the highest and lowest levels of users' participation are related to identifying problems of previous information system (1.44) and needs analysis of developing HIS (1.06), respectively; whereas at the stage of design, the highest and lowest levels of participation are related to determining the data elements (information needs) of HIS (2.44) and the software features of HIS (1.64), respectively.At the stage of implementation, the highest and lowest levels of users' participation are related to attending in training courses of developing HIS (3.92) and purchasing and selecting HIS system (2.24), respectively; while at the stage of evaluation, the highest and lowest levels of users' participation are related to determining errors and problems of HIS system (3.32) and monitoring and updating HIS system (2.25), respectively.

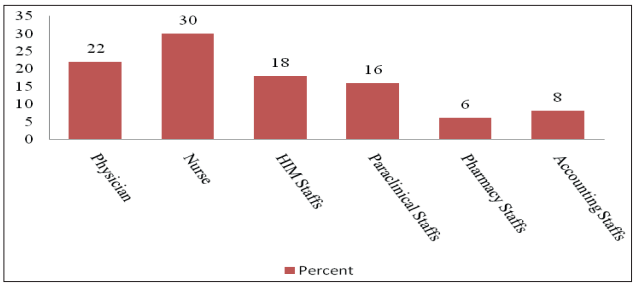

Diagram 1. *Distribution of respondents according to job*

Stages	Mean	SD	P-value
Analysis	1.23	0.84	0.001
Design	2.15	0.77	0.003
Implementation	3.36	0.67	0.005
Evaluation	2.73	0.71	0.001

Table 2. *The rateof users' participation in the four-fold stages of developing hospital information systems and determining the acceptable level*

According to the above table, in the four-fold stages of development, the highest and lowest levels of users' participation are related to implementation (2.88) and analysis (1.23), respectively. In order to determine whether the level of users' participation in each of the stages is acceptable or not, one-way one-sample Test was used.If at least 75% (score of 3.75 out of 5) is obtained in each item, the status will be considered appropriate and if a less grade is obtained, it will be considered as an inappropriate status.Given that P=0.00, this assumption (H: μ>3.75) was rejected at the error level of α=0.05 i.e. in none of the stages of development (analysis, design, implementation and evaluation), users' participation was satisfactory.In analyzing the relationship between background variables and user's participation, no significant correlation was observed (P>0.05).

Effective factors	Mean	SD
Understanding and awareness of the benefits of HIS development	4.18	0.56
Training the knowledge and skills required for working with HIS	4.15	0.76
Supporting top managers from the development of HIS	4.33	0.68
Creating motivation by encouraging and rewarding	3.93	0.78
Operational planning and drawing a detailed roadmap	3.35	0.75
Forming the work group of individuals and attracting users' participation	4.44	0.64
High speed and easily using HIS	3.32	0.83
Ensuring from the security and confidentiality of information in the development of HIS	4.22	0.71

Table 3. *Effective factors on users' participation in the development of hospital information systems (range of changes 1-5)*

According to the table above, the most factors affecting the level of user's participation are related to forming the work group of individuals and attracting user's participation (4.44) and supporting high- level managers from the development of HIS (4.33), respectively.

4. DISCUSSION

In a study entitled "Usability Evaluation of Hospital Information Systems based on IsoMetric 9241", Ahmadi et al (2010) suggest that for full and efficient use of HIS, vendors these systems in Iran should pay more attention to the adaption of the software with the level of users' skill and knowledge and also, the changeability of orders and works according to the users' needs and coordination of the software's response times with work faster (17). In their study conducted as a systematic review about users' participation, Robinson et al state that the end-users are the first informational source used in designing the system and their participation is necessary in determining the informational needs, technical requirements and its implementation and evaluation (18). In a study,entitled "Hospital information systems quality: a customer satisfaction assessment tool", Ribiere et al concluded that the best way to maintain user' satisfaction with hospital information systems is to design the system based on comments and needs of the users of the system not based on the comments and needs of the designersof the system (19). Given the importance of the issue, in this study, the level of users' participation was also investigated and the obtained results indicate that users' participation was not optimal in any of the four-fold stages of developing HIS in a way that at the stages of analysis and design, participation was very low.

In a study by McGregor (2005),entitled "End-user involvement in health technology assessment (HTA) development: a way to increase impact", the results showed that 66% at the stage of evaluation, 47% at the stage of implementation, 38% at the stage of design and 24% at the stage of analysis have played a role that compared to the conducted study, users' participation has been higher in all fields (20).

Martikainen et al studied the experiences of physicians in the field of participation with IT system that among from 124 participated physicians, 74 ones (60%) believed that their perspectives are ignored by designers and developers of the system and 28 individuals (22%) believed that designers do not apply their recommendations about modifying the system and generally, they felt their role is not profound (21).In the conducted study, at the design and evaluation of the system, level of users' participation is less.

5. CONCLUSION

Give that the level of users participation in the development of HIS is very low; therefore, in order to ensure the success of the system, it seems necessary that before developing and purchasing any systems, the health care managers plan to attract users participation at all stages, especially at the stage of analysis and design of the system so that real needs of information and process will be fully identified and commitment and motivation of the users in developing, maintaining and upgrading the system be also increased.

6. SUGGESTIONS

According to the results obtained from the present study, proper solutions to enhance usersparticipation include: assessing the preparation of organization and individuals in developing HIS, establishing appropriate communication and attracting full support of high- level clinical and executive managers, forming work-group with various specializations (clinical, managerial and information technology), selecting appropriate leadership, training and creating necessary skills for providers of health care, properly notifying benefits of the system and creating motivation in providers of health care.

Acknowledgement

I sincerely appreciate research deputy and all providers of health services in health centers of Urmia University of Medical Science thatcordially contributed to this study.

CONFLICT OF INTEREST: NONE DECLARED.

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