Published online: 26/03/2016 Published print: 04/2016

ORIGINAL PAPER

Accreditation of Management Communication and Information Systems in Public Hospitals of Sabzevar City, Iran

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doi: 10.5455/aim.2016.24.124-129
ACTA INFORM MED. 2016 APR; 24(2): 124-129
Received: JAN 13, 2016 • Accepted: MAR 05, 2016

ABSTRACT

Objective: Information systems are "computer systems that collect, store, process, retrieve, show, and provide timely information required in practice, education, management, and research". The purpose of these systems is to support hospital activities in practical, tactical, and strategic levels in order to provide better service to patients. This study aimed to evaluate the communication and information system (MCI) in public hospitals in Sabzevar city in 2014 from the perspective of human resources according to international standards of the Joint Commission Accreditation Hospital (JCAH). **Methods**: This study was a practical, descriptive, cross-sectional study. The study population consisted of Sabzevar nurses who used hospital information system. Sampling was done by classification method and in proportion to the number of nurses in each health care units in hospitals in 2014. The sample size was 200 and after referring to hospitals, 200 questionnaires were completed. Sample size was calculated by the formula $n=Z^2P(1-P)/d^2$ with P=0.5, α=0.05, d=0.05, and Z=1.96. Data collection tool was the questionnaire of assessment of hospital information systems of JCAH, which has 124 specific questions, including 6 areas. To assess the effect of demographic variables with MCI standards of two questionnaires (feasibility and implementation), the following steps were taken. 1. Kolmogorov-Smirnov test was used to determine whether responses were normal or not. 2. In case of normal data, t-test was used for dual groups and one-way ANOVA test for groups of three or more. 3. If not normal, Mann-Whitney test was used for dual groups and Kruskal-Wallis test for groups of three or more. **Results:** Research findings show the mean results of feasibility and implementation of all 6 areas of international standards MCI have feasibility in three hospitals in Sabzevar in 20 sections (H1=105.01±10.468), (H1=196.31±4.662), (H2=104.26±9.099), (H2=195.33±3.778) (H3=106.48±11.545) and (H3=197.57±4.943), respectively. **Conclusion**: The results showed that the mean feasibility and implementation of all six areas of MCI international standards is practical in three hospitals in Sabzevar in 20 wards. Also, 50% of users in clinical departments, physicians, and nurses agreed to appropriateness of the hospital information and communication systems for doing their duties.

Key words: Joint Commission Accreditation Hospital, Management Communication and Information System.

1. INTRODUCTION

Information technology (IT) has newly-emerged for healthcare (1, 2). IT specialists and hospital administrators must select and implement information technology that can reduce costs while providing high-quality healthcare (3). New technologies are associated with lower costs, saving time, improving work processes, and reducing medical error while delivering high-quality services in healthcare (4, 5). Although the use of modern technology offers many opportunities, this technology comes with risks. Modern information systems are costly and the failure of such systems can have negative effects on patients and operators and can waste the time of healthcare professionals if they are not properly designed (6). Generally, healthcare organizations, especially hospitals, benefit from the use of appropriate information systems (7).

Information systems are "computer systems that collect, store, process, retrieve, show, and provide timely information required in practice, education, management, and research" (8). The purpose of these systems is to support hospital activities in practical, tactical, and strategic levels in order to provide better service to patients (9). Nursing

information systems "as a part of health care information system deals with aspects of nursing care, especially nursing documents" (10). Clinical information systems support medical and nursing staff in their daily work by electronic data processing (11) and are often used as an efficient tool for delivering high-quality care through fast data retrieval and efficient data management (12,13). Given the extensive effect of IT and associated service costs in organizations, there is a growing need to assess the quality of these services, especially for measuring user satisfaction (11).

Users are the internal customers of management communication and information (MCI) systems and hospital information systems (HIS). Nurses, physicians and other healthcare workers who work with software spend a great deal of time each day filling out forms and reviewing forms of test results (12, 13). They are more than simple users and they evaluate the quality of the system in their daily use. If they are not satisfied with the quality of the system, they will not use it or will not use it correctly and efficiently. The staff in hospital environments may be pessimistic about a system or even reject new technology. If the communication and information system is based on MCI standards of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) (14-16) and users have the skills necessary to use them, they can complete their tasks well. Otherwise, they will not use the system properly; ease of use is an important aspect of user satisfaction (10, 11).

Approximately $36 million was allocated as economic stimulus to advance the creation of electronic healthcare records from 2011 to 2015 in the United States (4). The widespread use of hospitals information and communication systems has made evaluation of such systems essential. The perception of the successful implementation of hospital information and communication systems is critical for improving healthcare services (10-16). Evaluation of these systems is of great importance for decision-makers and future users of information systems. This study evaluated the management communication and information (MCI) system in the public hospitals of the city of Sabzevar, Iran in 2014 from the perspective of human resources according to international standards of the JCAHO.

2. MATERIAL AND METHODS

This was a practical, descriptive, cross-sectional study. The study population consisted of Sabzevar nurses who used hospital information systems. Sampling was done by classification and in proportion to the number of nurses in each health care unit in the hospitals in 2014. The sample size was 200 and 200 questionnaires were completed. Sample size was calculated as:

$n = Z^2p\ (1\text{-}p)/d^2$

Where n denotes the sample size; p denotes level of significance and equaled 0.5, α denotes Chronbach's alpha and equaled 0.05, d denotes and equaled 0.05, and Z denotes Kolmogorov-Smirnov and equaled 1.96.

The data collection tool was a questionnaire to assess hospital information systems according to JCAHO (14-17). It contained 124 questions covering six areas (14, 15) designed according to JCAHO criteria (2, 15):

- Communicating with society;
- Communicating with patients and their families;
- Contacting suppliers inside and outside the organization leadership and programming;
- Clinical records of patient;
- Data and information.

The questionnaires were categorized based on the Bugardos spectrum as feasible (2), relatively feasible (1), and not feasible (0). Scores of 0 to 2 were allocated to each question according to their importance and then each subject was weighed. Some questions had negative nature scores and their Bugardos spectrum scores were reversed using $r_i'=5-r_i$ for analysis (17). The validity of the questionnaire was confirmed by professors. The questionnaires were given to a number of staff members in two stages within one week. Agreement between the responses produced Cronbach's alpha scores of 0.85 and 0.86 for stage one and two, respectively.

To assess the effect of demographic variables on MCI standards for feasibility and implementation of the questionnaire, the following steps were taken:

- The Kolmogorov-Smirnov test was used to determine whether responses were normal.
- For normal data, the t-test was used for dual groups and one-way ANOVA for groups of three or more.

If not normal, the Mann-Whitney test was used for dual groups and Kruskal-Wallis test for groups of three or more.

3. RESULTS

Tables 1 and 2 shows the frequency distribution and demographics of the participants, respectively. Of the 200 participants, 63% were female and 37% were male. Of the participants who stated their qualifications, most had completed a bachelor level degree (68.5%) and 31.5% had completed a master's or doctoral degree. Of the participants, 25.5% had 11-30 years of occupational experience and none had participated in hospital communication and information courses. All hospitals were equipped with IT. The majority of respondents were aged 33-43 years (100 participants).

Hospitals	*n* (%)	Wards	*n* (%)	Clinical Manpower	*N* (%)	Non Clinical Manpower	*n* (%)
H1 (100 beds)	85 (42.5)	4	45 (22.5)	115	45 (22.5)	39	45 (22.5)
H2 (250 beds)	70 (35.0)	8	85 (42.5)	126	85 (42.5)	47	85 (42.5)
H3 (110 beds)	45 (22.5)	12	70 (35.0)	250	70 (35.0)	84	70 (35.0)

Table 1. Frequency distribution of 200 participants

Age	N(%)	Gender	N(%)	Marital Status	N(%)	Residence	N(%)
25-33	53(26.5)	Male	74(37.0)	Single	47(23.5)	Urban	162
33-43	100(50.0)	Female	126(63.0)	Married	153(76.5)	Rural	38
43-60	47(23.5)	Total	200(100.0)	Total	200(100.0)	Total	200
Total	200(100.0)						

Table 2. Demographic variables of 200 participants

Tables 3 and 4 show the results of normality testing for the feasibility and the implementation questionnaires, respectively. The test distribution was normal. Table 3 demonstrates the results of normality testing of normal test results of the implementation questionnaire. At an error level of 0.05, the responses to MCI standards were not normal in the six areas of feasibility.

Because the responses were not normal, the Mann-Whitney

Feasibility		MCI1	MCI2	MCI3	MCI4	MCI5	MCI6	MCIT
n		200	200	200	197	200	200	197
Normal Parameters	Mean	7.80	9.48	35.36	69.94	47.66	25.94	196.25
	SD*	.488	.862	2.197	2.156	.561	1.288	4.498
Most Extreme Difference	Absolute	.500	.424	.144	.151	.435	.215	.108
	Positive	.345	.271	.115	.105	.275	.155	.078
	Negative	-.500	-.424	-.144	-.151	-.435	-.215	-.108
Kolmogorov-Smirnov Z		7.075	5.993	2.033	2.113	6.151	3.042	1.518
p-value		.000	.000	.001	.000	.000	.000	.020

Table 3. One-sample Kolmogorov-Smirnov results for feasibility. a. normal test distribution, *SD = standard deviation

Implementation		MCI1	MCI2	MCI3	MCI4	MCI5	MCI6	MCIT
n		200	200	200	197	200	200	197
Normal Parameters[a]	Mean	5.14	6.30	19.98	29.69	34.44	9.42	105.08
	SD*	1.323	1.895	5.483	4.702	2.553	2.704	10.249
Most Extreme Differences	Absolute	.258	.143	.163	.167	.119	.135	.136
	Positive	.212	.125	.099	.167	.119	.135	.136
	Negative	-.258	-.143	-.163	-.083	-.079	-.090	-.094
Kolmogorov-Smirnov Z		3.647	2.024	2.310	2.345	1.687	1.913	1.905
p-value		.000	.001	.000	.000	.007	.001	.001

Table 4. One-sample Kolmogorov-Smirnov results for implementation.*SD = standard deviation

test was used to compare gender, and the Kruskal-Wallis test was used to compare groups of three or more. Table 5 shows the results for feasibility and Table 6 shows the results for implementation.

Tests	Gender	Marital status	Residence	Job	Employment	Education
Mann-Whitney U	3.827	2.966	1.922	1.534	1.870	3.896
Wilcoxon W	6.455	4.094	2.664	3.304	1.710	5.912
Z	-1.753	-1.644	-3.492	-6.947	-.512	-.874
p-value	.080	.100	.000	.000	.609	.382

Table 5. Demographic variables versus mean responses for feasibility

Tests	Gender	Marital status	Residence	Job	Employment	Education
Mann-Whitney U	3.276	3.342	2.589	1.112	1.654	4.117
Wilcoxon W	5.904	1.467	3.330	2.882	1.930	1.316
Z	-3.179	-.537	-1.370	-8.083	-1.350	-.279
p-value	.001	.591	.171	.000	.177	.780

Table 6. Demographic variables versus mean responses for implementation

Feasibility

There was a significant association at a 0.05 error level for contacting suppliers inside and outside the organization and data and information ($p = 0.080$). The mean responses of married participants at the 0.05 error level were higher for contacting suppliers inside and outside the organization than for single participants ($p < 0.05$). In other areas, there was no significant association between marital status and responses.

The mean response of urban participants was higher at a 0.05 error level than the others for communicating with society, communicating with patients and their families, and contacting suppliers inside and outside the organization ($p = 0.000$). No significant correlation was found between residence and responses in the remaining areas.

The mean response for Clinical Manpower was higher at a 0.05 error level than for non Clinical Manpower for communicating with society, communicating with patients and their families, contacting suppliers inside and outside the organization, leadership and programming, clinical record of patient), and overall ($p = 0.000$). In other areas, no significant correlation was found between occupation and response.

Implementation

The mean response was higher for men than for women at a 0.05 error level for communicating with society and data and information. The mean response was higher for women than men ($p < 0.001$) for contacting suppliers inside and outside the organization, leadership and programming, and overall. There was no significant relationship between gender and response in other areas.

The mean response of single participants was higher than for married at a 0.05 error level for communicating with society ($p < 0.05$). In other areas, there was no significant association between marital status and response.

The mean response of urban participants was higher than rural at a 0.05 error level for contacting suppliers inside and outside the organization and leadership and programming. The mean response of rural participants was higher for data and information and overall; there was no significant association between residence and response ($p > 0.05$).

The mean response of official staff was higher than for clinical staff at a 0.05 error level for communicating with society and data and information; the mean response of clinical staff was higher for contacting suppliers inside and outside the organization, leadership and programming, clinical records of the patient, and overall ($p = 0.000$). In other areas, there was no significant association between occupation type and response.

The mean response of permanent employees was higher than for temporary employees at a 0.05 error level for communicating with society and leadership and programming ($p < 0.05$). In other areas, there was no significant association between employment level and response.

The mean response of participants with a bachelor degree was higher at a 0.05 error level than for individuals with a master's or doctoral degree for communicating with society and leadership and programming ($p < 0.05$). In other areas, there was no significant association between educational level and response.

For contacting suppliers inside and outside the organization and overall, the mean response by hospital was: hospital 1 (H1: 100 beds), hospital 2 (H2: 250 beds), and hospital 3 (H3: 110 beds). There was no significant association between hospitals and response in other areas at a 0.05 error level. A significant association was seen between age group and staff position at a 0.05 error level ($p = 0.022$ and $p = 0.000$, respectively).

Tables 7, 8 and 9 show the mean results of feasibility (H1 = 105.01 ± 10.468, H1 = 196.31 ± 4.662, H2 = 104.26 ± 9.099) and implementation (H2 = 195.33 ± 3.778, H3 = 106.48 ± 11.545, and H3 = 197.57 ± 4.943) in all areas of MCI. A total of 50% of users in clinical departments, and physicians and nurses agreed that their hospital information and communication systems were adequate for the duties required.

Tests	Hospital	Age	Staff Position
chi-square	8.082	7.604	53.641
df	2	2	2
p-value	.018	.022	.000

Table 7. Mean response for age group versus staff position for feasibility a. Kruskal-Wallis, b. grouping variable

Hospital		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Total
H1	Mean	7.78	9.42	35.47	70.00	47.66	25.93	196.31
	n	85	85	85	84	85	85	85
	SD*	.520	.905	2.202	2.151	.568	1.352	4.662
H2	Mean	7.77	9.54	34.79	69.64	47.64	25.90	195.33
	n	70	70	70	69	70	70	70
	SD	.543	.811	2.226	2.086	.591	1.118	3.787
H3	Mean	7.91	9.47	36.07	70.30	47.71	26.00	197.57
	n	45	45	45	44	45	45	45
	SD	.288	.869	1.935	2.258	.506	1.430	4.943
Total	Mean	7.81	9.47	35.36	69.94	47.67	25.93	196.25
	n	200	200	200	197	200	200	200
	SD	.488	.862	2.197	2.156	.561	1.288	4.498

Table 8. Mean feasibility for MCI standards by hospital, *SD = standard deviation

Hospital		Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Total
H1	Mean	5.04	6.19	20.24	29.81	34.33	9.34	105.01
	n	85	85	85	84	85	85	85
	SD*	1.331	1.887	5.349	4.750	2.514	2.754	10.468
H2	Mean	5.44	6.46	18.89	29.04	34.59	9.76	104.26
	n	70	70	70	69	70	70	70
	SD	1.369	1.847	5.767	4.303	2.684	2.505	9.099
H3	Mean	4.87	6.29	21.22	30.45	34.44	9.04	106.48
	n	45	45	45	44	45	45	45
	SD	1.160	2.007	5.058	5.160	2.464	2.899	11.545
Total	Mean	5.14	6.31	19.99	29.69	34.45	9.42	105.08
	n	200	200	200	197	200	200	200
	SD	1.323	1.895	5.483	4.702	2.553	2.704	10.249

Table 9. Mean implementation for MCI standards by hospital. *SD = standard deviation

4. DISCUSSION

A management communication and information system is a group of processes that help increase the efficiency and effectiveness of healthcare organizations (hospitals) to implement their duties properly and achieve their desired goals (2, 10-11). Assessing the usefulness of MCI includes assessment and monitoring of all aspects of planning, development, implementation, and related activities required for decision-making in that environment (10, 15). MCI systematic evaluation of clinical healthcare workers helps improve performance, prevent medical error, and reduce stressful reactions and MCI costs by the adapting software to the needs of employees and network users (15, 16).

Users should understand how MCI functions; otherwise it will lead to system failure. If users of MCI do not have the knowledge necessary to use the system, achieving desired goals will be difficult (13, 18-21). Aggelidis concluded that assessment of user satisfaction with information systems may be the most effective method of assessment (22). User acceptance reflects how well a system matches the user (computer science) and job characteristics (reporting). User acceptance can be a sufficient indicator of whether an information system supports users in their clinical processes. When this support is the goal of an information system, user acceptance is a sufficient indicator of the overall success of the system (1, 14, 23).

The results of the present study for the adequacy of the criteria for a hospital information system indicate that 50% of the clinical and non-clinical users agreed and 27.8% partially agreed with the standards for communication with society. Mean scores for this criterion was 2.93 compared to 2.70 found by (14). Subramoniam et al. found that the suitability of criterion acquired the least satisfaction, which does not match the results of the current and other studies (5). A study conducted in Malaysia recorded higher mean nurse satisfaction than for other working groups (6). The greatest user opposition to software was for additional work that is not a user task. Tioelicact et al. quoted from Ahmadi et al. that of four types of software for hospital information, Dx required additional non-related tasks, which is consistent with the results of this study (24). The highest agreement (19.6%) for criterion was for suitability of terms used for the application environment. A study in Zahedan found that 80% of users assessed their hospital information system as appropriate for the job and 20% as relatively appropriate (25).

All clinical users agreed about the criterion of communicating with patients and their families. Most agreement was for immediate understanding of messages on the screen. The mean score for this criterion was 3 compared to 2.68 found (14) and 3.71 by Alipour et al. (26). A study in Taiwan showed that nurses observed that ease of use and usefulness of the HMIS system had a significant effect on acceptance of the system (45.1%) (13).

For contacting suppliers inside and outside the organization, 40.8% of clinical and non-clinical users partially agreed that this criterion was fulfilled. The most opposition was with the lack of sufficient guides in the system. Tioelicact et al. quoted from Ahmadi et al. that none of the four types of software offered a guide to users; this is consistent the results of the present study. Software manufacturers should seriously consider this issue when designing software. The mean for this criterion was 2.72 (24), compared to 2.97 for Hamborg et al. (14) and 3.8 for Alipour et al. (26).

Area 4 (leadership and programming) was in agreement with 16.1% of user expectations. The item upon which the majority of users agreed was the leadership and programming ability and the most fundamental problem in this field from the view of the majority of users was the instability of leadership and programming in all parts of the software. The mean of this area in the current study was 2.96, 3.06 for Hamborg et al. (14), and 3.5 for Alipour et al. (26). The results of this study are consistent with those from the other studies. In all three studies, this area ranked first among the six areas (14, 26). One study on information systems found that user expectations ranked second rank among 33 items on user satisfaction. The results of Zare-Fazlollahi suggest that the needs of 70.5% of personnel running communications and information systems were not met.

When the expectations of people whose occupational environment changes are not considered, they will not receive necessary training, and cannot accomplish their duties properly. This disregards the concept of position, expertise, and views on the implementation of the system. In such circumstances, lack of cooperation seems natural, because the system has been imposed upon them (27). Clinical user expectations in all wards, especially nursing wards, met with the lowest satisfaction, which ultimately means that failure to meet user

expectations in nursing wards resulted from lack of functionality and usability in a communication and information system that is limited more to financial and administrative tasks than support of clinical functions (21, 23, 26-30) .

For area 5 (clinical record of the patient), 15.3% of users completely agreed; the item with most opposition was system error (system hanging) which occurred while working with the software. The mean of system error tolerance was 2.83 in the present study, 2.85 for Hamborg et al. (14), and 3.48 for Alipour et al. (26). Another study reported that tolerance of system error tolerance by nurses was significantly better than by physicians, because of the greater occupational experience of nurses than physicians. Most nursing staff (43.8%) had worked with MCI software for more than 62 months, while 46.8% of physicians had used the software for over 12 months (13).

Only 20.9% of users agreed with area 6 (data and information). The most important problem from user perspective was adjustment of software response speed to user speed. The mean of this criterion was 2.56 in the present study, 2.12 for Hamborg et al. (14), 3.38 for Alipour et al. (26), and 2.57 for Ahmadi et al. (24). The results of this study are consistent with results of the other studies and all studies showed that the area of total data and information had the lowest score. These results suggest that hospital information and communication systems have a fundamental problem in this area and this criterion requires careful consideration.

For appropriateness of training, 37.9% of users relatively agreed and the highest percentage of user agreement was for ease of learning how to use the system again after prolonged abandonment of the system. This criterion ranked first in user satisfaction for Subramoniam (5). Nosratpanah et al,2010 found that 79% of users reported hospital information systems for educational assessment and meeting educational needs were appropriate and 21% relatively appropriate (25).

Azizi et al. showed that the hospital communication and information system in Tehran, Iran and Shahid Beheshti University poorly matched the criteria of colleges in the US. The most important reason for this discrepancy was lack of scientific and standard criteria (28). Kahooei et al. studied the acceptance rate of nurses and physicians of hospital information systems in Italy and found that 60% of nurses were satisfied with the usefulness of the system, 44% with the ease of use of the system and 88% were satisfied with the increased efficiency in daily activities with the hospital information system (9).

The results of studies in automated hospitals in the US found that management information, financial, and clinical systems reduced costs at all hospitals (31). Laerum et al. reported at hospitals in Norway hospitals that hospital secretaries used communication and information systems more than did physicians and nurses and believed that their job was simpler and their satisfaction higher (32). The results of a study in educational hospitals of Mashhad, Iran showed that 53.2% of users were satisfied with the quality of the hospital information system (18). Another study found that 55% of users agreed that using hospital information systems increased access to information, 45.8% decreased errors in patient care, and 28% improved patient monitoring of treatment (9).

5. CONCLUSION

Hospital communication and information systems should promote a fuller and deeper understanding of the needs and comments of users during development to increase their chances of success in achieving their goals, especially to improve patient care and community health using information technology. The results showed that the mean feasibility and implementation of all six areas of MCI international standards were in practice in 20 wards of the public hospitals in Sabzevar. Also, 50% of users in clinical departments, physicians, and nurses agreed to appropriateness of the hospital information and communication system for carrying out their duties.

All six areas of MCI international standards were assessed as desirable. Three public hospitals in Sabzevar totaling 460 beds were examined in partnership with donors, cardiac, neonatal, pediatrics, emergency, male and female internal medicine wards, and para-clinic units for thalassemia, hemodialysis, laser therapy, laboratory, radiology, mammography, ultrasound, and stress testing. The electronic hospital information system was launched in 1998 and successive phases have been completed. As noted, many employees shared in the success of these programs. It is evident that the more employees are informed about and have a more positive opinion of the programs, the greater the effect this will have on their success. Researchers assessed the effect of the hospital information system on hospital performance and work processes from the managerial and user points of view over the years since its design and initiation to help managers in Sabzevar University of Medical Sciences improve planning.

Suggestions:

The results of the study suggest the following for improvement and attainment of the desired goals of the MCI systems:

- Application of all six areas of information and communication standards in academic hospitals;
- Evaluation and validation of academic hospitals according to JCAHO standards;
- Training of all academic hospitals with the use of international accreditation standards;
- Involvement of all users by asking about their clinical and administrative needs and expectations of the system to prevent imposing duties that are not part of their job descriptions;
- The use of general descriptions and real examples with video tips when designing the software;
- Provision of sufficient guides for the system;
- Use of similar and exclusive definitions for meanings and words throughout the system;
- Using advanced hardware and proper communication channels to enhance the system response speed;
- Addition of menus, graphic interfaces, and other features to enhance user customization ability.

- **Acknowledgments:** This research is part of the PhD dissertation of the second author, which received financial support from Pardis International and Tehran University of Medical Sciences. We would like to thank all the managers and users who helped the researchers in this study.
- **Declaration of Conflicting Interests:** The author(s) declared no potential conflicts of interest with respect to the research, au-

thorship, and/or publication of this article.

- **Funding:** The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: which received financial support from Pardis International and Tehran University of Medical Sciences. We would like to thank all the managers and users who helped the researchers in this study.

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