

# A model for assessment of health care workers' health monitoring

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## Abstract

**Aims:** Application of Information Technology in health domain has led to improvement of treatment, optimization of management methods and reduction of health costs. The aim of this study was to propose a framework for healthcare employees' health monitoring system assessment and treatment based on the timetable, questions and the indexes of assessment.

**Methods:** This cross-sectional descriptive study was carried out in 2010. The statistical population consisted of individuals who were familiar with electronic health systems and had related job experience. 35 people were selected by systematic sampling method. Library research, Internet search and e-mail were used for data collection and indexes were classified based on their importance and a 20-question questionnaire was designed based on it. Data were analyzed by SPSS 14 software using Pearson correlation and non-parametric Mann-Whitney U and Kruskal-Wallis tests.

**Results:** There was significant relationship between the health monitoring system assessment efficacy and efficiency improvement ( $p < 0.001$ ), between the health monitoring system assessment recognition of the weak points of the services ( $p < 0.05$ ), between the managers' decision making and the employees' health situation ( $p < 0.001$ ) and between the system assessment and responding the researchers' needs ( $p < 0.001$ ). There was no significant relationship between the given scores and age, gender, job experience and education level ( $p > 0.05$ ).

**Conclusion:** Most assessments of health monitoring systems focus more on economic factors, but human factors and knowledge development should also be observed. Assessing the Health Information System in three areas of effectiveness measurement, efficiency improvement and knowledge development before, during and after the system administration are presented in the suggested framework of the present research.

**Keywords:** Assessment, Health Information System, Monitoring

## Introduction

System of information about health monitoring is a computerized system which has been designed to facilitate the management of medical and treatment information so as to improve the quality of health care [1]. The common goal of informative health systems is to unify the health systems in order to meet client's needs, to conduct epidemiological research and manage health information, avoidance of repetitions, promoting the quality of cares and to reduce the cost [2]. System of information about health monitoring is recognized as an informative system which normally has the responsibility of managing the data which could include re-reading, saving, analyzing or searching the data. The information found in this informative system is current information concerning people's health [3].

The implementation of system of information about health monitoring includes four main stages: 1- objectives, 2- design, 3- execution and function and 4- assessment. Therefore, it should be considered that assessing health information systems is not a detached

stage; rather, along the main work, the assessment stage should always continue [4]. Assessment means determining the importance, value and common situation by accurate scaling and study [4]. In other words, assessment is part of the study which indicates whether specific activities will have favorable effects or not. Assessment is an essential part of the cycle of developing informative systems [5].

There are different criteria for assessing informative health systems. None of informative health systems would divide their content and functions in a formal fashion. Hence, it is not surprising to find diverse variety in employed assessment methods both in work and executive areas; although there are principles which may direct us; the crucial point in assessing systems is that whether informative system has been useful for that center or not [5]? Or what has been the objective of assessment and that how and with the help of which approach, it should be accomplished [6]?

Health information systems are software systems on which both rural and native rules play a great effect both in designing and assessing. Thus, it is observed

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that a software is produced in one place of the world and will be used worldwide in other parts of the world but as for the systems of health information, this is not the case and will not be. That is why assessing and value making of health information systems have faced different problems both in terms of purchase and level making and designing. As for the approach to assessing informative systems, there are various recommendations [7]. Most books and articles regard assessment as quantitative widespread processes which will calculate the cost of benefit. *King et al.* provide genetic and final assessment for informative systems [8]. In other research, it is indicated that this framework could be based on 13 principles: Strategic view, contribution, public accompaniment, law decree, transparency, responding, equality of rights, comprehensiveness, effectiveness, efficiency, responsibility, intelligence and information, morality [9].

*Salarian Zadeh & Yousefian Aspeli* have addressed the objectives of assessment in five categories [10]:

- 1) Improving the quality and increasing the output
- 2) Better decision making
- 3) Gathering data required for responding (and taking responsibility)
- 4) Creating the possibility of comparison and safe rivalry
- 5) Creating a sense of responsibility for achieving the objectives

In each year, diverse software enter the new market of technology so as to be used in health and treatment centers to increase health in an attempt to smooth this path. This has led to creating new business in recent years. The recognition of the capabilities of these programs and the selection of these programs are of crucial issues that organizations and centers face. The existence of standards in this regard can be useful and essential but they do not seem enough.

Although information technology has provided the countries with great benefits and opportunities, there are some side effects and damages along with them which their neglect in health section could sometimes be dangerous and irreparable. On the other side, considering that Iran has no option but to use these technologies, there should be written policies and counter-active approaches to its consequences, and it is necessary to scrutinize the assessment of this employment and that it be calculated as far as possible while being appropriate with its native features.

The objective of this study is to provide a framework for assessing the system of health care workers' health monitoring on the basis of assessment time schedule, assessment questions and indexes.

## Methods

This research is of descriptive-cross sectional nature which was done in 2010 in one of Tehran's military hospitals. The people under investigation were those who were familiar with health electronic systems and had worked with these systems. These included: a few members of scientific board (OFIS) of medical science university belonging to the same hospital, IT section chairman of this university, manager of informatics section of this hospital, a few experts of the deputy of research and development of health and medical training ministry and a few managers of the companies operating in this field. The samples under investigation were selected by systematic sampling and the sample volume was defined using related formula, amounting 35 individuals. In order to gather data, first, library studies and searches were done on internet and information databases of EiDis, Medline, PubMed and also searches in articles from 1998 to 2010. The keywords in this search included: assessing health information systems, assessing sanitation information systems, effective framework for health system and health electronic files. The objectives of these researches were the concept of scaling and assessing, the reason for assessing and diverse types of assessment in informative health systems and assessment indexes. In research findings, several methods and frameworks were indicated to assess informative systems, each of which had their own advantages and disadvantages [11 and 12]. Eventually, the sum of assessing indexes in developing countries, which was done in 2008 by Michigan University and also by assessing indexes of *Brukle* and Health field, was ordered according to their importance and a questionnaire was formed on their basis [13 and 14]. This questionnaire included 20 questions which scrutinized the system from public aspects, science development, financial and human factors. The mentioned questionnaire was scrutinized by related teachers (or masters) in terms of validity, reliability and was applied to experts in the field. To determine the validity of the questionnaire, the method of content validity was used and to determine the content validity, samples of the questionnaire were offered to a few of the Faculty's dear masters and related experts in the hospital so as to express their views on the accuracy and clarity of the questionnaire's questions which they finally confirmed its validity. To determine the reliability of the questionnaire, the Alpha Cronbach criterion was used. It is necessary to mention that a questionnaire could be called reliable when the amount of its Alpha Cronbach is more than

0.7. In recent questionnaire the Alpha was equivalent to 0.891 which, in turn, showed the reliability of the questionnaire. The questionnaire was given to 40 people of whom 35 people completed it.

To determine the most important indexes of assessing the system, the indexes which more than 75% of people recognized their importance as excellent or good were selected as the most important indexes.

According to the findings, the assessment of health monitoring system is done in 6 stages which are in order as follows:

- 1) The necessity of doing assessment (why assessment is necessary)?
- 2) Time scheduling of assessment (in three stages, before, middle and after performance)
- 3) The concept of assessment (determining the importance, value and common situation, using scales and precise research)
- 4) The way of assessment (determining indexes and the way of gathering data)
- 5) The way of analyzing the assessment outcome and its report
- 6) Assessing proposals and decision making based on them

To analyze gathered data, the absolute and relative frequency of research variables was determined. Gathered data was investigated to scrutinize the status of data distribution, using Kolmogorov-Smirnov test which did not have normal distribution. Then, to determine the existence of the relation between age, work experience, education level and the give scores, Kruskal Wallis non-parametric test was used and to investigate the relation between gender and the given score, Mann Whitney U non-parametric test was employed. To analyze research hypotheses such as the relation between the scales of effectiveness of health monitoring system and increase of productivity rate, (the relation between) scale of health monitoring and recognizing the weak points of the provided services, the organization's authorities decision making and the health status of organization's staff, the system's scale and response to researchers' needs, the test of Spearman's correlation coefficient was used. Also, data analysis was done using the software SPSS 14.

## Results

Respondents to the questionnaire were, in terms of education, 37% PHD, 26% Master of Arts, and 37% Bachelor. In terms of gender, 29% were women and 71% were men. In terms of work experience, 51% were having from one to ten years of experience, 43%

from 10 to 20 years of experience and 6% were having more than 20 years of work experience. There was not a significant relation between age categories, gender, work experience and education level and the given scores. In other words, the questions were the same, in terms of score and concept, for all age categories, all genders and all education levels and work experience.

**Table 1-** The investigation of the relation between research hypotheses and the given scores

Research hypothesis	Level of significance	Correlation coefficient
<b>Relation between scales of the effectiveness of health monitoring system and Increased productivity rate</b>	0.0001	0.922
<b>Relation between scales of health monitoring and recognition of weak points of provided services</b>	0.077	0.303
<b>Relation between organization's authorities decisions making and the health Status of the organization's crew</b>	0.0001	0.811
<b>Relation between scales of system and response to researchers' needs</b>	0.0001	0.821

Respondents to the questionnaire selected 60% good option, 8.5% mediocre option, 31.5% weak option in terms of the effectiveness of the system, 69% good option, 31% mediocre option in terms of the recognition of weak points of the provided services, 60% good option, 9% mediocre option and 31% weak option in terms of the possibility of responding to the users' needs by scales. There was a linear and significant relation between scales of the effectiveness of health monitoring system and increase in productivity rate ( $p < 0.001$ ), between scales of health monitoring and recognition of the weak points of the provided services ( $p > 0.05$ ), between the organization's authorities decision making and the health status of the organization's crew ( $p < 0.001$ ), between the scales of the system and responses to researchers' needs ( $p < 0.001$ ) (Table 1).

Eventually, a model was proposed to scale the system in three areas:

To scale effectiveness: Measuring results (Table 2), Scaling improvement of effectiveness (Table 3), and scaling development of knowledge (Table 4).

**Table 2-** The framework of scales of effectiveness: Measuring results

Time schedule	Typical questions	Indices
<b>Before performance</b>	1- Does the system work as it has been designed?	Validity making, accuracy, test' capability
	2- Does system create the required outcomes?	Usefulness, validity making, productivity, access to data, accuracy and their completeness
<b>During and after performance</b>	1- Does running the system create a harm to the control of the system	managerial structures, supporting schemes, safety and confidentiality structures
	2- Is the speed of access to the system in a satisfactory level	Response time of system, the easiness of using options, crew's satisfaction
	3- Does the system reveal the weak points of the provided services?	The cost of executing systems, the length of patient's stay, use of irrelevant experiments, the number of doctor's visits

**Table 3-** The framework of assessing the improvement of function

Time schedule	Typical questions	Indices
<b>Before performance</b>	1- Have standards and documentaries required to access the systems been recognized and written?	Documents of management of the project, standards, documentaries, effectiveness, desirability
	2- Have security procedures such as confidentiality, manual control, etc. in the system been recognized and written?	Validity making, credit building, security confidentiality structures and safety in the place
	3- Are there enough connected- to –the- internet computers as many as the users?	Productivity, interactional patterns, network infrastructure
	4- Do different facilities in the organization use enough technology?	The quality of service, the installation capability, cost estimation, benefits
<b>During and after performance</b>	1- Is the system cost-effective?	Cost estimation, benefits and capital refund
	2- Is the system used as predicted?	Time schedule table, function, modification capability, prediction capability
	3- Is the system accepted and used?	Assessing human factors, usage capability
	4- Is the employed software used entirely in the form of network in the organization?	Network's patterns and its network in the organization? infrastructure, usage capability

**Table 4-** The framework for scales of developing science

Time schedule	Typical questions	Indices
<b>Before performance</b>	1- Are the crew aware of the effects of using IT on the increase of productivity and function output?	The staff's function in pretending, users' reaction, analysis of tasks, cited expectations about the effect of the system
	2- Are the crew satisfied with the provided software in the organization in terms of meeting the needs?	The assessment of human factors, user's satisfaction, workforce's faithfulness, explorative investigation
	3- Have the crew been received enough training in terms of this software?	Training the crew, interactional patterns, description of tasks
<b>During and after performance</b>	1- Does using the system lead to better and effective decision making of managers to provide health services?	The time for doing the tasks, using the system in decision making, daily use of the system
	2- Does health monitoring system meet the researchers' information needs in terms of doing medical science researches?	Access to clinical information, using the system in decision making, accuracy and comprehensiveness of the data
	3- Can the system recognize the variety of crew's diseases?	Assessing clinical effects, access to clinical information when required, use capability

**Discussion**

Brukle has assessed the informative systems from several aspects which include: Confirmation of systems, validity making, human factors and assessing clinical effects. In the assessment framework derived from this research, assessing the system of health monitoring is done in three aspects of scaling

effectiveness, improving efficiency and developing the crew's knowledge. However, considering the stated concepts, system confirmation equates effectiveness and validity making equates improving efficiency. Human factors and clinical effects have equated with "creating awareness or developing knowledge" in this research. Health field has proposed the assessment of

informative systems in three periods of time, before the performance, during the performance and after the performance, which the researcher has tried to use these periods of time in the proposed assessment.

ISO 9126 assessment model, which is based on *Bohem & McCal* assessment models, emphasizes on system's function and also recognition of qualitative particulars of the system which the researcher has considered it as the efficiency improvement framework of the system [15].

*Margaret's* proposed model from Michigan University was comprised of comparison among three assessment indexes of effectiveness, efficiency, the equality of rights in health informative systems in developing countries [13]. Researcher designed a framework, using this standard framework along with other provided frameworks, which possesses the benefits of above-mentioned models and on the other side, to be compatible with native conditions of health electronic systems in Iran [16]. It has been tried in this framework to consider more the factors of knowledge and awareness expansion, which have been devoted less attention in other frameworks, in addition to economic and financial factors.

The crucial point is that assessing and scaling the human factors is too much difficult and to do so, there is a need for experts in this field and according to *Jabrieli et al.*, the factors raising awareness and affecting user's knowledge should be identified and the necessary training, to increase computer skills and people's awareness, be provided [17].

In the proposed framework, the index of user's satisfaction was assessed. But the important point to be considered is that it is approaches like questionnaires, interviews with the crew dependent on user's memory and their work experience of computerized informative systems that could be different from their real behavior and as such, it could not be an appropriate assessment in this area [16]. So, it is proposed that assessment processes be in harmony with the system under investigation.

Considering the previous researches and above-mentioned research, what should be taken into account is that constant assessment of health electronic systems should be done and to achieve this, it is necessary to define a standard framework based on scientific principles and in collaboration with native conditions of health electronic systems. To do so, it should be a section or department to scale the health system. In this section, considering the previous assessments based on the framework, there should be launched a major step to achieve assessment goals such as quality promotion and increase in productivity

and better decision making, creating a safe competition and the possibility of making comparisons with other systems and also gathering required information to respond.

## Conclusion

In most cases of the assessments of health monitoring systems, financial and economic factors are considered more, while human and raising awareness factors should be taken into account equally. In the proposed framework of this research, assessing health informative systems is provided in three areas of scaling effectiveness, improving efficiency and developing knowledge within the time period of before performance, during and after performance of the system.

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