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The Iranian Journal of Radiology is the official journal of *Tehran University of Medical Sciences* and the *Iranian Society of Radiology*. It is a scientific forum dedicated primarily to the topics relevant to radiology and allied sciences of the developing countries, which have been neglected or have received little attention in the Western medical literature.

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Presenting an Implementation Model of Nursing Wireless Terminals in Electronic Hospital

Reza Safdari¹, Mashallah Torabi², Zahra Azadmanjir^{1,*}

¹Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran

²Faculty of Tehran University of Medical Sciences, Tehran, Iran

* Corresponding author: Zahra Azadmanjir, Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-9128118827, E-mail: azadm@razi.tums.ac.ir

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Background: Wireless technologies-based systems particularly mobile devices have a great potential for help to nurses in the hospitals. They can be used as wireless terminals of large-scale information systems. There are affecting aspects about the implementation process of wireless terminals in nursing.

Objective: The purpose of current study is presenting a model for implementation of this technology in hospitals of the country.

Materials and Methods: This research is a descriptive-comparative study. After review of literature on wireless technology in nursing care, comparative study has done in several countries that are using from wireless terminals in nursing including Canada, Australia, England, Taiwan and South Korea. Then, based on the results and best practices in selected countries, a model proposed.

Results: All five studied countries use wireless local area network for establishment of communication infrastructure. Connection with the admission, discharge system of hospital, retrieving patient's data from database, recording nursing observations, accessing to care plans, documenting nursing notes and connecting to laboratory and radiology systems are common functions of the terminals in studied countries.

Conclusions: In the proposed model, implementation key aspects that include the purpose, application domains, and the functions of wireless terminals, network technology, mobile devices, user interface and the information structure of the system have described in the logical framework. Because, the model has presented based on scientific principles and the experiences of other countries, it can be an appropriate model for future efforts in this field.

Keywords: Mobile Health; Nursing; Wireless Technology; Bedside; Hospital

1. Background

Wireless technologies-based systems particularly mobile or handheld devices with clinical applications have a great potential to meet communication needs for medical and nursing staff in the today hospitals and the future electronic hospitals. These can be used by nurses in order to complete data communicating and processing duties in a faster and better way (1-4).

In some of countries such as Finland, Germany, Canada, Brazil, South Korea and Taiwan, mobile devices used by nursing staff as wireless terminals or input-output part of large-scale information systems, for instance hospital information system, clinical information system (CIS) or nursing information system (5-11).

Several studies conducted on the benefits of using from wireless or mobile terminals in nursing practice. These benefits are including following cases: 1) real-time electronic documentation and charting of patient care data

(e.g. vital signs, assessments, observations, and body hydroelectric balance) in the bedside (9-12). 2), timely retrieving of archived clinical data related to patients (e.g. health history, care plans, nursing notes, lab results) from central database (5, 9). 3), Controlling of medicine administration based on physician orders for each of patients and completing of the medicine administration record in real-time that will be accountable for the decrees of medication errors related to nursing performance (12-16). 4), decision support for nurses by mobile devices equipped to drug or medical reference applications and capabilities of alerting for drug interactions (17). 5), Clinical data exchanging in every time and setting (4, 18, 19). 6), enhancing productivity of nursing staff (2, 19). Several projects can performed in around the world for develop and implement mobile-based applications that used by nurses but accomplishment of these in form of fully integrated in the hospitals is more complex than which are stand along. Nevertheless, there are different

Implication for health policy/practice/research/medical education:

The paper is about one of the telehealth applications. It can be useful for develop and implement wireless technologies or mobile terminals for use in clinical practice in hospitals.

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aspects in the process of development and implementation of wireless terminals in care practice which affecting on outcomes of that. For this reason, we studied different aspects through rational framework and examined the aspects in real examples available in some of countries for presenting of a model for implementation.

2. Objectives

The objectives of present study are identify the most important aspects based on previous studies and then, the comparative study of nursing wireless terminals in several countries and finally, presenting a model for implementation of this technology in hospitals of the country.

3. Materials and Methods

This research conducted in descriptive-comparative method. Information gathered from several sources. First, review of literature about wireless or mobile technology in nursing care by search in paper resources and electronic databases such as Pub Med, EBSCO and Ovid and so on. Second, comparative study has done in several countries that use from mobile terminals in nursing practice. The studied countries were Canada, Australia, England, Taiwan and South Korea. The purpose and application domain of the wireless nursing terminal system, type of selected network technology and mobile device for implementation and functions or capabilities compared. In addition, if possible, the structure of information in the system and the process of development studied. Selection of studied countries performed based on following reasons:

In America, Brazil and Canada have initiatives related to this high-tech solution. In Brazil hand-mobile device with integrated wireless network interface use to help nurses in the nursing process (9). However, enough information is not available for present studies. In contrast,

Canada has a nursing information system (5) that used in expended level in the country. The system equipped to wireless nursing charting technology (6). Therefore, Canada selected.

In Oceania, Australia was selected because this technology developed by university projects in some of hospitals (20-22). In Europe, England, Finland and Germany are active; however, only required information for this study has been exist on England. In this reason, this country has studied. In Asia, Taiwan and South Korea developed nursing wireless terminals in the some of their hospitals and information related to these has been available. Then both two countries have selected.

4. Results

The results of first section of present study showed that there are several issues on use of wireless technologies in healthcare and particularly nursing care, which should considered. They are include but not limited to following issues:

4.1. Communication infrastructure

Communication infrastructure described as telecommunication technologies, networks and protocols used. They are fundamental technical requirements which effect on capabilities of system (23). Specifications and data transfer capacity in wireless network technologies should be considering according to aims of implementation and expected functions. In the present of time, most wireless technologies in care industry are wireless local area networks (WLANs), Bluetooth and ZigBee. The features of these network described in Table 1 (23, 24). According to Ammenwerth, due to good range and data transfer rate in WLANs and their potential for connect with existing wired local networks, they are proper networks in care (4).

Table 1. Specifications of Wireless Network Technologies in Healthcare

Network Specifications	WLANs (Wi-Fi ^a) (IEEE802.11b/g)	Bluetooth (IEEE802.15.1)	ZigBee (IEEE802.15.4)
Frequency band	2.4 GHz	2.4 GHz	2.4 GHz
Bandwidth	20 MHz	1 MHz	5 MHz
Data transfer rate	54 MBPs	732-733 KBPs	250 KBPs
Range	50-100 m indoor 100-500m outdoor	0-100 m	0-30 m

^a Wireless Fidelity

ZigBee in healthcare domain usually is appropriate technology in order to establish the wireless body area networks for transferring biomedical signals such as electrocardiography (ECG) and electroencephalography (EEG), from body sensors to bedside monitoring equipment (24). Bluetooth often applied as a communicating method between wearable sensors and mobile phones, Personal digital assistant or laptops in form of wireless personal area

network (WPAN) for telecare and telemedicine (25, 26). For this reasons, two technologies, which noted, cannot provide most proper capabilities for nursing terminals.

According to some researcher, nurses are often moving between bedside and nursing workstation in wards of the hospital for conducting of their duties such as care documentation and orders communication. For this reason, they stated that it seems that WLAN is proper net-

work for connect between mobile devices used by nurses with central clinical database and other information systems in the hospital (4, 27, 28).

4.2. Device Type

Personal digital assistant (PDA), tablet and laptop are three types of common handheld devices which used by care providers. Using from PDA in healthcare begins from 1990 and then gradually was popular device for timely access to information resources in clinical and educational domains of nursing (29-32). Findings of several research showed that PDA is proper from functional aspect for documentation (33). In contrast, other same studies showed, physical specifications, limited memory and small screen size, difficulty of data entry and low speed processor of PDA are problems for using from it by medical and nursing staff (23, 34, 35). However, laptop has not limitations of PDA, but according to some of experts, tablet is the best alternative for PDA in care practices for documenting, retrieve and display of medical images in beside (23, 36).

4.3. Interface Configuration and Data Display

It is refer to design of user interface and display various types of data such as text, image and multimedia data. In this regard, ergonomic design of used device, data entry methods, resolution, structure of screen and navigational capabilities are notable issues that will effect on adaptation of the system by nurses as end-users of nursing wireless terminals (12, 13, 23, 28, 36).

4.4. Purpose and Functions of the System

wireless systems applied in different area of healthcare such as emergency settings for triage (21, 37, 38) or monitoring of patients physiological signals (39). Purposes of using are various in depended on application domains. Nursing application domain is extended from physiological condition of patients, documenting or charting to decision support and medication administration (24, 40). Based on previous studies, documentation and medication therapy management are two aspects of nursing practice which will be utilized from wireless terminals more than other (41).

4.5. Security Mechanism

Wireless terminals as well as other information systems are in face to different kinds of security threats. In this reason, data protection and security of mobile or wireless technologies are key aspects in order to increase user acceptance of these in health industry. There are various standards and protocols or mechanisms to provide secure wireless networks. In this condition, will not easy to decision about selection of the best solutions. It is a hot topic that considered by research today. Marti and his colleagues in their study recommended proper security

mechanisms based on the different levels of the wireless networks as following items:

Security in the data link layer provides hop-to hop protection by Bluetooth, Zigbee. Security in the network layer provides node-to node protection by IP security (IP sec). In the transport layer provides an end-to end protection. Secure Sockets Layer/ Transport Layer Security (SSL/ TLS) or Hypertext Transfer Protocol over Secure Socket (HTTPS) are examples of security protocols in this layer. Also application layer security is provided through the encryption or signature of the data sent through the communications stack in form of application to application and application-user to application-user protection (42, 43). Moreover, for provide a secure mobile devices can be used from biometric technology such as fingerprint capability or iris scan mechanism (44).

4.5. Nursing Wireless Terminals in Hospitals of Selected Countries

The comparative study indicated that in Canada, wireless nursing charting system developed as terminal of nursing information system (5) which used by nurses in order to real-time charting in bedside. Laptop is selected device used nurses for connected with central server of NIS through WLAN in hospital in order to loading archived patient data or recording and saving new data to the database (6).

In Australia, the wireless terminals have been implemented through various academic projects in order to facilitate nursing activities in some hospitals (21, 22). At the Austin and Heidelberg hospitals, tablet used to wireless communicate with hospital information system (45) for unrestricted access to clinical data in wired local area network-based hospital systems. This connection is established through a IEEE 802.11g standard of wireless local area network (46).

Also in England, bedside wireless terminals in form of multi-purpose implemented in some of the NHS hospitals. These purposes are entertainment for patients and data entry by nurses as well as physicians to electronic patient records (EPR) through 802.11 b/g wireless LAN in the bedside (47).

Mobile Nurse System in Korea as terminals designed to communicate with hospital information system (45) via mobile support system (MSS) which interchanges and stores clinical data. The type of network and mobile device were WLAN and PDA (7).

In Taiwan, mobile nursing information system designed to perform paperless recording of nursing information at the bedside. PDA-based terminals on wireless local area network connected with clinical database central server (8).

The results of this study on performances and capabilities of nursing wireless terminals in selected countries showed in Table 2.

Table 2. Features of Wireless Terminals in the Countries.

Item	Studied countries				
	Canada	Australia	England	Korea	Taiwan
Integrated to admission, discharge, transfer system for providing of patients list in wards	√	√	√	√	√
Possibility of retrieving patients clinical data	√	√	√	√	√
Capability of recording vital signs & input/output fluids data in flow sheets	√	√	√	√	√
Access to care plan related to patients & completing its components such as problems, aims & nursing interventions	√	√	√	√	√
Documenting nurses reports in the nursing notes	√	√	√	√	√
Possibility of retrieving the physician orders list related to patients	-	√	√	√	-
Possibility of retrieving the electronic medication record and documenting drug used by patient according to orders	-	-	√	√	-
Connecting to laboratory & radiology systems in the hospital	√	√	√	√	√
Display of discharge summery	-	√	-	-	-
Equipped to drug or medical reference applications	-	-	√	-	-
Access to the Internet	-	√	√	-	-
Equipped to RFID^atechnology for control of drug administration	-	-	√	-	-

^a Radio Frequency Identification

The results of study on implementation process of this technology showed that the system in Canada developed in modular design and Melfort hospital became the pilot site (6). No more information exists in this area. In Australia, the system has designed following the survey on attitude of the nurses working in ICU and the oncology units. The physical characteristics and environmental conditions evaluated in order to define the infrastructures and selection of the network components. After prototype implementation, nursing staff trained in order to working with the terminals. Satisfaction of nurses on terminals performance and work flow in these were evaluated in six months after the implementation (22). No information was available on the development process of the wireless bedside terminals in England. Development process of terminals in Korea was composed of following steps: daily nursing workflow analysis, define functions which can be facilitated by terminals, software and user interface design based on nurse's requirements analysis, prototype development and implementing of clinical trial in hospital of Seoul National University (7). The structure of software on PDA designed in form of multi-layers. It is include initial browser in first layer, general information, orders, nursing note, and nursing unit process in second layer and detailed records in subsequent layers (7). The process in Taiwan was included workflow analysis to clearly understand nurses' daily work and to determine which nursing tasks could be appropriately perform on a PDA, to define user requirements, develop interface and prototype based on considerations of mo-

bile human-computer interaction. Designed system implemented in a pilot site at hospital and its usability evaluated (8). Moreover, the structure of system was included the three layers of identification, main functions and sub-functions (8).

5. Discussion

Based on the research findings, all five countries use wireless local area network for establishment of connection between wired local network in the hospital and mobile or wireless terminals used by nurses. It is according to previous studies on proper wireless network technology for nursing practice (4, 27, 28).

The findings of the study indicate that PDA is most popular mobile device, which used for bedside nursing charting which is similar to other researches on this issue (29-33).

Findings of the present research showed that connection with admission, discharge system of hospital, retrieving patient's clinical data, recording vital sign and input/output fluids data, access to care plan related to patients & completing it, documenting nurse's reports in the nursing notes and connecting to laboratory and radiology systems are main and common functions of the terminals. In a research by Chang and et al, results showed all of respondent nurses (n = 26) stated that quick access to patient information through mobile devices was very helpful (48). Results of the study of Lazarus showed in response to this statement "did the PDA device

improve access to patient information at the bedside?" 23 cases have strongly agreed and 585 agreed (49). Findings of present study will support from the research of Chang and Lazarus.

In addition, in the all of the countries where information on implementation process of their nursing wireless terminals was available; workflow analysis was one of first phases. In addition, evaluation of user's requirements in primary step and their satisfaction or views after system design has done in Korea and Taiwan.

Results on information structure of the system indicated that, general information relative to patient, orders list, nursing notes and lab results are minimum information components in mobile devices in selected countries.

Therefore, based on results of current study on most important aspects of successful implement of wireless technologies in nursing practice and experiences of several developed countries in this issue, the following model proposed:

5.1. The Implementation Model of Nursing Wireless Terminals in Hospitals of Iran

As a regard of key aspects of wireless systems implementation and best practices in selected countries, we are presenting a model for implementing nursing wireless terminals in hospitals of Iran. Proposed model is including following steps:

5.1.1. Conceptual Design of the System Functions

1- Define of purposes and application domains:

Because, expected purposes specify application domains of the terminals, in first step, they should be identifying. Based on former studies, improve the productivity of nursing staff in the hospital, (2, 19) facilitate the nursing time consuming of activities such as documentation and orders communication (9, 50) are some of the purposes of use wireless or mobile technologies. In addition, the enhancing of patient safety and care quality by decries of medication errors relevant to nurses performance, are other the purposes of use (14, 50, 51).

With regard to these purposes, which can be considering for Iran, application domains are nursing documentation and medication administration.

2- Analysis of workflow related to defined application domains for identify expected functions:

In general, workflow for nursing documentation closely related to nursing process that include assessment, identify patient problems and diagnosis, identify expected outcomes, care plan, implementation and evaluation (51, 52). Moreover, nurse's duties about medication therapy management usually are in relation with drug administration and documentation. However, detailed workflow in each of facilities can be different. Therefore, it should exactly analyze.

3- Define expected functions for terminals:

Based on the results of comparative study, following functions have expected for nursing wireless terminals:

- Integrated to Admission, Discharge and Transfer system for access to patients list
- Connected with clinical database in the hospital
- Recording patient vital signs and input/output data in the bedside
- Access to care plan and completing it in the bedside
- Documenting nursing reports in nursing notes
- Retrieving physician orders relative to each patient
- Connected with laboratory and radiology information systems existing in the hospital
- Access to electronic medication record relative to each patients for documenting administrated drug data according to orders
- Access to drug references

5.1.2. Conceptual Design of the System Structure

1- Determine data types that gathered or displayed by wireless terminal:

As regard to defined functions, types of data will specified. Often, the type of data is text, unless connection to radiology systems in order to retrieving medical images or scanning medication or patient wristband barcodes defined as a function for the system.

2- Selection of mobile device:

In this stage, should be selected mobile device used as terminals based on defined functions and data types.

3- Selection of communication network and description of network components architecture:

According to previous studies by Ammenwerth (4) and other researches (27, 28, 50, 53) and also the results of comparative study recommended that "IEEE 802.11b/g or n" used for network development. However, survey should be conducted on environment in order to determine the required communication equipment configuration and proper location for install the Access Points, antenna and other components of the network.

5.1.3. Technical Design

In present model recommended to considering the ISO 13407 standard in technical design. It provides a framework for human-centered design processes for interactive systems that include specify the context of use, specify the user and organizational requirements, producing prototype and evaluate designs against user requirements (53).based on this standard, prior to technical design, users and other stockholders requirements should be analyzed. It may implement by interview or survey with nurses and others about the system expected functions and specifications of user interface and information structures in the software.

1. Technical design of user interface in the terminals:

In addition to users requirements analysis, should be attention to ergonomic principles in during of user interface design. In this reason, ISO 9241 standard used that originally titled "Ergonomic requirements for work with visual display terminals (VDTs)" and so called by "Ergonomics of human-system interaction" now. It provides the comprehensive guidelines on design of layout, menus, icons, commend dialogues, error alerts, navigational structures and so on that can be helpful for increase usability of nursing wireless terminals and convenience of working with them.

2- Technical design of information structure in terminals:

Because nursing documentation is one main function of the wireless terminals, modules and electronic forms available at them should be organized in way that data retrieving and navigation in different sections easy. Best approach is constitutes sections in different layers as well as Korea and Taiwan.

Therefore, recommended that information components in the software of terminals should be organized as follows:

- First layer: it is home or entrance page that have three parts includes authentication and log in, the system help and medication reference.

- Second layer: it wills accessible after log in and include patient list hospitalized in clinical departments of the hospital. By selection of each patient, user can be access to information relative to selected patient that is available in next layer.

- Third layer: include general information related to patient, health history, nursing record and physician orders.

- Fourth layer: this layer is including sections of nursing record that completed by nurses such as vital sign and input/output flow sheets, nursing care plan, nursing notes and medication administration record.

5.5. Implementation

According to ISO 13407, after technical design, the prototype system should be offered to users in small scale (pilot site can be one department of the hospital). In this stage, the emphasis will be on obtaining feedback to detect of possible defects, which can be used to improve the design before full implementation. Time response, usability, compatibility with other systems in the hospital and user-friendly of interface should be evaluated. It is a formative evaluation, which is essential to reduce the financial losses due to defects and possible rejection of the new technology by users. After installation and full implementation, nursing staff should receive train on how work with the system. In addition, summative evaluation is essential to assess whether the purposes have achieved.

In the present model, tried to implementation key aspects that include the purpose, application domains, the

functions of wireless terminals, network type, mobile devices, user interface and information structure of the system described in the logical framework. Emphasis on the technical design, based on ISO 13407 and ISO 9241 standards are the notable features of the proposed model. Finally, because the proposed model in this study presented based on scientific principles and the experiences of other countries, it seems, that is an appropriate model for future efforts in this field.

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Authors' contribution

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Virtual Clinic: Core Solution to Diabetic Patient Relationship Management

Patricia Khashayar¹, Maryam Aalaa², Babak Mahmoudzadeh², Maryam Peymani³, Zahra Khazraei², Mahnaz Sanjari², Mohammadreza Amini², Mashallah Torabi^{4,5,*}, Bagher Larijani²

¹ Osteoporosis Research center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

² Endocrinology and Metabolism Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

³ Diabetes Research center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

⁴ E-Health Department, Virtual School, Tehran University of Medical Sciences, Tehran, Iran

⁵ Innovation Initiative, Tehran University of Medical Sciences, Tehran, Iran

* Corresponding author: Mashallah Torabi, EMRC, Shariati Hospital, Kargar St. Tehran, Iran. Tel: +98-9121334806, Fax: +98-2188220052, E-mail: torabim@yahoo.com

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Background: The diabetes virtual clinic was designed and launched by the “Endocrinology and Metabolism Research Institute” affiliated to Tehran University of Medical Sciences. It was designed to provide not only a wide range of information on different aspects of diabetes but also a consultation service to help patients with their problems. Diabetes virtual clinic, providing access to knowledgeable healthcare providers 24 / 7, as a core solution and a preferred method for developing and managing patients needs, not only provides the diabetic patients and their families with up-to-date and accurate information but also reduces their concerns regarding the progress of the disease and lowers the number of out-clinic visits.

Objectives: The present article aimed to cast light on different aspects of the service and facilities provided by the diabetes virtual clinic, as the pioneer such website in our country.

Materials and Methods: As the first step, the diabetes virtual clinic team gathered the topics of interest in the field. Thereafter, a need assessment was performed to identify the missing issues, based on both the healthcare providers' and patients' point of view. Articles related to each topic was then prepared and uploaded to a multifunctional website developed for virtual clinic.

Results: When the website became available, the prepared educational materials, categorized into 12 main topics, were published at <http://emri.tums.ac.ir/vclinic> based on a pre-determined timetable.

Conclusions: The integrated medical records gathered in this system may also provide the basis for the development of a national diabetes registry system and can be utilized as a valuable source for further researches conducted in this field.

Keywords: Virtual Clinic, Self-Management, Diabetes, Multidisciplinary Approach

1. Background

E-health delivers services with the aim of overcoming the needs of the consumers or customers rather than those of the producer, promising the offering of more patient-focused health services personalized at the point of care (1-3). In order to increase revenue, healthcare organizations have all the potential to build some kinds of relationship with patients (PRM), similar to CRM in the business world, to retain customer loyalty, providing individualized services, lowering the prices and improving the quality of customer service, it can offer more tangible benefits to both patients and providers, too (4). In other words, PRM aims at reducing medical errors, and improving customer service and health outcomes through implementing complex technological and organizational changes to co-ordinate and judge between various courses of action and to evaluate the worth or value of particular actions towards configuring a patient

health service relationship (2, 3).

There are few relationships as important as the common one-to-one relationship between a patient and his or her healthcare provider; virtual clinic is one of them. Virtual clinic provides an interactive, multidisciplinary and unlimited approach in dealing with various problems particularly chronic diseases, helping healthcare providers to not only improve the quality of care offered but also lower the time needed to achieve this goal (5-7).

Latest figures have revealed that more than 2 million Iranian adults suffer from diabetes and an additional 4.4 million have impaired fasting glucose, turning the disease into one of the most prevalent chronic conditions in our country (8). In view of the fact that there are not many special comprehensive tools to provide the round-the-clock service to these patients, we developed the “diabetes virtual clinic,” based on PRM model,

Implication for health policy/practice/research/medical education:

The article aims to point out the importance of virtual clinic in managing diabetic patients

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to build an effective direct relation between the health-care provider, the patient and his/her family as well as the medical team, themselves.

Accordingly, the concept of providing a diabetes virtual clinic was to provide a structured care that provided timely advice to general practitioners regarding their patients with diabetes, reducing the number of visits to the diabetes outpatient clinic (5, 6). The online tool also aimed at providing both healthcare providers and general public (patients and their families) with up-to-date accurate essential information.

2. Objectives

The present article, therefore, has attempted to cast light on different aspects of the service and facilities provided by the diabetes virtual clinic, as the pioneer such website in our country.

3. Material and Methods

Aiming to develop a comprehensive care system to deal with an unlimited number of diabetics living in different parts of the country, the diabetes virtual clinic team was formed in the "Endocrinology and Metabolism Research Institute" affiliated to Tehran University of Medical Sciences, as a referral center for treating diabetic patients, in fall 2008. The team consisted of several endocrinologists, cardiologists, vascular surgeons, ophthalmologists, nephrologists, infection disease specialists, psychologists, dentists, general practitioners, nutritionists, educationists and nurses, all of whom had long been working in the field of diabetes.

As the first step, they gathered the topics of available information, presented in the form of pamphlets, books, booklets and guideline, in this field. Thereafter, the content of these materials was revised and updated. A need assessment was then performed in order to identify the missing issues, based on both the healthcare providers' and patients' point of view.

In this regard, diabetes researchers were divided into several small groups, each of which became responsible for developing articles on the abovementioned topics to be presented on the website.

At the same time, an expert IT team developed a multi-functional website for the virtual clinic. The website with four levels of accessibility (administrator, manager, author / publisher, user / member) was designed in a way which an unlimited number of pages, either in a pre-designed or new format, could be created when needed.

4. Results

When the website became available, the prepared edu-

cational materials, categorized into 12 main topics, were published at <http://emri.tums.ac.ir/vclinic> based on a pre-determined timetable (Figure 1). The main titles covered in the articles included, everything about diabetes, treatment in diabetics, nutritional guide for diabetes patients, diabetes and sports, personal care in diabetes, acute/chronic complications of diabetes, diabetic foot, diabetes mental health, diabetes and families, frequent questions, and diabetes glossary (Table 1). The beta version of the website launched in September 2009 and its final version was ready by spring 2010. The data uploaded in the website are still up-dating on a regular basis.



Figure 1. The Translated Website.

Table 1. Count of View for Different Pages Categorized Under the Main Heading (until 7 December 2010).

Heading	Count of view
Everything about Diabetes (What is Diabetes, Type 1 Diabetes, Type 2 Diabetes, Gestational Diabetes, Pre diabetes, Diabetes Prevention, Diabetes Diagnosis, Diabetes Life cycle, Diabetes & Fasting, Diabetes & Pregnancy, Diabetes in Travel, and Routine Tests)	2964
Treatment in Diabetics (Insulin Therapy, oral agents, novel treatment and Insulin Pumps)	1232
Nutritional Guide for Diabetics (Food Intake and Blood Sugar, Food Pyramid, Food Composition, Food Labels, Food Exchange List, Good Timing For Eating, Hypoglycemia, Diet in Special Conditions, Non-Nutritive Sweeteners, Diabetic Food Recipes, Over Weight And Obesity/ABI Calculation, Carbohydrate Intake During Exercise, Nutrition and Exercise)	2659
Diabetes and Sports (Diabetes and Physical Activity, Diabetic Exercise Comments, Diabetes Prevention and Exercise, Appropriate Suggestion For Diabetes Prevention, Exercise Tips, Appropriate Foot Exercise For Diabetics)	1064
Personal Care in Diabetes (Self Care, HbA1c, Glucometer, Insulin Injection, Blood Glucose Registry Notebook, Diabetes and Party, Sleep Disorders in Diabetics, Method of Lowering Neuropathy pain, Diabetes and Driving, Medical Emergency Tips, Diabetes and Alcohol)	2205
Acute Complications of Diabetes (Diabetic Ketoacidosis, Hyperosmular Coma and Diabetes in Disease Days)	520
Chronic Complications of Diabetes (Diabetes and Dental Health, Diabetes And Cardiovascular Diseases, Diabetes and Peripheral Neuropathy, Diabetes and Lower Limb Disorders, Diabetes And Gestational Disorders, Diabetes and Nephropathy, Diabetes And Hypertension, Diabetes and Hypercholesterolemia, Diabetic Retinopathy, Diabetes and Skin Diseases, Living with Diabetes Complications)	2868
Diabetic Foot (Diabetes and Foot Problems, Healthy Foot Affected by Diabetes, Diabetic Foot Predisposing Factors, Warning Signs, Diabetic Foot Treatment, Musts and Must Nots, Appropriate Foot Wearing, Important Factors before Wearing Shoes, Everything about Shoes, What is Neuropathy)	1467
Diabetes Mental Health (Family and Diabetic Teenager, Diabetes and Stress, Depression, Stress Management, How to Deal with Diabetes)	171
Diabetes and Families (Diabetic Patient Care, Living with Diabetes, Diabetes and Influenza Type A, Diabetes Education for Kids, Diabetes and School, Diabetes and Needle-phobia, Type 2 Diabetes in Children, Young Diabetics, Elderly Diabetics, False Beliefs about Diabetes, Metabolic Syndrome)	1711
Frequent Questions (Common Questions about Diabetes, Diabetes and Fasting)	288
Diabetes Glossary	493
Total	17642

5. Discussion

There has been significant debate regarding the changing nature of the relationship between patients and the health care system. In view of the increasing tendency towards consumerism and technophilia, online tools (E-health) are becoming a substitute for the traditional physician-patient relations in the locus of the consultation and shared decision-making (1, 9). E-health, as a technology of representation, policy planning and delivery of healthcare, promises services that are not only patient-focused individually but also have a multidisciplinary approach towards the disorder (4).

Every diabetic patient should be reviewed physically on an annual basis in the conventional clinic to assess overall control, risk factors modifications and complications management. Considering the limited time of each visit, many of their questions yet remains unanswered, making the patients and their families find other sources to find solutions for their problems. A number of interven-

tions, including written information that supplements clinical consultations, web sites and other electronic information sources, training for health professionals in communication skills, coaching and question prompts for patients, decision aids for patients, self-management education programs, have shown promising results in building health literacy, promoting patient involvement in treatment decisions and educating patients to play an active role in self-management of their chronic condition (9, 10).

Online websites seem to be the best information resource for such individuals as the published information provided by the physicians and the clinics may not contain all the topics. But how accurate are the information published in different websites?

The concept of providing a virtual clinic was to provide patients as well as healthcare providers with a structured educational material regarding their underlying condition. The consultation service offered in this system also provides timely advice to general practitioners regarding

their diabetic patients. It also remains open to the questions faced by patients in an effort to not only reduce the demand on the diabetes outpatient clinic but also empowers them improve diabetes self-management (5-7).

Virtual Diabetes Clinic, created based on PRM modeling, thus helps to reach more patients and keep them loyal by increasing their well being through providing more effective and optimized personalized physician-patient relations and management. In other words, Virtual Diabetes Clinic benefits from information technology to improve patient access to services and information through direct consultation with skilled diabetologists and a wide variety of uploaded materials. In this regard, technology-assisted support measures, electronic delivery of information, effective physician and patient communication contribute largely in keeping the patient satisfied (4, 11).

It could be concluded that 24 / 7 online accessibility to knowledgeable healthcare providers, as a core solution and a preferred method for developing and managing patients needs, not only provides the diabetic patients and their families with up-to-date and accurate information but also reduces their concerns regarding the progress of the disease and lowers the number of out-clinic visits. More importantly, it improves self-efficacy and quality of life in these patients through optimizing HbA1c levels and subsequently reducing morbidity, mortality and burden imposed to the society.

Virtual Diabetes Clinic will progressively take on more complex projects to leverage existing legacy systems and/or create new ones. Accordingly, creating an individual profile for each of the patients and providing the physicians with a total view of every patient and his/her latest laboratory findings are among the upcoming facilities provided by this virtual clinic. A full electronic medical record with all the relevant information about a particular patient will be valuable in future as it can be used to deliver the appropriate care, at the appropriate time (12).

5.1. Limitations

Based on PRM model, virtual clinic aims to build an effective direct relation between the healthcare provider and the patient and his/her family. At the time being, however, there is no available data regarding whether the goal has been achieved in the patients and their family point of view. Our team is set to have the patients to express their opinion regarding different parts of the website as soon the website, in its current form, is approved by the professionals working in this field.

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Diabetes BPMN: Modeling Clinical Workflow

Maryam Aalaa¹, Patricia Khashayar², Mahnaz Sanjari¹, Zahra Khazraei¹, Hamidreza Aghaei Meybodi¹, Mohammad Reza Mohajeri-Tehrani¹, Nooshin Shirzad¹, Narjes Aghel³, Masoud Rahmanian¹, Banafshe Shahnazar¹, Masoome Noorani¹, Mashallah Torabi^{4,5,*}

¹ Endocrinology and Metabolism Research Center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

² Osteoporosis Research center, Endocrinology and Metabolism Clinical Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

³ Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran

⁴ E-Health Department, Virtual School, Tehran University of Medical Sciences, Tehran, Iran

⁵ Innovation Initiative, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding author: Mashallah Torabi, EMRC, Shariati Hospital, Kargar St. Tehran, Iran. Tel: +98-9121334806, Fax: +98-2188220052, E-mail: torabim@yahoo.com

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Background: The increasing number of diabetic cases and the decline noted in the mortality rate of those suffering from the disease has turned diabetes into a global challenge. The rising trend of the disease cannot be attributed to a single cause, but rather, to a combination of demographic, lifestyle and clinical factors. As a result its management needs the collaboration of a multidisciplinary team.

Objectives: Diabetes has become one of the most prevalent diseases worldwide. Since its management is a multidisciplinary approach, a professional team should come together in order to meet the goals. Using a Business Process Model and Notation (BPMN) can help healthcare providers working with this team to have a holistic view on the management of the disease. This study therefore aimed to develop a BPMN model to improve the services provided by the diabetes team.

Materials and Methods: Several sessions, attended by the endocrinologists, nurses and etc., were held to assess the regular management process of diabetes in our center. The Diabetes care process developed with the Architecture of Integrated Information Systems (ARIS) software was then compared with the standard process. The BPMN was then developed as the final step.

Results: Developing a BPMN for diagnosis, management and follow up of diabetes provides the healthcare providers with a comprehensive model and a holistic view regarding the whole process, and therefore enables them to treat different aspects of the disease. The tool also reduces the time needed for the whole process to be done.

Conclusions: Diabetes BPMN is a clinical workflow which reflects different aspects of diabetes, each of which may affect the health condition or quality of life of the diabetics.

Keywords: Diabetes, Multidisciplinary, Business Process Model

1. Background

The increasing number of diabetic cases and the decline noted in the mortality rate of those suffering from the disease has turned diabetes into a global challenge (1, 2). The rising trend of the disease cannot be attributed to a single cause, but rather, to a combination of demographic, lifestyle and clinical factors. As a result its management needs the collaboration of a multidisciplinary team. Fundamental to the diabetes multidisciplinary approach is the development of an initiative to help diabetics live healthier and experience fewer complications. The team should provide the patients with a considerate and permanent individualized care.

In recent years, the structure of the teams working in this regard has changed considerably to answer the

changes made in the model of care. There has been a shift from the traditional, physician-centered 'acute-care model,' in which the diabetics were not involved, to a 'chronic care model,' in which all the members of the team are equal and interdependent, and the diabetics play an active role in the daily management of their disease.

This multidisciplinary approach is therefore considered as an effective method in educating and also supporting the patients and their families. Its use is also associated with improved health outcomes and reduced economic burden (3-6).

Any reduction in the economic burden of diabetes is an important consideration, from both the patient and society point of view. Understanding the cost of diabetes, on the other hand, can be helpful as the first step in estimating the cost effectiveness of a strategy launched to pre-

Implication for health policy/practice/research/medical education:

Diabetes has become one of the most prevalent diseases worldwide. Since its management is a multidisciplinary approach, a professional team should come together in order to meet the goals.

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vent or treat the disease. The management of chronic disease imposes two main costs on the society: indirect and direct costs. From a societal perspective, indirect costs of diabetes – those resulted from loss of productivity due to the illness or premature mortality - are more important to be considered as they indicate the co-morbidity and complications that accompany diabetes as well as its mortality rate.

Despite all these benefits, such an approach has not been quite beneficial in many systems as there is no comprehensive guideline for such an intervention and the members of the team are not well-aware of their responsibilities.

2. Objectives

The present study was therefore developed to identify the workflow and key components in diabetes care. Developing a BPMN model, as the final objective, can help improve the care provided by the diabetes team.

3. Methods and Materials

In order to develop a uniform viewpoint regarding diabetes management and follow up, weekly sessions, attended by endocrinologists, internists, residents, fellows, nurses, head nurse and, were held. After agreeing on the approach, the flowchart for clinical diabetes care was illustrated using ARIS software. All the forms including admission forms, discharge forms, consent forms and etc.

were added to the flowchart. This helped us figure out the deficiencies in our system. The trend was then compared with international guidelines and evidence-based material on diabetes. Based on the gathered information the BPMN process for diabetes care was developed using ARIS software (Figure 1).

Dimensions of diabetes	Medical	Emotional	Behavioral	Social
Positive	Accesses to expert healthcare providers, Other specialty consultation	Cope with especial changes in lifestyle because of diabetes	Self-management of diabetes including blood sugar control, exercise, diet	Availability of diabetes care system for management, early diagnosis of complication
Negative	Lack of the diabetes team to manage diabetic patient	Disappointed To have a healthy lifestyle	Be deficient in diabetes care knowledge	Lack of facility to diabetes care

Figure 1. Diabetes BPMN

4. Results

Developing a BPMN for diagnosis, management and follow up of diabetes provides the healthcare providers with a comprehensive model and a holistic view regarding the whole process, and therefore enables them to treat different aspects of the disease. The tool also reduces the time needed for the whole process to be done (Table 1).

Table 1. BPMN, a Tool to Assess Different Aspects of Diabetes

Dimensions of diabetes	Medical	Emotional	Behavioral	Social
Positive	Accesses to expert healthcare providers, Other specialty consultation	Cope with especial changes in lifestyle because of diabetes	Self-management of diabetes including blood sugar control, exercise, diet	Availability of diabetes care system for management, early diagnosis of complication
Negative	Lack of the diabetes team to manage diabetic patient	Disappointed To have a healthy lifestyle	Be deficient in diabetes care knowledge	Lack of facility to diabetes care

4.1. Holistic care Planning According to the Guideline

BPMN can also help healthcare providers develop a holistic care plan based on the available guidelines. Using this model, the members of diabetes team would exactly know their role in the whole process and what is going to be next. This not only improves the quality of the provided care but also reduces the cost through preventing repeated procedures.

4.2. Patient, the Focal Point of Diabetes Management

The patient is the center of diabetes care and the most important member of the diabetes management team.

4.3. Diabetes Management Problems

According to the diabetes BPMN, following problems were seen in diabetes management.

1. It is not necessary to hospitalize all diabetic patients for insulin injection. If we have enough trained general practitioner and nurse educator, diabetic patient be able to have self management.

Another way could be use of the telephone base follow up by physician in which patient have received services without referring to the hospital.

It seems that just patient suffering from type I diabetes and DKA should have hospitalized.

2. Another problem is HbA1C value which is not valid because of different kits. The normal range reported is not standard.

3. Unfortunately the consultants for macro and micro vascular complication are residents however we need to specialist comments in this field.

4. Interns are less involved in the diabetes management process in endocrine ward. In near future interns as a general practitioner should work with first line of diabetes management so that it is clear to have responsibility in diabetic patient management in endocrinology ward.

5. The lack of proper education to the patient and healthcare providers is another problem. The patient

should train about insulin injection since admission time not at the time of leaving hospital.

After recognizing the mentioned problems, the session attended by all healthcare providers involved in the diabetes management process was held. Using the free plane software (free mind mapping & knowledge management software) all solution and comments gathered. During two other sessions all these suggestions were discussed so that the best solutions were chosen. The latest free plan consists of the following explanations for each problem (Figure 2).

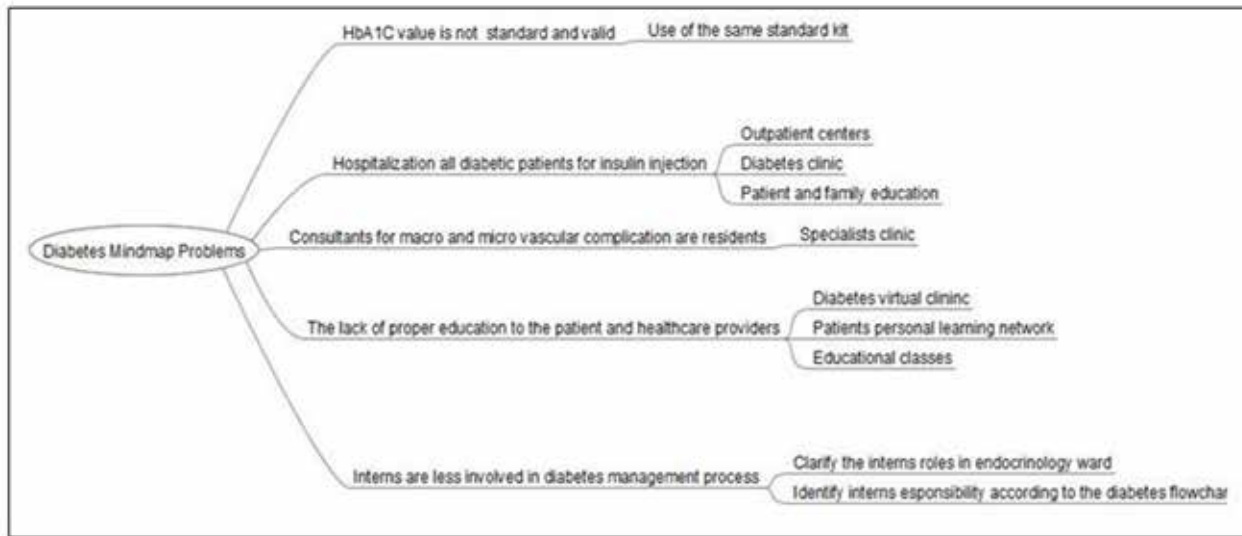


Figure 2. Diabetes Management Problem Free plane

5. Discussion

The Business Process Management Initiative (BPMI) developed a standard Business Process Modeling Notation (BPMN) in 2004. The primary goal of BPMN was to provide a comprehensible notation for all business users, from the analysts who develop the initial drafts of the processes to the technical developers responsible for implementing the technology, and finally, to the businessmen who manage and monitor the process. In other words, BPMN creates a standardized bridge for the gap between the business process design and process implementation.

BPMN also defines the Business Process Diagram (BPD), a flowcharting technique tailored for creating graphical models of business process operations, the activities and the flow controls that define their order of performance. BPMN, the standard for creating process models, was created in the first decade of the 21st century by a consortium of industry-leading companies including SAP, Oracle and IDS Scheer. Such an instrument can help provide a common view point for health care providers regarding a single disease and as a result can be used as a tool for developing a foundation for diabetes care.

5.1. BPMN, a Tool to Assess Different Aspects of Diabetes

Treating diabetes needs a multidisciplinary approach. This comes as a diabetic patient not only suffers from medical problems but also from emotional, behavioral and social problems.

1. It seems that setting up diabetes outpatient centers or Diabetes clinic in order to Patient and his/her family have trained could be effective strategy to decrease the occupied hospital beds in endocrinology ward. We also need the diabetes nurse educator to follow the blood glucose of diabetics who have injected insulin.

2. Use of the same standard kit would be the only reasonable solution to prevent the errors due to variable rates of HbA1c.

3. Setting up the specialist's clinic including vascular surgeon, infection disease specialist, dermatologist, cardiologist, ophthalmologist, psychologist near the hospital resolve this problem.

4. To identify intern's responsibility according to the diabetes flowchart and clarify the interns' roles in endocrinology ward were two practical suggestions in this area. In this

regard not only the interns but also all healthcare providers in the ward should be aware of interns' responsibilities.

5. Diabetes virtual clinic and the patient's personal learning network along with daily educational courses could be beneficial for diabetic patients.

Diabetes BPMN as a diabetes map cause to continue the next steps in providing electronic patient records, Simple cycle of activities between healthcare providers, Care planning according to the guideline, Same educational program and high quality structured education. It should be mentioned that Diabetes BPMN as a dynamic process and practical tool for action would be assessed in other research projects.

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Authors Contributions

All authors have participated to the study.

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Application of Care Intelligence in Hospital

Maryam Goodarzi¹, Mashallah Torabi^{1*}, Samira Elmi¹, Samira Mortezaei¹, Maryam Ahmadi¹, Fatemeh Golmahi¹

¹Innovation Initiative, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding author: Mashallah Torabi, Innovation Initiative of Tehran University of Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-2181633804, Fax: +98-2181634105, Email: mtorabi@tums.ac.ir

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Background: By implementation of business intelligence strategies, the gap between the middle and senior managers will disappear from the information relation perspective, and the needed information on every level, at any moment and with the best quality will be at the managers' disposal. Also the experts and analysts can improve their activities with simple facilities and reach better results. In the field of medical sciences, business intelligence is defined in terms of care intelligence and it is an instrument which helps health care organizations, doctors, nurses and healthcare staff to use the financial, operational and clinical information in order to realize the existing circumstances and improve the health care and financial management in their organizations.

Objectives: The application for virtual organization of Tehran University of Medical Sciences in the university hospitals, as one of the applicable care intelligence tools, has led to the presentation of management reports, starting of new virtual processes and smart cooperation of the staff.

Methods and Materials: In this paper, the general framework of the care intelligence infrastructure aimed at improving care outcomes, efficiency and reduction in costs is defined and the virtual organization applications in the form of hospital dashboard which are based on performing tables of nursery staff in 7 hospitals of Tehran medical science university will presented.

Results: The various dashboards show the rate of nurses' activity in each hospital, the ratio of delay and haste of nurses and the number of vacations in the quarter of summer.

Conclusions: Information extracted from different sectors of university virtual organization in some hospitals, is an instance of the application of care intelligence which develops information dashboards as an effective tool for information-based improvements in the hospitals.

Keywords: Care Intelligence; Business Intelligence; Information Technology; Hospital; Data Storage; Virtual Organization

1. Background

The demand for the business intelligence application is rising in the world. Health intelligence information can assist to acquire different visions for encountering the goals of care and service. Also, the solution of health intelligence contains databases, knowledge, its application and regulations to advocate clinical, operational intelligence and financial performance (1). The precise diagnoses, service improvement, the production of revenue and cost decreasing are business intelligence and clinical intelligence. Thus, hospitals normally apply clinical intelligence to enhance the productivity and importance of networks which are related to doctors that some of them include boosting planning, budgeting and coordination between various departments and awards (2). On the other hand, Business intelligence is related to diminish the risk. So, many tools of business intelligence are arranged to analyze symptoms of these risks from different sources (3).

Clinical dashboards can help hospitals control the situations and better management of chronic diseases (4). In another study, process intelligence solution is clarified as four parts, include: design, configuration, execution and evaluation which are contained process to interpret model (5). The approach of business intelligence in health care results in some consequences as following: Patient satisfaction, improving treatment and retaining expenditures (6). According to Bonney (7), business intelligence is a tool which helps organization identify the functions, competition and markets most better and in addition, it involved various technologies which consist of gathering, keeping, evaluating and result in better decision making.

Although the term "business intelligence" is pretty new, but the computer based business intelligence systems in another form are related to 40 years ago. The decision support, applicable information systems and informa-

Implication for health policy/practice/research/medical education:

The application of virtual organization of Tehran Medical Sciences University in the university hospitals, as one of the applicable care intelligence tools, has led to the presentation of management reports, starting of new virtual processes and smart cooperation of the staff.

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tion management systems are replaced with “business intelligence”. In the paper business intelligence systems are defined as:

Business intelligence systems combine data collection, data storage and knowledge management with the analysis tools in order to present comprehensive combined and internal information for the planners and policy makers.

Sometimes business intelligence refers to the online decision making which is a rapid responding system. In most cases, it refers to reduction in time frame work in which the information is still useful for decision makers in time of decision making. In all cases application of business intelligence is proactive. The main parts of proactive business intelligence are:

- Data storage in real time
- Data mining
- Automatic detection of exceptions and unusual cases
- Proactive warning by an automatic receiver
- Geographical information systems
- Data illustration

There is the diversity of information inputs such as unstructured (Texts, Videos, Images, etc.) and structured (OLAP, DSS, DW, etc.) which supply the intelligence for decision making process (8).

2. Objectives

1. Clarifying activities
2. Creating integration in the outspread information of practical software
3. Ability to analyze and represent instantaneous events
4. Future foresight
5. Implementing the layers of intelligence in hospital environment

3. Materials and Methods

3.1. Business Intelligence Function

Business intelligence helps strategic and operational decision making. Gartner’s study shows the strategic application of business intelligence as following (9):

1. Management of Organization performance
2. Customer relation optimization, business activity monitoring and traditional decision making support
3. Independent application of business intelligence packaged for special strategies or operations
4. Management of Business intelligence reporting

Business intelligence converts data into useful information and then by using human analysis into knowledge. Some business intelligence applications are (10):

- Predictions based on historic, past and present input performance and estimating future direction
- Analysis of the effects of alternative scenario and changes

- Strategic vision

3.2. Input Framework in Business Intelligence

Business intelligence needs the analyzers who work both with structured and unstructured data. The term “semi-structured data”, is used for all the inputs which are unsuited to the relational or simple files (structured data).

Semi-structured data is not easily searchable by using existing tools for conventional database. However, analyzing and making decision based on semi-structured data is as same as business processes, video files, movies, picture files, reports, etc.

3.3. Business Intelligence Performance in Hospitals

Health care organizations are under pressure to improve their performance and care quality. Every year they are looking for initiatives to achieve the following objectives:

- Improving quality of services
- Increasing patients satisfaction
- Increasing revenue and reducing in costs
- Quality accreditation support and complying with new rules
- Efficient scheduling for the staff

Care intelligence can help to solve serious problems which financially trouble both the provider and payer of health care industry. Large organizations which are both provider (hospitals, clinics, doctors) and payer accept the policies, instruments or application of data management facilities in recent years by starting up data storage projects.

Nowadays in all large health care organizations, there are one or more data storage projects which are completed or being completed. In some cases the problem is that there are several data storages and integration and merger of them is needed for the care intelligence process.

Small health care organizations are less likely to have large data storages; but they may have other kinds of data merger and simple performance of care intelligence for reporting and financial tools.

There are basically 3 different data categorizations used in hospitals: financial, clinical and operational. Although in this vast categorization, the data which the provider and payer request on analysis is quietly different. This data includes reporting claims, the care of patients, patients’ health records, and treatments and their results, hospital supply chain costs, reception data, uncollected debts, etc.

The main subjects in hospital management are analytical applications and data management solutions for solving the following problems:

- Reduction in operational costs
- explore new revenue opportunities
- Costs optimization

- Fraud detection
- Finding cost effective cures verses inefficient costs

Effective development of the latest generation of care intelligence instruments can help hospital executive and clinical leadership which provide achieving strategic goals and maximizing the value of investment in both financial and clinical applications. These insights can be helpful in identifying the improvements in the following items:

- Patient safety and reduce the risk
- Timing and availability of clinical resources (such as beds, operating rooms, imaging systems)
- Patients satisfaction
- Assessment and management of patient referral patterns
- Doctors patterns including positive effects on patient and cost results based on treatment protocols
- Length of stay, hospital costs, income and operations sides

Briefly, the developing path of intelligence care in organizations includes:

1. Data discovery and data access: discovery and access to the data which is available for decision making and analysis. By improving discovery and access to data, the organizations can access a wide range of resources.

2. Data management and optimization: to consolidate data in suitable data storage (such as data repository, data center, ODS), put data in the business zone and transform data to information. Due to the increase in resources and data capacity, deployment range must be developed by lower cost and better value of capabilities of data performance management.

3. Data analysis: to analyze data in order to understand business performance of the organization. Analysis development must be more than traditional application and mostly use for today needs and problems.

4. Participation and decision making: to provide analytic results for the others and approach business insight. The goal is to use participation technology in order to start business intelligence for more users with less experience (11).

3.4. The Capabilities of Care Intelligence

The method of care intelligence in the set of coordinated facilities for facilitating the process of organizational decision-making at all levels which can be implemented easily with low cost.

Data coordination: organizations are usually faced with information discrepancy. Using various tools makes it possible to create different information banks with varying structures in an organization. The information-coordinating service in the mechanism of business intelligence enables constructing an integrated information bank from useful information.

Data repository: data discrepancy is one of the major

problems in organizations. Data repository makes it possible to place the data in an integrated data bank after passing through coordination stage.

Reports dashboard: there are many ways for displaying information as different reports, but this is only one part of care intelligence solution. An effective report should communicate with audience and meet their needs (12).

Considering the extensive works of virtual organization in different hospitals such as Children's Medical Center, Sina, Valiasr, Farabi, Bahrami, Baharloo, Women's Hospital, and Razi, and using the outputs of this system, the hospital dashboard is proposed based on the performance tables of nursing personnel. They include the diagrams of amount of nurses activity by virtual organization, haste, delay, rate of vacations in nursing groups of Tehran University of Medical Sciences.

The information outputs of virtual organization are provided in four diagrams by QlikView software (personal Edition).

This dashboard provides hospital managers with the possibility of reporting, and clinical, operational and financial intelligence in real time.

The technologies of access development and care intelligence in virtual organization include text and data mining, event analysis in technology application area, visualization improvement, and working group integration in IT sector.

4. Results

The following tables are presented according to the information available in the virtual organization of Tehran University of Medical Sciences. As the diagrams clearly indicate, in hospitals where the level of delay and haste was lower, the use of virtual organization was more developed and the operations were sufficiently fluid. In these hospitals, the leaves of the personnel were more organized and optimal (diagram 3,4). This means that in units where there are much delay and haste, use of leaves is more limited and unorganized. This conclusion can help managers consider important issues such as the free times of the personnel and their impacts on the quality of services, by better analyzing real condition in their plans. As, in hospitals where leaves management is more organized, better performance can be observed. Some of such hospitals include Children Hospital, Valiasr, Farabi, and Baharloo (diagram 1, 2).

Also, through the surveys conducted, it was found that hospitals where the flow of virtual activities is over 90% were more successful in implementing informatics systems in clinical, and particularly radiology wards. They made more practical attempts at developing infrastructures necessary for using dashboard services in radiology ward, and at the time of writing the present paper, some parts of the dashboard were designed according to the findings of the present study in radiology ward.

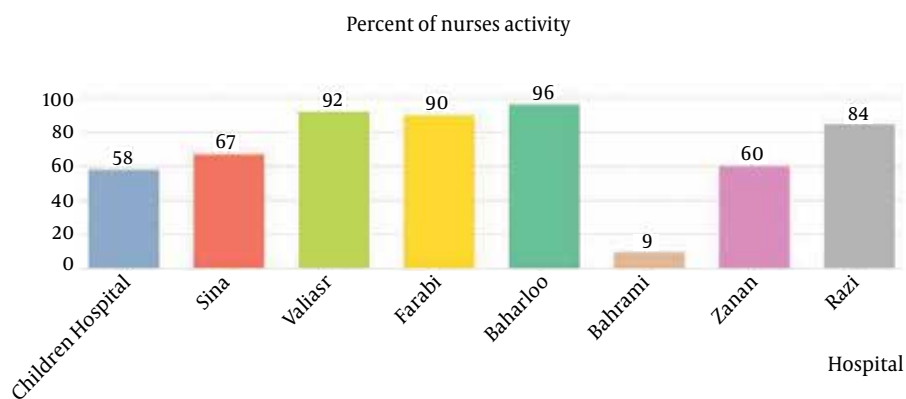


Figure 1. The Rate of Nurses' Activity in Each Hospital

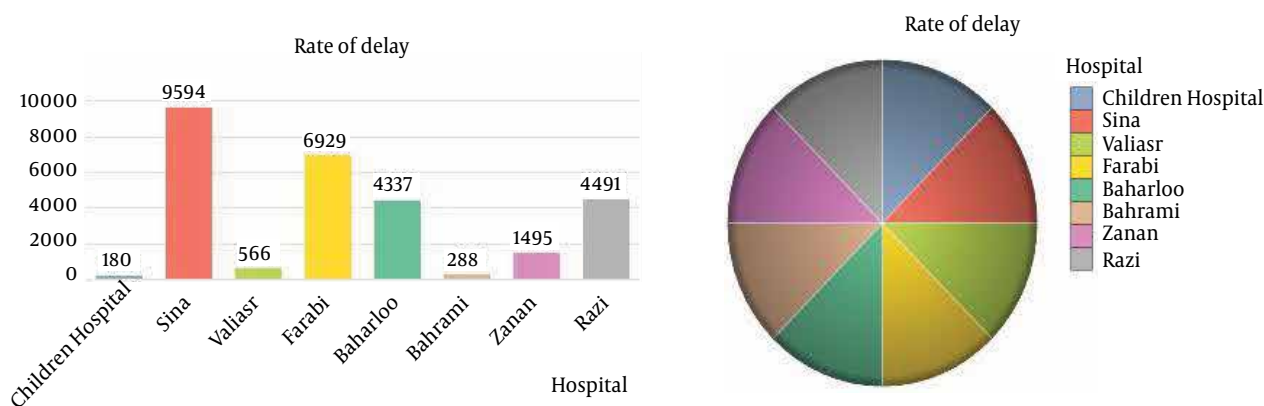


Figure 2. The Total Number of Delays and Early Haste of the Nurses

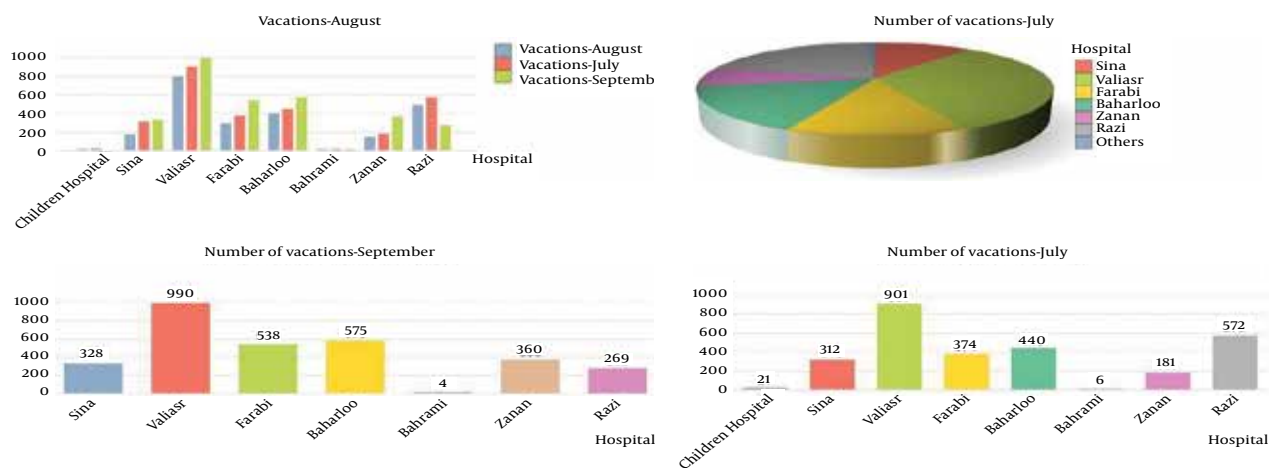


Figure 3. The Number of Vacations in the Quarter of Summer

5. Discussion

Care intelligence is gaining a comprehensive knowledge about all factors affecting the hospital. Using care intelligence, one can understand “what is going on in the hospital”.

By processing the existing information, different questions can be answered: “which performances were better? Where are the weakness and why? Does the number of personnel fit to the volume of services?”

Finally, through the decisions managers make, it can be predicted “how it is possible to make a continuous change and improvement in the hospital”. Care intelligence provides the condition for identifying new relations and answering numerous questions by combining information produced in different software.

Information extracted from different sectors of university virtual organization in hospitals, is an instance of the application of care intelligence which develops information dashboards as an effective tool for information-based improvements in the hospitals.

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Authors Contribution

All authors have participated to the study.

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Intelligent Clinical Laboratory: the most Important Strategy for Improving the Laboratory Management

Reza Safdari¹, Niloofar Mohammadzadeh^{1,*}

¹Department of Health Information Management, Tehran University of Medical Sciences, Tehran, Iran

*Corresponding author: Niloofar Mohammadzadeh, Department of Health Information Management, Tehran University of Medical Sciences, Tehran, Iran, Tel.: +98-2188622766, Fax: +98-2188622533, E-mail: rsafdari@sina.tums.ac.ir, niloofar.mohammadzadeh@razi.tums.ac.ir

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Background: Clinical laboratory provide information needs for physicians and influence on clinical decisions. A significant portion of health care costs is devoted to labs, so consider the quality of the tests, lab reports, and appropriate lab management are very important.

Objectives: The purpose of this study is recommending a framework to help design an intelligent clinical lab in order to increase the quality of actions.

Materials and Methods: In this review article with key word Intelligent, Laboratory, Laboratory Information Management System, LIMS related article searched in pub med, science direct and Google scholar databases and laboratory situation in national level according to draft indicators for evaluating the performance of the hospital information system (HIS) second edition, that published by office of statistics and information technology of the Iran ministry of health and medical education in 2011 with standard manual 1578 for LIMS is reviewed.

Results: Laboratory information management systems (LIMS) despite the significant advantages are limited by some factors. The main challenge of the systems is problem in adaption to new instruments that may discontinue or change existing work processes in laboratory or using the new software that are needed for the analysis of new data to different data formats. The greatest limitation of current systems is log, data store and statistical tools that linked in only one direction. Applications of intelligent software with existing information systems, in addition to removing these restrictions, have important benefits. For example intelligent software Autonomy in response and reaction to environment changes, intelligent software Proactiveness means being able to exhibit goal-directed behavior.

Conclusions: It should be noted that the implementation intelligent laboratory require comprehensive studies, notification of other countries experiences and determining the appropriate national pattern have a systematic view and considering social and human aspects, motivations, users views, improvement quality of tools and laboratory equipment and so on are essential And should be considered in planning.

Keywords: Intelligent, Laboratory, Laboratory Information Management System, LIMS

1. Background

According to the Pentagon reports, People who die from medical errors each year in the United States are more than the number of Americans killed in the Korean and Vietnam Wars. However, studies show 40% of these errors was preventable (1). Approximately 200000 die from preventable medical errors in America. Institute of medicine (IOM) in 1998 announce 98000 annually deaths occur due to preventable medical errors (2). Around 3-16 % of patients around the world are suffering from injuries caused by medical intervention. Adverse effects of drugs are the most common intervention (3). The most common preventable medical errors in health care are: Human errors due to illegible handwriting of doctors in patient records or prescription, failure in Integration of

clinical information systems, lack of timely access to patient records and lack of information on patient allergies when providing health care (1).

Clinical laboratory provide information needs for physicians and influence on clinical decisions. A significant portion of health care costs is devoted to labs (4). Poor communication between health care providers and clinical laboratories personnel can lead to medical errors. 6.4 % of medical errors lead to wrong decisions in providing health care, inappropriate treatment and or change the patient's treatment plan by mistake (5-10).

Most medical errors in clinical laboratories that have a significant impact on the performance of this sector, including samples condition, inadequate samples, incorrect samples, sample handling transfer, improper data entry, error in report or analysis, laboratory equipment

Implication for health policy/practice/research/medical education:

This article can be interesting for all researchers in medical informatics, health information management and laboratory science and policy makers in health care domain.

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malfunction, turnaround times (10-12). Because of the pivotal role of laboratory on create and use of clinical information and impact on diagnosis, treatment, delivery of appropriate health services to patients, costs and quality of health care and influence of the laboratory results on the management of patients can be stated consider the quality of the tests, lab reports, timely and easily access to high-quality laboratory data and appropriate lab management are very important. In other words reduce laboratory-related error rates or optimize use of laboratory testing have a significant effect on patient safety, clinical decision making about treatments and interventions, health outcomes, and costs. Also for providing effectiveness health care, shared information and all actions need to be coordinate. To facilitate decision making need to interoperability and effective communications between various professionals with different skills. In this way medical error reduced, quality of health care increased and outcome patient improved. To meets these needs information technology tools play important role and electronic health systems must be proactive in anticipating the health information needs, deliver it timely, support communications, and facilitate coordination among providers involved in delivering health services. Artificial intelligence (AI) researches are one of the new technologies in information technologies areas, especially in the generation of practical solutions for real problems. Applying this technology has enormous advantages in health care systems and laboratory systems.

2. Objectives

The purpose of this study is recommending a framework to help design an intelligent clinical lab in order to increase the quality of actions and benefit from artificial intelligent advantages.

3. Materials and Methods

In this review article with key word Intelligent, Laboratory, Laboratory Information Management System, LIMS related article searched in pub med, science direct and Google scholar databases and laboratory situation in national level according to draft indicators for evaluating the performance of the hospital information system (HIS) second edition, that published by office of statistics and information technology of the Iran ministry of health and medical education in 2011 with standard manual 1578 for LIMS is reviewed.

4. Results

In recent years internal changes in health systems and the evolution of disease-oriented approach to health oriented, individual oriented to community based med-

icine and significant progress of information technology in the world, lead to necessitate usage of information communication technology (ICT) to effectiveness and high quality health care. Information technology and communication capabilities on the one hand, the growing needs of patients, increased costs of the disease and shortage of resource, health approach have led to the e-health. The literature review implies that information technologies are useful and important tool for the identification and reduction of medical errors, enhance the quality of health care services, support decision making, information availability, decrease duplications and fragmentation of services results in delays in care, progress of health researches and educations, improving communication and coordination between health care providers (13-15). Hospital information system (HIS) can be identified 89 % adverse events and mistakes through physician orders monitoring, check drug interactions, access to relevant information about patient allergies to specific drugs, drug doses control, and so on (15). Information technology has a key role in delivery health care and home care with reducing error costs, increase coordination among health care providers, rapid and real time access to relevant patient information, decrease traveling from remote regions to health care centers, education to patients and providers, decrease health care costs, appropriate performance management (16, 17). Role of laboratory medicine is strongly and equally challenged by economic and new technological pressures. In clinical labs, samples management, analysis and reporting are time consuming tasks, if done manually are associated with several errors (18). Hence health care centers interested in using information systems in laboratories in order to reduce medical errors, decrease costs, saving time, resource management, quality improvement and increase effectiveness and efficiency. one of the information technology tools that can be used as the subsystem of hospital information system (HIS) or apply independently are electronic system in laboratory department.

At present most computer systems in laboratory department introduced under the headings of laboratory information management system (LIMS). These systems collect and manage relevant data in clinical labs, track data and metadata provides analysis and store them in relevant databases. LIMS have had an important role in disease diagnosis, online fast and effective access to data, decrease redundancy and costs, high speed data retrieval with low data missed, provide various reports according to the user needs. The main use of these electronic systems is to facilitate the integration and collection of data and metadata from different types of instruments and systems. Most laboratory information management system uses the database model to describe the experi-

ences and collect results (19). LIMS models in 2004 based on modern web oriented software technologies (20, 21). From 2010 to now these systems more focused on providing a user-friendly and integrated data management solution (21). Application of laboratory information management systems will lead to improved: planning and resource allocations and budget, samples and orders entry, distribution of samples for analysis, documentation, and automatic provide and deliver of reports, health information flow. In the conceptual model LIMS presented in the standard manual 1578, capability of LIMS is divided into three levels. Level one or core level is nearest to center and represents core LIMS function, levels 2 and 3 respectively show intermediate and advanced functions. Also in this model environment factors that effects on system are mentioned such as: the environment that LIMS delivers information, computer systems that send and receive data / information to / from a LIMS, issues that have an impact on all LIMS functions. These important principles include: change control (configuration management), communication infrastructures, documentation, performance, quality, security, training, user interface and validation.

Functions of laboratory information management system in this conceptual model described in five sections that are: 1- data / information capture such as: manual result entry, bar code entry, two way links to external systems 2-data analysis for example: basic calculations, comparison of result to specification predefined math functions 3- reporting such as: queries, sorts, filters, bulk data transfers 4 - lab management for example: scheduling of lab work, location of sample, advanced qc management 5 - system management such as: backup and recovery, system fault tolerance, advanced communication links to external systems. In this model, data and information flow between sections through the LIMS database. Database is the hub for all laboratory information management system interactions and composed of two sections: the static area is where descriptive information about tests, profiles, calculations, specifications, etc. is stored. The dynamic area is where sample and result information is stored (22).

Minimum laboratory information management system functions based on the conceptual model presented in the standard manual 1578 are in table below at five sections and three core, medium and advanced level.

Table 1. Minimum Laboratory Information Management System Functions

Function	Core Level	Intermediate Level	Advance Level
Data / Information Capture	Manual Sample Login, Manual Result Entry	On-Line from instruments (one-way), File Transfers (one-way), Bar Code Entry, User Qualification Checking	Bidirectional Communications to / from Instruments, IR, UV, NMR Spectra File Transfer, Two Way Links to External Systems, Multimedia/Imaging, Electronic Notebook
Data analysis	Result Verification, Basic Calculations	Comparison of Result to Specification Predefined Math Functions, Intra-Test Calculations Graphical Presentation Basic Statistics QA/QC on Samples	Inter Test/Sample Calculations, Advanced Math Functions User-Defined Functions, 3-D Graphs, Advanced Statistics, Dynamic Links to Prior Results and Other Systems
Reporting	Pre-Defined Reports, Sample Labels	User Defined Reports, Queries, Sorts, Filters, Basic Graphics, Ad Hoc Querying and Reporting	Natural Language Reporting Methods, Batch Reports, Event Triggers Export to External Systems, Bulk Data Transfers, Advanced Graphics, Multi-Site LIMS Reports
Lab management	Sample/Order. Status, Sample/Order. Tracking, Backlog Report	Scheduling of Lab Work, Location of Sample, Workload Prediction Pricing/Invoicing Time (shelf life) Schedule, Sample Inventory	Resource Management, External System Scheduling Work, AI Decision Making Tools, Revenue/Cost. Tracking, Advanced QC Management, Multi-Site LIMS Management
System management	Backup and Recovery	Archiving, Manual Performance. Tuning, System Fault Tolerance	Dynamic Performance. Tuning, Advanced System. Fault Tolerance Redundant Systems, Advanced Communication. Links to External Systems

In review of Draft indicators for evaluating the performance of the hospital information system (HIS) second edition, that published by office of statistics and information technology of the Iran ministry of health and

medical education in 2011, in laboratory department is found a list of minimum requirements for electronic systems in this section. In this draft mentioned laboratory is a place that allows acceptance tests and perform

them. Of course laboratories in hospitals can admit outpatient but about the inpatient, results of test must be integrated into the patient electronic records and cost of tests will be calculated at the time of discharge. In this draft, main subgroups of clinical laboratory information system along with descriptions of each subgroups are listed. subgroups of clinical laboratories in this document are: transfer test orders from wards to laboratory, admission of outpatient examinations, and the possibility of using existing capabilities in data communication systems within a hospital, ability to identify emergency patient and giving priority to her / his experiments, definition of special groups in laboratory, automatic assignment tests, present the testing situation, use of capabilities of nomenclature standards, defining various tests, defining the normal range and alarm range in quantitative tests, system can be alarmed before the providing the final result if needs additional test, insert note and comment in Persian and Latin below of test, use of open text or pre-defined in Persian and Latin for pathology reports, be issued automatically labeled samples, register requester physician, insert date and time of perform test, issue a receipt form for the patient to determine the response time, define the costs and insurance consideration, resource management (storage devices, laboratory equipment and consumables materials), reports of patient tests and department tests in define period time, provide reports according to needs of insurance organization, possibility of data extract and statistical analysis and quality control curves in the laboratory, presentation of past test and new test as a text, connect to instruments and equipment in laboratory and send automatically results in electronic health records, entry of describes the macroscopic and microscopic pathology examinations, record type specimens received for testing, entry the final diagnosis of pathologist in patient relevant examination, entry holiday calendar for response result to patient. The following are descriptions of some subgroups in this draft. Descriptions for the transfer test orders from wards to laboratory: laboratory system should be capable of receiving requests tests from various departments of the hospital and transferred them to the laboratory unit. Descriptions for the Ability to identify emergency patient and giving priority to her / his experiments: emergency patient's tests must be as a priority, so methods in the system must be designed to distinguish of priority of tests. For example in some systems the priority tests with numbers or colors may be specified. Descriptions for present the testing situation: test status is including request, in progress and done. Situation of tests must be shown in the system; the requesting reference can follow up its request. De-

scriptions for use of capabilities of nomenclature standards: laboratory system use of standard laboratory coding system such as LOINC. Descriptions for defining the normal range and alarm range in quantitative tests: in various tests to alert should be define normal range and scope of quantitative tests such as blood glucose. If the test result is outside the normal range, the electronic lab system shows the alert. Description for the system can be alarmed before the providing the final result if needs additional test: for example in request for re-test by laboratory physicians. Description for the register requester physician: clinical laboratory system must be can record identification of physician that orders the examinations. Description for define the costs and insurance consideration: tests costs and insurance consideration in laboratory system must be defined as a code. Description for the Resource Management: Laboratory system should be able to use some of the features and functionality of existing resource management system. Description for the reports of patient tests and department tests in define period time: clinical lab system should be capable of provide reports in specific time period, from patient examination and department test requests. Description for provide reports according to needs of insurance organization: laboratory system should be having ability to provide reports with desired insurance format and regulate the reports based on the information that insurance agencies seek. Description for Possibility of data extract and statistical analysis and quality control curves in the laboratory: the system must be able to perform statistical analyzes of information based on user needs, including the result of patient tests and able to draw the relative curve. Description for presentation of past test and new test as a text: clinical lab system must be able to display non-numeric result tests such as urine color, urine protein levels as text. Description for connect to instruments and equipment in laboratory and send automatically results in electronic health records: In order to eliminate errors caused by manually data recording, should enable data exchange between devices in laboratory and database for provide the tests results. Description for entry the final diagnosis of pathologist in patient relevant examination: the final diagnosis that completes by the pathologist and includes details such as the location of samples (topography), and the morphology. Description for entry holiday calendar for response result to patient: Due to the holidays, there is no possibility to provide the test results, laboratory system shall be calendar holidays in terms of accountability (23). Performance evaluation indicators for clinical laboratory information system in the draft of Iran health ministry according to the ASTM standard can classified in the following table.

Table 2. Performance Evaluation Indicators for LIMS in the Draft of Iran Health Ministry According to the ASTM Standard

Function	Description of Function
Data / Information Capture	transfer test orders from wards to laboratory, definition of special groups in laboratory, insert note and comment in Persian and Latin below of test, use of capabilities of nomenclature standards, use of open text or pre-defined in Persian and Latin for pathology reports, Be issued automatically labeled samples , register requester physician, connect to instruments and equipment in laboratory and send automatically results in electronic health records. Entry of describes the macroscopic and microscopic pathology examinations. Record type specimens received for testing, entry the final diagnosis of pathologist in patient relevant examination.
Data Analysis	Defining the normal range and alarm range in quantitative tests, system can be alarmed before the providing the final result if needs additional test, Possibility of data extract and statistical analysis and quality control curves in the laboratory
Reporting	Automatic assignment tests, present The testing situation ,reports of patient tests and department tests in define period time, provide reports according to needs of insurance organization, presentation of past test and new test as a text
Lab Management	The possibility of using existing capabilities in data communication systems within a hospital, Ability to identify emergency patient and giving priority to her experiments, insert date and time of perform test, issue a receipt form for the patient to determine the response time, define the costs and insurance consideration, Resource Management(Storage devices, laboratory equipment and consumables materials),entry holiday calendar for response result to patient
System Management	--

Electronic laboratory systems despite the significant advantages are limited by some factors. The main challenge of the systems is problem in adaption to new instruments that may discontinue or change existing work processes in laboratory or using the new or advance software that are needed for the analysis of new data to different data formats. The greatest limitation of current systems is log, data store and statistical tools that linked in only one direction (Hypothesis to data and data to conclusion). Sometimes users need to analyze the results with various statistical methods and find new theories. Existing electronic laboratory systems can't use results or hypothesis derived from data analysis to direct automatically (19).

Use of artificial intelligence as one of the new technology in health systems lead to facility, acceleration and improvement of health care (24). Applications of intelligent software with existing information systems, in addition to removing these restrictions, have important benefits. For example intelligent software can maintain the autonomy of the collaborating participants, improve the performance of a computerized system in terms of interoperability, scalability and configurability, integrate disparate operating environments, coordinate distributed data, such as patient records held in different departments within a hospital or in several hospitals, dynamically manage distributed data and resources, handle the complexity of solutions through decomposition, modeling and organizing the interrelationships between components , are able to communicate between themselves in order to exchange any kind of information ,provide remote care monitoring and information for elder people and chronic diseases; supply diagnosis decision-support;

improve remote medical training and E-education; gather, compile and organize medical knowledge available on the Internet (25, 26).

5. Discussion

Dynamic health environment needs high speed access to real-time health information, high interoperability among different providers with various skills. Because of potential capability of intelligent systems to solve complex and dynamic health solutions, health care system to gain full advantages of E- health must be move to take this technology.

This study expressed that using intelligent systems in clinical laboratories includes significant advantages. The main benefits of using this system is quality improvement of health care services to patients through: 1- reducing health care costs by decrease errors, speed communications, provide timely, transparent results and reports, appropriate information management, accurate analysis, online access to quality information, 2- improve the efficiency and effectiveness with fast-labeled samples, quickly create lists of working, transfer fast and accurate laboratory orders, 3- offer services according to user needs 4-decision support 5- ability to respond to changes and adaptation of necessary changes.

Intelligent laboratory information management system needs to benefit from automation algorithms, informatics tools, skill and trained personnel and latest technologies like open sources and they must have high flexibility, appropriate database, integration with other tools and related systems such as electronic health record (EHR) and hospital information system (HIS). Also

be considered that preparation of back up laboratory data in these systems is especially important.

Study the international clinical laboratory standard by ASTM and performance evaluation indicators for HIS draft by office of statistics and information technology of ministry of health in Iran published in 2011, it can be stated that indicators of electronic laboratory system in national level at 2 sections (Data/Information Capture and Reporting) are fairly comprehensive. Evaluation indicators in lab management been fairly well, but in data analysis section, indicators are in minimum requirements level. Also separate and distinct evaluation indicators are not intended for the system management. The evaluation indicators presented in the draft is not graded expression, it seems that the assessment indicators considered are core level functions of electronic laboratory systems. Obviously, in order to benefit from artificial intelligence and implementation of intelligent laboratory management in Iran must in primarily step, provide technical, equipment infrastructure, financial and human resources for implementation of electronic laboratories information systems in appropriate level.

Implementing electronic systems must be done step by step, systems implemented flexibly to changes and have the capability to develop and benefit from intelligent devices. In conceptual model, artificial intelligent decision making tools apply in advance level of lab management section. Therefore, electronic laboratory systems performance must be improve to advance level until artificial intelligent applications can be used.

It is necessary that define appropriate indicators with collaboration of different professional that involved in patient treatment like laboratory professional, physicians, health information management, managers, representative from clinical department, and nursing, insurance agencies, stakeholders and other related organization, technical experts and system users. Determine indicators in detailed at different level based on desired operational capabilities of the electronic system. Strengthen laboratory information systems indicators in all areas of LIMS system components at various levels like: core, intermediate and advanced level. Evaluation and accreditation of these systems and comprehensive management support have significantly influence towards achieving intelligent laboratory management.

It should be noted that the implementation intelligent laboratory require comprehensive studies. Benefit and notification to other countries experiences and determining the appropriate national pattern is essential. Conceptual model provided by ASTM focused on functions not technology but successful implementation needs to have a systematic view and considering social and human aspects, motivations, user's attitudes, improvement quality of tools and laboratory equipment, providing suitable tools and equipment, database tech-

nology and structure, security, confidentially and so on. Adequate education to people who cooperation in project and user involvement in all steps of implementation intelligent laboratory systems are critical factors for success and should be considered in planning.

An important point to be noted is that the laboratory information management system requirements vary from laboratory to laboratory. Localization systems based on users' needs, organizational requirements and attention to the characteristics of each organization will have a significant role in the success of the system.

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Challenges of Health Information Managers in Electronic Environment

Marjan Ghazisaeidi¹, Maryam Ahmadi^{1,*}, Fateme Sadeghi¹, Sakineh Hamidi¹, Elham Khayamdar²

¹Department of Health Information Management School of Health Management and Information Sciences, Tehran University Medical Sciences, Tehran, Iran

²Library and Information, Tarbiat Modares University, Tehran, Iran

*Corresponding author: Maryam Ahmadi, Department of Health Information Management School of Health Management and Information Sciences, Tehran University Medical Sciences, Tehran, Iran. Tel: +98-2188003372, E-mail: m-ahmadi@tums.ac.ir

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Background: The fast growth of technology is running organizations and work environments toward electronic systems. Health care organizations will undoubtedly provide services in a semi or fully virtual manner. Information and its management is an important issue, which should be considered accordingly. Since the role of health information managers is directly in contact with the electronic information, health information managers should adapt themselves with the changes and plan to update the current students in related course and employers in the work environment.

Objectives: Studying the alterations in the working environment of experts of this field and their adaptation procedure with the changes and planning for the improvement of the staff accompanied by work environment.

Materials and Methods: In order to conduct this study, first it was tried to find suitable web sites in the related fields and then considering the aims of the study, appropriate key words were chosen and documented based on the medical science headlines; finally using the key words, related articles from reputable and valid journals were found and used.

Results: Fast growth of technology in the medical realms, the need to change the health information into electronic format, and forming a virtual work environment, seem to be quite obvious. With the rapid growth of technology and changing the concentration from paper based record to electronic form, it is necessary to obtain new skills and consequently, train the students and staff of health information management profession.

Conclusions: Therefore, it is recommended that in order to change management and collaboration of the people involved in transition, the leaders of this profession choose a group in order to follow up the case, so that the chosen group can train and plan for the changes and describe future of the career.

Keywords: Health Information Management; Electronic Health Information Management; Challenges Transition; Virtual Environment

1. Background

Health information management is established according to the needs to perfect and accurate data in the field of care and treatment of patients, and management of health and service systems (1). Management of health registry systems and services are the first responsibility of information management experts. This profession is concerned with gathering and analyzing health care and treatment data, information distribution and also information source management regarding research, planning and assessing the health care and treatment services. The aim of health information management is to support the quality of health care and treatment services through improvement and support of the information quality. Health information management, regarding its structural aspect and relying on information technol-

ogy, improves every day; and information revolution insists on the axis of knowledge, applying knowledge and information to produce new knowledge and transferring the information in innovation cycle. Changes in technology transitions in the realm of health information, and changing the approach from paper folders to electronic records increase the role of health information managers; so that, in the previous centuries, and specially the current one, health and treatment industry in general, and health information management in specific, have experienced significant and different changes (2).

Transition of traditional medical records to electronic health records, will change the planning of performances, and the structure of health information department (1).

In 1999, American health information management association, with a program named "White Paper on

Implication for health policy/practice/research/medical education:

This manuscript is useful for job planner, hospital manager, health information manager, chief information officer, executive manager in different level at health care centers.

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the Health and Well-being of Professional Education in the Health Information Management Discipline ", challenged the academic society to speed up the training changes, regarding better preparation of graduates for new careers in electronic performance environment. e-HIM is one of the main strategies of American health information management association which has been considered since 2003 (2).

2. Objectives

The current study investigated the transition procedure of health information management from paper environment (HIM) to electronic environment (e-HIM).

3. Materials and Methods

The current study was a library research and to conduct it, first, suitable websites were explored and then, considering the research goals, appropriate key words were chosen and recorded, regarding medical headlines. To find lectures, the following websites were used: Iran Medex, Pub med, Science Direct and information-scientific website, SID and articles were printed by AHIMA. Then, considering the experiments done in the other countries, the future career of health information managers was analyzed and necessary suggestions were given for adaptation.

4. Results and Discussion

In 1927, following the American College of Surgeons, the experimental career as "health records librarianship" was established. From mid 1930's, as one of the meanings of "record" directly refers to "archiving performances", the name of this career remained unchanged as "medical record". On the other hand, in the early years of 1950's, "medical record section" was changed significantly, in providing conditional information in training and research; 1980 was the beginning of improving the health concept and transition from medical record to the concept of health record. Finally, until 1990's, in the USA, the two terms of "health record" and "health information management", as thematic and professional concepts, replaced appropriately instead of "medical record" and were generally used. The years of 1990's faced the historic turbulent in the evolution of health information management; therefore, basic changes were made in the form of major phenomenon to move appropriately and professionally from paper based environment to computer based environment (1).

The speed of changes in health information management will increase in future, so that the changes of the next decade will be higher than that of the past 3 decades; and since the electronic health record is the criterion, many positions of this career will be changed, too (3). American health information management association, in 2003 chose a special group to study the situation and

future roles of health information management. The group focused on 3 criteria: influential factors in future of the health information management, career performance, and future roles of the field experts (3).

At present, health care domain, concerning the reliance on information technology is developing everyday (4); understanding the computer systems and information technology will increase the performance of health information management experts; in case of ability to apply electronic health record and informing the executive and clinical career they will be valuable in work environment (4). Therefore, most of the patient information becomes electronic and working procedures of health information management gets functional (5). Of course, the impact of electronic health records on the organizational structure of health information management section should not be ignored. Many theoreticians believe that by increasing the use of electronic records, a lot of activities of this section will be done in electronic environment and from far distances; and there will be no need for the activities and positions of this section. Therefore, the organizational structure of this domain will gradually become virtual (6). Health information management experts should be involved directly in selection, planning and execution of electronic health record systems (7). As electronic health record, recommends electronic access to medical records, traditional performances of health information management such as: encoding, explaining, records application, information revealing and assessment will change to virtual procedures.

It seems that reforming the health and treatment system, is an instrument to improve providing services (8). Here, reform has significant impact on health information management and highly changes its working procedures (8, 9).

In this fast changing, health information experts should regularly upgrade their knowledge, skills and abilities to keep up with the environment speed. They have to trust on applying career main performances by relying on the quality of medical information for all organizations and health care areas which are producing or applying the information. The main performances of health information management do not disappear, when the health care reaches information era, they become even stronger (8). For example; Strategic concentration of American health information management association, is in facilitating the transition of paper records to electronic ones and reviewing the procedures of health information management career. Determination and generalization of electronic health information management standards make this organization a leader in changing the procedures under the name of health information management, in transition from paper based environment to electronic form.

The main aim of establishing electronic health information management is to speed up the change of paper

health information infrastructure to electronic form, reconstruction of documents and records management procedure from establishment to application, providing measurable cost, and approvable results through the improved information management (8). Electronic health information management is a beginning to ensure that the information is available at the right time and place. Transition from health information management to electronic health information management will have three stages; 1- traditional paper health information documents, 2- changing to dual paper-electronic, 3- pure electronic in future (8, 9).

Health information management experts should play a managerial role in changing all the functions to electronic form (8). When this field is improved, information technology will be an important part of medical world, and health information management will experience a transition from traditional and paper based management to a very efficient electronic management accompanied by electronic health records. Experts will manage information sources, health care data, and also the patients, chorally or individually in all health care organizations. The first step in management is to change the current situation in health information management organization, such as expressing all the major processes and the number of staff in each, diagnosing the strengths of staff and their skills, job definition, job needs and quality assessment. Need analysis of the staff will help to evaluate how this section could be managed, and health information manager should plan to create an optimum environment. The review might be, as the planning procedures, in line with the goals. Future conditions should be defined appropriately considering experts' knowledge. After defining the current and future situations, the leader of the section, compares the current and future situations to identify the existing differences. It is important for health information managers to have a supervisor to guarantee the transition procedure from health information management to electronic health information management (8).

The performances of health information managers which will be changed are as follows:

- 1- Analyzing
- 2- Summarizing
- 3- Gathering
- 4- Vital medical records
- 5- Coding
- 6- Reporting
- 7- Evaluation quality and integrity of information
- 8- Denial management
- 9- Authentication of documents
- 10- Documentation training
- 11- Designing forms
- 12- Completion of charts
- 13- Preserving main patient index(MPI)
- 14- Disclosure information

15- Preserving financial statements

16- Expenditure returns management

Job categories of electronic health information management which will be provided are as follows (8, 9):

Health information management supervisor: aimed to manage and coordinate day to day performances in the field; will report to health information management executive manager.

Project managers: leading all the stages of implementation, such as budget management, drawing project risks, probable planning, project development schedule, time management, development and management of detection equipment, and general coordination to implement the project successfully.

Integrated data analyst HIM EHR: providing overview and management of all electronic processes related to electronic health record (including, HIMs: Health Information Management Systems), functions of document processing and electronic MPI. This situation, e-PHI is used to assess and correct the problems of integrity and aspects of system, and reports to HIM director, or project manager of electronic health record. it is in touch with computerized information systems, section, commercial office, physicians and other sections that need performance and implementation of solution to the problems and mutual relations with a system provider in order to diagnose and solve the problems in an effective and on time method.

Health information administrator: responsible for general management and supporting health information management systems including implementation of design, system maintenance and reports to health information management, director, and IT executive manager.

Health information director: who is responsible for guidance, and leading health information management services among the integrated health care system supplier, trying to follow and improve the best performance and training in all subjects and reporting to Chief Information Officer (CIO), finance manager and other executive system superiors.

Health data analyst: who works in order to provide skills to collect, manage and analyze data, result reports, and as an analyst among clinical staff and IT technical planning in improvement of electronic health record and clinical records and make sure that product which is being improved is in accordance with the need of clinical staff.

Clinical applications coordinator: provides development and maintenance of applications of clinical health electronic records and make sure that product meets the needs of clinical staff by analyzing job circulation; and cooperates with health information management, in order to coordinate the efforts, to fix the mistakes which take place in electronic records.

Terminology asset manager: to use categorizing, labeling and applying other standard terms efficiently in order to ensure that data, permanent codes for reimburse-

ment, electronic health record documents, comparative reports and statistical classification, tax and mortality are used appropriately. He should be an expert in clinical terminology, medical terms, and classification systems, skilled in searching, clinical ontological engineering.

Enterprise application specialist: is responsible for maintenance and development of organizational electronic health record. This specialist is an efficient combination of health information management and IT, using the ever growing complicated documentary systems. Clinical information coordinator: is responsible to facilitate the relationship between clinical care and technical implementation team and health electronic record advisor for the organization.

Clinical research association: responsible for organization and coordination of clinical studies, development of clinical studies protocols, informal consultations, designing and preparing report forms and other documents. Also, controlling clinical study projects to guarantee all the regulations and commitment to good clinical methods, standard operational methods and study protocols are observed.

Enterprise content report manager: who is responsible for management, control, leading centers and active occupational evidence systems including document organization, non-active document systems, correspondence control, orders and reports control and preserving records, providing reference services to all sections and levels of staff and also processing the input information, design, development and implementation of appropriate methods to provide, receive, recycle, preserve and maintain information regardless of media and based on rules and regulations.

According to statistics of Bureau job statistics reference 2010-2011, it is expected to have an increase up to 16% in the field of medical documents and care information managers, during 2008-2018, which is higher than the average speed of other careers. Besides, only 38% of health information managers are working in hospitals, 19% of these positions indicate job opportunities in physician offices, nursing facilities (part time or full time jobs), and the rest of opportunities are in home care facilities, governmental institutions, outpatient care institutions (9), and insurance group or social health care institutions.

In order to achieve e-HIM, some practical cases are suggested by a group of authorities of American health information management which include:

1- Leading and conducting groups and organizations within national effective efforts to move towards e-HIM.

2- Moving towards development of institute and its members view points, and HIM for all and health care industry.

3- Betterment of attempts in order to increase the understanding of benefits and value of health information management and their jobs.

4- Financial support in order to make use of jobs with a

perfect function of HIM in the electronic realm.

5- Development and publishing the best related functions related to e-HIM.

6- Designing and implementing an innovative strategy in order to attract competent candidates in the realm of HIM from the new commercial sections.

7- Speeding the projects and activities in order to apply alterations in educational program, training HIM staff.

8- Providing periodic recertification, centralized permanent training programs, and approved certifications for the members of society, in order to document the skills and regular training in e-HIM.

9- Development and application of programs to prepare and train HIM experts better, to perform leading roles in present and future of the career.

10- Development of motivating programs and giving permission for future efforts, in order to promote policies or new responsibilities in the electronic realm.

Training is a vital part of each section, because the presence of trained staff improves the service quality in an organization. Health care career experts, because of the changes in regulations, developments of technology and improvement of processes, should be regularly updating themselves in their related field. Health care information management experts, in order to face the issues of health care system need training. Because of the importance, American society of HIM has taken regular training as part of the procedures for granting certifications.

Health information managers have to be updated, and should be trained differently in order to choose an appropriate approach for future. To support this change, HIM experts need new skills such as training opportunities to upgrade their skills regularly. They should tolerate the technological changes easily and should have the ability to adapt themselves to the environmental changes such as system update, replacement and optimization.

Good predication approach helps the staff to prepare themselves to face the big change and this prediction is not complicated. This process is an interaction between training and repetition, in order to facilitate understanding, change management, transition management, electronic health record and its impact on the function of HIM.

Prediction process includes some stages as follows: decisiveness of top manager as a supporter of change for transition from HIM to the electronic form of the career, to being prediction training for the supervisors and managers of this career to form the future picture by drawing pictures of the future operation (diagram, flowchart), and work with the staff of this work level (this will be the time that managers will have a better feeling about future).

e-HIM experts will be skilled in the following fields:

1- Guidance, promoting the implementation, and development of local and national health information strategy.

2- Promoting and implementing policies, functions, and effective actions taken, on the aspect of HIM.

3- Promoting and implementing standards for privacy, safety and confidentiality of medical information.

4- Promoting and implementing standards and guide lines to control integrity, accuracy, validity, reliability and data record control.

5- Development of content standards and form of health information to make sure of a health information collection which is accurate, complete and on time,

6- Being skilled in communicating health information among health care teams of organizational and different entities.

7- Skilled in using health information for different purposes (such as guidance and care patients, evaluating and assessing outputs, prevention and health research, development of public health).

8- Managing the activities and programs for certificates, licenses, confirmations and adaptation.

9- Analysis and combination of qualitative and quantitative health information for different and varied needs.

10- Designing, implementing, and developing a clinical glossary.

11- Translation and interpretation of health information for the users.

12- Helping the users to access and get health information differently and usually in a complex manner.

13- Giving information and training the patients regarding the publication of health information.

14- Providing content to understand the analysis and interpretation of health information.

15- To help the providers, understand the circulation of data, and reporting the facilities within the format of directions and dynamic rules and regulations.

16- Guiding, the efforts to reconstruct job processes (13).

Internet and its technologies have quick changing effects on paper based medical records to electronic medical records for complete health care. In the transitional stage of HIM career, we should follow technology and employ new technologies to understand the necessary techniques to change processes of the career. Since there are new models of health care to make sure that information is complete, accurate, on time and reliable, we should learn them as well as we can understand the reporting and using the information (8).

Health care ability was enhanced with successful movement toward e-HIM and considerable changing in function of health information management. The need to employment is accelerated and the need to train HIM experts in order to face the future needs of the industry is an obvious priority.

Training and regular educational programs should be promptly reformed and upgraded, so that experts of the field will be prepared and completely ready to employ their knowledge skills, and expertise in different organizations, and branches within the future territory of e-HIM. A large number of HIM experts need new skills to remain in future work environment, to succeed; the

HIM experts should accept the change and improve their technical skills and also their understanding of content, structure analysis, and data application.

In fact, by employment of information technology in health system, HIM experts will have a key role to quality assurance, confidentiality, and efficiency of health information. By increasing the pace and shifting from concentration on paper based records to health information records, the need to obtain new skills based on their new role and responsibility is felt more seriously. HIM experts should actively prepare themselves in the organization and make sure that they also get involved in designing and implementing all aspects of health information records. Important roles are not guaranteed for HIM experts, they should obtain the positions; otherwise other experts take the responsibility even if they are not qualified for the post.

Other benefits of organizational reconstruction of medical documents section are:

Motivating the staff, improvement of communication, participation, innovation, users and staff satisfaction, improvement of information activities, revenue increase in many special hospitals based on reports of a lot of researches.

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Author's Contribution

All authors have participated in the study.

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Financial Disclosure

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The Necessity Usage of Electronic Games in Chronic Disease Management

Reza Safdari¹, Azade Goodini^{2,*}, Mahboobeh Mirzaee¹, Jebraeil Farzi¹, Maryam Goudarzi², Syyed Mohammad Tabatabaee³

¹Department of Health Information Management, Faculty of Allied Health Sciences, Tehran, Iran

²Department of Industrial Engineering Tehran University of Medical Sciences, Tehran, Iran

³Department of Medical Informatics, Faculty of Allied Health Sciences, Shahid Beheshti University of Medical Sciences, Tehran, Iran

*Corresponding author: Azadeh Goodini, Department of Health Information Management, Faculty of Allied Medicine, Tehran University of Medical Sciences, Tehran, Iran, E-mail: azigoodini@yahoo.com; a-goodini@razi.tums.ac.ir

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Background: Effectively caring for patients with complex chronic diseases like cancer, diabetes, or heart disease is difficult. The incidence of chronic disease among people is increasing. For this reason, appropriate managing and treating these diseases across the care continuum requires a high degree of care coordination and patient engagement.

Objectives: The aim of this study is to get familiar with electronic games and its applications in Chronic Diseases Management.

Materials and Methods: The present research is a review study, which has been carried out by searching the chronic disease, electronic games and disease management keywords through the authentic scientific sources, including PubMed, Google scholar, Scopus and other information source.

Results: The findings showed capabilities of electronic games as a new technology that used for health related functions particularly in chronic disease management domains.

Conclusions: Electronic games provide education for patients without limitation of time and space through combine well-known principles of learning and health behavior change with current game design strategies. The uses of this technology can leading to patient empowerment and improve quality of care. This technology is also support behavioral change, Life style modification and self-management for patients with chronic disease.

Keywords: Electronic Games; Chronic Disease; Chronic Disease Management

1. Background

Chronic diseases are diseases of long duration and generally slow progression (1). Chronic diseases, such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes, are by far the leading cause of mortality in the world, representing 63 % of all deaths. Out of the 36 million people who died from chronic disease in 2008, nine million were under 60 and ninety per cent of these premature deaths occurred in low- and middle-income countries (2, 3). Given these circumstances, management of chronic diseases is increasingly becoming an important issue for policy-makers and researchers and policy makers are searching interventions and strategies for the management of chronic disease (4). The use of digital tools such as electronic games could reduce health care costs, facilitate and accelerate the improvement of health services for patients with chronic disease (5). Nowadays patients confront with increase complexity of control chronic disease. Some of

the most important of them are: increase Consumption risk factors such as tobacco smoking, decrease level of education, Poor diet, physical inactivity, and changing n lifestyles toward unhealthy habits (6, 7). The problems of chronic disease in the world are so huge that makes it difficult to find the right solution to improve them. One of the most practical methods is management disease.

The advance of the third generation (3G) network and handheld technologies in recent years has resulted in a number of new mobile innovations being pushed on to the market. Of these innovations, mobile gaming is one of the most promising and profitable services. It is now experiencing a rapid period of worldwide growth. Plenty of research has been conducted to evaluate use of electronic games in the educational setting. Recently, a new movement of serious games for health has been proposed to apply electronic games for health related purposes such as disease management (6, 7).

Implication for health policy/practice/research/medical education:

The study results will elucidate that if policy makers, researchers and medical staff want to better manage chronic disease require new interventions, strategies and along with the advancement of technology.

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3. Materials and methods

The present research is a review study, which has been carried out by searching the chronic disease, electronic games and disease management keywords through the authentic scientific sources, including PubMed, Google scholar, Scopus and other information source.

4. Results

Health education for people consisted only of what they learned during secondary education and visits to their doctors. However, the proliferations of household computers and Internet access have allowed many people to educate themselves about their illnesses and injuries (8, 9). The rapid expansion of information and communications technologies (ICT) within health service delivery and public health systems has created a range of new opportunities to deliver new forms of interactive health services to patients, clinicians, and caregivers alike (10). Video games and game-based technologies that derived from development this technology (ICT) are emerging as one of the most engaging and entertaining venues for meeting need for personal health care management. Indeed, self-care and health care management have been a major focus of games for health from early on and continue to receive attention from both academic and commercial developers (11, 12). Generally, good electronic games include necessary elements to train as Gagen and Gardner listed it. Gagen theory says learning and training has several different levels. Each level has different procedure in learning. Although these two procedures converge each other but each of them has specifications that differentiate them each other. Gardner theory discusses social and cultural training, while Gagen theory is focused on trainings (13). Gagen offered nine principals in game selection. These principals are prerequisite of learning. Principals have used in games including: 1. Attract attention (receive): in this case, program plays automatically and by showing game elements try to attract player in game; 2. Informing about learning purposes (expectations): A part of game is shown and necessary conditions to win this game are explained; 3. Remembering before learned materials (remembering): It is in form of providing some backgrounds that are introduction to new game. Sometimes, the beginning of new game is backgrounds of past games and a person is ready to begin new game; 4. Motivating (selective perception): It is game control and challenging designs that are encouraging designs too; 5. Directing (receiving meaningful information): games are complete and player can learn many by them; 6. Operating (responding): interaction is basic element of game. A game isn't considered game without interaction; 7. Feedback (responding): after seeing score, this show and response are done; 8. Assessment (recovering): game design must be somewhat that a person has

enough feedback and doesn't lose his motive; 9. Improving memory and using cases have been learned (generality): skills and strategies which are learned in game, is used in other games (14, 15).

So far over 300 Health electronic Games have been developed for people and patients. The number and variety according to the Gaming for Health game database are growing rapidly as more and more games are being identified from developers and sponsors in the worldwide (16). In the domain of healthcare, electronic games can be divided in to several categories such as, exergames which incorporate exercise in to playing or learning games which educated children about health condition. One of these important categories is condition management games which used for chronic disease such as diabetics, asthma, cancer and pain management.

Among the available education tools designed to improve diabetes patient outcomes are, many educational games. These include casual games, collections of diabetes-related mini games wrapped in narratives (17), classic side-scrolling video games, and glucose-monitoring peripherals related to games. In addition, the increasingly popular Exergaming subgenre is being explored as a tool for reducing obesity-related health risks, including diabetes (17). In Candy Castle game, children team up with their parents in order to take on the role of creative builders. Both jointly document a part of their daily routines such as meals, physical activity or blood sugar levels. The data is gained in real world locations, for instance, in school or in the office and then transferred to the game environment. Thus, while the game is progressing, a virtual landscape is built up on the screen. This on screen landscape partly corresponds to the real space; players walk, eat, study or live in (17).

Re- Mission is a computer game including 20 levels designed for young cancer patient the player will play as a Nano robot that goes inside the body of cancer patients undergoing chemotherapy, radiation, or immunotherapy. by acting out as the Nano robot inside a cancer patient body and observing how medication and chemotherapy help the body fight against cancer cells, players get to know more about cancer and become more confident in fighting the disease. Another game in condition management called Bronkie the Bronchiasaurus emphasize players self- efficacy related to asthma. In this game, kids play as a dinosaur with asthma and help him save his homeland with trying to avoid asthma triggers and keep asthma under control .The game is set in prehistoric times and the world is covered in dust. A fan that usually keeps the dust at bay has broken. Players help the two in game characters, Bronkie and Trakie, keep their asthma at bay by avoiding triggers such as dust and smoke while they go on their quest (16).

These findings contribute to our knowledge about what electronic games can do to affect important health be-

liefs and practices among young children and adults.

5. Discussion

Chronic disease is one of the important public health problems. Disease management, as one of the most practical preventable methods, help control and prevention of disease. New technologies improve treatment, patient empowerment, self-management and risk prevention. Electronic games combine well-known principles of learning and health behavior change with current game design strategies. Serious games seek to be pleasurable and to support, educate or train users in their real life. With the rise of ubiquitous computing, mobile serious games stress an important aspect, since they address the boundaries between user's game experience and daily routines (16).

Health-related domain experts play a critical role as stakeholders in product development. As a result, the competitive ground in this area has moved from visual realism to fulfilling the health-related needs of the product.

Different type's electronic games suggest the serious goal to collect as much data as possible for the game period. All concepts are developed to run on a mobile or PC computer.

In order to implement this technology for disease management, there was a need to identify the elements of effective health game design and to show which games and game features work best, depending on the health topic and the target population. Beyond that the field needed to know how and why certain health games work, and for whom, so that the most effective design strategies could be used in games. Involving users in initial stages games has led to several insights to this new and evolving topic, and has revealed a variety of unexpected impulses and research questions. This may render a participatory design approach as encouraging for further exploration.

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Authors Contributions

All authors have participated to the study.

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There are not any non-financial competing interests (political, personal, religious, ideological, academic, intellectual, commercial, or any other) to declare in relation to this manuscript.

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➤ We will NOT accept any images with resolution below 300 dpi.
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• **Units, symbols, and abbreviations:** Internationally accepted units (International System of Units), symbols, and abbreviations must be used. Abbreviations should be used sparingly and must be introduced in parentheses upon first mention. Abbreviations that have meaning only within the context of the specific manuscript should be avoided.

• **Drug names:** Generic drug names must be used in the title and throughout the manuscript text. The proprietary name should be included in parentheses, along with the name of manufacturer, and city upon first mention in the text.

REFERENCES

Iranian Journal of Radiology accepts references according to a style based on Vancouver style (with some minor changes). Vancouver, a numbered style, follows rules established by the International Committee of Medical Journal Editors. Writing references as an ENDNOTE or REFMAN file will be considered as an advantage when submitting a manuscript. For more information please refer to: http://iranradiol.com/?page=pages&page_id=127#16

Some Examples:

Books

➤ Ford MJ, Munro JF. Introduction to Clinical Examination. 7th ed. Edinburgh: Churchill Livingstone; 2000.

Journal Articles

➤ Meydani SN, Leka LS, Fine BC, Dallal GE, Keusch GT, Singh MF, et al. Vitamin E and Respiratory Tract Infections in Elderly Nursing Home Residents: a Randomized Controlled Trial. JAMA. 2004 Aug 18;292(7):828-36.

Online Sources

Royal College of General Practitioners. The Primary Health Care Team. RCGP website 2003 [cited 2004 Sep 22]; Available from: URL:http://www.rcgp.org.uk/information/publications/information/PDFInfo/21_OCT_03.pdf

TIPS

a) How can we cite Iranian Journal of Radiology in the reference part?

Some other journals have more than two parts and should be abbreviated when written in the references. Example: Iranian Journal of Radiology which should be written as Iran J Radiol.

b) How can we cite Iranian Journals in the reference part?

• Some of the Iranian journals are named according to their universities, like Scientific Research Journal of Babol Medical Science. Authors should write these journals like below:

[[: Abbreviation of Journal]] [full name of the city] [Univ: Abbreviation of University] [Med: Abbreviation of Medical] [Sci: Abbreviation of Sciences]

• Example: J Babol Univ Med Sci

• Some other journals have unique names and should be written as complete names in the reference part.

Example: Yakhteh

REVIEW PROCESS

All submitted manuscripts are subject to peer review and editorial approval. Articles will be sent to at least three reviewers. Sometimes, the reviewers are masked as to the identity of the authors and their affiliation. Authors are usually notified within 3-6 months about the acceptability of their manuscript. Reviewers are selected based on their expertise within the topic area of the submission, and their purpose is to assist the authors and the journal by providing a critical review of the manuscript. On receiving reviewers comments, authors are requested to send the revised article, and a copy of their reply to the reviewers, including the comment and explaining the replies to questions and changes made to the revised version. Communication regarding a specific manuscript will take place between the journal and the designated corresponding author only.

PROOFS

Proofs will be sent to the corresponding author. Galley proofs should be returned within 72 hours from receipt with clear indication of any changes.

NEW GUIDELINES FOR AUTHORS

To improve success rate of publishing articles, authors can have a look at these checklists which will be considered as a checklist by reviewers in the review process.

http://IranJRadiol.com/?page=pages&page_id=127#19, NEW GUIDELINES FOR AUTHORS

TYPE OF ARTICLES

Iranian Journal of Radiology publishes original articles, systematic review articles, meta-analyses, invited review articles, case reports, and letter to editors monthly. (The papers in all fields of Radiology, which will assist the Radiologists to conduct basic research, are welcomed.)

ORIGINAL ARTICLES

The content of the paper must justify its length. For reports of original investigative work, traditional division into sections is required: Title, Keywords, Addresses and the corresponding author's address, Structured Abstract, Introduction, Materials and Methods, Results, Discussion, References and Acknowledgements, Legends for display items (Figures and Tables)

SYSTEMATIC REVIEW / META-ANALYSIS

Authors should report systematic reviews and meta-analyses in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement. For Systematic Reviews, the abstract should be subdivided into the following sequential sections: Background; Objectives; Search Strategy; Selection Criteria; Data Collection and Analysis; Main Results; Conclusions; and Keywords. Systematic reviews are welcome. They should be critical assessments of current evidence covering a broad range of topics of concern to those working in the field of Radiology. Systematic reviews should be 4000-5000 words (abstracts to be structured as above). N. B. For advice on writing systematic reviews consult: The Cochrane Reviewers' Handbook

Meta-analysis of observational studies: A MOOSE checklist is required for meta-analysis of observational studies

REVIEW ARTICLE

Only invited review articles will be accepted. In a review article both abstract and text of the manuscript, include following items:

➤ **Context:** Include 1 or 2 sentences describing the clinical question or issue and its importance in clinical practice or public health.

➤ **Evidence Acquisition:** Describe the data sources used, including the search strategies, years searched, and other sources of material, such as subsequent reference searches of retrieved articles. Explain the methods used for quality assessment and the inclusion of identified articles.

➤ **Results:** Address the major findings of the review of the clinical issue or topic in an evidence-based, objective, and balanced fashion, emphasizing the highest-quality evidence available.

➤ **Conclusions:** Clearly state the conclusions to answer the questions

posed if applicable, basing the conclusions on available evidence, and emphasize how clinicians should apply current knowledge.

Review methods:

Specify how studies were identified by describing:

- Who conducted the searches
- Databases searched (were hand-searches conducted and if so, how?)
- Inclusive years of the search
- Keywords and combinations used

Define specific inclusion and exclusion criteria used to select studies

- Describe data extraction
- Describe strategy for the assessment of the quality of each study. See Olivo et al. (2008) for a review of scales to assess the quality of randomized controlled trials.

- Describe method(s) of data synthesis

Review results:

- Provide details of how the studies were excluded and the numbers excluded at each stage (a figure can be used to illustrate these steps).

- Review details of the included studies (a succinct table can be used to summarize major characteristics of the included studies).

- Findings of the review (tables can be used to summarize extracted data as appropriate)

Discussion:

- State principal findings of the review
- Strengths and weaknesses of the review method
- Strengths and weaknesses of the evidence from the review
- Applicability of the findings
- Implications of the findings for practice, education, and/or policy
- Questions unanswered by the review with implications for research

PICTORIAL ESSAY

Pictorial essay is an educational exercise demonstrating messages through the images, their legends and the text. The quality of the illustrations together with the appropriateness and practicability of the information define the importance of this paper.

The introduction explains the aim and significance of this paper.

BRIEF REPORT

Brief Report should not exceed 1200 words and should contain a structured abstract of 250 words maximum. Short reports should comprise sections of Introduction, Materials & Methods, Results and Discussion with not more than 4 tables or figures and up to 20 references.

LETTER TO THE EDITOR

Letter to the editor will be considered if they give significant comments on recent articles published in Iranian Journal of Radiology or they contain relevant preliminary data providing new insights. Letters need no abstract and must cite the previous article in Iranian Journal of Radiology that is being discussed, and should have no more than 10 references.

PHOTO QUIZ

Photo quiz presents a striking image that is meant to challenge and inform readers and to illustrate and teach important medical points and

the diagnosis and discussion should make an important medical teaching point. Photo quizzes need no abstract but should include up to 10 references.

CLINICAL TRIALS

"Iranian Journal of Radiology" requires registration of randomized clinical trials in such public trial registries as those of the National Institutes of Health and the International Standard Randomized Controlled Trials. The International Committee of Medical Journal Editors (ICMJE) has established a requirement that all clinical trials be entered in a public registry before the onset of patient enrollment, as a condition of consideration for publication. The definition of a clinical trial as established by the ICMJE is any research project that prospectively assigns human subjects to intervention and comparison groups to study the cause-and-effect relation between a medical intervention and a health outcome. ClinicalTrials.gov or similar registries provide a vehicle which allows organizations and individuals to provide the data requested by ICMJE, which has adopted the World Health Organization (WHO) minimal registration data set. Clinical trials should have a NCT registration code or IRCT code or other similar codes (see below) which can be Starting on July 2010. Iranian Journal of Radiology will be including the identifier number in Clinical Trial articles. This rule is concluded from the International Committee of Medical Journal Editors (ICMJE) Web site for their editorial and updates on the topic of registering clinical trials before publication of the results. The ICMJE recommends that the clinical trial registration number be included at the end of the abstract. A sample of general display format for the code obtained from ClinicalTrials.gov is: an alphabetic label of ClinicalTrials.gov followed by a slash and then an 11-digit alphanumeric string starting with NCT followed by eight numbers. For instance, an example in the Citation format display would be: ClinicalTrials.gov/NCT00000161.

Which trial registries are acceptable to the Iranian Journal of Radiology

Phase III trials must be registered, and phase II trials are appropriate to register. Most phase I trials do not need to be registered. Please clearly state in the methods section of the manuscript the trial registration number including where the registration is publicly available. Visit the website of the Consolidated Standards of Reporting Trials (CONSORT) for more information. Iranian Journal of Radiology accepts registration in the following registries:

1. www.irct.ir
2. www.actr.org.au
3. www.clinicaltrials.gov
4. www.ISRCTN.org
5. www.umin.ac.jp/ctr/index/htm
6. www.trialregister.nl

More information and update can be found at: http://www.icmje.org/faq_clinical.html and Primary Registries in the WHO Registry Network.

HEALTH POLICY CHALLENGE

Health policy challenge identifies and discusses important issues of Radiology linked to health policies of a country or region as well as analysis of social, economic, ethical and political issues. Health policy challenge should normally not be more than 2500 words with an unstructured abstract of no more than 150 words.

IRANIAN JOURNAL OF RADIOLOGY



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Address: Iranian Journal of Radiology Office, Medical Imaging Center, Imam Khomeini Hospital, Keshavarz Blvd., Tehran, Iran.

Tel: + 98 21 66581579 +98 21 66944041 Fax: + 98 21 66581578 Email: info@iranjradiol.com

Indexing Sources

International: PubMed, Science Citation Index Expanded (SCIE), Web of Knowledge, Thomson Reuters (ISI), SCOPUS, EMBASE, CABI, EBSCO, Index Medicus for the WHO Eastern Mediterranean Region (IMEMR), Index Copernicus

Local: ISC, SID (Scientific Information Database), Iran Medex