

Electronic Health Record Implementation: A SWOT Analysis

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Abstract- Electronic Health Record (EHR) is one of the most important achievements of information technology in healthcare domain, and if deployed effectively, it can yield predominant results. The aim of this study was a SWOT (strengths, weaknesses, opportunities, and threats) analysis in electronic health record implementation. This is a descriptive, analytical study conducted with the participation of a 90-member work force from Hospitals affiliated to Tehran University of Medical Sciences (TUMS). The data were collected by using a self-structured questionnaire and analyzed by SPSS software. Based on the results, the highest priority in strength analysis was related to timely and quick access to information. However, lack of hardware and infrastructures was the most important weakness. Having the potential to share information between different sectors and access to a variety of health statistics was the significant opportunity of EHR. Finally, the most substantial threats were the lack of strategic planning in the field of electronic health records together with physicians' and other clinical staff's resistance in the use of electronic health records. To facilitate successful adoption of electronic health record, some organizational, technical and resource elements contribute; moreover, the consideration of these factors is essential for HER implementation.

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Introduction

Nowadays information technology (IT) is seen as an important determinant for improving the quality of health care and patient safety (1). EHR is an essential component of IT and is defined as a comprehensive set of a patient's conditions that is maintained by the healthcare provider over time, and includes all key clinical data relevant to the patient. For handling data quality and increasing, communication in healthcare organizations, deployment of EHR systems is essential because they can be shared between different healthcare units and lead to the creation of integrated health delivery networks (2).

With the capability to address population and public health information needs, electronic health records can contribute to the creation of health policies, decision making, and promotion of lifestyles (3). An EHR can be continuously used to improve communication, enhance the quality of care, reduce medical errors, and eliminate waste (4). It can also have the potential to transform the healthcare system from a mostly paper-based industry to one that utilizes multiple sets of information to assist

providers in delivering a higher quality of care to their patients (5).

EHRs accelerate access to information and have the potential to upgrade clinical workflow; they also have the capacity to support other associated activities by means of various tools such as decision support system (DSS) and intelligent systems (6). On the other hand, essential problems highlighted in different studies about EHR acquisition are cost issues and return on investment (ROI), technical failures, privacy and confidentiality concerns, and lack of resources.

Electronic health record acquisition is one of the most important decisions for healthcare organizations (7) because, despite the financial and other incentives provided by the government, the adoption of EHRs remain problematic; one of the most important reasons for such a thing is the lack of a clear understanding of all the factors that are likely to affect EHR adoption (8).

EHR acquisition involves many user groups including patients, care givers, and health care managers, based on healthcare financial management's report, the most important barrier to EHR acquisition was the lack of

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national information standards (9). In another study conducted by different healthcare professionals, *i. e.*, nurses, physicians, top management and Health Information Technology staffs, the critical success factor in EHR implementation was project management issues (10). Another study indicates that absence of knowledge and experience in using an EHR system is considered the most important barrier (11). Some staff members may refuse to adopt new technologies such as EHR systems, as some study stated this concern because they believe that the new system disturbs normal workflow (12).

SWOT analysis can be used by healthcare providers for strategic planning in any field of health care. This type of analysis nowadays is used as an unavoidable part of situational analysis due to its simplicity, intelligibility, and applicability in all organizations (13). SWOT analysis is powerful and can open up new possibilities for a short period of time, from which numerous advantages can be gained. It is used to detect the drawbacks of an organization or information system so that the dangers can be suppressed and eliminated.

In Iran, EHR is defined as electronic health records system project (SEPAS) that had been supported by Ministry of Health and Medical Education (MOHME). Because of the importance of the structure, processes, performance aspects, and uniformity systems of the healthcare center for the health of the network connection (14), The expected benefits and risks of EHR implementation system can be revealed by SWOT analysis (15).

In this study, we have tried to carefully construct a SWOT analysis with relevant questions to managers and health information management staffs in hospitals affiliated to Tehran University of Medical Sciences (TUMS) on EHR implementation. This analysis can display the great strengths of the system and its major pitfalls, opportunities that can be taken, and the key threats to the system according to the staffs' point of view.

Materials and Methods

Subjects

This descriptive, analytical study was conducted in hospitals affiliated to Tehran University of Medical Sciences. The study's sample included 90 managers and health information management staffs. We used census

and convenience sampling.

Tools

For data collection, we distributed a questionnaire to the hospitals. For its reliability, we used test-retest method, and it was measured by Pearson correlation coefficient ($r=0.84\%$). The questionnaire had also 3 major sections. The first part was related to demographic information; the second part had 15 questions about internal factors including EHR strengths (8 questions) and weaknesses (7 questions), and the third part contained 15 questions about external factors including EHR opportunities (7 questions) and threats (8 questions).

Data analysis

To evaluate each question, the following manner/procedure was applied: to represent the relationship of each question with EHR, a scale of 1 to 10 was used (1=lack of importance and 10=very important) and). By summing up the scores of one question in all questionnaires and dividing that total one score of all factors, the weight of each factor was obtained. The answers ranged on a 5-point scale (score 1 to score 5) from fundamental weakness to excellent. The average of these numbers revealed the mean score. Weighted score was obtained by multiplying the weight by the mean. Finally, by applying weighted score, each question having a higher score is considered to have high priority.

For data collection, we visited 15 hospitals and explained the questionnaire to the respondents. After one week, we again contacted with the hospitals and collected the questionnaires. After that, we imported the collected data to SPSS software for processing. We deliberately analyzed the results through descriptive statistics and parameters such as frequency, mean and standard deviation; also, statistical tests such as one-sample t-test and SWOT matrix for EHR implementation were applied.

Results

According to our study, 65 persons (67%) in our research population were female, and most of them were at an age ranging between 31-41(45.55%). Nearly 75.55% of the respondents had a B.Sc degree, and about 46.67% had an employment history of less than 15 years (Table 1).

Table 1. Distribution of demographic characteristics of respondents

Variable	Definition	Frequency	Percent
Sex	Male	25	33
	Female	65	67
Age	20-30	29	32.22
	31-40	41	45.55
	41 and higher	20	88
Educational status	Associate degree	3	3.3
	B.Sc	68	75.55
	M.Sc	14	15.55
	Ph.D	5	5.55
Employment history	Lower than 15 years	56	62.22
	15-25	28	31.11
	Higher than 25	6	6.66
Field of study	Medical records	51	56.66
	Health information	15	16.66
	Technology	4	4.44
	Statistics	20	23.32
	Hospital management		

Based on the obtained results, the strong point of EHR implementation was timely and quick access to information (weight score=0.147) and the insignificant strength was pertained to preventing from medical error

(weight score=0.099); also, lack of infrastructure for EHR implementation was the most important weakness (weight score=0.094) (Table 2).

Table 2. Evaluation of strengths and weaknesses (internal factors) of EHR implementation

Strength	Managers				Health Information Management Staffs			
	Weight	Mean score	Weight score	Priority	Weight	Mean score	Weight score	Priority
Timely and quick access to information	0.039	3.75	0.147	1	0.041	2.32	0.094	1
Low-volume storage of information	0.037	3.38	0.125	2	0.035	2.20	0.076	4
Reduction of duplicate testing including laboratory tests	0.036	3.38	0.123	3	0.034	2.17	0.074	5
Electronic exchange of information and participation in medical care	0.036	3.31	0.119	4	0.036	2.17	0.078	3
Increasing the speed of service delivery	0.037	3.13	0.116	5	0.039	2.27	0.089	2
Accurate record of provided services	0.035	3.19	0.113	6	0.034	2.20	0.075	6
Ability to computerize analysis and interpretation	0.034	3.25	0.110	7	0.032	2.10	0.068	7
Prevention of medical Errors	0.034	2.94	0.099	8	0.031	1.88	0.059	8
Weakness	Weight	Mean score	Weight score	Priority	Weight	Mean score	Weight score	Priority
Lack of necessary equipment and hardware appropriate for EHR implementation	0.034	2.81	0.094	1	0.032	1.85	0.060	1
Being time-consuming and difficult to link the information contained in legacy systems to that in new systems	0.035	2.50	0.087	2	0.029	1.85	0.054	3
Increasing the workload of healthcare providers	0.028	2.69	0.076	3	0.025	1.63	0.041	7
Creation of typing problems by secretaries	0.030	2.50	0.074	4	0.031	1.90	0.059	2
Absence of rapid profit	0.027	2.50	0.067	5	0.026	1.85	0.048	5
Imposing much discipline and control on employees	0.028	2.06	0.057	6	0.027	1.83	0.050	4
Jeopardizing job positions through EHR implementation	0.023	1.75	0.040	7	0.027	1.63	0.044	6

According to the results obtained from this research, the sharing of information between healthcare providers and the possibility for better information management (weight score=0.121) and access to a variety of health statistics (weight score=0.084) was the significant opportunity of implementing EHR (weight score=0.121) and applying as legal document about the type of services provided were the insignificant one (weight

score=0.062). Lack of strategic planning in the field of electronic health records (weight score=0.127) and physicians and other clinical staff's resistance in the use of electronic health records (weight score=0.076) as a considerable threat and the absence of a national standard vocabulary for the establishment of electronic health records was the trivial threat (weight score=0.080) (Table 3).

Table 3. Evaluation of opportunities and threats of EHR implementation

Opportunity	Weight	Managers			Health information management staffs			
		Mean score	Weight score	Priority	Weight	Mean score	Weight score	Priority
Sharing of information between healthcare providers and better information management	0.037	3.25	0.121	1	0.037	2.20	0.080	2
Being used as the main source of training for physicians and providers of public services	0.035	3.25	0.114	2	0.035	2.20	0.076	5
Access to a variety of health statistics	0.033	3.19	0.105	3	0.037	2.27	0.084	1
Accurate records of services provided in order to perform individual tax refunds	0.033	2.56	0.084	4	0.036	2.22	0.080	3
Ensuring the integrity of the entire system	0.034	2.50	0.084	5	0.036	2.15	0.078	4
Semantic coordination and communication between internal and external parts	0.028	2.56	0.071	6	0.035	2.07	0.073	6
Applying as legal document about the type of services provided	0.030	2.06	0.062	7	0.032	1.93	0.061	7
Threat	Weight	Mean score	Weight score	Priority	Weight	Mean score	Weight score	Priority
Lack of strategic planning in the field of electronic health records	0.038	3.38	0.127	1	0.038	1.98	0.074	3
Problems related to programming and software developed according to the needs	0.037	3.13	0.116	2	0.030	2.02	0.062	7
Physicians and other clinical staff's resistance in the use of electronic health records	0.036	2.94	0.105	3	0.035	2.20	0.076	1
Lack of funds for the design, implementation and use of electronic health records	0.035	2.94	0.103	4	0.035	1.85	0.064	6
Lack of expert human resources	0.036	2.69	0.097	5	0.034	1.93	0.066	5
Unauthorized access to patient information	0.034	2.69	0.090	6	0.030	1.78	0.053	8
Limited awareness of healthcare providers about the benefits of electronic health records	0.031	2.75	0.084	7	0.036	2.05	0.075	2
Absence of a national standard vocabulary for the establishment of electronic health records	0.032	2.50	0.080	8	0.034	2.05	0.070	4

Below, table 4 demonstrates the "SO" (strength-opportunity) strategy that relies on internal strength and external opportunity and "WO" (weakness-opportunity)

strategy whose aim is the deployment of opportunity in order to decrease of weakness to the implementation of EHR.

Table 4. Strategies (internal factors with opportunities) is leading to EHR implementation

SO (strength-opportunity) strategy	WO (weakness-opportunity) strategy
<ul style="list-style-type: none"> -By timely and quick access to information, it can be shared among healthcare providers. - Due to the advantage of the low volume of stored information, services provided can be accurately recorded and kept. - By reducing duplicate testing including laboratory tests, and prevention of medical errors, the integrity of the entire system is achieved. -Using items such as electronic exchange of information, participation in medical care, accurate record of services provided and computerized ability to analysis and interpret the information, EHR can be used as the main source of training for physicians and providers of public services as well as access to a variety of health statistics. - Accurate record of services provided to individuals can be used to carry out tax refunds. 	<ul style="list-style-type: none"> - For accurate registration of services provided, a lot of discipline is imposed on employees, but indeed if salary repayment performed properly, then such a thing may enhance their satisfaction. -If the secretary is aware of EHR as a legal document, then the possibility of typographical errors will be reduced. - For access to a variety of health statistics, employee’s workload will increase, but by fruition of results, employees’ satisfaction and willingness will increase.

Based on table 5, we can use internal strength in order to decrease the negative effects of external factors (ST strategy) and also deploying WT strategy to decrease the

consequences of internal weakness and avoidance of destructive results of external threats.

Table 5. Strategies (internal factors with threats) is leading to EHR implementation

ST (strength- threats) strategy	WT (weakness- threats) strategy
<ul style="list-style-type: none"> - Performance of technical and economic feasibility studies, software development according to user needs and emphasis on efficiency and effectiveness - People's resistance to EHR implementation will reduce by emphasis on the training of physicians and other clinical staff and the importance of prevention of medical errors, the ability to computerize analysis and interpretation of data and an accurate record of services. - Since national income, economic growth and production are related to people's health; the acceptable budget should be considered for the promotion of healthcare system. -Prevention of unauthorized access to patient information -Use of experts to creation of standard medical vocabulary for use in electronic health records 	<ul style="list-style-type: none"> - Developing a strategic plan for the implementation of electronic health records - Staff training, before implementation of electronic health records - Existence of a long-term and realistic plan, to link the information contained in legacy systems to the new systems

According to independent samples t-test (to compare the means of two groups), there was a significant relationship between the mean scores of managers (2.85)

and staff (2.03) about EHR implementation ($P</.5$) (Table 6).

Table 6. Independent samples test

Mean	Response	N	Mean	Std. Deviation	Sig. (2-tailed)
	Managers	30	2.8510	.45803	0.000
	Staff	31	2.0329	.19255	0.000

Discussion

In our assessment, the highest priority in strength analysis was related to timely and quick access to information and capability of information storage as confirmed in (16), (17) study. Joukes study identified most important topics in EHR pre-implementation phase, data use and reuse and data registration were among key enabler to work properly with EHR system (18). By using

EHR, information will be accessible whenever and wherever needed, and greater access to information will improve patient care and also caregiver will able to communicate with each other remotely. However, we should pay particular attention to privacy and confidentiality of information is essential.

In weakness assessment, the most considerable shortcoming in EHR implementation was related to the lack of hardware and infrastructures as taken into account

in (19). Yoon indicated that the amount of capital needed to purchase and implement an EHR system was the highest barrier to the adoption of electronic health records (20). In some of the organizations, the purchase of sufficient health information technology devices and their physical placement are the most important barriers; network connectivity and installation of EHR systems are also more challenging concerns for managers and policymakers (21,22). In this regard, time-consuming and difficult to link the information contained in legacy systems to new systems and increase the workload of healthcare providers were the second and third priorities in weakness analysis that are in line with Richards (23) findings. Lack of time and increase of workload are the concerns that are stated in McGinn's study (24) while user resistance is a barrier that has been reported in some other articles (25). The lack of perceived return on investment inhibits the acceptance of health IT (26). The decision regarding the development of any health IT project depends on stockholders' understanding about the benefit of technology application.

Based on Canada Health Info way' report, sharing of information between healthcare providers and having national rules for data sharing should be considered in any health IT-related project (27), as confirmed by the present study. EHR systems improve communication between different departments. Most patients cared by collective team and EHR provide information that needs for various specialists and give a comprehensive view of patient conditions (28,29). "Use of EHR" as the main source of training for physicians and other healthcare providers and "access to a variety of health statistics" are the other opportunities that the participants of this study emphasized.

Deutsch believes that preparing a strategic plan in EHR pre-implementation phase is essential (30). Based on Singapore's National Electronic Health Record roadmap (31), having IT-related strategies and clear policies for EHR acquisition is essential and lack of strategic planning in the field of electronic health records- as taken into account in this study- is the most important threat (3,32). From strategic standpoint, it is essential that EHR system warrants integrity of systems; in this way, the overall plan should encompass the whole SDLC (system development life cycle) process. Business process re-engineering and change management principles should be followed.

Problems related to programming and software development as whereas physicians and other clinical staff's resistance are significant threat as confirmed in Alipours' study (33). In order to facilitate successful

adoption of electronic health record, the involvement of physicians and other caregivers would be essentially required during the EHR designing, implementation and usage phases. Usually, an EHR design for clinical purposes is poor and should be customized based on the users' needs. A one-sample t-test revealed that the difference between the scores of managers and staff members in EHR acquisition was significant and this finding emphasized the importance of manager's role in support of and commitment to EHR implementation. The ability to manage change in an organization (30), staff workload balance (34), clear definition of roles, identification of stockholders' demands (35), preparation of a strategic plan (25), and identification of the needed financial and human recourses (36) are the most important factors that must be considered.

This study examined the SWOT analysis in EHR system implementation in hospitals affiliated to Tehran University of Medical Sciences (TUMS). Based on the research results, a broad range of administrative, technical, financial and organizational factors should be considered when adopting an EHR system. The SWOT analysis can be used by healthcare organizations in any health-related project since different groups in the organization pursue various goals, different interests, and needs, this analysis between stockholders can be beneficial to successful EHR implementation. EHR system with the ability to share and integrate information in various sectors is necessary and beneficial, and this strength has led to better information exploitation; on the other hand, it is fundamental for design and adopts of other health-related technology at the national level. Since we have a detailed strategic plan for EHR acquisition, developing a national standard for security, privacy, and confidentiality is essential; moreover, increasing financial resources for IT development is a step that can be taken into account in EHR acquisition.

Communication between different healthcare providers can enable hospitals to properly plan, select, implement and integrate different health IT projects; this communication is also essential for the long-term maintenance of EHR capabilities. On the other hand, hospitals should collaborate with each other to bridge the gap between internal capacity and external resources. Defining clear vision to staff members and communicating with vendors about the process and the expected outcome, training new staff members, and applying tailored training materials are essential for EHR adoption and utilization.

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Electronic health record implementation

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