



## **E-Health Readiness Assessment Framework in Iran**

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### **Abstract**

**Background:** Concept of e-readiness is used in many areas such as e-business, e-commerce, e-government, and e-banking. In terms of healthcare, e-readiness is a rather new concept, and is propounded under the title of E-healthcare. E-health readiness refers to the readiness of communities and healthcare institutions for the expected changes brought by programs related to Information and Communications Technology (ICT). The present research is conducted aiming at designing E-health Readiness Assessment Framework (EHRAF) in Iran.

**Methods:** The e-health readiness assessment framework was designed based on reviewing literature on e-readiness assessment models and opinions of ICT and health experts. In the next step, Delphi method was used to develop and test the designed framework. Three questionnaires developed to test and modify the model while determining weights of the indices; afterward they were either sent to experts through email or delivered to them in face.

**Results:** The designed framework approved with 4 dimensions, 11 constituents and 58 indices. Technical readiness had the highest importance coefficient (0.256099), and the other dimensions were of the next levels of coefficient importance: core readiness (0.25520), social communication readiness (0.244658), and engagement readiness (0.244039).

**Conclusion:** The framework presents the movement route and investment priorities in e-health in Iran. The proposed framework is a good instrument for measuring the e-readiness in health centers in Iran, and for identifying strengths and weaknesses of these centers to access ICT and its implementation for more effectiveness and for analyzing digital divide between them, as well.

**Keywords:** E-health, E-Readiness, Information, ICT, Healthcare institutions, Iran

### **Introduction**

Technology may contribute to solve many problems such as improving healthcare delivery quality or opening up commerce opportunities in both developed and developing countries. Nowadays, many countries use e-commerce as a solution to some of their problems, and as internet connections come into use this e-commerce increase and become a part of business activities around the world (1).

E-health includes 3 main areas: 1) using internet and telecommunication to deliver health informa-

tion to health professionals and clients, 2) utilizing the power of IT and e-commerce to improve the quality of public health services, and 3) utilizing e-commerce and e-business for management of health systems. It also provides a new method for using health resources (information, money, and medicines), and will improve efficient use of the resources. Information dissemination, interaction and collaboration among institutions, health professionals, health providers and the public is done through a new medium- the Internet (2).

A WHO meeting on e-Health on 2004, recommended that WHO should adopt e-Health activities that would support information for 1) health promotion and awareness, medical education, health and biomedical research, evidence-based medicine and e-learning; 2) health information systems (disease surveillance, health statistics, management information systems, financial, logistical, and geographic information systems), monitoring and evaluation; and 3) health-care delivery: diagnostics, treatment, consultation (telemedicine applications) and electronic patient records (3).

In its Millennium Development Declaration (MDG), the UN General Assembly in 2000 called on all Member Countries to cooperate with the private sector to "make available the benefits of new technologies, especially information and communication" (4).

Reducing health care expenditure and providing quality health care has become a world-wide priority (5, 6). Technology and automation are potential factors, which contribute to reducing these costs (7, 8). Developing countries are constantly working to use ICT in providing health care in order to answer issues such as inequalities and meet international goals of public health (9). In terms of health care, e-readiness is a new concept which implies the readiness of individuals, societies and organizations to accept e-health programs. The main goal of e-health readiness assessment (EHRS) is to fill the digital gap between health care providers and end-users and to use ICT to have access to public health for all (10).

E-readiness assessment carried out in different countries can facilitate and fuel concrete planning and can be useful in providing opportunities for networking for experts and institutions (11).

There are two approaches toward e-readiness assessment: quantitative assessment (in which a numerical score is given to every country's performance) and qualitative measures (which assesses different components such as connectivity, human capital, applications, sophistication of use, and geographical dispersion) (12).

The Computer Systems Policy Project (CSPP) defined e-readiness in a community that had high-

speed access to a competitive market; with constant access and application of IT in schools, government offices, businesses, healthcare facilities and homes; users' privacy and online security; and government policies which are favorable to promote connectedness and use of the network (13). Several e-readiness tools have emerged through efforts of development agencies, research organizations, academia, business enterprises and individuals. Bridges.org divides existing e-readiness assessment tools and models into two main categories while considering their perspective: e-society and e-economy (14). E-Health readiness assessment could also bring about other advantages, such as: 1) avoiding huge losses in time, money, and effort; 2) avoiding delays and disappointments among planners, staff, and users of services; and 3) facilitating the process of change in the institutions and communities involved, from the stage of precontemplation (firmness and resistance to change) through contemplation (acceptance of new ideas) and preparation (preparedness for change) (15).

After the preparation of the first e-readiness tool, different e-readiness tools were developed by different research institutions, universities, individuals, and business units. Some institutions pioneer in producing these tools are McConnell International (MI), Economist Intelligence Unit (EIU), United Nation Conference on Trade and Development (UNCTAD), Center for International Development (CID) Harvard university, United Nation Development Program (UNDP), and Mosaic Group (12). Some of these e-readiness assessment models and their main indices used in this study are: CSPP (13), CID (16), APEC Electronic Commerce Steering Group (17), McConnell (18), WEF (14), The Mosaic Group, 1998 (11), World Information Technology and Services Alliance (WISTA) (19), Crenshaw & Robinson (20), Center for International Development and Conflict Management (CIDCM) at the University of Maryland (21), WB (22), International Telecommunications Union (ITU) (23), EIU (24), World Times / IDC (25), KAM (26), Bridges (11), MIT (27), UNDP (11, 14), EMM@ (28), Ready? Network, Go! (18, 22), KPMG (29), eTechnology

Group (30), Heeks (31), Wickramasinghe (1), Khoja & Ramzan (10), Jennett et al. (32), Overhage et al. (33), Li et al. (34).

With respect to the annual budget spent by state organizations/institutions to benefit from the advantages of ICT and the importance of accurate planning before implementing ITs, it seems that assessment of technical, educational, human resources, legal, etc., infrastructure is a necessity to use it effectively and in compliance with organizational needs. Therefore, in order to carry out studies to assess e-readiness, proper assessment frameworks suitable for each country should be planned. So far, a framework for e-readiness assessment in health organizations has not been presented in Iran.

The present research was conducted to present an E-Health Readiness Assessment Framework (EHRAF) in Iran. Among different indices which could be used for e-health readiness assessment, some indices with higher impact were recognized. The present framework consists of technological, engagement, societal, and core readiness (Table 1). Using EHRAF, health care managers and authorities could analyze the present situation of their health care centers; and through identifying the strengths and weaknesses of their health center with regard to ICT access, the relevant centers can be developed in accordance with e-readiness.

**Table 1:** Initial E-Health Readiness Assessment Framework (EHRAF) in Iran

Component	Indices
<i>Technological Readiness</i>	
Availability & Affordability of Hardware & Software/ ICT Infrastructure Quality	Availability and affordability of hardware and software (10), Availability and affordability of ICT (10)
Using Network	Telephone mainlines per employee (11, 19, 24), computers per personnel (16, 17), computers linked to internet per personnel (11, 14, 19, 24), kind of internet link (dial-up, ADSL, wireless,...) (16, 17, 23, 26), Internet connection bandwidth (17), ICT quality support (11, 14, 16, 35)
ICT support personnel	Internet use for doing tasks (36), extensive use of e-mail for different tasks (37), using LAN and WAN (38) and websites (39) for doing different tasks, use of electronic data exchange (38)
IT Security	Presence of ICT experts with relevant degrees (16, 17, 22, 38), access to ICT expert consultants (35), personnel with English skills as a prerequisite of using ICT (40)
	Software and hardware infrastructure of information security in the organization (e.g. firewall system, network VPN, antivirus software) (41), utilization rate of security systems in the organization (e.g. identification, data accuracy, privacy, access control) (41)
<i>Engagement Readiness</i>	
Recognition of benefits	Better provision of patients' information (34), effective medical measures/practice (34), 24/7 access to medical services/care (42), better patient diagnosis (42), communication development (42), improving health quality and social skills promotion (42), reduce medical errors (42)
Potentially negative impacts	High investment and low reimbursement (34), Individual limitation of IT knowledge (34), time cost (34), worries about changes in workflow (34)
e-Health Education	Comprehensive need assessment and suitable context for ICT educational programs (23), suitable educational softwares (13, 21,24), adequate hours for ICT learning (16)

**Table 1:** Cond

Strategies and Legal and Financial Support of ICT	Clear strategies and policies in government programs for the ICT development (18), enough control for ensuring the implementation of ICT projects (14), legal framework in support of ICT development in the organization (17), financial support in forms of budgets for ICT development in the organization (38), support of rights of clients and consumers of ICT in the organization (38), supporting and encouraging information security in providing ICT-based services to citizens (17) (1)
<b>Societal Readiness</b>	
Societal Readiness	Communication links of healthcare organizations with other institutions (i.e. hospitals and administrative centers) (34), communication links with clients and communities (10, 15), provision of care in collaboration with other healthcare organizations (e.g. connected diagnostic facilities like pathology/radiology) (34), internal communication among healthcare providers (e.g. telephone, e-mail, etc.) (34), adaptation of ICT use to dominant social values (19), general trust of users (personnel and citizens) in implementing ICT (11), access to ICT (computer, Telephone, etc.) in everyday life (11), use of networking services (Internet, e-mail, websites, etc.) in everyday life (16), used by all socioeconomic status among clients (10, 15)
<b>Core Readiness</b>	
Realization of Problems related to patient's documentation	Inefficient documentation (34), breached patient privacy (34)
Providers' Satisfaction with paper-based health records (PHR)	Of poor sharing records (34), incompleteness & inaccuracy (34)

## Methods

In the present applied research, the e-health readiness assessment framework was designed based on a literature review on e-readiness assessment frameworks (EHRAF) compatible with the circumstances in Iran and the opinions of ICT and health experts. In the next step, Delphi method was selected to develop and test the designed framework. Three questionnaires developed to test and modify the model, while determining weights of the indices; afterward they were either sent to experts through email or delivered to them in face.

In this study, a judgment sampling with snowball method was used. In all, 24 experts were selected as an expert panel and 24 questionnaires were sent to experts. In the first phase, 14 questionnaires were returned in the proposed period and were analyzed. In the second phase, 14 and in the third phase 12 questionnaires were gathered and ana-

lyzed. The experts in the panel were selected among health and IT experts; especially among those who had academic specialty and or executive backgrounds.

In the first phase, the data was analyzed using descriptive statistics. Besides using descriptive analysis, *t*-test was applied in the second phase in order to identify the most statistically significant indices in the EHRAF suitable for Iran. The last phase, descriptive analysis using mean weighting coefficients for weighting the analogous dimensions, constituents, and indices was used in the study.

## Results

This study was done in three phases which the findings will be presented separately:

**I. First Delphi study:** The findings of this phase are shown in Table 2.

**Table 2:** Mean of the Indices of Readiness in the first Delphi phase

Dimension	Component	Index with high Priority (Mean)*
Technological Readiness	Availability and Affordability of Hardware and Software/ ICT Infrastructure Quality	Availability of hardware and software (4.71)
	Using Network	Internet connection bandwidth (4.50) ICT quality support (4.50) Using LAN and WAN for doing different tasks (4.29)
	ICT Support Personnel	Presence of ICT experts with relevant degrees (4.21) Access to ICT expert consultants (4.21)
	IT Security	Utilization rate of security systems in the organization (e.g. identification, data accuracy, privacy, access control) (4.86)
	Engagement Readiness	Recognition of Benefits 24/7 Access to medical services/care (4.64)
Societal Readiness	Potentially Negative Impacts	High investment and low reimbursement (4.07)
	e-Health Education	Suitable educational softwares (4.00)
	Strategies and Legal and Financial Support of ICT	Enough control for ensuring the implementation of ICT projects (4.43)
Core Readiness	Societal Readiness	Provision of care in collaboration with other health-care organizations (e.g. connected diagnostic facilities like pathology/radiology) (4.50)
Core Readiness	Realization of Problems related to patient's documentation	Inefficient documentation (4.21)
	Providers' Satisfaction with paper-based health records (PHR)	Of poor sharing records (4.21)

\* The medium was estimated from a 5 point Likert scale.

Prioritization of all the indices indicated that the index 'Utilization rate of Security systems in the organization (e.g. identification, data accuracy, privacy, access control)' had the highest priority and 'telephone mainlines per personnel' had the lowest priority. In this phase, 7 other indices were also recognized and recommended by the experts: 1) standard-based information architecture, 2) use of weblogs for doing different tasks, 3) use of tele-medicine, 4) worries about private sector not participating, 5) suitable education for implementing e-health systems by ministry of health and medical education with the cooperation of mass media, schools, and universities, 6) information literacy rate of users (personnel and citizens), and 7) rate of computer skills of users (personnel and citizens).

**II. Second Delphi study:** In order to find out which of the indices of EHRAF statistically have significant impact in Iran, a *t*-test was used. The test indicated that all indices except 'use of weblogs for doing different tasks' and 'concerns about private sector not participating' were approved. These two indices were part of the indices which was recommended by experts in the first phase of Delphi. Therefore, the two aforesaid indices were omitted from the indices.

**III. Third Delphi study:** The findings indicated that the framework with 4 dimensions, 11 components, and 58 indices were finally approved. Because no new indices were introduced, it seems that we have come up with a theoretical consensus among experts. In this phase, the relative weight of dimensions, components, and indices were determined:

1. The relative weight of the indices of technological readiness indicated that ‘utilization rate of security systems in the organization’ had the highest and ‘telephone mainlines per employee’ had the lowest weight; among the indices of engagement readiness indicated that ‘efficient medical practice’ had the highest and ‘time cost’ had the lowest weight; among the indices of societal readiness showed that ‘communication links of healthcare organizations with other institutions (i.e. hospitals and administrative centers) and provision of care in collaboration with other healthcare organizations (e.g. connected diagnostic facilities like pathology/radiology)’ had the highest and ‘use buy all socioeconomic status among clients’ had the lowest weight; and among the indices of core readiness showed that ‘incompleteness & inaccuracy of paper-based health records (PHR)’ had the highest and ‘breached patient privacy’ had the lowest weight.
2. The final prioritization of main dimensions of the framework indicated that technical readiness with 0.256099 points had the highest impact and other dimensions consecutively had the following impact: core readiness (0.25520), societal readiness (0.244658), and engagement readiness (0.244039).

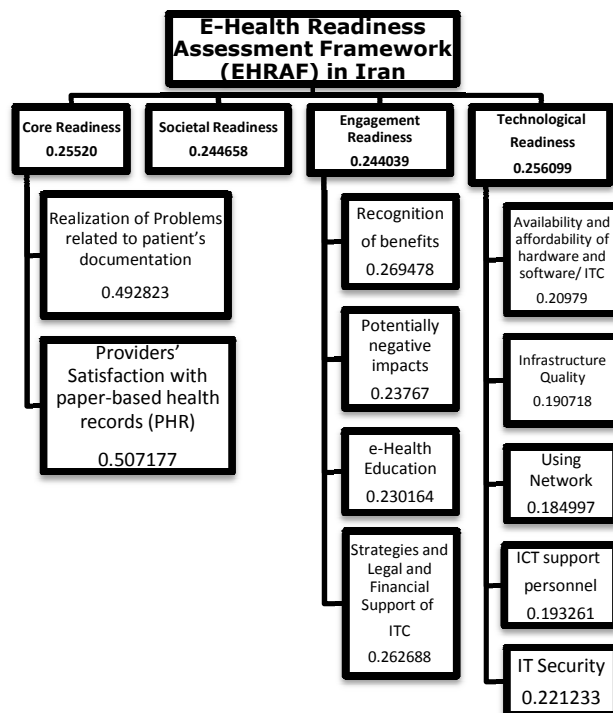


Fig. 1: Final EHRAF for Iran (with Means)

Many studies have been implemented related to e-readiness assessment in Iran to design an assessment framework. In these studies, especially in other sectors, most have used technological factors (43-45) and societal factors (43, 45) as main dimensions on their population of study. In the study implemented in Iranian universities, factors such as ICT-based management, strategies, and policies, access to ICT and ICT infrastructure had the highest impact (46). Another study indicated that cultural factors such as information literacy rate among managers and general believe of staff were among the most effective factors which had the most impact on e-readiness in small and medium enterprises (SMES) (41). Network programs and services' dimensions had the most relative importance in libraries (29). In the present study, technical readiness had the most impact among others. One of the main reasons for different results achieved from these studies is the different population of study.

The results of this study indicated that the framework proposed with 4 dimensions, 11

components, and 58 indices were finalized; and the prioritization of the framework showed that technical, core, societal, and engagement readiness had the relative impact, respectively. This framework could provide the path and the priority of investment towards e-health. It also could assess the e-readiness situation in health care institutions in Iran and show the strengths and weaknesses, i.e. digital divide, of these organizations. Due to the relative high impact of technical readiness factors, we must invest more in technical dimension in e-health readiness.

The generality of some components and the need to investigate for more specific components and dimensions, and some of components and dimensions being in-between others and their connection with two or more components, considering economical factors as constant were among the constraints of this study. Another important constraint could be the limited access to experts, limited in Tehran, which had the competence in giving expert advice and recommendations and participated in this study.

In this study, e-readiness assessment indices were identified for health care centers. By applying these indices, health care institutions could be assessed. With e-readiness assessment in health care centers, will provide valuable information related to resource allocation and policy setting/making for CEOs of ministry of health. By using this framework, administrators and authorities could have the opportunities to prepare suitable backgrounds to implement the indices proposed in the model and in turn achieve e-health goals. Better utilization of the framework depends on the required training related to e-health readiness and implementing the indices. One of the prerequisites of implementing the framework is its acceptance and support by CEOs of ministry of health. Therefore, it is recommended that opportunities made by the implementation of the framework be completely explained. In order to have improvements in e-health and provide better service to health clients, it is also recommended that health care administrators and policy makers of health ministry consider all the dimensions and

components of the framework and not to focus on one dimension.

## Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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