A Ranking Framework for Designing a Portal Based on Healthcare Solutions The Case of Cardiovascular Disease

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Abstract— **Cyber-health is one of the most important results of IT revolution by enabling the communication between health workers & patients. So far several countries & enterprises have offered different services to their consumers. In Iran, many island activities have been carried out to conducting cyber-health too. But they are not as progressed as Iran ICT capabilities. In this study we are on the way of identifying & ranking essential criteria for cyber-health. Since it is not implementable for all medical specialties, we have chosen cardiovascular disease users, including cardiovascular medicine, patients & also their families. So in this paper after a brief literature review on cyber-health, cardiovascular criteria will be identified & collected. Then using the methods of Multiple Criteria Decision Making, collected criteria, according to Iran local conditions, will be ranked. At last due to ranked criteria, a framework on cyber-health will be presented.**

I. INTRODUCTION

ICT revolution has provided new roles and forms of communication for health customers. Cyberspace as one of ICT capabilities has introduced many features for effectiveness and efficiency of cyber medicine implementing. "Cyber medicine is the science of applying Internet and global networking technologies to the area of medicine and public health, of studying the impact and implications of the Internet and of evaluating opportunities and the challenges in healthcare & a solution using global networking technologies as a way of promoting medical practice, commerce, scholarship, and empowerment."[1], [2]

So far several countries like japan & Cuba & so many enterprises or campaigns including Google, Microsoft, and HIFA2015 campaign … have started to offer different health services to their consumers. Although since 2013, Google Health has been permanently discontinued & has introduced Microsoft health Vault Company as an e-health presenter [3]. The reason that makes all stakeholders over the world to think about cyber services in the field of healthcare is because of consumer interesting in their written queries searched through the web. In Great Britain there are about 15000 to 100000 health related sites and approximately 30 million visitors & users of these sites & 35% of U.S. adults have done online search as a

medical question [4]. Statistic queries in Persian language are a confirmation on providing a national cyber space too. The statistical results of Google queries about Healthcare in Persian language reveals that although the healthcare subject is not on the top, but it has considerable interests in contrast with other
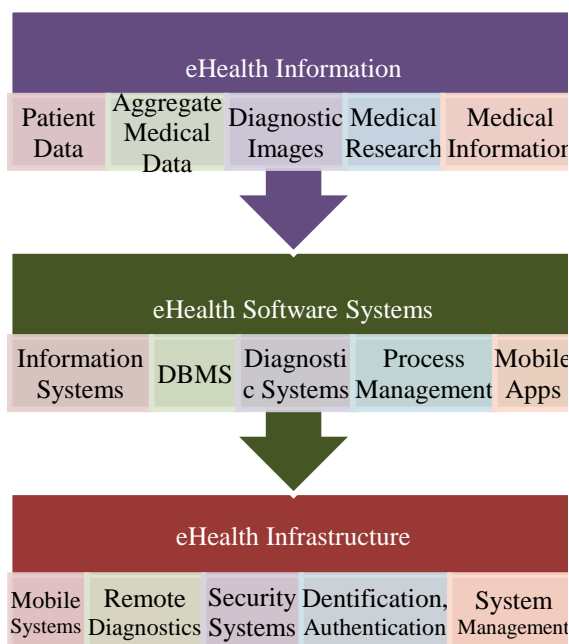

Figure 1-A layer model for e-health by ITU [5]

Integrations of Porter e-Health * ITU e-health model	Porter forces	ITU e-health model
content		Patient Data Medical Information
User supporting		Information Systems DBMS Process management Mobile Apps Security Systems Identification Authentication
Required services		Medical Research Diagnostic research Aggregate medical research Remote Diagnostics
e-business	Revenue Pricing Quality Asset	
challenges	Supplier Customer environment	

implementation	Supplier Devices	System Management Devices

Table 1-Method of Classification of reviewed features due to porter model and ITU e-health model[22]
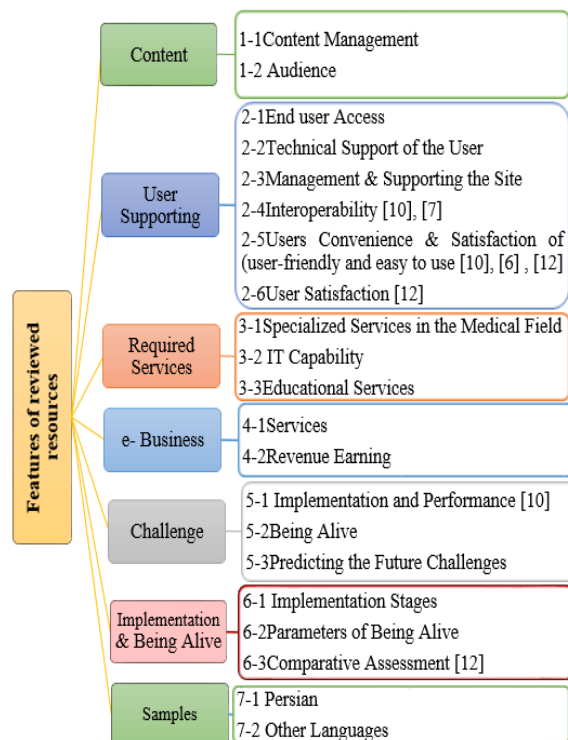

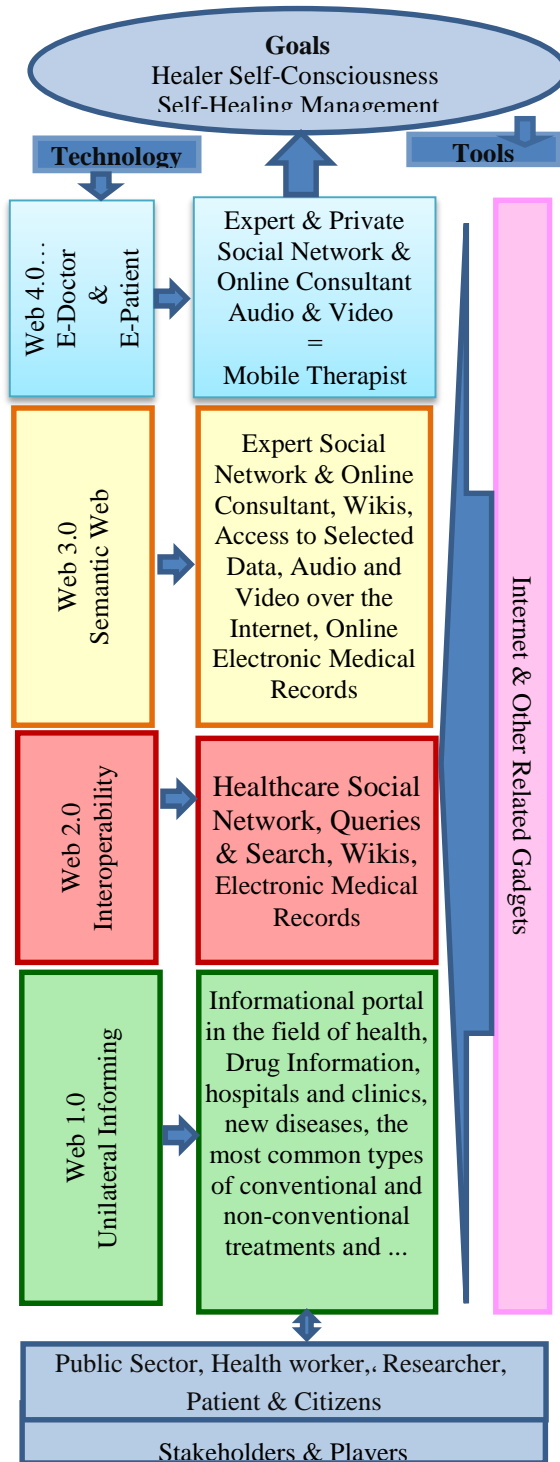Figure 2-Features of reviewed resources for e-health criteria

subjects like money & Education. The present study is concentrated in Iran to find the national capabilities of health services in the world of web according to Persian consumers' requests and understanding their expectations of cyber-health. Of particular interest in the article is study the web health services based on online wisdom. So first we will identify considering the other studies and rational governance, specified criteria will be identified. Because of the huge number of criteria provided in reference articles, inspired by the ITU layer model for e-health & porter 5 competitive forces model, a classification of criteria is presented on the table 10 in the attachment. Then obtained criteria in the form of multi criteria decision making questionnaire is filled by three groups of consumers including patients, physicians & IT experts. So in this step ranking of criteria in the form of AHP will be extracted. One can mention this study is concentrated on cardiovascular diseases as a case study. So in the fifth step, the application chart for designing a cyber-health portal due to 11 cardiologists' confirmations entropy method will be submitted. At last a framework on healthcare portal based on online wisdom due to cardiovascular customers' needs will be presented. This framework is a sample for other specialized branches of medicine.

II. COMPARATIVE STUDY: EFFECTIVE FACTORS ON CYBER HEALTH

Cyber health while increasing collective consciousness provides medical consultation and

diagnosis or one can say "doctors with no borders". Thus knowledge and wisdom exporting will occur. But while needing audience trust, there are many barriers

Goals
Healer Self-Consciousness
Self-Healing Management

Technology   **Tools**

Web 4.0... E-Doctor & E-Patient

Expert & Private Social Network & Online Consultant Audio & Video = Mobile Therapist

Web 3.0 Semantic Web

Expert Social Network & Online Consultant, Wikis, Access to Selected Data, Audio and Video over the Internet, Online Electronic Medical Records

Web 2.0 Interoperability

Healthcare Social Network, Queries & Search, Wikis, Electronic Medical Records

Web 1.0 Unilateral Informing

Informational portal in the field of health, Drug Information, hospitals and clinics, new diseases, the most common types of conventional and non-conventional treatments and ...

Internet & Other Related Gadgets

Public Sector, Health worker, Researcher, Patient & Citizens

Stakeholders & Players

and concerns through this progress. So far any

Figure 3-Basic framework of cyber health framework [21]

Ownership & Management

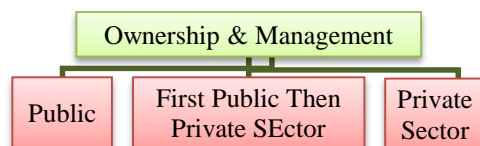Public   First Public Then Private SEctor   Private Sector

Figure 4- Ownership & Management methods for cyber health framework

wisdom based framework has not been designed. But ITU has offered an authorized model for e-health [5].

According to Figure 1, ITU standard model introduces three layers for realization of e-health including information, software and infrastructure. E-health Information includes Patient Data, Aggregate Medical Data, Diagnostic Images, Medical Research, and Information Systems, Data Base Management Systems, Diagnostic Systems, Process Management and Mobile Apps; and finally eHealth Infrastructure includes Mobile Systems, Remote Diagnostics, Security Systems, Identification, Authentication and System Management.

In order to attract interested to a healthcare portal, some features are necessary. Due to ITU classification in this part as shown on table 10 and in summery in figure 2, in the attachment, reviewed features are presented in following six groups. 1) Content: Content is a set of text, audio and video data placed on answering the needs of audiences. The phrase "content is king" is a common behavioral pattern [20] means the main focus on any internet portal is on content. On content subject, audience and content management is considered. 2) User supporting: Technical and user support in health field including access conditions on behalf of user, management, supporting and user satisfaction are considered. 3) Required services: Includes all services according to values and methods of providing income. 4) E-business: The way of providing income providing and value earning. May this theory propound that free services and value earning is sufficient. 5) Challenges: Set of concerns in implementation process, the life time of portal due to advances in technology is facing. 6) Implementing and life time: Defining implementing steps, life time parameters and evaluating is being studied in this step. It is important that a web site can be easily displayed through the web and a high ranking in the search engine ranking is achieved. Sources of information should be specified. Mistakes have to be prevented. Sites must have the ability to search for all kinds of mentioned content. So to be continued, usability tests and web site evaluating is suggested. 7) Samples: All samples including Persians & non Persians are reviewed in this article.

The seven mentioned factors show the required criteria for the framework of healthcare. Due to the portal usage in the field of healthcare, two questionnaires were produced based on the basic framework of e-health services due to figure 3. First questionnaire was designed in three group including Ownership and Management methods, web based criteria and Business income as shown in figure 4 to 6 and indicates the important criteria for cyber health. Next questionnaire designed for physicians in table 9, shows the usage of healthcare portal based on two parameters including information and interaction. In information group, two parameters including disease prevention disease treatment and users may be required by users. For example in disease prevention life style of user may be questioned or following the medical consultants, living in stressful environments is one of the important risk factors in cardiovascular diseases.

In the group of diseases caused by other problems, diabetes is a significant sample of cardiovascular disease more likely to be followed. The interoperability feature is an online consultation between user and health worker. Of Corse the user may be another health worker. The necessity at this stage is to encourage professionals to provide remote healthcare services.
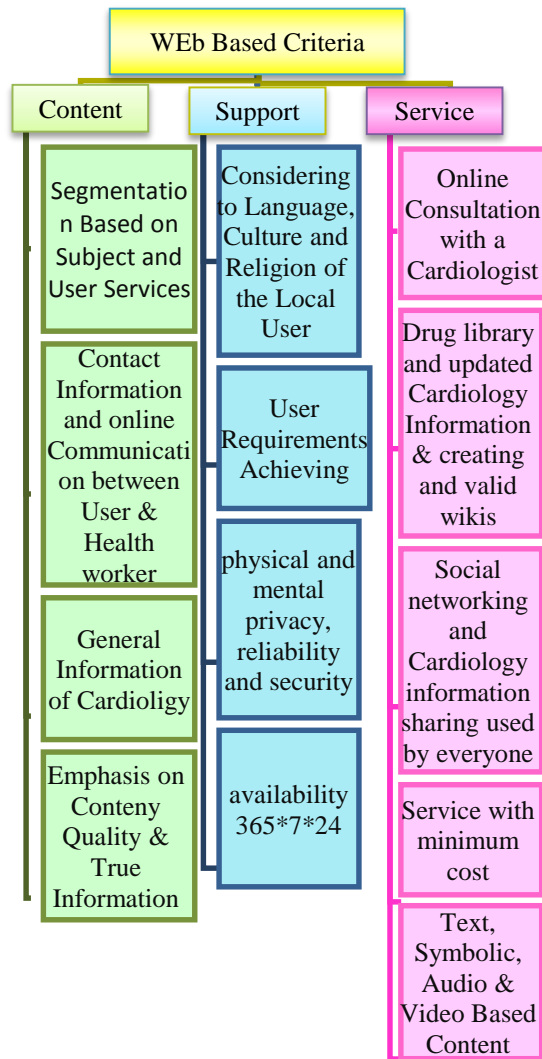

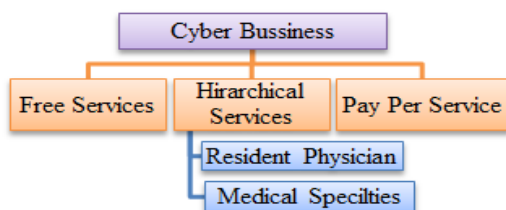Figure 5- Classification of recommended web based criteria for cyber health framework

Figure 6- Business income methods for cyber health framework

III. RESERCH METHOD AND DESIGNING THE QUESTIONNAIRE

In this section we are on answering two questions: First whether the validation of proposed measures with respect to the Iranian situation and second finding the priorities of each measure for implementation of designed program. The questionnaire was completed in the presence of authors, because, each of those polled had a new benchmark add or remove any of the criteria, if necessary. So criteria selection and classification verification in addition to ranking is desired then knowing the weight of each criterion in the selection of priorities and strategies for service providers is very important. In such cases the most common way of making decisions is the multi-criteria decision making [17]. These models are divided in two groups of multi-objective and multi-criteria. Multi-criteria models are used for prioritization. In this chapter, the used decision making methods including Entropy and AHP will be discussed. So in both methods, the first step to gather information is identifying those responsible and the quality of communication with them. In both questionnaires the personal information like age, job, the average of using internet in a week and the reason of filling the form were asked. For example if the user is a patient or health worker…here two applications are intended: First assessing the features of online healthcare space, second finding the features on a specified field of healthcare, here cardiology.

A. AHP method

The AHP method prioritization is performed by polling experts. In this method, expert compares measures two by two and the results will be recorded. AHP method does not require a large number of experts and even an expert would be assessed [18], [19]. Since this research is needed to access physicians to deal with the internet, AHP method is appropriate. Chosen people for answering the questionnaires, due to table 1, are including three groups of health workers, citizens and IT men, owners of such a portal.

1) The hierarchical structure of the questionnaire

Hierarchical structure of AHP questionnaire was designed according to the classification of designed subjects and sharing concepts. All criteria in the AHP questionnaire was designed in three groups as follows: 1) Business approaches. 2) Ownership and management of Portal. 3) Criteria include content, supporting and services. Based on AHP model the criteria for each level are surveyed as shown on table 2-8. In this section the priority of the first level measures including content, supporting and services are compared. Comparing the criteria defines the first level relative effectiveness between each criterion. Hierarchical criteria in the three groups are shown in Figures 4, 5 & 6. Figure 4 is the ownership and management of such a portal. Thus, the respondent is defined that the government is the owner or the private sector. Also an intermediate solution based on investing by government and continuing by private section is presented. In figure 5 features of cyber-health is presented. This figure is a combination of the criteria laid down in the preceding sections in three groups of quality of services, quality of content and quality of supporting. Finally the result of figure 6 indicates the importance of criteria between the receiving high quality services or paying the cost and receiving free service. Of Corse free services does not necessarily mean there is no income but rather the parameters of business model will differ.

B. Entropy Method

In the Entropy method, due to table 9, desired people rate each criterion and finally priorities were chosen due to the most distribution. This method is used to estimate the defined processes in cyber health. So experimental data and medical expertise is necessary. Thus the designed structure, as seen on the table 9,

was initially confirmed by 3 physicians and the necessary changes were implemented.

Table 2-Respondent to the questionnaire of cyber health framework

Place-Participant	Expert field	Questionnaire Type		Participant No.
		AHP	Entropy	
Rasool Akram Hospital: 3 Shahid Rajaii Hospital:9	Cardiologist	9	8	15
Shahid Rajaii Hospital:1	Cardiologist prof.	0	1	
Dental Clinic: 1	Dentist	1	1	
Clinic: 1	Physician	1	1	
Iran Telecommunication Research center: 8 Tarbiat Modares University:4	IT Experts	12	0	12
Others: 22	Cardiovascular Users	24	0	22
Sum		47	11	49

Table 3-Analysis of the business income for cyber health framework

Business Model	IT Experts		Cardiovascular Medicine		Cardiovascular Users	
	Test Result	I.R	Test Result	I.R	Test Result	I.R[1]
Hierarchical Clustering of Services • residents and subspecialty cardiology replace as part of their service plan • Physicians with payment of fee	0.453	0.03	0.461	0.00016	0.472	0.00139
Providing free Services	0.452		0.402		0.402	
all the services Membership to benefit in the form of user paid	0.095		0.137		0.126	

Table 4-Analysis of the Ownership & Management for cyber health framework

Ownership & Management	IT Experts		Cardiovascular Medicine		Cardiovascular Users	
	Test Result	I.R	Test Result	I.R	Test Result	I.R
Public Sector	0.083	0.02	0.165	0.00009	0.227	0.00192
Private Sector	0.311		0.277		0.330	
First Public Sector then After Profitability Transfer to the private sector	0.606		0.558		0.444	

Table 5-Analysis of the three main groups of criteria for cyber health framework

Criteria	IT Experts		Cardiovascular Medicine		Cardiovascular Users	
	Test Result	I.R	Test Result	I.R	Test Result	I.R
Services	0.501	0.00897	0.465	0.02	0.442	0.00391
Support	0.370		0.273		0.394	
Content	0.130		0.261		0.164	

Table 6-Analysis of the content criteria for cyber health framework

Criteria in Content	IT Experts		Cardiovascular Medicine		Cardiovascular Users	
	Test Result	I.R	Test Result	I.R	Test Result	I.R
Emphasis on Quality of Content	0.514	0.06	0.403	0.04	0.382	0.07
Segmentation according to Subject Field and Needed Services	0.186		0.384		0.178	

[1] Inconsistency Rate

| Contact Information Of Health work Subject 2016 | 0.153 | | 0.140 | | 0.316 | |
| Providing information on Cardiovascular Subject | 0.147 | | 0.109 | | 0.123 | |

Table 7-Analysis of the Supporting criteria for cyber health framework

Criteria in Supporting	IT Experts		Cardiovascular Medicine		Cardiovascular Users	
	Test Result	I.R	Test Result	I.R	Test Result	I.R
Physical and mental privacy, reliability and security	0.349		0.384		0.321	
Achieving User Requirements	0.301	0.02	0.269	0.06	0.406	0.03
Availability 365*7*24	0.283		0.206		0.193	
Religion, culture and language	0.067		0.140		0.08	

Table 8-Analysis of the services criteria for cyber health framework

Criteria in Services	IT Experts		Cardiovascular Medicine		Cardiovascular Users	
	Test Result	I.R	Test Result	I.R	Test Result	I.R
Online consultation with a cardiologist	0.385		0.311		0.372	
Text, Symbolic, Audio, Visual & Video Information	0.197		0.296		0.150	
Service Providing with Minimum Cost	0.191	0.06	0.173	0.01	0.162	0.003
Cardiology Based Drug Library & Valid Wikis	0.143		0.149		0.144	
Use of Social Networking and the Sharing of Health Public Information	0.085		0.071		0.172	

Then to confirm the figure, a group of eleven physicians and cardiologists and a dentist were used.

C. Analyzing the result of questionnaires

Since this study targeted users of Cardiology, the sample can be used to implement in other medical fields. But the priority may differ in other branches. Thus for a specialized branch of healthcare issues, the expert opinions is needed.

1) Analyzing the result of questionnaire of healthcare portal

In AHP analyzing, as shown in tables 2-8, the priority of three groups of ownership, profitability and criteria for implementing is assessed. As it can be seen in table 2, all three groups of users including patients, IT experts and cardiology health workers are agree with hierarchical paying. In next priority free charging and payment to the health worker via user is acceptable. During the prescience negotiation, Quality of Content with minimum error is important for cardiologists, as table 5. So due to this order, it is better that to use the knowledge of residents for free services with the condition that is part of their shift and to use the cardiologist opinion paying the charge of service is necessary, as table 2. Based on interviews 100% of respondent agreed to this proposal. In the analysis of management and ownership, as table 3, of all three groups did not agree the ownership and management of the public sector. All three groups believe that the best solution is to start with the public sector and continuing with the private sector. At last Sub criteria ranking of cardio portal is shown on the figure 7. Due to this graph online consultation is the most important factor.

2) The cyber-health framework

Based on the web architecture generations, the proposed framework, as shown in summery in figure 8 and then in figure 9, is defined in four main groups as follows: 1) Principles: cyber health is based on the necessity of e-health issues, coordination with the specific characteristics of the environment, avoiding of problems due to the lack of knowledge and poor efficiency of resources. These principles are defined with regard to the expert indexes, tariffs and standards. Environmental factors: it is the collection of factors involved in the decision-making process; the implementation and survival factors are in 4 groups including: a) Characteristics of the geographic environment. b)Political, economic and cultural barriers and supports. c) Barriers and opportunities resulting from technological changes with the latest available technology capabilities anytime and anywhere. d) The hierarchy of operating devices (PC, mobile, tablet and ...) and services.3) Players and stakeholders: they are as following groups: a) Technicals: those who provide services in accordance with the technology. For example, cloud computing and content distribution networks are new technologies. b) Public and governmental sector: these two important sectors can create opportunities for development of new technologies such as fiber-optic platform across the country and planning to provide free bandwidth for knowledge based data centers. c) Professionals and researchers in the field of healthcare and ICT. d) Citizens. 4) Goals: the main goal is achieving to the healing self-wisdom and managing the health process as following points: a) Increasing public awareness and educating citizens. b) Ability to search health knowledge for users to benefit from the knowledge of English language and the world. c) Employment and referral health centers and health workers. d) Reducing Medical Errors. e) Provision of services to the most remote parts of the land in accordance with the native language and culture.

2) Limitations and challenges

Collecting ICT experts and health workers seems impossible. Moreover physicians do not have much

IT Experts		Cardiovascular medicine		Cardiovascular Users	
Prioritization & Evaluation	I.R	Prioritization & Evaluation	I.R	Prioritization & Evaluation	I.R
Online consultation with a cardiologist		Online consultation with a cardiologist		Online consultation with a cardiologist	
Physical and mental privacy, reliability and security		Text, Symbolic, Audio, Visual & Video Information		Achieving User Requirements	
Availability 365*7*24		Physical and mental privacy, reliability and security		Physical and mental privacy, reliability and security	
Achieving User Requirements		Emphasis on Quality of Content		Use of Social Networking and the Sharing of Health Public Information	
Text, Symbolic, Audio, Visual & Video Information		Cardiology Based Drug Library & Valid Wikis		Service Providing with Minimum Cost	
Service Providing with Minimum Cost	0.02	Segmentation according to Subject Field and Needed Services	0.03	Availability 365*7*24	0.02
Cardiology Based Drug Library & Valid Wikis		Use of Social Networking and the Sharing of Health Public Information		Text, Symbolic, Audio, Visual & Video Information	
Emphasis on Quality of Content		Achieving User Requirements		Cardiology Based Drug Library & Valid Wikis	
Use of Social Networking and the Sharing of Health Public Information		Availability 365*7*24		Emphasis on Quality of Content	
Religion, culture and language		Service Providing with Minimum Cost		Contact Information of Health worker & User	
Segmentation according to Subject Field and Needed Services		Religion, culture and language		Segmentation according to Subject Field and Needed Services	
Contact Information of Health worker & User		Providing information on Cardiovascular Subject		Religion, culture and language	
Providing information on Cardiovascular Subject		Contact Information of Health worker & User		Providing information on Cardiovascular Subject	

confidence to provide information for patients. So a trusting culture establishing should be done. Moreover clear regulations about the rights of users

and operators are important factors seriously depended on users and health workers trusting.

Vol

Table 9-Ranking analysis of sub criteria for cyber health framework

One of the major causes of failure in modern technology in Iran is ignoring profitability, revenue sources and cost estimating. The elderly and residents of deprived areas are Useful groups in needing health information, but unfortunately, these two groups have little knowledge of the Internet. So other campaign must be waged. At last high-speed Internet service in many areas is impossible yet. Providing broadband to citizens, one of the objectives of the national information network should be operational as soon as possible in the shortest time and the best quality. In addition young force, physicians, pharmacists, physiotherapists, nurses, paramedics and recent graduates are the potential of who can also speed up the execution of the movement and needs to be programed in a high quality.

I. RESULTS

The present study was assessment of factors affecting the cyber health. Due to the mentioned points, high priority parameter is delivering the services in best quality. The most important factor in delivering services is emphasizing on the wisdom of a specialist adviser. So the proposed solution for hierarchical servicing is using knowledge of internet and residents for free to be part of their shift duty. Continuing priorities evaluation, the best owner of the portal, is the private sector with government support. Thus, the priorities of each group are determined.
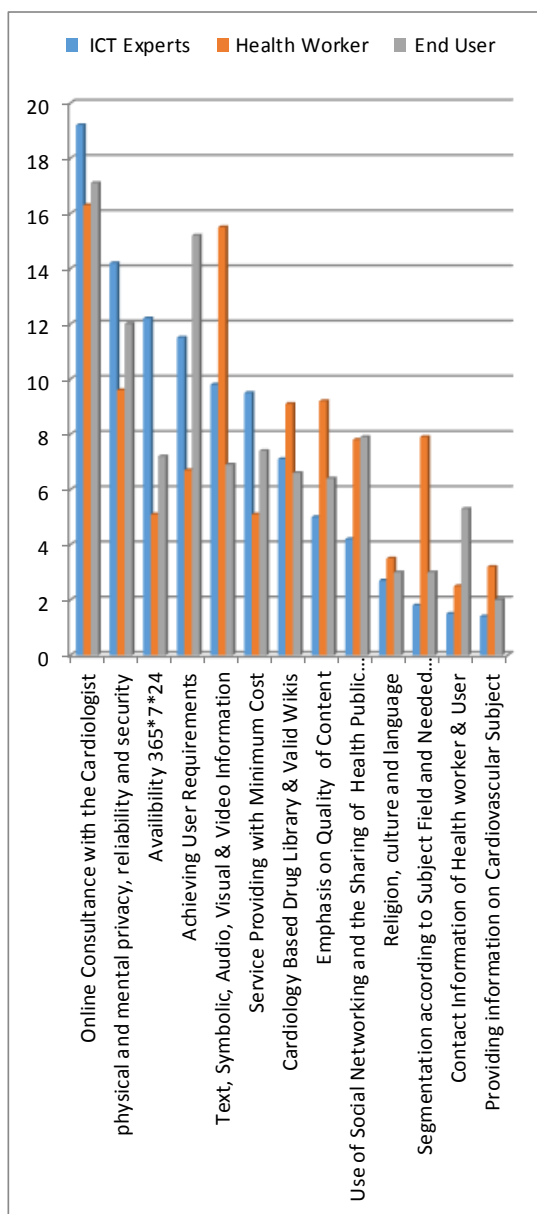
Figure 7-Sub criteria ranking of cardio portal

Figure 8- Basic parameters of cyber health framework

Table 10-Recommended criteria ranking to the physicians for cyber health framework

Cardiovascular Functional Classification Portal based on Wisdom				
Providing Knowledge: 0.525848	Disease Prevention: 0.509039	Cardiovascular Disease due to Other Disease & Problems: 0.49021	Medication Side Effects: 0.239343	
			Malfunction such as Failure to Identify the Disease or Medication Error :0.26237	
			Identical Symptoms of Chest Pain: 0.244067	
			Inheritance: 0.254219	
		Lifestyle: 0.50979	Exercise: 0.251159	
			Feed: 0.251389	
			Career: 0.24848	
			personal Habits: 0.248972	
			Environmental and social Terms: 0.25108	
	Treatment Methodology: 0.490961	Chronic: 0.499528	Medication: 0.362528	
			Behavioral therapy: 0.359623	
			Hospitalization: 0.277849	
			Alternative medicine: It is recommended at last by some people but not Health worker	
		Urgency: 0.500472	Surgery: 0.482901	
			Hospitalization: 0.517099	
Interaction Ability: 0.474152	Determination the Type of Relationship: 0.505087		Electronic meeting: 0.502399	
			Request for Appointment: 0.497601	
	Determination of Audience Type: 0.494913	User: Seeking Sympathy and Understanding of the Experiences: 0.432701		
		Health Worker: 0.567299	Consultation: 0.357696	
			Exchange of Clinical Documents: 0.357967	
			Receive and Pay Bills: 0.284337	

Goals

Ultimate Goal
Develop a User-Based Framework to Raise Social Awareness

Vision
Healer Self Awareness & Self-healing

The Primary Goal
First Framework for Cyber Space to Cardiology Patient

Principles

Environmental Factors

Webometery
Survey of Indicators, Standards& Tariffs

Determination of Evaluation Indicators & Tariffs & Use of Cyber health Systems Due to Reliable sources such as standards (HL7)

Services
Scope of Performance
Sample for Statistical Society
Intended Range of Disease Areas
Geographic Zone

Cardiovascular Disease

Children, Youth, Researchers & Experts, Middle-aged, Elderly

Prevention, Medical, Diagnosis, Cure Treatment, Caring Services, Research

Hospitals, Urban Area, National Area

Comparative Studies

Survey Frameworks, Models and Experiences in the field of Cyber Healthcare

- A Comparative Study of Language, Active NGOs, Cyber Health of the World
- Evaluation of the Progress or Lack of Progress or Failure in Achieving the Objectives
- Study Protections & Remedies Provided by UNESCO in the field of Cyber Health
- Studying of the Prevailing Situations in Iran, Including the Ministry of Health, Portals and other Persian-Language Cyberspaces

ICT

Web 1.0
Web 2.0
Web 3.0
Web 4.0
…

- Expert & Private Social Network & Online Consultant Audio & Video = Mobile Therapist
- Expert Social Network & Online Consultant, Wikis, Access to Selected Data, Audio and Video over the Internet, Online Electronic Medical Records
- Healthcare Social Network, Queries & Search, Wikis, Electronic Medical Records
- Informational portal in the field of health, Drug Information, hospitals and clinics, new diseases, the most common types of conventional and non-conventional treatments & ...

Environmental Factors (list):
- Characteristics of the Geographical Environment
- Political Obstacles
- Economic and Cultural barriers and protections
- Barriers and Possibilities of Technological
- Change at any Time and any Place
- Hierarchy of Devices (computer, phone, tablet, etc.)

Necessity
Cyber Health Coordination with the National and International Knowledge Level in the field of Specific Diseases, Coordination with the Specific Characteristics of the Environment Permanent Servicing, Avoiding the Problems Caused by the Lack of Information and Poor Efficiency of Resources

Citizens | Experts, Researchers & Specialists | Public Sector | Technologists
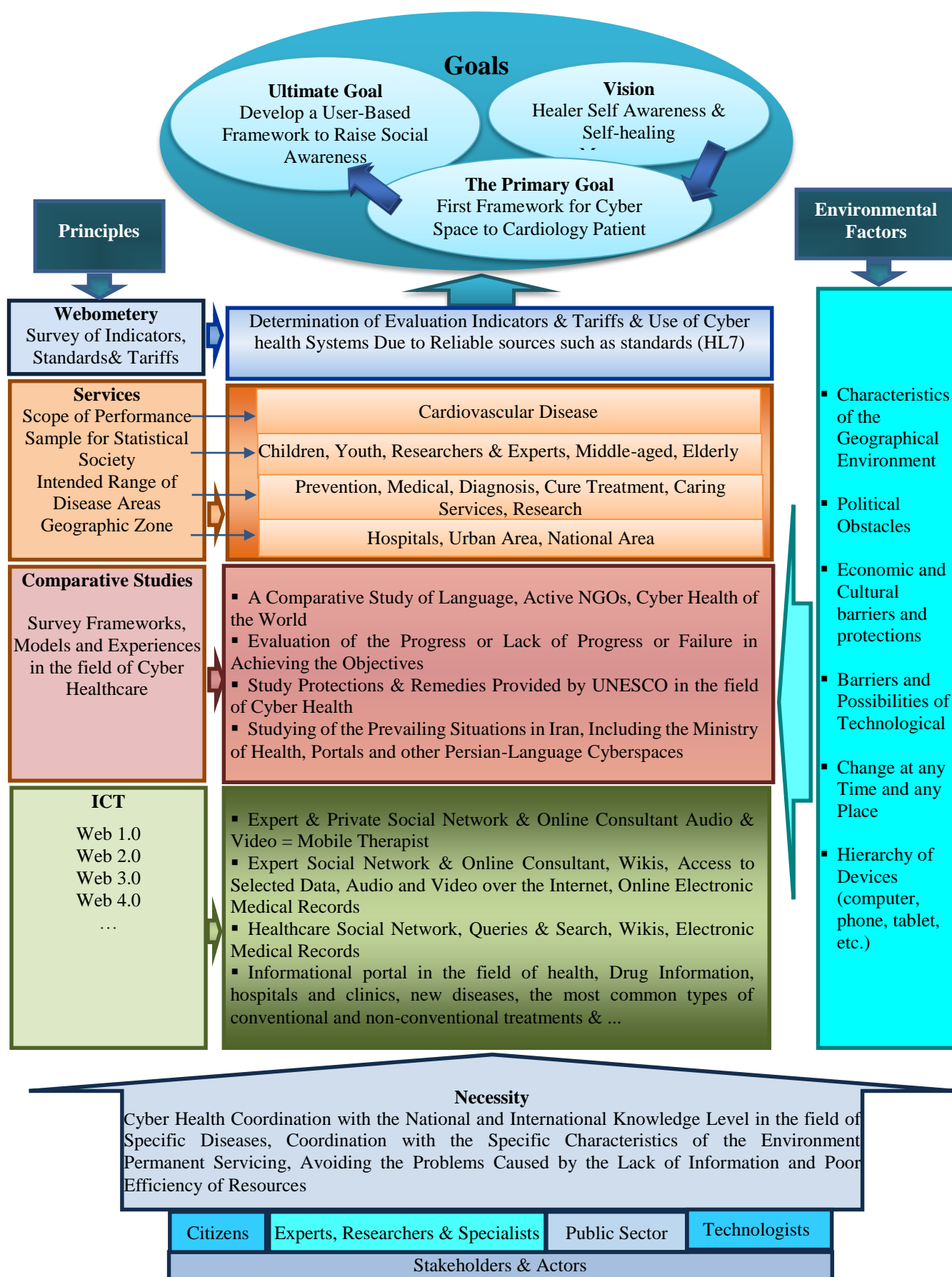
Stakeholders & Actors

Figure 9- Recommended framework for cyber health

The challenge in evaluating medical Opinions, is lack of understanding between 3 groups of interviewees. So due to the disagreement two solutions are recommended. First, is creating a group of cardiologists, ICT professionals and home users to finalize the priority of criteria. Second, is defining the hierarchical accessing level. So each user due to the level of medical knowledge and the level of needs can design its cyber medicine site. But this solution is applicable when the restrictions on the provision of services by service providers (operator) do not exist. More over the chart of user interface according to medical experts were confirmed. In this chart the required information and doctor-patient interaction was confirmed. The most important result of this study is providing a framework of cardiovascular users. This framework consists of principles, environmental factors, players, goals to achieving self-healer consecutions. Since none of web architectures has been provided a subjected health based cyberspace, this framework shows the important features for better servicing.

REFERENCES

[1] Eysenbach G, Sa E R, Diepgen T L. "Shopping the Internet today and tomorrow" - Towards the Millennium of Cybermedicine. BMJ. 1999 Nov.

[2] Solez, K. and S. M. Katz. "Cybermedicine: Mainstream Medicine by 2020/Crossing Boudnaries." J. Marshall J. Computer & Info. 2000, L. 19: 557.

[3] Google, "Google Health has been discontinued. ", http://www.google.com/intl/en_us/health/about/, 2013.

[4] Duggan, S. F. M. "Health Online 2013. A project of the PewReseachCenter, California Healthcare Foundation"

[5] E-health Standards and Interoperability: ITU-T Technology Watch Report," ITU, April 2012

[6] COSTA, C. J., APARÍCIO, M. & FIGUEIREDO, J. P. "Patient Health Portal: user calendar perspective." Procedia Technology, 2012. 5, 849-858

[7] D'AURIA, J. P." Health Web Sites for Teens. "Journal of Pediatric HealthCare, 2011. 25, e1-e5

[8] PROVOST, M., KOOMPALUM, D., DONG, D. & MARTIN, B. C. "The initial development of the WebMedQual scale: Domain assessment of the construct of quality of health web sites." International Journal of Medical Informatics, 2006. 75, 42-5

[9] TAYLOR, H. A., SULLIVAN, D., MULLEN, C. & JOHNSON, C. M. "Implementation of a user-centered framework in the development of a web-based health information database and call center." Journal of Biomedical Informatics, 2011. 44, 897-908

[10] CARLOS, V. S. & RODRIGUES, R. G. "Web site quality evaluation in Higher Education Institutions." Procedia Technology, 2012. 5, 273- 282.

[11] CHOI, J. & BAKKEN, S. "Web-based education for low-literate parents in Neonatal Intensive Care Unit: Development of a website and heuristic evaluation and usability testing." International Journal of Medical Informatics, 2010. 79, 565-575

[12] M. AZIMZADEH, M. FARHOODI, M.MAHMOODI, A.HADIZADEH. "Leadership and monitoring the development projects of Persian Search Engine." 2013

[13] RIPPEN, H. E., PAN, E. C., RUSSELL, C., BYRNE, C. M. & SWIFT, E. K. "Organizational framework for health information technology." International Journal of Medical Informatics, 2013. 82, e1-e13

[14] BUHI ,E. R., DALEY, E. M., OBERNE, A., SMITH, S. A., SCHNEIDER, T. & FUHRMANN, H. J. "Quality and Accuracy of Sexual Health Information Web Sites Visited by Young People." Journal of Adolescent Health, 2010. 47, 206-208.

[15] ADAMS, S. A. "Revisiting the online health information reliability debate in the wake of "web 2.0": An inter-disciplinary literature and website review." International Journal of Medical Informatics, 2010.79, 391-400.

[16] SUOMINEN, O., HYVÖNEN, E., VILJANEN, K. & HUKKA, E. "HealthFinland—A national semantic publishing network and portal for health information." Web Semantics: Science, Services and Agents on the World Wide Web, 2009. 7, 287-297

[17] Asgharpour, M. J.Multiple Criteria Decision Marking. (1390).

[18] Saaty, Thomas L. "How to make a decision: the analytic hierarchy process." *European journal of operational research* 48.1 (1990): 9-26.

[19] Cheng, Eddie WL, and Heng Li. "Analytic hierarchy process: an approach to determine measures for business performance." *Measuring Business Excellence* 5.3 (2001): 30-37.

[20] Birchall, Amy. "Content is king". Management Today, Sep 2013: 22-23.

[21] A.Hadizadeh and M.Sepehri. "Providing a basic framework for Web-based wisdom in Healthcare Based on ontology". 5th e-health Conference, BME group. 2012

[22] John Mitchell, Dr Andrew Cottrill, "Improving your competitive advantage through e-health". The Australian Financial Review 4th Annual Health Congress, 25-27 February 2002.

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