Original Article

Electronic health indicators in the selected countries: Are these indicators the best?

Somaye Afshari, Elahe Khorasani, Mohammad Hossein Yarmohammadian[1], Golrokh Atighechian[2], Mohsen Ghaffari Darab

Department of Health Services Management,[1]Health Management and Economic Research Centre, Isfahan University of Medical Sciences, Isfahan, [2]Department of Health in Disaster and Emergency, Tehran University of Medical Sciences, Tehran, Iran.

ABSTRACT

Background: Many changes have been made in different sciences by developing and advancing information and communication technology in last two decades. E-health is a very broad term that includes many different activities related to the use of electronic devices, software as well as hardware in health organizations. **Aims:** The aim of this study is comparing electronic health indicators in the selected countries and discussion on the best indicators. **Settings and Design:** This study has chosen 12 countries randomly based on the regional division of the WHO. The relevant numbers of health indicators and general indicators and information technology indicators are extracted of these countries. We use data from the Bitarf's comparative study, which is conducted by the Iranian Supreme Council of Information Technology in 2007. **Materials and Methods:** By using Pearson correlation test, the relations between health general indicators and IT indicators are studied. **Statistical Analysis Used:** Data was analyzed based on the research objectives using SPSS software and in accordance with research questions Pearson correlation test were used. **Results:** The findings show that there is a positive relation between indicators related to IT and "Total per capita health, healthy life expectancy, percent literacy". Furthermore, there is a mutual relation between IT indicators and "mortality indicator". **Conclusion:** This study showed differences between selective indicators among different countries. The modern world, with its technological advances, is not powerless in the face of these geographic and health disparity challenges. Researchers must not rely on the available indicators. They must consider indicators like e-business companies, electronic data internet, medical supplies, health electronic record, health information system, etc., In future, continuous studies in this field, to provide the exact and regular reports of amount of using of these indicators through different countries must be necessary.

Key words: E-health indicators, e-health, information technology

Address for correspondence: Miss. Elahe Khorasani (MSc. student)
Department of Health Services Management, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: khorasani.elahe@yahoo.com

Access this article online	
Quick Response Code:	Website: www.jehp.net
	DOI: 10.4103/2277-9531.115811

INTRODUCTION

Many changes have been made in different sciences by developing and advancing Information and communication technology in last two decades.[1] E-health is a very broad term that includes many different activities related to the use of the internet for healthcare provision. The extent to which health professionals are using the internet as a source of consumer information about health and medicine is rapidly increasing. It has been reported by healthcare professionals that large numbers of patients arrive at their offices either with questions related to online medical

This article may be cited as: Afshari S, Khorasani E, Yarmohammadian MH, Atighechian G, Darab MG. Electronic health indicators in the selected countries: Are these indicators the best?. J Edu Health Promot 2013;2:31.

information or a large variety of health products on the internet.[2,3]

"e-health" can be described as an emerging field at the interaction of medical informatics, public health and business, referring to health services and information delivered or enhanced through the internet and related technologies.[4] In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking to improve healthcare locally, regionally, and worldwide by using information and communication technology.[3]

There are different definitions for e-health. World Health Organization (WHO) defines e-health as a new term used to describe the combined use of electronic communication and information technology in the health sector or application of digital data, transmitted stored and retrieved electronically, for clinical educational and administrative purposes in the health sector both at the local site and at a distance.[5]

There is a confusion on terms e-health and telemedicine and there is no clarity in application of the terms in literature.[6] While telemedicine is certainly a theme in the e-health literature, and the information and communication technology (ICT) s used in this area are common to many e-health functions, it clearly represents only one domain of the broader field. Similarly, while several definitions extend to e-business, primarily meaning online transactions between suppliers and purchasers (2% of e-health-related articles appear in journals of finance), and most of these portray it as merely one application of e-health for service management or care delivery.[7]

Most definitions appear to encompass applications for all stakeholder groups, although many emphasize support for providers and organizations and a few see e-health as an application of consumer health informatics or, even narrower, as the use of "internet and other electronic media to disseminate or provide access to health and lifestyle information or services."[8] Our review of e-health topics in the research and web-based literature also indicates that the concept extends across stakeholder groups, including providers, patients, citizens, organizations, managers, academics and policymakers. A tendency has been noted for an inclusive model to predominate in Europe and a narrower consumer-focused one in the USA, possibly reflecting top-down versus bottom-up health systems and cultures. However, our results indicates that there is currently more overlap than difference between conceptualizations emanating from either side of the Atlantic, with the inclusive view predominating. Even of those conceptualizations tending toward the consumer informatics model, most emphasize interaction with professionals rather than simply passive delivery or provision of information to citizens or patients, thus drawing in the professional stakeholder. While there may be a valid argument for narrowing e-health down to consumer health informatics in the future, namely to circumscribe the field and thereby make it more manageable, analysis of the existing e-health landscape suggests that the concept is currently more inclusive.[7]

E-health indicators

In a system of evaluation, there is a need to design and apply indicators for value judging. Indicators are necessary for comparing and ranking. In complex topics like electronic health, finding the indicators that show all aspects is very difficult and it is necessary to identify and select a set of indicators. There are three categories of indicators to have a comprehensive view about e-health [Figure 1].

Various indicators have different effects on e-health. For example, it is commonly supposed that the percentage of literate population causes the population to be a good use of e-health. If a country has suitable infrastructures for e-health but awareness and education level of people as users is not desirable, e-health projects in such country are doomed. On the other hand, various environmental variables such as population, geographical and economic area, etc., can affect this issue. Maybe you can perform e-health card in a country with a population of 30,000 completely but can you easily do this in a country with 60 million people?.[1]

MATERIALS AND METHODS

This is comparative study. We used data from the Bitarf's study, which was conducted by the Iranian Supreme Council of Information Technology in 2007. Bitarf's study had been discussed by 174 countries in terms of e-health indicators. Those indicators were included health indicators and general indicators and information technology indicators that each of them had sub- indicators.

In this study, some of sub-indicators that seemed more relevant to e-health are selected according to expert's opinions. They have been mentioned in Figure 1.

In this study, we have chosen 12 countries randomly based on the regional division of the WHO. We have tried to cover all

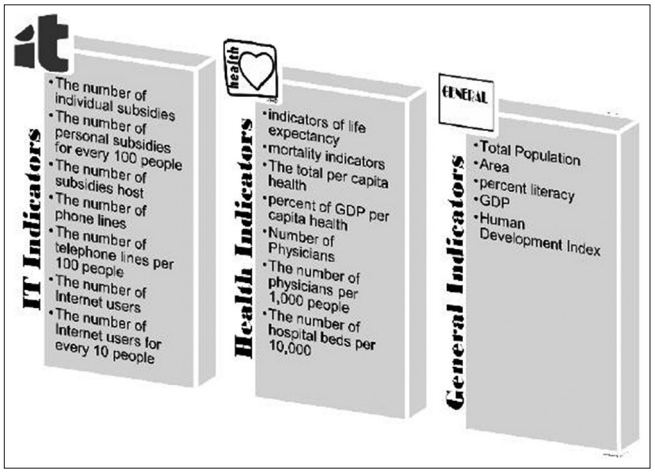

Figure 1: Information about the categories of selected indicators

areas of the world approximately so as to give a better picture of the relevant indicators. The countries are Chile and Mexico from America, Ethiopia and Nigeria from Africa, India and Thailand from Southeast of Asia, Turkey and Romania from Europe region, Malaysia and China from Western Pacific and Iran and Bahrain from Eastern Mediterranean. The relevant numbers of the health indicators and general indicators and information technology indicators are extracted from these countries [9-23] [Tables 1-3].

Finally, by using Pearson correlation test, the relations between health general indicators and IT indicators are studied. We wanted to indicate, which of these indicators are best for comparison.

After studying selected countries, all data were entered in the comparative tables at the end; the recommendations were presented by researchers in order to select appropriate indicators for the comparison of e-health in the world.

RESULTS

The findings shows that there is a positive relation between indicators related to IT (The number of personal computers for every 100 people, the number of telephone lines per 100 people, the number of Internet users for every 100 people) and "total per capita health, healthy life expectancy, percent literacy". Furthermore, there is a mutual relation between IT indicators and "mortality indicator". These findings also showed that there is no relationship between "the numbers of host computers for every 10,000 people" indicators and other indicators. So, we can ignore this indicator from all the indicators of IT for studying e-health. [Table 4].

Sub-indicators were compared in 12 countries. The data of each sub-indicator is sorted from highest to lowest in the Tables. [Tables 1-3].

General indicators include four sub-indicators population/million, area/km^2, percent literacy and GDP. China has the highest and Bahrain the lowest level in the sub-indicators of population/million and area/km^2. Romania has the highest and Ethiopia the lowest percent literacy sub-indicator. Bahrain has the highest and Ethiopia lowest level in the GDP sub-indicator [Table 1].

Health indicators includes eight sub-indicators healthy life expectancy, mortality, total per capita health, percent of GDP per capita health, the number of physicians per 1,000 people and the number of hospital beds per 10,000. Chile has the highest and Nigeria the lowest life expectancy sub- indicator. Chile has the highest and Ethiopia the lowest healthy life expectancy sub-indicator. Nigeria has the highest and Chile the lowest mortality sub-indicator. Nigeria has the highest and Bahrain the lowest adult mortality sub-indicator. Bahrain has the highest and Ethiopia the lowest total per capita health sub-indicator. Turkey has the highest and Nigeria the lowest percent of GDP per capita health sub-indicator. China has the highest and Ethiopia the lowest the number of physicians per 1,000 people sub-indicator. Romania has the highest and India the lowest the number of hospital beds per 10,000 sub-indicator [Table 2].

IT indicators includes four sub-indicators the number of personal computers for every 100 people, the number of host computers for every 10,000 people, the number of telephone lines per 100 people and the number of internet users for every 100 people. Malaysia has the highest and Ethiopia the lowest computers for every 100 people and the number of internet users for every 100 people sub- indicators. Mexico has the highest and Ethiopia the lowest the number of host computers for every 10,000 people sub-indicator. Bahrain has the highest and Ethiopia the lowest the number of telephone lines per 100 people sub-indicator [Table 3].

DISCUSSION

Innovations in health care have the potential power to improve both quality and efficiency of services. Such innovation is the practice of health care supported by information technology

Table 1: Selective general indicators: Adopted from[9-23]

General indicators											
Population/million			Area/km^2			Percent literacy			GDP		
Rating	Country	Value	Rating	Country	Value	Rating	Country	Value	Rating	Country	Value
1	China	1323345	1	China	9596960	1	Romania	97/3	1	Bahrain	21441
2	India	1103371	2	India	3287590	2	Chile	95/7	2	Chile	12505
3	Nigeria	131530	3	Mexico	1972550	3	Thailand	92/6	3	Malaysia	10613
4	Mexico	107029	4	Iran	1648195	4	China	90/9	4	Mexico	10158
5	Ethiopia	77431	5	Ethiopia	1104300	5	Mexico	90/3	5	Romania	9884
6	Turkey	73193	6	Nigeria	923768	6	Malaysia	88/7	6	Thailand	8373
7	Iran	69515	7	Turkey	780580	7	Turkey	88/3	7	Iran	8367
8	Thailand	64233	8	Chile	756950	8	Bahrain	87/7	8	Turkey	7688
9	Malaysia	25347	9	Thailand	514000	9	Iran	77	9	China	5581
10	Romania	21711	10	Malaysia	329758	10	Nigeria	66/8	10	India	1830
11	Chile	16295	11	Romania	238391	11	India	61	11	Nigeria	1085
12	Bahrain	727	12	Bahrain	665	12	Ethiopia	41/5	12	Ethiopia	381

General indicators include four sub-indicators population/million, area/km^2, percent literacy and GDP. China has the highest and Bahrain the lowest level in the sub-indicators of population/million and area/km^2

Table 2: Selective health indicators: Adopted from.[9-23]

Health indicators											
Life expectancy			Healthy life expectancy			Mortality			Adult mortality		
Rating	Country	Value	Rating	Country	Value	Rating	Country	Value	Rating	Country	Value
1	Chile	77/5	1	Chile	67/45	1	Nigeria	196/5	1	Nigeria	495/5
2	Mexico	74/5	2	Mexico	65/65	2	Ethiopia	166/5	2	Ethiopia	420
3	Bahrain	74	3	Bahrain	64/1	3	India	85	3	India	238/5
4	China	72	4	China	64/05	4	Iran	37/5	4	Thailand	209/5
5	Romania	72	5	Malaysia	63/3	5	Turkey	32	5	Romania	166
6	Malaysia	71/5	6	Romania	63	6	China	31/5	6	Malaysia	154/5
7	Turkey	71	7	Turkey	62/1	7	Mexico	28	7	Iran	154
8	Thailand	70	8	Thailand	59/85	8	Thailand	21/5	8	Turkey	146
9	Iran	70	9	Iran	58/5	9	Romania	20	9	China	128/5
10	India	62	10	India	53/65	10	Malaysia	12/5	10	Mexico	127/5
11	Ethiopia	50	11	Nigeria	41/65	11	Bahrain	11	11	Chile	99/5
12	Nigeria	45/5	12	Ethiopia	41/35	12	Chile	9/5	12	Bahrain	97
Health indicators											
Total per capita health			Percent of GDP per capita health			The number of physicians per 1,000 people			The number of hospital beds per 10,000		
Rating	Country	Value	Rating	Country	Value	Rating	Country	Value	Rating	Country	Value
1	Bahrain	813	1	Turkey	7/6	1	China	10/6	1	Romania	66
2	Chile	707	2	Iran	6/5	2	Mexico	1/98	2	Bahrain	28
3	Mexico	582	3	Mexico	6/2	3	Romania	1/9	3	Turkey	26
4	Romania	540	4	Chile	6/1	4	Turkey	1/35	4	Chile	25
5	Turkey	528	4	Romania	6/1	5	Bahrain	1/09	5	China	23
6	Iran		5	Ethiopia	5/9	5	Chile	1/09	6	Thailand	22
7	Malaysia	374	6	China	5/6	6	Malaysia	0/7	7	Malaysia	19
8	China	278	7	India	4/8	7	India	0/6	8	Iran	16
9	Thailand	260	8	Bahrain	4/1	8	Iran	0/45	9	Mexico	10
10	India	82	9	Malaysia	3/8	9	Thailand	0/37	10	India	7
11	Nigeria	51	10	Thailand	3/3	10	Nigeria	0/28	11	Ethiopia	-
12	Ethiopia	20	11	Nigeria	0/5	11	Ethiopia	0/3	12	Nigeria	-

Health indicators includes eight sub-indicators healthy life expectancy, mortality, total per capita health, percent of GDP per capita health, the number of physicians per 1,000 people and the number of hospital beds per 10,000. Chile has the highest and Nigeria the lowest life expectancy sub- indicator

Table 3: Selective IT indicators. Adopted from[9-23]

IT indicators											
The number of personal computers for every 100 people			The number of host computers for every 10000 people			The number of telephone lines per 100 people			The number of internet users for every 100 people		
Rating	Country	Value	Rating	Country	Value	Rating	Country	Value	Rating	Country	Value
1	Malaysia	19/16	1	Mexico	145/17	1	Bahrain	130/2	1	Malaysia	38/62
2	Bahrain	16/88	2	Chile	142/27	2	Malaysia	91/97	2	Chile	27/9
3	Chile	13/87	3	turkey	65/56	3	Chile	89/82	3	Bahrain	21/3
4	Romania	11/3	4	Thailand	58/13	4	turkey	85/51	4	Romania	20/76
5	Mexico	10/68	5	Malaysia	52/81	5	Romania	81/73	5	turkey	14/13
6	Iran	2/53	6	Bahrain	25/8	6	Mexico	62/58	6	Mexico	13/38
7	Thailand	6	7	Romania	22/64	7	China	56/53	7	Thailand	11/25
8	turkey	5/12	8	India	1/33	8	Thailand	37/4	8	Iran	7/88
9	China	4/08	9	China	1/25	9	Iran	37/3	9	China	7/23
10	India	1/21	10	Iran	0/95	10	Nigeria	15/07	10	India	3/24
11	Nigeria	0/68	11	Nigeria	0/08	11	India	11/31	11	Nigeria	1/39
12	Ethiopia	0/31	12	Ethiopia	0/01	12	Ethiopia	0/77	12	Ethiopia	0/16

IT indicators includes four sub-indicators the number of personal computers for every 100 people, the number of host computers for every 10,000 people, the number of telephone lines per 100 people and the number of Internet users for every 100 people. Mexico has the highest and Ethiopia the lowest the number of host computers for every 10,000 people sub-indicator

Table 4: Pearson correlation of selected general, health and IT indicators

Indicators	Percent literacy	Healthy life expectancy	Mortality	Total per capita health
The number of personal computers for every 100 people	0.66 *P* value=0.01	0.66 *P* value=0.01	-0.68 *P* value=0.01	0.72 *P* value=0.01
The number of host computers for every 10000 people	0.53 *P* value=0.07	0.55 *P* value=0.06	-0.48 *P* value=0.01	0.56 *P* value=0.057
The number of telephone lines per 100 people	0.76 *P* value=0.00	0.73 *P* value=0.00	-0.75 *P* value=0.00	0.88 *P* value=0.00
The number of internet users for every 100 people	0.66 *P* value=0.01	0.65 *P* value=0.02	-0.69 *P* value=0.01	0.64 *P* value=0.02

The findings show there is a mutual relation between IT indicators and "mortality indicator"

or e-health.[4] E-health includes information and services related to health education and prevention, information about diseases and illness, treatment options, social support, and health care organizations available on the internet. This study showed differences between selective indicators among different countries. The modern world, with its technological advances, is not powerless in the face of these geographic and health disparity challenges. Historically, health care was enacted face to face through families and health services providers at close proximity. The recent emergence of the internet has been heralded as a potentially leveling device given the promise of universal access to health information that transcends time and distance, and provides a level of anonymity. Unfortunately, the internet actually has not always lived up to this potential and may even serve to increase health disparities in some situations.

In this article, after studying IT, health and general indicators in selective countries and by using correlation test; we concluded that there is more relation between "total per capita health, healthy life expectancy, and percent literacy" indicators and IT indicators. However, still there is a big question in mind; can mentioned indicators show efficiency of e-health in these national health systems? Because, for example the number of private computers, telephones or the amount of using of internet has not the specific application in e-health and maybe, we can offer indicators, which can make a better presentation of e-health. Those indicators must show practical application of e-health across the health system. So researchers must not rely on the available indicators. They must consider indicators like e-business companies, electronic data internet (EDI), medical supplies, health electronic record (HER), health information system (HIS), etc., In future, continuous studies in this field, to provide the exact and regular reports of amount of using of these indicators through different countries must be necessary.

REFERENCES

1. Dehghan R, Ghorbani V. Development of electronic health; strategic specialty in health system. Manage Inf healthc J 2004;2:57-70.
2. E-Health in the Medical Field. 2003.
3. Wickramasinghe N, Gupta JN, Sharma SK. Creating Knowledge-Based Healthcare Organizations. United States: United States of America Idea Group Inc; 2005.
4. Eysenbach G. What is e-health? J Med Int Res 2001;2001:3.
5. Bitaraf E, Riyazi H, Fathirudsari B. Comparative study of electronic health in the world. Iran: Minister of technology and Information of Iran; 2007.
6. Mitchell J. From telehealth to e-health: The unstoppable rise of e-health. Canberra, Australia: National Office for the Information Technology; 1999.
7. Pagliari C, Sloan D, Gregor P, Sullivan F, Detmer D, Kahan JP, *et al*. What is eHealth (4): A scoping exercise to map the Field. J Med Internet Res 2005;7:e9.
8. Wyatt J. eHealth: What are the likely impacts on patients, professionals and organisations?, in Netherlands: The Congress on ICT in Healthcare, Amersfoort; 2003.
9. Ojo T. Communication Networking. ICTs and health information in Africa information development. United States: Sage Publications; vol. 22. 2006. p. 94-101.
10. Geissbuhler A, Ly O, Lovis C, L'Haire JF. Telemedicine in Western Africa: lessons learned from a pilot project in Mali' perspectives and recommendations. AMIA Annu Symp Proc 2003:249-53.
11. Séror AC. A Case Analysis of INFOMED: The cuban national health care telecommunications network and portal. J Med Internet Res 2006;8:e1.
12. FrameWork For Information Technology Infrastructure for Health in India.
13. Kaushal R, Blumenthal D, Poon E. Cost of National Health Information Network Working Group.The costs of a national health information network. Ann Intern Med 2005;143:165-73.
14. Schneider E, Riehl V, Courte-Wienecke S, Eddy DM, Sennett C. Enhancing performance measurement: NCQA's road map for a health information framework. JAMA 1999;282:184-90.
15. Sittig D, Shiffman R, Leonard K. A draft framework for measuring progress towards the development of a National Health Information Infrastructure. BMC Med Inform Decis Mak 2005;5:14.
16. The New Partnership for Africa's Development (NEPAD).2001. Available on: www.dfa.gov.za/au.nepad/nepad.pdf
17. Männistö L, Kelly T, Petrazzini B.Internet and Global Information Infrastructure in Africa ITU.1996. Available on: www.itu.int/ITU-D/ict/papers/witwatersrand/tam_tam.pdf World Health Organization.
18. The World Health Report 2006: working together for health.
19. World Health Organisation. Health statistics and health information systems. Available on: http: //www.who.int/healthinfo/systems/en
20. Monitoring Human Development: Enlarging People's Choices. Available on: folk.uio.no/sveinsj/UNDPtabeller.
21. pdf Health Informatics World Wide. Available on: www.hiww.org
22. UNESCO Institute for Statistics-Adult literacy rates. Available on / www.uis.unesco.org/literacy/Pages/Literacy-adult-youth-2011.aspx
23. Gustafson D, Wyatt J. Evaluation of ehealth systems and services. Br Med J 2004; 328:1150.

Source of Support: Nil, **Conflict of Interest:** None declared