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

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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

INTRODUCTION

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 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
information or a large variety of health products on the internet.[1,3]

“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.[1]

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?[11]

**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
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/km², percent literacy and GDP. China has the highest and Bahrain the lowest level in the sub-indicators of population/million and area/km². 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 10,000 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.

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

| Population/million | Area/km² | Percent literacy | GDP |
|-------------------|----------|-----------------|------|
| 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   |

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General indicators include four sub-indicators population/million, area/km², percent literacy and GDP. China has the highest and Bahrain the lowest level in the sub-indicators of population/million and area/km².
### Table 2: Selective health indicators: Adopted from [9‑23]

| Health indicators | Country | Value | Health indicators | Country | Value | Health indicators | Country | Value | Health indicators | Country | Value | Health indicators | Country | Value | Health indicators | Country | Value |
|-------------------|---------|-------|-------------------|---------|-------|-------------------|---------|-------|-------------------|---------|-------|-------------------|---------|-------|-------------------|---------|-------|
| **Life expectancy** | Chile | 77/5 | Healthy life expectancy | Chile | 67/45 | Mortality | Nigeria | 196/5 | Adult mortality | Nigeria | 495/5 |
| **Mortality** | Mexico | 74/5 | | Mexico | 65/65 | | Ethiopia | 166/5 | | Ethiopia | 420 |
| **Adult mortality** | Bahrain | 74 | | Bahrain | 64/1 | | India | 85 | | India | 238/5 |
| | China | 72 | | China | 64/05 | | Iran | 37/5 | | Thailand | 209/5 |
| | Romania | 72 | | Romania | 63/3 | | Turkey | 32 | | Romania | 166 |
| | Malaysia | 71/5 | | Malaysia | 63 | | China | 31/5 | | Malaysia | 154/5 |
| | Turkey | 71 | | Turkey | 62/1 | | Mexico | 28 | | Iran | 154 |
| | Thailand | 70 | | Thailand | 59/85 | | Thailand | 21/5 | | Turkey | 146 |
| | Iran | 70 | | Iran | 58/5 | | Romania | 20 | | China | 128/5 |
| | India | 62 | | India | 53/65 | | Malaysia | 12/5 | | Mexico | 127/5 |
| | Ethiopia | 50 | | Ethiopia | 41/65 | | Bahrain | 11 | | China | 99/5 |
| | Nigeria | 45/5 | | Nigeria | 41/35 | | Chile | 9/5 | | Bahrain | 97 |

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

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