

## The Quality of E-Health: First Steps on How to Implement and Evaluate Digitalization in Health

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### Abstract

E-Health is a new modern way to offer better services in health care system worldwide. Many countries have developed during the last years specific tools to implement digital in health care system. In this paper, we focus on the e-Health indicators used across the world in order to select the ones who may be used in future research. The study is longitudinal and uses data with no limit in time and space, observational with the focus on the existing reports, studies. Most of the data gathered is qualitative, the information was processed and interpreted. Each country followed specific rules in order to create the framework for e-Health. There is a need for digital health services in all countries and to create new pathways to offer better services for those who needed. In the paper below we analyzed a number of 26 sources, in order to describe the process of implementing a program in health system such as electronic health records, to find quality indicators for e-Health in order to evaluate it and the dimension of digital information in medical system.

### Keyword

E-Health, Indicators, E-Health Dimension, Electronic Health Records.

## 1. INTRODUCTION

e-Health implementation world wide is a desired action because of the benefits for the patients and for the medical staff. Although many countries develop hardware and software especially for implementing e-health, there are unclear and not established indicators to assure the same evaluation (Hypponen, Ammenwerth, Nohr, Faxvaag, & Walldius, 2012). e-Health helps the medical system using information and communication technology. It consists of online consultation, diagnosis, prescribing, prevention and education through online technology. e-Health is composed from telemedicine, tele-care, m-Health, e-Public health, tele-health and e-Mental health (Ossebaard & Van Gemert-Pijnen, 2016). The main definition of e-Health is the following: e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. 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 health care locally, regionally, and worldwide by using information and communication technology (Eysenbach, 2001).

Modern information and communication technology (ICT) is widely used by the patients and medical staff. Socio-demographic aspects are influencing the use of this technology for healthcare. Moreover, the possibilities of e-health applications particularly for inter-sectoral communication and data exchange appear to extend impressively. Further studies should also be developed in order to verify data safety and data security (Holderried, 2016).

Usually there are benefits from implementing electronic health records, but not always it can be measured. Whatsoever, there are benefits to the adherence to guidelines, in surveillance and monitoring and in decrease medical error (Knight, Szucs, Dhillon, Lembke, & Mitchell, 2014).

The National Library of Medicine defines quality indicators as ‘norms, criteria, standards and other direct qualitative and quantitative measures used in determining the quality of health care’ (Alguren, 2018).

In the process of implementation, telemedicine meets some barriers like connectivity problems, adherence of the medical staff and patients, financial issues, data security, effectiveness, rural setting, legal liability. (Kruse, Karem, Shifflett, Vegi, Ravi, & Brooks, 2018). This study reports on implementing e-Health and quality indicators and may offer some information about future creation of specific guides.

## 2. CONCEPTUAL FRAMEWORK

Analyzing the current situation of the measurements regarding quality of e-Health may offer information of the areas that can benefit the most and regular upgrade following the international changes in the field (Black, și alții, 2011). Patients prefer to access their online records, and this can lead to a stronger doctor-patient relationship, following the medication prescribed and increase empowerment (Knight, Szucs, Dhillon, Lembke, & Mitchell, 2014).

In a systematic review conducted in 2014, on over 53 reviews revealed that usually the benefits of the e-Health aren't measured at all or in small amounts conducting to insufficient data. The lack of data may block the development and improving. The evaluation of e-Health is needed in order to take into consideration development on a large-scale (Black et al., 2011). In a study on evaluation, there were identified 75 different evaluation systems that shows the inexistence of a standardized protocol. The study is a guide for e-Health researchers to find the suitable evaluation approach for each phase of their studies. The most used evaluation approach were questionnaires in all of the studies and feasibility studies in 88 % of the studies (Bonten et.al, 2020).

In a study conducted on 2784 of patients, one in every three adult consultation and one in five pediatric consultation was replayed. Recording health consultation is important to the patients and has benefits in the medical practice (Wolderslung, 2015). Checklist may improve the referrals letters from gastroenterologist in a survey in Norway. The process is easier and less time consuming, but the effect is limited (Eskeland S. L., 2018). During COVID-19 lockdown and despite the barriers like costs, legal liability, video consultations were very much appreciated by 90% of the patients, but significantly lower between medical staff which 40% had high level of satisfaction. The main reasons are technical problems and more work in order to successfully attend consultations (Barkai, Gadot, Amir, Menashe, Shvimer-Rotschild, & Zimlichman, 2020).

Another example of benefits from telemedicine is telestroke, a program that allows rapid diagnosis and treatment of the patients with signs of stroke. There are some barriers also like costs, effectiveness, but over the years this program showed its benefits (Wechsler et al., 2016). Some aspiration of telehealth were established in a study in the case of home dialysis patients: increases supervision, decrease clinic visits, decrease hospitalization rate, increase access to practitioner by patients, earlier diagnosis and treatment of medical conditions, allows the practitioner to adjust therapy, increases patient and practitioner satisfaction and quality of life. The advantages of telehealth by stakeholder are: decrease travel time and cost, increase supervision of care, decrease visits, improve adherence to treatment, and disadvantages are possible loss of privacy and security, set up telehealth equipment and services, obtain monthly labs by another venue, unable to collect the facility fee (Lew, 2020).

For the integration of eHealth, three important principles should be considered in the same time. First, the role of the patient needs to be integrated in the decision, structure of the organization and daily care process. Second, the technology should be very well integrated to

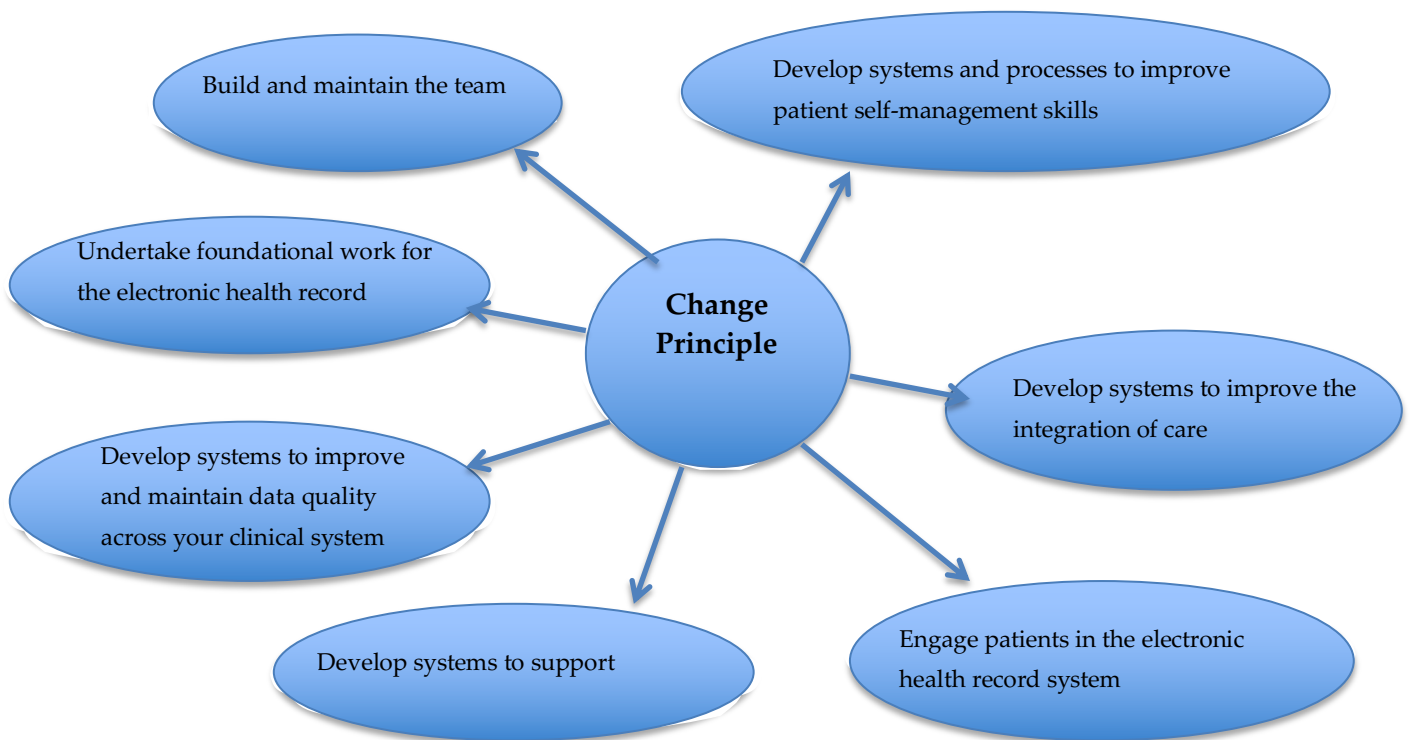
the structure of the organization and daily care process. Third, human resources needs to be linked with the desired end results (Tossaint-Schoenmakers, Versluis, Chavannels, Talboom-Kamp, & Kasteleyn, 2021).

### 2. 1 Integration of E-Health Into Health Care

For implementing a program for health records, the following are necessary (Knight, Szucs, Dhillon, Lembke, & Mitchell, 2014):

- staff that register patients,
- new software and hardware if necessary,
- improving and maintaining data quality,
- patient consent,
- access to patient to introduce information.

For implementing a program in Australia between 2011 and 2012, experts set change principles and improvements measures.



**Figure 1.** Change Principles for Implementing A Health Program

Source: adapted from (Knight, Szucs, Dhillon, Lembke, & Mitchell, 2014)

The same program used some improvement measures like number of uploads in the program, percentage of coded diagnoses and percentage of current prescriptions.

Regarding the integration of e-Health into health care, the following principles are useful to take into account: the role of the patient has to be integrated in the daily care process, the

technology must be adapted to the structure of the organization and the involvement of human resources to the care system must be appropriate with the desired results (Tossaint-Schoenmakers, Versluis, Chavannels, Talboom-Kamp, & Kasteleyn, 2021).

## 2.2 Digital Dimension of the Healthcare

Digital and social media innovation has developed in three broad areas as follows (Halvorson, Goldbriugh, Kennedy, Kent, Close, & Becker, 2012):

1. Digital Channel for Health – in which healthcare providers are implementing digital services in the traditional healthcare system in order to improve quality, productivity and access to medical services. Examples are: online access to laboratory results, follow-up consultations by e-mail, mobile access to radiology images.
2. Digital Innovation for Consumers – in which patients take better care of their own chronic illnesses. Examples: online communities of patients in which they share experience.
3. Digital Initiatives for Social Impact – public and private organizations target people in order to promote campaigns to prevent diseases and promote health. Examples: stop smoking campaigns, reduce child obesity through sport and healthy diet.

The healthcare sector has three traditional spaces like hospitals, clinics and homes. The three digital areas listed above are considered a new “fourth space” in the medical system. Among services offered by the fourth space, there are as follows: hospital/clinic websites, physician-patient e-mails exchanging information, social media to patients, medication reminders, appointment booking, physicians networks, e-prescribing, lab result reporting, health information and advice, remote imaging review, online pharmacies, video consultations, provider wellbeing apps, remote monitoring (Halvorson, Goldbriugh, Kennedy, Kent, Close, & Becker, 2012).

## 2.3 Dimensions of Digital Health

According to The Healthcare Information and Management Systems Society (HIMSS), there are four key dimensions of digital health: Person-Enabled Health, Predictive Analytics, Governance and Workforce, and Interoperability (HIMSS).

1. Person-Enabled Health expresses the connection between patients and their health providers based on the personal values, needs and health targets. It can be measured by personal care delivery, proactive risk management and predictive population health.
2. Predictive analytics represents the transformation of data into knowledge and it can be measured by personalized analytics, predictive analytics, operational analytics.
3. Governance and workforce supervises digital health systems through policies and law and assures security, privacy, stewardship and accountability.
4. Interoperability expresses the connection between different digital health systems, apps, devices in order to provide information easily with no borders. His dimension is measured by foundational interoperability, structural interoperability, semantic interoperability and organizational interoperability.

Digital Health Indicator measures improvement of the digital health ecosystem and is based on the four dimensions developed by HIMSS with the purpose to help the transformation of digital health.

In a study, a new approach for scale development of the e-health service quality was established. The model of e-Health service quality has 3 dimensions, each one with sub-dimensions, as follows (Hadwich, Georgi, Tuzovic, Buttner, & Bruhn, 2010):

1. potential quality: accessibility, competence,
2. process quality: information, usability/user friendliness, security of data/system, system integration, trust, individualization, empathy, ethical conduct,
3. outcome quality: degree of performance, reliability, ability to respond.

#### 2.4 Quality Indicators

According to OECD, developed in 2013 almost 70 health care quality indicators (HCQI) regarding primary care, acute care, mental health, cancer care, patient safety and patient experiences (Carinci et al., 2015).

Also they defined criteria to score the HCQI such as validity, reliability, relevance, actionability, international feasibility, international comparability. These criteria help to decide which indicators are reliable and should be kept or omitted from future data collection and also help prioritize relevant indicators (Carinci et al., 2015).

According to US Institute of Medicine, there are six components of quality in health care for the 21<sup>st</sup> century: safety, effectiveness, patient-centeredness, timeliness, efficacy and equity (Ossebaard & Van Gemert-Pijnen, 2016).

World Health Organization developed a Global Observatory for e-Health and there where established indicators to measure the benefits of e-Health (Haux et al., 2018).

1. Access to health care professionals to their patients health record data.
2. Access of patients to their health record data.
3. Access of caregivers to the patients health record data.
4. Enabling health care professionals to add data to their patients health records.
5. Enabling patients to add data to their health record(s).
6. Enabling caregivers to add data tot the patients health record(s).

WHO conducted study in 7 countries (Austria, Finland, Germany, Hong Kong, South Korea, Sweden and Unites States) based on the 6 indicators for e-Health. The results varied between the countries and if three of the six indicators where completed, it was a sign for good development of the e-Health, especially for the benefit of the patients (Haux et al., 2018).

Other e-Health indicators are (Hypponen, Ammenwerth, & Keizer, Exploring a methodology for eHealth indicator development, 2012):

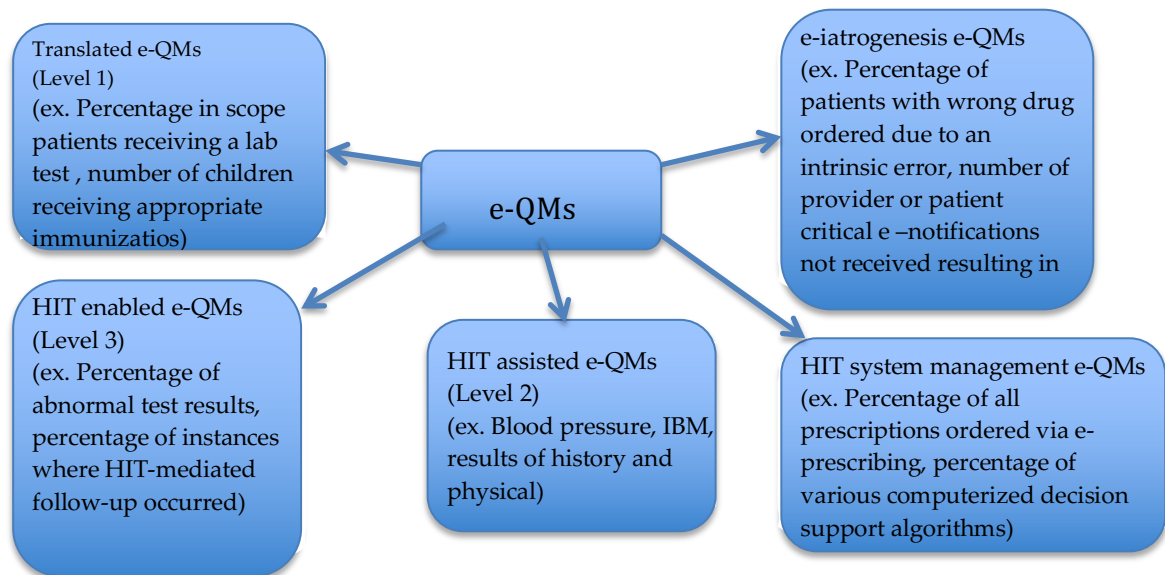
1. Structural quality: hardware quality, software quality, computer information and agreement of the users;
2. Information logistics quality: information quality, user satisfaction, costs of information processing, usage patterns;
3. Effects of e-Health on the processes quality: processes efficiency, organizational and social issues, appropriateness of care;
4. Effects of e-Health on quality of care outcome: costs of care, patient outcome, patient-related knowledge or behavior, patient satisfaction.

Regarding the access to health care professionals to their patients health data, one example is that electronic checklists improved the quality of referral letters (Eskeland, Rueegg, Brunborg, Aabakken, & De Lange, 2018).

When there is lesser referral information can take longer to see a specialist and this may lead to delayed diagnosis. Tele-health may improve the delay to diagnosis and early treatment (Tay, Lim, Lee, Low, & Cheung, 2014).

## 2.5 E-Quality Measures of Electronic Health Records

The importance of implementation of electronic health records (EHRs) increased over the years along with health information technology (HIT). HIT is composed of clinical decision support systems (CDS), computerized provider order entry (CPOE) and web-based personal health records (PHRs). In USA, health system uses five electronic quality measures (e-QMs) to define it.



**Figure 2.** EHR/HIT e-Quality Measures of Provider Performance

Source: adapted from (Weiner, Fowels, & Chan, 2012)

Implementation of EHR must be easy to use, easy to understand how it works, easy to adjust over time, with the help of users, departmental leaders and information technology specialists. This requires regular evaluation and changes in systems (Ovretveit, Scott, Rundall, Shortell, & Brommels, 2007).

In France was evaluated the implementation of EHR in the “Hôpital numérique 2012–2017” program taking into consideration four quality indicators: the quality of patient record, the evaluation of pain status, the delay in sending information at hospital discharge and the nutritional status evaluation. The model showed positive aspects of the use of EHR by improving the quality of care management (Plantier et al., 2017).

The benefits of EHRs (electronic health records) are easier accessibility, manipulation, legibility, sharing, transportation and preservation of electronic data. The risks are represented by threats to patient safety if paper persistence, unwanted access to unsecured networks, organizational inefficiency due to increased time to document and retrieve data (Black, și alții, 2011).

### 3. METHODOLOGY

The present article includes an analysis of the documentation found in various publications and scientific articles in order to illustrate the indicators, dimension of the e-Health. Therefore, we used a comprehensive search into numerous sources of secondary data, such as articles, reports and books from the domains of e-Health from electronic databases, such as e-Information, PubMed, Academia, EDU, and websites using keywords like quality indicators in eHealth, quality indicators in telehealth. A study was excluded if the full text was not available, if it was in other language other than English.

The study is longitudinal and uses data with no limit in time and space, observational with the focus on the existing reports, studies. Most of the data gathered is qualitative, the information was processed and interpreted.

The main hypothesis is that the existence of e-Health increases the quality of the medical services provided to the patients by the medical staff. In order to evaluate, it is necessary to establish the suitable indicators for each phase or program.

#### **4. RESULTS**

In this article were included a variety of study designs, some of them on specific diseases. All studies showed definition, structure, evolution, and indicators that were potentially related to the evaluation of eHealth.

First step in e-Health is implementing electronic health records. There are specific steps to implement it like preparing staff in order to work properly with the new program, installing new software and hardware if needed, continuous analysis and improvement of the process. Some countries selected specific indicators to assess the process. In US, the Institute of Medicine selected six main components of health care: safety, effectiveness, patient-centeredness, timeliness, efficacy and equity which are more general. These components have five specific indicators called quality measures like number of children receiving immunization, abnormal lab test results, IBM, etc. These indicators are more specific and show an image of the e-Health at some point.

On the other hand, the World Health Organization established six indicators to measure the benefits of e-Health. These indicators are more specific on base activities in telemedicine like if health care professionals have access and the permit to add data to their patients health record data, access and the power to change medical data by patients, access of caregivers to the patients health data.

To evaluate a system, there is a need of specific indicators that show the activity of implementing and using the benefits of medicine. In some countries there are indicators that can present a clear image on a specific subject, but in others countries there are not well establish or comprehensive indicators. These may lead to not be able to compare and adjust using the experience of the countries with better e-Health programs.

#### **5. DISCUSSIONS**

There are not worldwide indicators for evaluating the efficacy of implementing e-Health in the medical sector. Each country or organization developed some indicators for e-Health in general or for specific compounds of e-Health. Some indicators such as those developed by WHO refer to the access and the possibility of modifying the health records by the caregivers, patients and health care professionals.

Other indicators refer to the entire process such as software needed, hardware, knowhow, information quality, costs, patient satisfaction, etc. Many countries started to developed EHR in order to make an easier access to medical information.

The efforts of applying e-health in developed countries are limitative and not properly evaluated. In order to increase the quality of e-health worldwide, it is recommended to select specific indicators and use them by all the countries, or at least by the countries in the same area, region or continent.

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