

# A Review of Factors Influencing e-Health Adoption in Kenya: Barriers And Facilitators

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**Abstract:** Over the past few decades, there has been a great leap in the development of Information and Communication Technology (ICT); both in hardware and software capabilities. This has provided a sound platform for their application in relation to healthcare provision in diverse forms. The application of ICT in healthcare, referred to as e-health, is an all-encompassing terminology with health and technology as driving focus. E-health is an idea whose time has come as can be evidenced by the World Health Organization (WHO), urging all its member states to embrace its adoption. Globally, e-health has been significantly embraced by a good number of developed nations with well documented benefits; yet there has been very little in terms of adoption in the developing nations especially in the Sub-Sahara African continent. This paper reviewed e-health adoption globally and in Kenya with the objective of determining barriers and facilitators to its adoption, eliciting interventions to address adoption and to assess evidence available to support potential for improving or promoting e-health. The literature synthesis included as many dimensions as possible that related to barriers and facilitators in both clinical and public health care. This was necessary to identify the scope of the adoption and research experiences; it also permitted broad categorization of relevant issues deliberated on by health/ICT experts. Broadly these were considered in terms of the context, processes involved and the event outcomes.

**Keywords:** E-Health, facilitators and barriers, adoption, Kenya.

## 1. Introduction

E-Health services are a relatively new idea; particularly in the developing countries, it has therefore received limited previous academic research. Where it does exist, the majority of the publications relates to developed countries (Chau and Hu, 2002). Literature available identifies that the healthcare industry has not fully exploited the benefits of ICT as has been done by other industries in the utilization of ICT applications (Schaper and Pervan, 2007).

Fragmentation, lack of coordination, systems automation and integration, availability of timely and comprehensive data, quality, transparent and safety provision by healthcare providers, and efficient healthcare service delivery to the patient have been cited as major issues affecting healthcare delivery in the developing world. In the Kenyan context, the Ministry of Public Health and Sanitation 2008 reported that despite extensive previous investments by the Kenyan Government, the Health Management Information System (HMIS) does not provide timely and comprehensive data. Taking into account the emerging decentralized systems, disease burden, prevention and other epidemiological trends, the health system currently available provides limited information for monitoring health goals

and empowering individuals and communities with timely and understandable information on health.

Healthcare facilities are experiencing both financial and operation stress due to scarcity of resources. Patient volumes are constantly increasing; rather than increase physical capacity to meet growth in volume, healthcare facilities can increase their service capacity by improving their ability to move patients through the care provision (treatment) system. Effective management of both complex chronic and acute diseases in this scenario represents one of the greatest challenges now facing health systems; this will require new ways of delivering healthcare, involving integration of care providers or, at least, much closer coordination of their activities. New patient tracking technologies help caregivers work more efficiently by providing them with real-time information on patients flow or progression through the healthcare facility. It also gives an update about lab tests, orders, drug dispensing from the pharmacy and any other notifications that are crucial to the workflow. Other challenges related to patient flow are medicine error, tracking diseases outbreak through drugs dispensing pattern at the pharmacy.

## 2. Objective(s)

The key objective of the study was to conduct a systematic literature review to elicit determinants of e-health adoption in Africa. We specifically focused on the barriers, facilitators and evidence available to support potential interventions to address these aspects. The findings can be used to develop a framework for improving adoption practices for e-health.

## 3. Literature Review and Related Work

Currently, there is no distinct E-Health definition in the healthcare industry but rather a number of overlapping definitions. It is however agreed that e-health is an all-encompassing terminology with the health and technology as the driving focus. Oh et al 2005, captures it well that it has numerous definitions. This is mainly due to the diversity and dynamism that exists both in healthcare and ICT; the overall goal however is to improve the health status of patients. Critically looking at the definitions, it can be observed that they tend to focus on the themes of health and technology with the objectives of overcoming the barriers of distance and location, enhancing care, achieving better quality and portability of health care services and decreasing health costs. According to Wooten et al 2009, the term e-health encompasses medical informatics, but tends to prioritize the delivery of clinical information, care and services rather than the functions of technologies. As ehealth covers a wide spectrum of healthcare applications, for the purpose of this study, the focus is on clinical aspects; diagnoses and treatment solutions of ehealth performed with the help of ICTs by healthcare providers. Table 1 enumerates key definitions as captured by lead organizations and authors. ICT is an enabler; its impact has been realized in different industries of the economy. A few of the technologies, their definitions, applications and functionalities, which enable the benefits of ehealth to be realized in healthcare setup, are captured in table2.

*Table1. Key eHealth definitions given by different authors and organizations*

<b>Author</b>	<b>Definition</b>
European Union (EU)	eHealth means ICT tools and services for health. eHealth covers the interaction between patients and health-service providers, institution-to-institution transmission of data, or peer-to-peer communication between patients and/or health professionals; e.g health information networks, electronic health records, telemedicine services, wearable and portable systems which communicate, health portals, and many other ICT-based tools assisting disease prevention, diagnosis, treatment and follow up.

Eysenbach, 2001	it is a holistic concept that “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” using ICT
World Health Organization (WHO 2004)	e-Health as “the secure and cost effective transmission and exchange of health data and information either locally or at a distance”, capturing a view of a basic functionality.
Commonwealth	i). use of modern ICTs to change and develop some clinical and working practices to improve the quality, access and efficiency of their health services. ii) it is about fostering and enabling better integration and interoperability of disparate and multiple clinical data silos for users to improve health and health care for patients and communities.
Wooten et al 2009,	the term e-health encompasses medical informatics, but tends to prioritize the delivery of clinical information, care and services rather than the functions of technologies.

### 3.1. Technologies

Table2: Technologies, definitions, their applications and functionalities

Technology	Definition	Application	Functionality
Electronic Medical Record/Computer-Based Patient Records (EMR/CPR)	– EMR is a computer based patient record (CPR) system containing patient-centric, electronically maintained information about an individual’s health status and care.	-Healthcare providers within the same CDO are able to look at a patient’s computer-based record to understand previous treatments, conditions, performed tests, order entry, prescription, generation of release notes, etc. - This type of application has the potential to reduce medical errors and increase quality of treatment by making information readily available at the point of care, including ambulatory settings.	-Ability to use and integrate patient information in the electronic process of ordering and transferring prescriptions (CPOE)
Electronic Health Record (EHR)	-is as an aggregation of patient-centric health data that originates from the patient record systems of multiple independent healthcare organizations; a long-term record for a patient, detailing his or her involvement with individual healthcare organizations and episodes of care.	-most commonly used to transfer patient’s information related to their health allowing stakeholders in the patient’s health to access this information remotely. Access to this information at the point of care allows for continuity of care between different care delivery organizations or other organizations that may come in contact with the patient such as social care	-allow the access and overview of patient relevant information which implies better information for decision making available at the point of care and less time and effort spent capturing patient data when crossing organizational boundaries.
Electronic Appointment Booking	-allow patients to choose the place, date and time of their first outpatient hospital appointment and automates the process by which a GP refers a patient for specialist care.	A patient is able to choose the date, time and place of their first outpatient appointment directly from the GP’s clinic or at a later stage over the phone or the internet.	-Ability to make electronic appointment bookings -Ability to triage referrals or enablement of e-consultations
Computerized Physician Order Entry (CPOE)	-computer system that allows direct entry of medical orders by the person with the licensure and privileges to do so.	Clinicians use CPOE to order medications electronically into on a system that is equipped with a series of rules designed to send alerts in the potential case of mis-medication.	When combined with decision support, CPOE enables the identification of potential medication errors in the prescription stage that may result in

			untoward events such as Adverse Drug Events (ADE's) for patients.
Electronic Transfer of Prescription (ETP)	-makes it easier for GPs to issue prescriptions; convenient for patients to collect their medication. -enables prescription data to be transmitted electronically between the prescribing health professional and the pharmacy, making prescribing and dispensing safer and more convenient for patients.	- physician submits a patient's prescription electronically either to a database shared by different pharmacies or to the patient's pharmacy of choice. The pharmacy is then able to retrieve the prescription and dispense the exact medication as indicated by the prescribing health professional.	-enables clinicians to electronically send prescriptions to the dispensing pharmacy reducing the incidence of errors due to illegible handwriting when the prescription is also captured electronically.
Picture Archiving and Communication System (PACS)	-enables images such as x-rays and scans to be captured, transmitted, stored and viewed electronically. PACS technology allows for a near filmless process, with all of the flexibility of digital systems	patient's electronic imaging tests are stored electronically and transmitted to specialist who can remotely make an assessment on the current condition of the patient.	-Filmless capture of imaging tests. - Ability to electronically capture, store and transfer imaging tests reducing the time required to obtain, perform and interpret these tests.
Personal Health Record	is an Internet-based patient owned and patient controlled set of tools that allow people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it.	Through a PHR a patient can record and track their healthcare information and make this available to those he or she chooses to.	-Enables communication with healthcare professionals via different media (email, phone, etc) - Ability to access medical information and access best practices for the better management of certain conditions.
Patient Portals	enable Web-based consumer self-service for scheduling, bill review/payment and other transaction services.	-used to provide information to patients on different conditions and their treatments. -In highly integrated functionality, allow for the patient to contact a nurse for advice and the more advanced portals will enable self-service applications such as the booking of appointments, self-registration at hospitals and clinics, etc.	-enable patients to access a medical information and general advice over electronic media such as the internet. - places healthcare professional at reach via the phone or other electronic means for advice and health related consultations.
Telemedicine	is part of a series of technologies that enable care services to be provided remotely.	can be applied in scenarios where the physical presence of a healthcare professional is restricted, by distance or time. Whether it is for analysis, diagnosis, consultation or treatment, Telemedicine represents a convenient way for patients to gain access to medical skills in a suitable and timely manner.	enabling remote consultation with the clinician resulting in a reduction or outpatient's visits and potentially an increase in availability

### 3.2. Benefits of E-Health

The following documented benefits in Table 3, have been identified as a direct result of adoption and usage of the above listed technologies.

Table 3: Documented benefits as a result of adoption of ehealth (ICT & Health)

gain in clinical staff productivity
reduction in missing dose medication errors
Improving cost-efficiency by streamlining processes, reducing waiting times and waste for outpatient appointments
reduction in drug interaction errors
increase in number of patients seen by GP and volumes of tests (increase in throughput)
reduction in lost images
reduction in number of repeat imaging tests
reduction in admin staff time spent filing and managing forms
reduction in number of redundant tests
reduction in cases of medicines running out where RFID is used for stock control and inventory management
improvement in radiologist productivity measured in number of tests read per radiologist
reduction in medication errors due to mistaken identity
Supporting the delivery of care tailored to individual patients, where ICT enables more informed decision making based both on evidence and patient-specific data;
Improving transparency and accountability of care processes and facilitating shared care across boundaries;
Improving diagnostic accuracy and treatment appropriateness;
Improving access to effective healthcare by reducing barriers created, for example, by physical location or disability;
Facilitating patient empowerment for self-care and health decision making

Tan; 2005 is of the view that in contrast to traditional health care systems, e-health has developed to become a niche industry with the potential of providing, in one way or another, greater access to a growing range of health care products and services. The author suggests that access can be increased in rural, inner-city, and remote areas; in underdeveloped as well as developing countries that lack the medical expertise or technology to protect and promote the health and well-being of their populations; and in areas that are difficult to reach, such as prisons, military bases, or aircraft, cruise ships, and space shuttles. As long as emerging e-technologies can be applied successfully, there is potential for e-health systems to evolve, survive, and thrive.

Kossi, et al; 2009, view effective Health Information Systems (HIS) as key instruments for countries to achieve the health related Millennium Development Goals. The authors agree that there is relative consensus among researchers and global agencies such as the Health Metrics Network (HMN) about key problems with the current HIS. They identify these problems in many, if not most, developing countries as related to i) fragmentation among a multitude of donor and disease specific health program driven vertical systems (HIV/AIDS, Immunization, Mother & Child Health, Tuberculosis, etc), (Chilundo and Aanestad, 2004), leading to ii) lack of shared standards (overlaps, gaps and inconsistent definitions of data in the various data reporting formats) (Kossi et al, 2008), iii) poor human capacity, and poor technical infrastructure in terms of; power and Internet. These problems are leading to poor data quality, no overview of data and information across sub-sectors, and negligible use of data by decision makers and health care providers.

### 3.3. Facilitators/Drivers to E-Health Adoption: broad classification

Table 4: A broad classification of facilitators/drivers to ehealth adoption

Patient Safety (evidence based healthcare, reduced risk of patient harm)
Quality of Care (patient satisfaction, effectiveness and efficiency of care service provision)
Availability (equal access, reduced waiting times and better utilization of resources)
Empowerment (patient-centricity, influence and direct involvement in the patient's own care)
Continuity of Care (coordination of activities and information sharing among caregivers)
Decreased waiting time for non-emergency services
Availability and timely accessibility of critical information in the event of emergencies
Savings for e-providers and e-patients in procedural, travel, and claims processing costs
Growing public awareness of the use of the Internet and its associated technologies and services
Modern technologies are now pervasive in many societies

### 3.4. Barriers to E-Health Adoption

Table 5: Barriers to adoption of ehealth

Leadership from healthcare authorities and providers, in particular focusing on financial and organizational aspects; considered essential elements for the successful deployment of eHealth.
Market fragmentation, lack of interoperability, ineffective standardization:
Legal uncertainty in deploying eHealth (cross border) services, ineffective funding, reimbursement, procurement and sustainable business models
Limited awareness of benefits among authorities and health professionals:
Specific concerns on privacy and protection of personal data, leading to lack of confidence and wide acceptance
Insufficient infrastructure (e.g lack of broadband in remote areas, essential for telemedicine services):
Lack of standards or at least a coalescing consensus on standards can be detrimental to building e-health infrastructures and highways for rapid transmission of e-health information, products, and services.
Data security and confidentiality of patient information are two of the most important concerns in the application of e-health technologies
e-work design, and need to adequately train staff members for engagement in implementation
confidence, security and accountability
Assurance for citizens and e-health care professionals that an e-health care system will lead to improved health as opposed to fraud, medical misinformation, abuse of consumer data, marketing of products and services that are of little or questionable value, or e-care services that fail to satisfy their needs
Fear of change, resistance from health care professionals, consumer concerns over privacy and security issues, competing interests among innovations for venture capitalists and funding sources, and continuing environmental and political uncertainties.

## 4. Theories Addressing E-Health Adoption

The utilization of e-health technology can either be enforced by health authorities or be achieved as a result of voluntarily adoption. User acceptance is an important factor for successful adoption and utilization of the targeted technology. During the last two decades, various models dealing with technology acceptance have been developed and verified. The effectiveness of several of these models have been proven for a broad spectrum of IT systems, such as personal digital assistants or electronic medical records (Dünnebeil, et al; 2012). TAM is the most widely recognized model of behavioral intention of using information systems (IS). Diffusion theory has equally been widely used, recently UTAUT (Unified Theory of Acceptance and Use of Technology) by Vankatesh; a modified version of TAM has also been tested and validated in the context of healthcare. CCM (Chronic Care Model) though not directly intended for technology adoption, has been used to verify outcomes of technology adoption. There are other theories/models that address user's attitudes and behavior towards technology adoption.

## 5. Methodological Approach

### 5.1. Design

A systematic review of qualitative and quantitative studies was conducted to identify barriers to and facilitators of adoption or uptake of e-health systems in health care context. Specific methodologies used by authors and their merits/qualities were documented to establish research experiences in this field and the potentials for developing the methodological approaches.

### 5.2. Dimensions of e-health systems

The literature synthesis included as many dimensions as possible that relate to both clinical and public health care. This was necessary to identify the scope of the adoption and research experiences. This also permitted broad categorization of relevant issues deliberated on by health/ICT experts. Broadly these were considered in terms of the context, processes involved and the event outcomes.

### 5.3. Type of interventions/phenomena of interest

The phenomena and strategies of primary interest were those that prompted or motivated e-health adoption, demotivators and institutional/regulatory frameworks provided in addition to progressive experience with the systems. Specifically, these included:

- i. Education and preparation for e-health application/use;
- ii. Regulations and guidelines available
- iii. Individual or institutional experiences hitherto – in terms of their contextual understanding and extent of use
- iv. Perceptions based on their current experiences and knowledge
- v. Factors perceived to ascertain suitability of e-health and;
- vi. Interventions that promote adoption and continuity of use of e-health systems.

Multiple studies were used to provide insight into how e-health systems are adopted, how they are deployed and factors that explained variability in effects. Findings were used to elicit how implementation of different promotion and intervention strategies aimed at improving adoption/sustained use work, their scope, specific inputs required to effectively implementing e-health promotion in different settings. Coding was constructed based on the evolving issues from literature reviewed. The derived codes were compared with the European Union Commission.

### 5.4. Type of outcome measures / outcomes

The outcomes of interest; included experiences in Africa in relation to decision-making for adoption of e-health; institutional/country experiences and capacities, drivers for adoption, and identified limitations.

### 5.5. Search strategies for studies

A search strategy was carried out in three stages:

1. First, an initial limited automated bibliography search in the CINAHL, MEDLINE and EMBASE databases of publications on e-health over the last thirteen years (since 2000) to analyse the words contained in the title, abstract and MeSh terms used to describe the most relevant articles on the subject to allow identification of additional search terms. This initial search used the filters established for seeking qualitative studies in CINAHL, EMBASE and adaptations to MEDLINE. The search included published

studies indexed in the major international bibliography databases and of unpublished studies, and interviews with key persons primarily to share their in-depth knowledge on the local context.

2. The second stage, again conducted an electronic search using all identified keywords and index terms and specific key words for each of the databases. The search included studies/abstracts of studies published mainly in English with no limit in time, although non-English articles will be undertaken for eligible studies for which translation resources are available.
3. A secondary search was conducted in the reference list of all identified reports and articles for additional studies.

The data-base searched included:

1. MEDLINE
2. Cochrane Library,
3. EMBASE,
4. PsycInfo,
5. ProQuest Health and Medical Complete
6. Psychology and Behavioural Science Collection
7. Qualitative Inquiry (<http://qix.sagepub.com/>)
8. Science Citation Index
9. Scopus
10. TRIP (Turning Research into Practice)
11. Quality web search tools, e.g. AllTheWeb, GoogleScholar, Scirus.com,
12. Netting the Evidence, Medscape
13. EBSCOhost CINAHL PLUS with full text

Bibliographies of articles were checked and key articles cross-checked in citation indexes. Databases covering multiple sources of literature were also searched to minimize bias from search process. Journals relevant to the topic accessible in local educational and health libraries or on-line were 'hand' searched for the period covering the last five years to ensure studies which have not been listed in the major indexing services are retrieved.

The search for unpublished studies included grey literature and unpublished material such as conference papers, research reports and dissertations wherever possible. The sources searched to locate unpublished studies included:

- ProQuest Dissertations and Theses
- Index to Theses
- Grey Literature Report
- PsycEXTRA
- Conference papers
- Research registers
- WWW sites of relevant associations
- Internet search engines
- Direct communication with researchers and relevant professional organizations.

The search terms used to locate studies for the review were drawn from the natural language terms of the topic and the controlled language indexing terms used by different databases, as applicable. Individual search strategies were developed for each index, adopting the different terminology of index thesauri. Initial keywords used were: e-health; adoption; uptake; clinical health care; public health; primary health care, health care; (used singly and in combination). Truncated versions of terms were also used where necessary.

## 5.6. *Methods of review*

### 5.6.1 *Selection of studies*

Three observers independently assessed the titles and abstracts of the studies identified for retrieval to evaluate their potential eligibility prior to inclusion in the review using the standardised critical appraisal instruments from the Cochrane Or Joanna Briggs Institute (JBI QARI Critical Appraisal Checklist for Interpretive & Critical Research,). The studies were included if they fulfilled all the inclusion criteria with regard to: 1) Type of studies; 2) Type of participants; 3) Interventions / phenomena studied; 4) Outcomes studied. Any disagreements were resolved through consensus. All included articles were archived according to their title, author, source, location and the database they were sourced from.

### 5.6.2 *Data extraction*

Data extraction from the eligible studies was done using the relevant QARI data extraction forms proposed by the Joanna Briggs Institute for Evidence-Based Practice (JBI QARI Data Extraction Form for Interpretive & Critical Research). The final numbers included in the study from the literature search were based on the concept of data saturation: the point at which 'increasing numbers of studies produce little extra value'. Again any disagreements between the reviewers were resolved by consensus.

### 5.6.3 *Data Synthesis*

Research findings from the qualitative studies were pooled using the Qualitative Assessment and Review Instrument (QARI) module. The main methods used to synthesise findings were: (i) textual narrative: this approach involved the identification of the relevant texts addressing the research question and aggregation or synthesis of findings to generate a set of statements that represented that aggregation, through assembling the findings. These were then rated with the aim of generating more homogenous groups (categories of similar meanings) based on their characteristics, context, quality and findings and using scope, differences and similarities to draw conclusions across studies. (ii) Thematic synthesis: in this approach free codes of the findings were used to organise results into descriptive themes. Subsequently these were interpreted to generate analytical themes and establish relationship between categories). Where textual pooling was not possible the findings are presented in narrative form.

### 5.6.4 *Assessment of the methodological quality of studies*

Critical reading and assessment of the quality of the studies followed the guide proposed by Calderon Gomez. The following considerations comprised the quality assessment criteria for the relevant studies retrieved:

1. Epistemological and methodological adequacy: whether the qualitative perspective best fitted the question and the research objectives, and whether the research design and development as a whole responded to this methodology;
2. Relevance: whether it contributed to better understanding of development of promotion intervention messages and potential for generalizability;
3. Validity; with regard to fidelity and rigor during data collection, processing and analysis, as well as plausibility of the interpreted results;
4. Reflexivity: with regard to the researchers' self-awareness of their own theoretical assumptions and perspectives in relation to the design of the study, relationships with participants, and the development of the study as a whole.

The methodological qualities of the articles were assessed independently by each reviewer using a checklist of ten questions which entailed the above concepts and variations in opinion resolved by consensus.

## 6. Results and Discussions

Abstracts from at least 258 studies were reviewed for relevance. Studies varied greatly in thematic and methodological contents.

The main themes were: [table in appendices]

The main study approaches were cross-sectional qualitative (52) and quantitative (48) methods.

The number of studies specifically designed to explore barriers and promoters of ehealth were 17, while the rest described experiential events during interventions.

In the Kenyan context, a summary of facilitators and barriers to ehealth adoption are captured in Tables 6 & 7 below.

*Table 6. Facilitators to ehealth adoption in Kenya*

Patient Safety (evidence based healthcare, reduced risk of patient harm)
Quality of Care (patient satisfaction, effectiveness and efficiency of care service provision)
Availability (equal access, reduced waiting times and better utilization of resources)
Empowerment (patient-centricity, influence and direct involvement in the patient's own care)
Continuity of Care (coordination of activities and information sharing among caregivers)
Decreased waiting time for non-emergency services
Availability and timely accessibility of critical information in the event of emergencies
Savings for e-providers and e-patients in procedural, travel, and claims processing costs
Growing public awareness of the use of the Internet and its associated technologies and services
Modern technologies are now pervasive in many societies

*Table 7. Barriers to ehealth adoption in Kenya*

<b>Barriers to eHealth adoption in Kenya</b>
Devolution resulting into disjointed and uncertainties in the existing systems
Lack of skilled leadership (Healthcare providers and HR staff- for administration are not sufficiently trained on e-health issues).
Competing interest, hence lack of standardization
Proper policies and regulations pertaining to e-health
Insufficient or no budgetary allocation for e-health (poor priority placement) and lack funding
Corrupt system
Lack of infrastructure (remote, rural and peri-urban centres lacking in stable power supply or backup)
Lack of awareness of the benefits of e-health by key stakeholders
Political leadership
Digital divide , Poverty and socio-economic setbacks

### 6.1. Limitations

- a. It was not possible to include studies conducted in non-English due to challenges with translations;
- b. Diversity in qualitative methodologies made synthesis of the results problematic;
- c. Access to unpublished information was challenging thus limiting potential sources of relevant information.

### 6.2. Conclusion

We identified a number of factors as captured in Tables 6 & 7 above to be peculiar facilitators and barriers to ehealth adoption in Kenya. Some factors appear to be critical for success, but none can guarantee either adoption or sustained use. Prioritization is problematic given the nature of the available evidence (and potentially the nature of the problem). Therefore, all factors need to be considered, albeit some will be less relevant in certain settings. By addressing or implementing these factors, planners and implements would realize a sustained ehealth adoption and therefore an improved outcome.

In the process of the review, the following key points were captured; i.e how care delivered can be fundamentally changed, extended, supported, and enriched by a number of different operating concepts that are made possible by changes in technology. These are:

1. The cost of care can be radically changed through better use and exchange of information.

2. The quality of care can be dramatically improved through better use and exchange of information.

3. Transforming health care is about the design of the delivery of care and how it is supported by better data for both consumers and providers.

By addressing the findings of this review, it would be appropriate to advocate for the development of a policy tool or framework to assess all domains and constituent factors, which would be applicable during the planning, implementation, and evaluation stages of policies and programs promoting specific technologies in the healthcare settings.

Finally to improve care, extend access to all, and do both of these in a more cost-effective manner – transformative change is required. This however requires sacrifice and disruptions.

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## Appendices

### Facilitators: Codes and definitions

[Search words: - Facilitators; enablers; strengths; motivators; ....]

Code	Definition
Ease of access & Availability of Information	Equal access, reduced waiting times and better utilization of resources Availability and timely accessibility of critical information in the event of emergencies; High penetration of GSM mobile phone handsets; Availability of affordable, reliable bandwidth (internet access) through mobile phones, fiber optic infrastructure; Low cost and ease of access to GSM mobile communications services (m-Health)
Continuity of Care	Coordination of activities and information sharing among caregivers; Healthcare to anyone, anytime, and anywhere concepts; Demand for health information anytime; Health record management, and; The remote, real-time monitoring of chronic conditions
Cost savings	Savings for e-providers and e-patients in procedural, travel, and claims processing costs
Suitable regulatory / political environment	Coherent national e-health policies and strategies which are in tune with national development plans, national ICT policies and with buy-in from healthcare workers – the users; Regulations and requirements for safety, security, correctness, reliability, Adaptability and user friendliness of systems; research activity; availability of a e-Government Strategy and guidelines that recognizes e-Health as a national priority; Political will to progress health-care reforms
Empowerment	Patient-centricity, influence and direct involvement in the patient's own care
Extensive awareness	Growing public awareness of the use of the Internet and its associated technologies and services
Modern technologies and advances in ICT	Availability of modern technologies in many societies; Advances in wireless networks and mobile computing, including medical sensors, mobile health (m-Health) and Personal Health System (PHS); Available e-health & ICT technology infrastructure, Available bandwidth for Internet access through mobile phones and fibre-optic infrastructure
Patient Safety	Evidence based healthcare, reduced risk of patient harm;
Quality of Care	Patient satisfaction, effectiveness and efficiency of care service provision; Tele-monitoring and remote healthcare
Time saved	Decreased waiting time for non-emergency services
Technology leaders (early adopters)	Technology leaders (early adopters)
sources of electrical power	sources of electrical power
Stakeholder support	goodwill from development partners and private sector (possible PPP); Collaboration and partnerships for shared information and services among stakeholders
Health systems infrastructure	A large pool of medical personnel with a variety of skills relevant to the entire spectrum of the medical sector; Advanced referral institutions that can carry out complex medical procedures; Health training institutions at all levels; Financing sources: Leverage Available Human, Financial and Technical Resources

Standards	Medical terminologies, messaging, software accreditation; Clinical coding, data presentation and security; Data structure (referrals, prescriptions, appointments, event summaries, orders and test results, real time data) Compliance services, QA/QC; Procurement; Professional accreditation;
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### Barriers to E-Health Adoption: codes and definitions

[NB: search words: - barriers; demotivators; weaknesses; challenges; ...]

Code	Definition
Change management challenges	Apathy to change; Fear of change, resistance from health care professionals, consumer concerns over privacy and security issues; competing interests among innovations for venture capitalists and funding sources; Continuing environmental and political uncertainties; Lack of cooperation & coordination; Inability/inertia to develop governance institutions and frameworks required for coordinating, regulating and ensuring mutually beneficial cooperation among different stakeholders.
Cost	high capital and operating costs of sustainable and scaled-up initiatives across regions; Scarcity of funds; Insufficient funding
Fragmented applications & uncoordinated systems	A landscape of isolated islands of small scale applications unable to effectively communicate and to share information with other health systems or across geographies, technologies or programs; Barriers to scale up to support a larger patient and care provider base; Duplication of efforts, may lead to impossibility to integrate solutions;
Insufficient infrastructure	Insufficient infrastructure (e.g. lack of broadband and energy platforms in remote areas, essential for telemedicine services); Inadequate ICT infrastructure (high speed data, computers); Insufficient human resource on e-Health; High staff turnover in health facilities; Insufficient/unreliable supply of electricity; inappropriate and unreliable software, equipment and devices; and inadequate and lack of essential technical know-how, skills and medical and technology experts; Difficulties in seeking integrated and interoperable e-Health solutions; Insufficient network coverage and access to mobile devices.
Awareness; Evidence-base	Limited awareness of benefits among authorities and health professionals; Inconsistent views of needs related to e-Health areas; Lack of knowledge or awareness of what already exist or what is available (e-Health tools and services)to countries; Lack of ability of decision makers to understand the actual health situation, to drive meaningful planning and to guide policy formulation; Little research in Cost–benefit / effectiveness studies;
ICT skills & Engagement	e-work design and need to adequately train staff members for engagement in implementation; Inadequate ICT skills in health sector, such as ICT maintenance staff; Training in e-Health skills not integrated into existing health

	<p>professionals' training curricula;  Limited expertise on medical and health informatics;  Developing policies, strategies and plans;  Lack of ICT in health professionals curricula and awareness of ICTs in the health sector;  Challenges in enhancing the capacity and capability of ICT infrastructure and services</p>
Standards, guidelines; Regulatory & Legal Issues	<p>Lack of or underdeveloped standards/ guidelines/consensus, e-legislation;  Lack of a national data protection policy, ICT and health policies and strategies;  Lack of both national policy and national health priorities;  Lack of technical standards to ensure or enforce interoperability and certifications;  Legal uncertainty in deploying e-Health (cross border) services, ineffective funding, reimbursement, procurement and sustainable business models;  Lack of e-Health framework legislation;  Product certification and professional accreditation.  Lack of capacity to develop national e-Health capacities and capabilities;  Market fragmentation, lack of interoperability, ineffective standardization;  No universal or coordinated systems</p>
Participation and/or Support	<p>Leadership from healthcare authorities and providers, in particular focusing on financial and organizational aspects;  considered essential elements for the successful deployment of e-Health;  Under funding of the Health sector by the government.</p>
Privacy/confidentiality; security & vulnerabilities of information concerns	<p>Data security and confidentiality of patient information are two of the most important concerns in the application of e-health technologies  Specific concerns on privacy and protection of personal data, leading to lack of confidence and wide acceptance;  confidence, security and accountability;  threats of information misuse either accidentally or maliciously</p>
Risks & Uncertainty over benefits	<p>Assurance for citizens and e-health care professionals that an e-health care system will lead to improved health as opposed to fraud, medical misinformation, abuse of consumer data, marketing of products and services that are of little or questionable value, or e-care services that fail to satisfy their needs;  financial risks of inadequate investments and incentives;  technological risks of inadequate, complex and plural hardware and software;  Risks to long-term certainty and sustainability;  Information and data security risks;  Rapid technological changes leading to obsolescence.</p>
Demand	perceived limited demand
Working with development timescales	Working with 5-year development timescales or vision 2030
Health systems challenges	<p>Improving primary health care and accessibility;  Immobility of existing health information and records among health providers, with little or no capacity to share information between health service providers;  Low penetration of computer equipment;  Pressure due to ageing population and infectious and Chronic diseases (emerging threats to public health);</p>

### Facilitators/Drivers to E-Health Adoption

	Author, title, year and place	Research methods used	Type of e-health technology	Functionality	Facilitators / drivers	Barriers / challenges
1.	Juma K, et al., Current Status of E-Health in Kenya and Emerging Global Research Trends. <i>International Journal of Information and Communication Technology Research. Volume 2 No. 1, January 2012</i>	Review of scientific research papers in journals and conference proceedings and government documents	EHR Telemedicine; Consumer health informatics; Health knowledge management; m-Health; Medical research using Grids; Healthcare Information Systems.		Right environment; Other support; Modern technologies and advances in ICT; Technology leaders (early adopters)	Lack of standards and guidelines; No universal or coordinated systems; Apathy to change; infrastructure; Lack of ICT skills; Lack of awareness; Lack of ICT skills;
2.	Ayub Many, group presentation; Ministry of Public Health & Sanitation		National e-health strategy		Ease of information access; Right regulatory environment; sources of electrical power	Lack of ICT skills; Lack of standards and guidelines
3.	Adesina Iluyemi; Tom Jones; Sylvia Anie. E-health in the Commonwealth Making National E-Health Policies and Strategies Work. <a href="http://www.thecommonwealth.org/subhomepage/34040/">http://www.thecommonwealth.org/subhomepage/34040/</a>				Suitable regulatory / political environment; Health systems infrastructure; Modern technologies and advances in ICT; Extensive awareness; Ease of information access;	Limited Demand; Regulatory uncertainty; Lack of standards and guidelines; Insufficient infrastructure; Lack of ICT skills; Lack of standards and guidelines; Working with 10-year development timescales; Health systems challenges
4.	National E-Health Strategy 2011-2017 April, 2011	Government document; participatory	e-health strategy		Modern technologies and advances in ICT; Health system infrastructure; Suitable regulatory / political environment; Other support;	Lack of standards and guidelines; Insufficient infrastructure; Cost; Lack of awareness; Regulatory uncertainty;
5.	WHO. 2011. m-Health: New horizons for health through mobile technologies: Based on the findings of the second global survey on e-Health. Global Observatory fore-Health series - Volume 3	Cross-sectional global survey (including 22 African countries)		Various: disease surveillance;	Health systems infrastructure; Modern technologies and advances in ICT; Modern technologies and advances in ICT	Cost; Lack of awareness; Insufficient infrastructure; Lack of standards and guidelines/policy; Priorities; Insufficient infrastructure; Lack of evidence-base;

6.	WHO-ITU National eHealth Strategy Toolkit <a href="http://www.itu.int/ITU-D/cyb/app/e-health.html">http://www.itu.int/ITU-D/cyb/app/e-health.html</a>					
7.	Roberto J Rodrigues, eHealth Strategies, USA; Compelling issues for adoption of e-health				Standardized information exchange and networking; Improvement in care-level links for consultation, logistics and quality assurance; A wide variety of expectations about greater access to healthcare and information; requirement for custom-built products and services and real-time delivery; need to keep evidence-based explicit knowledge up to date	Lack of clear definition of goals and effective collaboration among stakeholders; Vendor-driven expectations have too often overshot their target; Security and privacy; Resistance to change; Political and social Priorities; Haphazard development of 'islands' of innovation;
8.	MARIUSZ DUPLAGA; e-Health development policies in new Member States in Central Europe- E-HEALTH SUPPLEMENT: DEVELOPMENT POLICIES	eHealth European Research Area project 2005- 2007	e-prescribing; Telemedicine services; Internet-based disease management; EHR		Funding opportunities; Legal background- legislation regulating data protection, telecommunication services and digital signature, introduced.	Networking infrastructure:- availability of the broadband connections, limited in most countries Legal background- formal regulations addressing this field are not ready
9.	Peter Drury;	Review of scientific research papers in journals				
10.	John D Piette et al.; Impacts of e-health on the outcomes of care in low- and middle-income countries: where do we go from here?	a scoping review of the published and non-published literature	1 systems facilitating clinical practice; 2 institutional systems, and 3 systems facilitating care at a distance		Adoption of standards and definition of proper architecture;	intermittent power supplies and unreliable infrastructure;
11.	Osain M.W.; The Nigerian health care system: Need for integrating adequate medical intelligence and surveillance systems	Review of scientific research papers in journals and conference proceedings and government documents			Improve collection and monitoring of health data, Improve personnel development in the health care, Ensure provision of essential drug availability, Improve on immunization programs, Promote treatment of epidemic diseases, Improve material and child care, and family planning, Educate people on prevailing health problems and the methods of preventing and controlling them.	Lack of coordination, fragmentation of services, dearth of resources, inadequate and decaying infrastructure, inequity in resource distribution, and access to care and very deplorable quality of care.