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Electronic health (E-Health) system: Barriers to its utilization by consumers and providers of healthcare services in developing countries

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Abstract
Despite the fast-paced invention of Information and Communication Technology (ICT) devices, modified to meet health needs of consumers of healthcare, and coupled with the growing awareness about the availability and benefits of these e-health applications to human health improvement, promotion, protection, rehabilitation, and prevention and treatment of diseases and disabilities, there is a large body of evidence of resistance to the use of e-health in healthcare services delivery by consumers and providers of healthcare in developing countries. This paper therefore intends to discuss the barriers that have led to this resistance, and proffer solutions.

Keywords: E-Health, Healthcare Consumer, and Provider

Introduction

Information and Communication Technology (ICT) has devised electronic health tools or applications modified to meet health needs of healthcare consumers or patients. In this 21st century, the awareness of the impact of ICT in accessing and providing healthcare services is growing fast among consumers and providers of healthcare via various electronic applications out there in the market.

The advent of widely available e-health information has helped to provide massive amount of data each day and new opportunities to understand social interactions, environmental and social determinants of health and the impact of those environments on individuals (Minon, Singh, Meyer, Behmont, & Sitting, 2014) [13]. Health needs and demands of individuals are constantly changing with time and trends of development and modernization, and it will be difficult for healthcare consumers to confront some of the prevailing health issues and problems without e-health technologies. More so, the present economic pressure of ever-increasing costs and suboptimal health outcomes, especially in low-and –middle-income countries are driving search for new approaches to health management (Fiks, Alessandrini, Forrest, Khan, Localio, & Gerber, 2017) [8], which ICT has offered with the invention of e-health tools, applications or systems.

E-health is a means of ensuring that correct health information is provided in a timely and secure manner via electronic means for the purpose of improving the quality and efficiency of healthcare delivery and prevention of infections or diseases and disabilities. Electronic health (e-health) introduces a range of services, which include:

- E-health records, which are used to ensure continuity of patient care across time;
- Mobile health (m-health);
- Telehealth services for remote patient monitoring;
- E-health research;
- Consumer health informatics (CHI), which are modified to support individuals in health decision-making;
- E-learning by health workers (Coleman, 2014) [5].

According to American Medical Informatics Association [AMIA] (2014) [1] and International telecommunication Union [ITU] (2016) [11], e-health applications include smartphone applications, self-management systems, e-personal health records (e-PHRs), electronic laboratory reporting (ELR), patient portals, peer interaction systems, telemedicine, and e-learning, telehealth, mobile health, e-mail and text messaging. They are vital ICT tools developed to assist healthcare consumers and providers to have more control over and to improve their health and health of their clients so as to possible reach optimal health status of a complete physical, social and mental wellbeing of individuals. These computer software's are designed to assist consumers in making informed decisions, with healthcare providers tailoring interventions appropriately. Davis, Menon, Parrish, and Sitting (2015) [6] state that the tools are designed to affect many aspects of personal health self-management, including disease prevention, behavior change, and decision-making and chronic disease management.

Naraina and Roderico (2012) [15] note that with these information and communication devices available even in remote villages, there is a potential that these technologies could revolutionize health service delivery and act as a "game-changer" for an efficient and people-centered healthcare system in the 21st century. In a similar view, Rowe (2018) [20], observe that internet in particular, facilitates spread of consumer e-health and has become a popular public channel for funding health and healthcare information, and communicating with peers and health experts.

Some e-health applications are specifically modified to meet health needs of the consumers of healthcare services, and this new and emerging field is referred to as consumer health informatics (CHI). According to AMIA (2004) [1], CHI is a branch of medical informatics that analyzes consumers' health needs for information, studies and

implements methods of making information accessible to consumers, and models and integrates consumer preferences into medical information systems. The AMIA further describes CHI as the use of electronic health tools or applications, such as modern computers and telecommunications to support consumers in obtaining information, analyzing their unique healthcare needs, and helping them to make decision about their own health. CHI is a means for personal health self-management and plays a major role in providing information to patients, providers and the public, which facilitates promotion of self-care, enabling informed decision-making, promoting healthy behaviours and peer information exchange.

Consumer-centered and controlled e-health tools have become the new approaches for self-health management. These e-health systems signify the growing momentum of the consumer e-health phenomenon in which consumer engagement, decision-making and tools come together to support and enhance health (Goodman, Berner, Denite, Kaplan, Koppel, Rucker, Sands, & Wineelstein, 2013) [9].

The concept of personal health management refers to individuals' orientation toward their health information, and healthcare services as well as their capacity to engage in tasks that require ongoing attention 'Personal health management implies that everyone has at least some capacity no matter how limited that can be applied to decisions and actions about health (Wafa, 2010) [24]. According to Wafa, highly "activated" capable consumers would regularly seek out health information, maintain and cultivate a healthy lifestyle, participate in shared decision making with providers, monitors health conditions, maintain personal health records, compare healthcare cost and quality, while the less "activated persons might perform these tasks less frequently, less systematically, or they might ask someone to do it on their behalf. The term, personal health management is used by increasing number of organizations, thought leaders and policy documents to describe individuals' responsibility for their own health (Ash, Sitting, Poon, Guapponc, Campbell & Dykstra, 2017) [3].

Healthcare consumer is a person who seeks information and care about health promotion, disease prevention, and treatment of specific conditions and management of health condition and chronic diseases. Consumers of healthcare services consist not only of persons with specific health condition and their friends and family, but also of the public concerned about promoting optimal health. WHO (2010) [15] defines healthcare provider is an individual who provides preventive, curative, promotional or rehabilitative healthcare services in a systematic way to people including patients, families and communities, while a patient is a recipient of healthcare services. The patient is most often ill or injured, and in need of treatment by a physician, advanced practice registered nurse, physiotherapist, physician assistant, psychologist, veterinarian, and other healthcare providers (Tewart, 2001) [22].

E-health has a lot of benefits and these have been revealed and discussed by many researchers. International Telecommunication Union [ITU] (2016) [11], states that it is a very good means of ensuring that correct health information is provided in a timely and secure manner via electronic means for the purpose of improving the quality and efficiency of healthcare delivery. Fernandez-Aleman (2018) [7] enumerated benefits of e-health in five headings: provision of access to health information, supporting behavior change, creating online communities, provision of decision support, and disease management. E-health tools provide access to health intervention, either a spectrum of searchable information or more narrowly defined content. They also support specific behaviour change such as stopping smoking, binge drinking, starting regular exercise. In creating online communities, that is, internet-based communities, these tools facilitate interaction around common health concerns among consumers, patients or informal caregivers. Many online communities have multiple capacities not only providing social support, but also exchanging health information, and facilitating decision-making. Provision of decision support is another important benefit of e-health. The tools provide structured support treatment decisions. For example, 'demand management' tools help consumers choose and evaluate health programmes or healthcare providers. In disease management, e-health tools provide monitoring, record keeping, and communication devices to help consumers manage a specific disease, such as diabetes or cancer, typically in close interaction with healthcare providers.

One of the e-health applications, e-medical record system (EMRs) use has improved exchange of medical information. This system allows physicians and other healthcare providers to acquire and verify patient information in addition to encouraging patients to ask more questions than when paper form record system is used. EMR use contributes to improved accuracy in prescribing medications and medication-related counseling of patient because patients often referred to general descriptions rather than generic or brand names when requesting certain medications. Long-run productivity, communication and information sharing, and access to current health information are some of the benefits of electronic medical record implementation and use (Fiks *et al*., 2017) [8]. E-health tools offer health consumers a broad range of integrated interactive functions to enable personal health management. For consumers who are least to cope with volume of health information, decisions and care coordination, these tools if designed and disseminated appropriately ease the burden.

Achieving broad public acceptance of personal health management and e-health applications or systems require greater attention to the intended users' diverse perspectives, circumstances and experiences regarding health information and digital technologies as well as their differing capacities for health management. To this effect, South African Government e-Health Strategy for South Africa (2012) [20] suggested that achieving the goal of getting appropriate evidence-based e-health tools into wide and sustained public use requires coordinated strategies in the following areas:

- Strengthening the links among e-health tool development, evaluation and dissemination;
- Building viability and sustainability for e-health tool developers and suppliers;
- Protecting the privacy of personal health information; and
- Assuring the quality of e-tools and services, and availability to consumers.

Zhai, Brady, Li, Lingren, Wheeler, and Solti (2014) identified four requirements for a population-scale strategy for e-health tools. First, all tertiary institutions must be

adequately prepared to obtain, process, understand and apply health tools to meet the complex information demands of the changing healthcare and environments. Second, appropriate well-evaluated tools with adequate privacy protections and mechanisms to control access to personal health information must be widely available. Third, diverse and underserved individuals and communities must have access to e-resources, which include not only the physical connections but also appropriate content. Fourth, multiple stakeholders must come together to articulate and implement dissemination strategies that address the sustainability and reach of the tools across the populations. Easy acceptance and utilization of e-health informatics, extending the impact and benefits of these technologies requires public leadership robust public-private partnerships, and consumer-centric research analysis and strategies (Granja, Janssen & Johansen, 2018) [10]. The entire effort must be connected to disease prevention and health promotion objectives for nations that are articulated in healthy people.

Barriers to utilization of e-health

Literature reveals inexhaustible benefits of e-health, including that e-health tools are embedded in a broad shift toward a digital culture, but healthcare sector has been slow or adamant to adapting to the fast-centric world of internet and adopting e-health in the healthcare services delivery system in developing countries. It is clearly evident that healthcare sectors in developing countries have not reasonably integrated the modern technological applications of e-health, modified to meet the needs of healthcare consumers into the national healthcare services delivery system. This development may not be too far from the peculiar features of healthcare delivery systems in developing which are characterized mainly by analogue paper forms of healthcare delivery system, inadequate trained health personnel and modern technology-based health facilities, large populations of illiterate health consumers, ICT illiteracy, lack of political will of governments to implement digitization policies, health parity between the poor and the rich and the rural and urban dwellers, poor budgetary funding, and system dominated by informal and traditional health caregivers.

Study reports have noted that the utilization and application of e-health system by healthcare consumers and providers in many countries compared to the quantum of health information dished out to the public via e-health informatics devices on daily basis is poor. Reported resistance to the adoption of e-health systems in developing countries has been attributed to some barriers. These barriers or challenges include both personal factors, such as educational status, technology-knowledge base and skills, gender, culture and orientation; and socio-environmental factors, such as health facilities and personnel, national health philosophy and policy, national orientation and views, national technological status, information and communication facilities, capacities and capability of network providers and the interconnectivity issue, climate and weather fluctuations, and national economy (ITU, 2016; AMIA, 2004) [11, 1].

Tanriverdi and Lacono (2009) [21] categorize barriers to the use of e-health systems into technical, behavioural, economical and organizational barriers. Technical barrier involves non-availability of appropriate and adequate technology as well as knowledge about it. Behavioural barrier involves change management, especially with respect to resistance to change, power and politics around telehealth. Economical barrier includes reimburse healthcare workers for telehealth consultations, and open up of new patients markets. Organizational barrier involves integrating telehealth services into existing organizational structures and to provide institutional support to execute the services.

According to Thomas (2017) [23], at present, health information system both in print and digital is inadequate to serve many people both in rural and urban areas. He further noted that available e-health information is often needlessly jargon-filled, dense and complex, and in many cases not in the right language style or format for the intended beneficiaries of the information. Blumenthal and Tavenner (2017) add that the reliability of health information available to the public via e-devices has been questioned, and the quality of internet-based health resources as well as health information in mass media has been a major preoccupation of health professionals. More so, the limited literacy skills of many segments of population in developing countries makes it difficult for people to find and understand basic health information, engage in informed decision-making, and manage the consequences of their decisions (Papadouka, Schaeffer, Metroka, Borthwick, Tehranifar, Leighton *et al*., 20014). Due to deficiency in technological skills to use internet-based e-health tools, such as personal health records (PHRs) and disease management and behavior change (DMBC) applications, the public lacks the capacity and ability to utilize the applications.

Another important challenge to e-health utilization is that personal health management and informed decision – making are abstract ideals for large segments of the population because of many barriers to accessing and using health information and services (Nulan, 2017). According to him, large population of the society is savvy about digital technologies in general but largely unfamiliar with the range of e-health tools available for health management. Similarly, Granja, Janssen and Johansen (2018) [10] observe that some segments of populations are not ready or able to perform personal health management roles into which they are being cast, especially the vulnerable ones, who are those that are not yet persuaded of the value of e-health, often, because they do not see it as relevant to their lives, or they have serious concerns about the privacy of personal health information, or those who do not yet have the capacities to use information technology effectively, and those for whom available technology solutions are currently inappropriate.

On privacy issue, concern of many people about the privacy of their personal health data imposes a serious barrier to the adoption of e-healthcare system, especially in developing countries. Studies have noted that lack of stronger privacy protection nurtures public mistrust, and lack of quality assurance and quality control. On the confidentiality factor, Blumenthal and Tavenner (2017) state that resistance to e-health due to privacy concerns is increasing and poses security problem with the possible disclosure of confidential patent information. Fiks *et al*., (2017) [8] argue that among the risks posed by e-health records in comparison with the traditional paper records, to a greater extent, include comprehensive and outdated patient information in a single place, facilitating access to a larger amount of data, which can be damaging if it falls into wrong hands. That is, such information such as insurance, employer and other

demographic data collected during registration can be stolen and used inappropriately by dubious individuals. Naraina and Roderico (2012) [15] revealed that forty-eight per cent of health facilities admitted to having had at least one incident of lost or stolen e-health information. This is possible because within the frame work of interoperability, data exchange occurs over both the internet and network communications, which are often unsecured. More so, some other most significant threats to securing e-health information are the concerns of virus or malaria infections, loss of patient data (breaches), and malevolent employee attacks (Fiks *et al*., 2017) [8].

Apart from privacy concerns, Thomas (2017) [23] observed that e-health emerging in responses to market and policy demands do not yet have enough of a scientific basis to suggest that they will have their intended effect. And Naraina and Roderico (2012) [15] add that many of these tools in the market places do not have explicit evidence base. This suggests that consumers may not be able to access many evaluated e-health tools that would be beneficial to their health particularly given the increasing demands related to personal health management.

Researchers identify other challenges to the use of e-health system to include that many well-researched e-health tools are still not easily available to majority of healthcare consumers as well as providers (Kierkegaard, 2017) [12], not enough e-health tools are designed or disseminated with end user's experiences, requirements and capacities in mind (Pohjonen, 2012). Others are that the enormous variation in features as well as the number in niche products could make it difficult for consumers to compare and evaluate competing e-health tools, and although, some research-based e-health tools are successful in market terms, many more are not supported by business plans or other models of funding, apart from research grants, to sustain marketing dissemination, maintenance and innovation (Miller, West, Brown, Sim, & Ganchoff, 2015) [14].

According to ITU (2016) [11], studies have, in particular, identified various and several barriers to the use of e-medical record (EMR) system, which include that the use of EMR systems disrupts communication between healthcare providers and patients; documentation time takes a lot of time away from interaction between the providers and patients; and causes inability to maintain eye contact between the providers and the patients. According to Davis, Menon, Parrish and Sitting (2015) [6], access to EMR systems forces physicians to orient themselves toward the computer and away from the patient, contributing to less eye contact, fewer gestures and an increase in the number and length of pauses during interactions. Patients do not seem comfortable during pauses in communication, evidenced by the absence of fidgeting, sighing or look around the room; instead they use this time to ask questions. Granja, Janssen and Johansen (2018) [10] also identify that resistance to use e-health system is due to the former or conventional physician-patient relationship. EMRs requires a computer in the examination room, which can change the dynamics of the clinical encounter, because the time physicians spend on the computer may take away from the time spent on the patients.

In similar observation, Twart (2001) state that patient-centeredness is adversely affected because physicians and other healthcare providers tend to walk straight to the computers and spend considerable time viewing and recording information, instead of giving quality time and attention to the patients. Some patients complain that e-health tools such as laptops and other mobile devices depersonalize their encounter with the physicians (Rowe, 2018) [20]. Another concern is that most physicians using EMR systems spend more time per patient after EMR implementation over a period of months or years, contributing to longer work days or fewer patients seen or attended to. Patient records are normally transitioned from paper to e-health records, a time consuming process. E-medical record also has been associated with increased time during clinical encounter, that is, an additional time is needed to enter patient data or prescribe a medication, thereby disrupting workflow (Ash *et al*., 2017) [3]. Ash and others further observed that to facilitate data entry in the face of this demand, some physicians have resorted to simple solutions, such as the use of Post-Its or index cards.

Use of e-health systems, especially, e-medical record system adversely affects the conventional workflow. There are three identified underlying workflow issues: the first, being difficult following the automated work flow; the second, lack of integration with ancillary systems; the third, slow transition from one screen to the next (Granja, Janssen & Johansen, 2018) [10]. Another workflow-related concern is the inadequate support, including installation and training which is costly and time consuming.

Baron, Fabens, Scheffman, and Wolf in 2005 conducted a case study of the end-user experience from EMR system implementation in one internal medicine (Maekawa, & Majima, 2018). The report underscored the pervasive impact on workflow. The system rendered everyone in the office incompetent to do their core jobs. The front desk had to use new on-screen forms to record telephone messages; pairing electronic messages with paper charts required by the file clerk to follow a new workflow; physicians had to find telephone messages on their computer desktop; the medical assistants had to record vital signs and chief symptoms in the computer and had to learn how to record results of tests. According to the report, everyone in the office simultaneously experienced anxiety and unhappiness. Waiting time for patients drastically increased. People were miserable at work.

Migration is another issue of disruption to the workflow and has been considered as an issue creating additional problems that foster resistance to the implementation and use of electronic systems. Coleman (2014) [5] noted that in some cases, data from the old paper-based chart could not be migrated into the digital systems, and inadequate electronic exchange of data between EMR systems and other clinical data systems (like laboratory, radiology and referral systems) is also an issue, particularly, for solo and small group practices. Findings also indicate that computer-related problems may contribute to scheduling concerns, which include slow computers, computer's "timing out", lack of fast or available printers, and inability to type fast enough (Rowe, 2018) [20].

Studies indicate that healthcare providers seem to prefer paper forms to e-health system. Physicians often find it easier and faster to write prescriptions on paper than to log onto e-health applications and type in the information. Miller and Tucker (2015) [14] identified reasons for paper workarounds over e-health system, and these include that healthcare provider perceive paper use to enhance efficiency; providers lack knowledge or skills or find e-

health system difficult to use; paper work serves as a cognitive memory and provides sensory input or motor actively that is tangible.

According to Davis, Menon, Parrish & Sitting (2015) [6], Saleem and colleagues in 2015 identified some frequently reported benefits of paper forms by healthcare provider include: increased awareness of new information; needed to customize data for a particular patient, provider, or department; e-health system functionality does not support necessary tasks; display of e-data is not adequately organized; and tracking data over time is difficult to accomplish. Other reasons adduced for resistance to the adoption of e-health, particularly, EMR by healthcare providers are that implementation of EMR systems is seldom performed in a single phase. Different stages of the system may cause implementation to take longer time thus frustrating staff and thereby, causing resistance (Rowe, 2018) [20]. Menon *et al*. (2014) [6] had similar view that implementation of EMR systems almost take place in stages that can last as long as three to four years. This can allow resisters time to build negative momentum against the use. And a prolonged implementation can sometimes end in failure

These identified barriers or challenges have been responsible for the consumers' and providers' resistance to the use of e-health in healthcare delivery, despite increased awareness and understanding of the benefits e-health in the technology-fast moving world of the 20th century. This resistance is higher in developing countries than in developed nations, perhaps due to low of literacy, economy, and technological development in these middle-and low-income countries.

Conclusion

There is a large body of evidence that suggest numerous benefits, effectiveness and utility of e-health systems. However, some personal, social, technological and environmental factors have constituted barriers to the utilization e-health applications by healthcare consumers and providers in developing countries. This resistance has slowed down digitalization of healthcare delivery in this fast-centric world of internet, regrettably, in favour of the traditional analogue paper forms of healthcare, thus denying consumers the support in obtaining health information and services in timely and secure manner, opportunity to analyze their unique healthcare needs, make informed decisions about their health, and meet the complex demands of the changing healthcare environments.

Suggestions

To achieve public acceptance of the utilization of e-health applications by both consumers and providers of healthcare to improve health following reports of literature, the following suggestions are advanced:

1. Governments should come up with policies that will reorient the health sector, retrain the personnel, and encourage digitalization of the sector through partnership with telecommunication industries. This partnership should also include organizations that show interest in healthcare services such as e-health developers and researchers, healthcare institutions, purchasers, employers and public health programmers.
2. There should be ICT literacy programmes for healthcare providers and the public to improve on the capacities and ICT skills of people to use these e-health devices or systems. If the programmes are appropriately designed and implemented, it may reduce resistance to use of e-health tools by both the consumers and providers. More so, for the e-health applications to make maximum contributions to personal and public health management in a measurable way, consumers and their requirements should be at the center of the design and dissemination process.
3. Information security and privacy in the integration area in the digitalization of patients' data should be ensured. Privacy and security measures should be in place to ensure that personal health data do not fall into wrong hands. There should be also stringent laws and legislation to protect personal health data.
4. Customization of e-health applications should be done so that physicians or healthcare provider's input interface closely mimics previously utilizes paper forms. Customizing software's yields highest benefits because it is adapted for the users, and tailored to workflows specific to an institution. This is necessary because studies have shown that use of non-customized e-health tools have negative effects on communication, and also increases overtime and missing records.

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