

### E Health and M Health Technology in Health Care

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#### COLUMN ARTICLE

Electronic *health (e Health)* and Mobile *health (mHealth)* tools can sustain and advance the process of *health promotion (HP)* projects [1].

eHealth is a broad term, refers to the use of communication and information technologies in healthcare. Usage of the term varies as a study in 2005 found 51 unique definitions. eHealth covers a lot of territories, therefore, it's usually used as a synonym for Health IT. eHealth applications manages, transmit, stores or write information used in the delivery of healthcare treatment planning, payment or record handling [1]. E Health Ontario was started as a collaborative measure between the Ontario, Ministry of Health's electronic health program and the Smart Systems for Health Agency (SSHA), to develop electronic health charts for all patients in the province by 2015 [1].

Rendering Eysenbach's definition, "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 other related technologies" [2].

Contemporary communication technology has given rise to the notion of "mobile health" (or m-health, a division of "electronic health" or e-health), which is the use of mobile technology for improvising health outcomes. A valuable definition for m-health was presented by the National

Institute of Health as "the delivery of healthcare services through mobile communications devices" [1,3]. The most communal application of mHealth is the use of cell phone and communication apps to provide education to customers about prevention of health care amenities. Telemedicine had been overwhelmed by the reality of what we now call m-health. The recent statistic is astounding in that there are 6,835,000,000 cell phone subscribers in the world with a population of only 7.1 billion. In the developed world, the penetration of the cell phone is over 126% of the population [1]. Mobile telemedicine, or m-health, has expanded with the introduction of the smartphone, including Google's Android and Apple's iPhone, which has 8000 medical applications. An application download cost a few dollars, and we have an instant telemedicine station in the hand. In fact, m-health is a multibillion dollar contributor to the global telecommunications market. Google will bring you 1,600,000 sites for a mhealth search. M-health is divided into eight areas: Individual, Societal, Home-based Health 24-hour care, Community Teaching, Medicinal Records and Communication, Specialized Tutoring, Info and Consultation [1].

Involvement of patients and caregivers in the home with m-health and monitoring is growing and continues to be more medically relevant and pertinent to curtail complications of many chronic conditions like diabetes, congestive heart failure, hypertension, asthma, dementia, wound care, rehabilitation, and for routine surgical and medical follow-up after an emergency, are all proven

interventions. Public medical education for behavioral modification through the cell phone has shown worth in smoking termination, weight monitoring, and psychological health [1,3]. Personalized and generalized programs for reinforcement of positive behaviors have now been widely studied and carry great potential for improved disease outcomes. Medical records could certainly be accessed by m-health tools, and the idea of private healthiness accounts has been innovative. M-health technology to connect with patients in regarding notices, appointment schedules, and laboratory results endures to nurture and is recognized [1,3].

On the professional side of m-health, there is growing trust on the cellular technology regarding information about diseases in hospitals universally. One example was Epocrates; it offers 40 services in medical information. It claims to be the number one health tool health in this regard [1]. Professional teaching and info are distributed instead of travelling to get information and could also be documented for compliance. Information from the Web in the form of electronic libraries is accessible at anytime and anywhere. M-health allows the use of huge databases and medical literature from any point. Professionals can also enter their experience and that of their patients into databases for consistent tracking of quality, epidemiology, and application of best practices. M-health allows this process to extend around the world, creating the global virtual medical staff to share experiences. Images can be shared for interpretation, including radiology studies. The operating room can be made accessible to any consultant, and collaboration can be spread to any limit to achieve the proper expertise aimed at patient care. Encryption and password protection are adequate for current applications [1]. The World Health Organization (WHO) has announced that “m-health has the potential to transform the face of health service delivery across the globe” [3].

M-health is evolving as a hopeful instrument to deal with healthcare restraints in developing countries, like insufficient healthcare labor force, restricted monetary funds, and increase problem of illness, rise in populace development, and problems in relaying healthcare to difficult areas where people need the most. - [3]. Most of

data on mobile technology in chronic disease and risk issue management are from developed countries. Studies of emerging nations have emphasized the effect of m health on infectious diseases, such as tuberculosis, human immunodeficiency virus, and malaria [3]. Worldwide, chronic diseases are a leading cause of morbidity and mortality. The developing world carries this burden disproportionately with 80% -90% of deaths attributable to chronic infectious diseases occurring in lower and middle income countries (LMIC) [3]. Also chronic conditions have become an indicator of the increasing health disparities in LMIC, stressing the urgent need to implement more effective and lucrative interventions [3].

Systematic review done by Andrea Beratarrechea., *et al.* in 2012, discussed the impact of mobile technology (voice communication and short message service [SMS]) on chronic disease outcomes in low and middle income countries (LMIC) like China, Taiwan, Malaysia, Poland, India, Croatia, and Uruguay. Some fall in high income country bracket. Outcomes that were measured were disease, mortality, hospital admittance, change in lifestyle, prognosis better, clinical measures, expenses, satisfaction of patient and provider, compliance of patients, and health related quality of life (HRQoL). M technology positively impacted on chronic disease outcomes and was cost-effective [3].

Ostojic., *et al.* [3] studied the impact of messaging (SMS) on asthma; subjects transmitted home spirometry readings to physicians via SMS and then received telephone counseling. Patients in the intervention group had improved pulmonary function and HRQoL and decreased unscheduled visits to the emergency department and hospitalizations. Ramachandran., *et al.* [3] studied the impact of mobile technology counseling on New York Heart Association practical class, 6-min walk test, physical impairment, and symptoms in congestive heart failure subjects in India. At the end of the study period, significantly more study subjects were categorized as Class I and II compared with controls. Diabetic clinical outcomes improved with mhealth interventions. Wojcicki., *et al.* [3] found that patients who delivered daily glucose readings to physicians using a telemetric system and received telephonic medication

regimen feedback reported better diabetic glycaemic control than control subjects. Several studies have examined the effects of m-health technology on healthcare costs, and all have found that m-health is cost-effective. Chen., *et al.* and Leong., *et al.* [3] whose work concluded that messages via phones and prompts made attending appointments better by patients, evaluated cost-effectiveness as a secondary outcome. SMS was found to be 35% - 45% less expensive, than telephone reminders. Another study done in Kenya by Harsha Thirumurthya and Richard T Lester on m-health technology for health behaviour modification in areas where resources are less. HIV care also showed positive results [4].

Younger generation use e-health and m-health technology mostly [5]. Constructive changes like physical activity and a balanced diet could help to avert heart disease, hypertension, diabetes, obesity and even untimely death among older adults [5].

A systematic literature review was done by Ramon Kampmeijer., *et al.* on the use of e-health and m-health technology in health promotion and primary prevention among older adults. The majority of the publications were from United States, than Europe, few from Asia (Japan and Hong Kong), remaining from Canada and Australia. There were diverse kinds of e-health and m-health tools used for health promotion and primary prevention. These included application softwares, websites, devices, video apps and webinars. Facilitating factors were inspiration/support/feedback/ advice, self-regulation, information (progress, usefulness, awareness), Reward (financial), usability, accessibility (language, form, online or print), and remote help at home (no travelling). Barriers to use were personal choice lack of time/priority/cost, lack of observance or enthusiasm/support, not clear device or information/wrong interpretation/lack of control, barriers related with technology use, socio demographical barriers (age, educational level, skills with electronic device, and lack of resources for telecare Strategy/compensation required. The review concluded with the significance of e-health and m-health technology in health promotion and primary prevention among older adults [5].

Not much has been explored of the usage of m health technology in the promotion of oral health. Individuals living in rural and remote settings face oral health problems and barriers to access care due to the shortage of health care providers in these areas, topographical remoteness, and lack of appropriate infrastructure and lower socio-economic status, population susceptibility, higher rates of poverty, socioeconomic scarcity, reduced public services, and lower of private dental insurance coverage [2]. This has led to lower use of dental care, poorer oral health and displeasure with oral health care facilities in rural populations compared to urban populations [2]. Also, rural dentists might feel incompetent in treatment planning as they do not have access to specialist opinions. Professional incompetency such as inaccurate diagnosis can create barriers with regard to health care [2]. Patient satisfaction is a significant outcome variable for health care services. Patient's satisfaction includes various dimensions such as availability, accessibility, quality of care, physical setting, and cost [2]. Telemedicine in dentistry is just launching all over the world and many explanations have been proposed in order to overcome the inequalities, among which E-Health technology is undergoing the most rapid progress. The first worldwide implementation of E-Oral Health technology was designed to encompass dental diagnosis and treatment planning in rural areas. Today, the use of E-Oral Health technology has also been reported in dental education and preventive dentistry. Not many studies have been conducted on the effect of E-Oral Health technology on patient satisfaction especially in remote locations [2].

Systemic review done by Emami., *et al.* in 2017 highlights the importance of patient satisfaction with E-Oral Health care in rural and remote settings and concluded that the likely implications and benefits of E-Oral Health care can enlighten policymakers and health care professionals to take advantage of e health technology to address health care challenges especially in remote areas, to fulfill them and to remove the burden of diseases. The findings from their review can be used to address the lack of knowledge of dental care, where access to dental health care is less accessible and have the potential to permit the dental work force working in rural and remote zones across the world [2].

Another randomized controlled trial study was done by Scheerman, *et al.* to test the efficacy of smartphone application on oral-health behavior and oral hygiene in youths with fixed orthodontic appliances. Adolescents with fixed appliances are at a higher risk of developing carious lesions. Mhealth technology has seldom been used to support the protective behavior that can help prevent caries. A smartphone application, the WhiteTeeth app for preventing dental caries through improved oral-health and oral hygiene behaviour at home. The app is based on the Health Action Process Approach (HAPA) approach, and incorporates many behavior change practices that target the psychosocial factors of oral health. This RCT was done to evaluate the effects of the WhiteTeeth app on oral-health behavior and oral-hygiene outcomes (presence of dental plaque and gingival bleeding) compared with normal dental care. This intervention study results showed that the app caused greater improvements in oral-health and oral hygiene behaviour more than conventional oral-health-promotion programs and is also likely to affect caries progress. This study also highlighted the fact that preventive oral health interposition lessens orthodontic patients' long-term health costs [6].

There is an increase in consumer using mobile health apps (mHealth) in recent years. Prior studies have characterized the accessibility, usability, and quality of mHealth apps aiming a range of health behaviors, but none has examined apps that encourage better oral health care. Oral diseases distress billions of people worldwide and mobile phone use is on the upsurge, therefore the market for well-designed and effective oral health apps is considerable. In this context, a study was done by Tiffany, *et al.* in 2018 examined the content and usability of oral health promotion apps intended for Android or iOS, targeted adult consumers, to better understand the current state of these self-help interventions and apprise the need for future app development. Content review and heuristic analysis was done to assess each app's usability as an influential health technology. Content wise some apps were ok but overall the apps performed poorly on standard usability. Important strategies should be taken to change oral health promotion apps whose content is hypothetically sound and

evidence-based and that observe good design principles for convincing health technologies [7].

A pilot study was conducted in 2008 to estimate the potential of Personal Digital Assistant (PDA) technology to improve the oral health of people with mild to moderate intellectual incapacities, chronic oral health problems and history of poor oral hygiene. Oral health education videos and audio materials were prepared and shifted to PDAs. Patients were equipped at a regular dental appointment about the utilization of the PDA. This pilot study theoretically brought a range of health promotion activities (mHealth) within the reach of people with inadequate health literacy which may produce better management of chronic oral health conditions which are on the increase [8].

Another study done in 2005 regarding cost- effectiveness of tele dentistry in residential aged care facilities (RACF) concluded that tele dental asynchronous patient valuations were the lowest cost service model. Access to oral health professionals is generally low in RACFs. Therefore, the real time consultation could possibly attain better conclusions due to two way communication between the nurse and a remote oral health professional through health promotion/disease prevention carried out in conjunction with the oral examination [9].

Due to extensive use of mobile phones in the developing world, the application of m- health technology in healthcare has incredible potential. There is a need for more evidence based research on factors that influence the justifiable and accessible implementation of m-health in developing countries. In depth interviews with health professionals in Sri Lanka in 2008 to understand the views on the benefits and barriers to implementing and executing m-health. Study participants had mixed views on the enactment and adoption of this technology. Reasons for m-health acceptance included efficacy and usefulness in emergency situations. Barriers to implementation included risks for miscommunication/misapprehension and lack of strategies/guidelines for executing m-health technology. Assuming mobile technology afford improvements in health outcomes for developing countries, appropriate factors

regarding each setting should be considered in designing and adopting of m-health interventions [10].

### Practical Implications

M-health could benefit patients and health care providers by helping overcome resource limitations on the supply side of health care as well as structural barriers and behavioural restrictions on the demand side. Evolving evidence suggests that m-health could enable behaviour alteration and improve health outcomes in resource limited settings. Market competition has decreased the cost of mobile phone dramatically, to the point that people now have mobile phone communication in their daily lives everywhere. Easy-to-use software programmes that enable automated communication with many people at once have now been developed. Therefore, m-health interventions can be envisioned as a means of helping patients and the health-care providers in a suitable and cost-effective way. Growing interest in m-health creates the need to judiciously assess how efficiently m-health interventions can encourage health behaviour change and to compare their cost-effectiveness with that of other behaviour change strategies. Unless the acknowledged benefits of m-health can be empirically demonstrated, m-health program implementers run the risk of spending funds on interventions of uncertain benefit.

Developing countries must expand and improve the delivery of interventions to counter the rising morbidity and mortality of chronic diseases. Cellular phones are an established means of communication in developing countries and thus have been shown to be effective in managing the chronic diseases in the developed world. The incorporation of mobile interventions into the healthcare system in lower middle income countries (LMIC) like India, Pakistan and Bangladesh, may be achievable way to complement and improve policies for prevention and control of chronic diseases. The sustainability of these interventions depends on other factors besides mobile phone technology, such as the healthcare settings, societal values, and culture. In fact, public health and/or healthcare issues vary among LMIC (e.g. the prevalence's of diabetes in Poland and India are similar, but Poland has developed national programs

for diabetes management making it easier to implement [3]. Evidence regarding efficacy, effectiveness, safety, cost, and social, institutional, legal, and ethical implications of new technology adoption should be the priority, especially among LMIC where resources are scarce and demand for health services is more. Further research, preferably large, multi centre, Randomized control trials (RCTs) focusing on a variety of chronic diseases with long-term follow-up, is needed to better understand the impact of mobile technology.

Considering many ehealth strategic plans are being developed in rural and urban areas across the world, additional investigation will support policy decision-makers in planning for E-Oral Health programs and m-health, which would lead to the improvement of oral health care in rural and urban areas.

Worldwide countries could benefit from the use of e-health and m-health tools in health promotion and primary preventive programs. If these programs are designed with care to avoid probable barriers, and if the cost effectiveness of the programs can be verified in future studies, governments might be hard pressed on to consider funding them.

Oral diseases distresses billions of people worldwide and mobile phone use is rapidly expanding around the world. Therefore, the impact of delivery of effective oral health interventions via mobile phone could be substantial. There is an essential need to create high quality oral health promotion apps targeting people of all ages. Preventive oral health interventions in the form of mobile apps reduce patients with oral problems and long term health costs and follow up studies could also incorporate healthcare costs.

### CONCLUSION

M-health technology has come a long way and might be the leading tool in critical and lifesaving information around the globe and elsewhere for the improvement of healthcare access, practice, and quality. Medicine cannot be considered any longer a lonely pursuit, and the applications of m-health

can be expected to proliferate. E Health and mhealth tools are helpful, but better policies and strategies are needed, as certainly not all the information is pure and commercial medical information does not represent the best in advice.

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