

ADVANCEMENT OF mHealth IN VARIOUS HEALTHCARE SECTORS- A NARRATIVE REVIEW

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ABSTRACT-

In this growing world, the recent years have seen an increased usage of smart phones by healthcare professionals as well as the general public. The developing technology has increased the smart phone in a new technology that combines mobile communication and computation in a handheld-sized device, facilitating mobile computing at the point of care. There is a growing body of evidence that demonstrates the potential of mobile communications to radically improve healthcare services—even in some of the most remote and resource-poor environments. This report examines at the heart of the rapidly evolving intersection of mobile phones and healthcare. It helps the reader to understand latest trend of mHealth's scope and implementation across developing regions, the health needs to which mHealth can be applied, and the mHealth applications that promise the greatest impact on health care initiatives. It also examines building blocks required to make mHealth more widely available through sustainable implementations and requirement. Finally, it calls for concerted action to help realize mHealth's full potential.

Keyword-mobile apps (mHealth), health care

INTRODUCTION

According to WHO, mHealth is a component of eHealth. To date, no standardized definition of mHealth has been established. For the purposes of the survey, the Global Observatory for eHealth (GOe) defined mHealth or mobile health as medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices. mHealth involves the use and capitalization on a mobile phone's core utility of voice and short messaging service (SMS) as well as more complex functionalities and applications including general packet radio service (GPRS), third and fourth generation mobile telecommunications (3G and 4G systems), global positioning system (GPS), and Bluetooth technology.¹ There are several types of mHealth apps developed for health purposes ranging from general health apps such as decision, support, vitals, and reproductive health apps; through fitness apps for an activity tracker, nutrition tracker and mindfulness² With the emergence of mobile communications and advanced networking technologies, a specific field within e-Health, namely Mobile Health (m-Health), has emerged. Mobile patient monitoring is one of the m-Health services for the continuous or periodic measurement and analysis of a mobile patient's biosignals. The physiological signals that can be (continuously or periodically) measured and monitored from living beings are referred to as biosignals. Some of the biosignals commonly measured are Electro Encephalo Gram (EEG), Magneto Encephalo Gram (MEG), Galvanic Skin Response (GSR) and Electro Cardio Gram

(ECG). Many other parameters, such as Heart Rate Variability (HRV), can be calculated from (derived from) measured biosignals³

MATERIALS AND METHODS

A computer-based literature search was done using the PUBMED, PUBMED CENTRAL, and GOOGLE SCHOLAR. Relevant articles with a full text published in English between the years 2011 to 2021 were screened and included. Editorials, Commentaries, Discussion papers, Conference abstracts, and Duplicates were excluded. We included primary studies that focuses on the topic, peer reviewed publications (journals) with full-text articles. After the screening through 80 articles 19 relevant articles were included in the review. Figure 1 shows the searching strategy for this review. Characteristic of the reviewed article was summarized in table 1. All studies have examined the association and the effect of mobile application in the day to day life with every field and health sectors.

SCREENING OF PAPERS FOR INCLUSION AND EXCLUSION

Inclusion criteria

1. Primary studies that focus on the topic
2. Peer reviewed publication (journals)
3. Studies which were written or published from 2011 to 2021

Exclusion criteria

1. Studies which were not in English studies that were very short (less than 4 pages) and remove duplication
2. Studies which are old from that 2011 where excluded
3. Studies that assess user experience with some type of mHealth apps or gathering requirement.

DISCUSSION

The present review suggested that how the mobile application has been growing in every sector and every field of the medicines. It also describes that how the normal individual and healthy adults and older people are getting aware about the apps and those too mobile health apps in their day to day life. Furthermore discussing the 100 articles were sorted from the various fields, 80 were included according to the inclusion criteria. Review of 19 articles was done according to the inclusion criteria and excluded the other according to the exclusion criteria. Various fields have been covered accordingly like stroke, diabetes, post operative conditions, mental illness, traumatic brain injury, corona, cardiac rehabilitation, chronic pain, medical emergencies, aging, primary dementia ,heart rate, weight management, urinary incontinence, neurorehabilitation, physical medicine and rehabilitation, gastroenterology, chronic illness, fitness and disabilities.

Mobile health (mHealth) applications (apps) offer potential to assist with the self-management of UI. Although there is growing interest in the development of mHealth technologies to support patients with UI. Effective collaboration between industry and research is needed to develop new user-centered mHealth apps that can empower patients with UI.⁴ The study highlights the current emphasis on the development of self-testing, quarantine monitoring,

and contact tracing apps for COVID 19. The review of the app functionalities revealed that information dissemination regarding the preventative measures was the primary function of the majority of the existing apps in India. Thus it is suggestive that even in the advancement of the growing world and disease like COVID 19 there are apps.⁵ Chronic pain is one of the major causes of disability in the general population. Even though there are effective treatment options available for reducing symptoms, these treatments often do not have consistent lasting effects. The literature on mobile application-based treatments for non-cancer chronic pain patients and the efficacy as well as the quality of the utilized apps suggest that apps-based treatment can be helpful in reducing pain, especially in the long-term⁶

Currently, smart phones and applications are developing rapidly, and mobile health applications are used to manage hypertension, but evidences related to effectiveness are limited. To assess the impact of m-Health apps on blood pressure control, medication adherence. M-Health apps are effective for hypertension management, it can favor the medication adherence and blood pressure control. Perhaps m-Health apps can be promoted in the blood pressure control.⁷ Mobile health apps (MHAs) and medical apps (MAs) are becoming increasingly popular as digital interventions in a wide range of health-related applications in almost all sectors of healthcare. They offer potential for diagnostic and treatment advances in the field of gastroenterology and the management of chronic diseases in general. In particular, patients with chronic diseases and health care professionals will benefit from these interventions in many different ways.⁸ The search for mHealth solutions can contribute to the development of modern, efficient, and sustainable health systems. It is also expected to reduce costly visits to the hospital, help citizens to take charge of their state of health and well-being, and promote health focused on prevention rather than cure. The literature review mentioned the relevant usage of mobile apps in the health emergency domain. In addition, this paper stated the need to investigate the realization of more studies on prehospital care. Thus taking into consideration the mobile application have reached to the various sectors and that too emergency and also is helpful for the same⁹ The usability of mHealth apps is critical to their implementation and have significant potential during the postoperative period for encouraging earlier discharge, improving patient engagement, and offering a safety net for early identification of complications. They have focused on satisfaction, a narrow dimension of usability, with simplistic self-created questionnaires.¹⁰ Stroke emerging today for every age group can also be treated with the help mHealth apps. Thus by using the mobile application for the video conferencing the treatment and assessment can be done effectively by taking into consideration of the literature.¹¹ So, it could be suggestive that mHealth apps have significant effect on the recovery. TBI can lead to significant motor, cognitive and emotional deficits. Mobile health (mHealth) is a promising technology to help diagnose and manage patients with TBI. The literature was to systematically examine and classify available TBI mobile applications (apps) and critically appraise the literature underpinning mHealth for the management of TBI.¹²

Dementia directly influences the quality of life of a person suffering from this chronic illness. The caregivers or carers of dementia people provide critical support to them but are subject to negative health outcomes because of burden and stress. The intervention of mobile health (mHealth) has become a fast-growing assistive technology (AT) in therapeutic treatment of individuals with chronic illness. The purpose of this comprehensive study is to identify, appraise, and synthesize the existing evidence on the use of mHealth applications (apps) as a healthcare resource for people with dementia and their caregivers. The comprehensive study concluded that mobile health apps appear as feasible AT intervention for PwD and their carers

irrespective of limited available research, but these apps have potential to provide different resources and strategies to help this community.¹³ To identify existing evidence on the efficacy of mobile health technology in facilitating weight management behaviors, such as healthy food consumption and physical activity. Mobile health apps are widely considered as satisfactory, easy to use, and helpful in the pursuit of weight loss goals by patients. The potential of mobile health apps in facilitating weight loss lies in their ability to increase treatment adherence through strategies such as self-monitoring. These findings indicate that satisfactory treatment adherence and consequent weight loss and maintenance are achieved in the presence of high levels of engagement with a mobile health app.¹⁴ To measure vital signs, smart phones are often connected to a mobile sensor or a medical device. However, by using the white light-emitting diode as light source and the phone camera as photo detector, a smart phone could be used to perform photo plethysmography (PPG), enabling the assessment of vital signs. The objective of this meta-analysis was to evaluate the available evidence on the use of smart phone apps to measure heart rate by performing PPG in comparison with a validated method.¹⁵

To conduct systematic review to better define how medical mobile applications (apps) have been used in environments relevant to physical medicine and rehabilitation. Some apps may have positive benefits when used to deliver exercise or gait training interventions, as self-management systems, or as measurement tools. Studies also revealed patient-centered app designs that accommodate a variety of user impairments and navigation, self-reporting, and education. When used as an intervention, they had positive effects on some medical and functional outcomes.¹⁶ Data from a national survey on the experiences, needs and potential solutions for mHealth technology by people with physical, cognitive, sensory and emotional disabilities.. Overall, few respondents reported moderate-to-high levels of satisfaction with their existing mHealth apps, and even fewer reported that finding effective mHealth apps was easy or very easy..¹⁷ mHealth approaches that use mobile phones to deliver interventions can help improve access to care for people with serious mental illness. The mHealth intervention showed superior patient engagement and produced patient satisfaction and clinical and recovery outcomes that were comparable to those from a widely used clinic-based group intervention for illness management.¹⁸

An app is a programme with special characteristics installed on a small mobile device, either a tablet or smartphone, with which the user interacts via a touch-based interface. The purpose of the app is to facilitate completion of a certain task or assist with daily activities. The evidence suggests that for some neurological diseases, certain apps are effective and reliable when used as complementary treatment alongside rehabilitation, especially those apps designed to promote a healthy lifestyle, retrain balance, assess disorders, and let patients and their therapists communicate in real time. Likewise, app selection criteria should be available to make it easier for healthcare professionals, patients, and their families and caregivers to select the most suitable app for each case.¹⁹ Ageing is often accompanied by an increased risk of age-related diseases and decline in function. This decline can be related to the ageing process, itself, with structural and functional changes in the brain and in cardiovascular, skeletal, and muscular systems. The literature on mobile technology, in particular wearable technology, such as smartphones, smartwatches, and wristbands, presents new ideas on how this technology can be used to encourage an active lifestyle, and discusses the way forward in order further to advance development and practice in the field of mobile technology for active, healthy ageing.²⁰ Cardiac disorders are increasing day by day if we get the mobile apps for the same at home than it will be effective and the rehabilitation by mobile will have the greater effect and less time consuming so

the articles suggest new strategies for promoting participation in cardiac rehabilitation are desperately needed while initial evidence supports the feasibility and acceptability of using mobile technology for cardiac rehabilitation in patients with IHD..²¹

Diabetes mellitus is a kind of chronic disease which can be effectively prevented and controlled only if the blood glucose level of the patient is constantly monitored, and the health education and professional medicine care is fully supported. The review showed that simple SMS system of sharing the diabetes report with the physician will have the effect that is helpful and useful for the self management ²²

CONCLUSION

All the literature reviewed suggested that in every field of medicine and health sectors there are usage of the mobile application. mHealth is increasing in every minute need of the person suffering from any of the disease. Thus, the literature of the study suggested the positive and negative effect of the mobile application but the purpose is fulfilled about the reviewing of the importance and usage mHealth is various healthcare sectors. Further study should be conducted with specific importance in each field individually.

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TABLE 1- SUMMARY OF THE REVIEWED ARTICLE

<u>SR NO</u>	<u>AUTHOR/ YEAR</u>	<u>AIM/PURPOSE</u>	<u>RESEARCH DESIGN</u>	<u>OUTCOME MEASURE</u>	<u>KEY FINDINGS</u>
1	Alexis L. Beatty et al (2021)	The existing literature shows the use of mobile technology for cardiac rehabilitation and propose a framework for developing and evaluating mobile applications for cardiac rehabilitation.	Review literature	<p>. Address core components of cardiac rehabilitation:</p> <ul style="list-style-type: none"> ● Patient assessment ● Exercise training ● Self management, <p>may include: eg- Physical activity</p> <p>2. Apply behavior change theory</p> <p>3. Enable individual tailoring of features</p> <p>4. Demonstrate high usability</p> <p>5. Improve patient-centered outcomes: eg-Participation in cardiac rehabilitation events</p> <p>6. Establish efficacy in a randomized clinical trial</p>	New strategies for promoting participation in cardiac rehabilitation are desperately needed. Initial evidence supports the feasibility and acceptability of using mobile technology for cardiac rehabilitation in patients with IHD.
2	Ann-Christin Pfeifer et al (2021)	The aim of this systematic review and meta-analysis was therefore twofold: first, to investigate the efficacy of mobile application-based treatments of chronic non-cancer pain; and second, to rate the quality of the apps in terms of	Systematic review and Meta analysis	Pain intensity and Mobile App Rating Scale (MARS)	This study demonstrates emerging evidence that mobile apps can be useful in reducing pain among non-cancer pain patients.

		content, ease-of-use, and functionality, from a user point of view. The meta-analytical procedures were applied to estimate the quality of the studies and the efficacy of the utilized apps..			
3	Abhinav Bassi et al (2020)	This study was aimed to systematically review COVID-19 related mobile apps and highlight gaps to inform the development of future mHealth initiatives.	Systematic Review of the Literature	The movements of quarantined individuals was the function of 27 (54%) and 19 (32%) apps, respectively. Eight (16%) apps had a contact tracing and hotspot identification function.	The review of the app functionalities revealed that information dissemination regarding the preventative measures was the primary function of the majority of the existing apps in India
4	Ke Gong et al (2020)	The purpose was to assess the impact of m-Health apps on blood pressure control, medication adherence	Randomized, controlled trial	Blood pressure	M-Health apps are effective for hypertension management, it can favor the medication adherence and blood pressure control. Perhaps m-Health apps can be promoted in the blood pressure control.
5	Lucas Ogura Dantas et al (2020)	To perform a systematic review of available mHealth apps for UI in Brazil.	Systematic review	MARS quality scale	Results suggested that an ideal mHealth app for patients with UI should provide content that is grounded in scientific evidence, respect the laws of privacy and security of the country in which it is

					being offered, include symptom trackers, keep individual records for personalized health goals, and allow for collaboration between users and healthcare professionals to design tailored pelvic floor muscle training programs.
6	Sven Kernebeck et al (2020)	The aim of this article is to provide an overview of the current status of MHA and MA use in the field of gastroenterology, describe the future perspectives in this field and point out some of the challenges that need to be addressed.	Review of literature	Patient education Telemedicine eHealth records Digital biomarkers	Digital interventions, such as MHAs and MAs, offer potential for diagnostic and treatment advances in the field of gastroenterology and the management of chronic diseases in general
7	Alejandro Plaza Roncero et al (2020)	The study aimed to identify common threads and gaps to support new challenging, interesting, and relevant research directions	Systematic Review	The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology	We found that all apps in the Google Play Store were free, and 73 apps in the Apple App Store were paid, with the price ranging from US \$0.89 to US \$5.99. Moreover, 39% (11/28) of the included studies were related to warning systems for emergency services and 21% (6/28) were associated with disaster management apps.
8	Li Li	This study aimed	Pilot Randomized	Validity and	Video conference with

	(2020) et al	to evaluate the feasibility, validity, and reliability of functional assessments administered through the videoconference function of a mobile phone-based app compared with administration through the telephone function in poststroke patients after rehabilitation hospitalization	Controlled Trial	reliability videoconference follow-up and home visit assessments, as well as telephone follow-up and home visit assessments. Feasibility was evaluated by the levels of completion, satisfaction, comfort, and confidence in the 2 groups.	high reliability and validity
9	Ben Patel et al (2020)	This systematic review evaluates the (1) methodology of usability analyses, (2) domains of usability being assessed, and (3) results of usability analyses.	Systematic review	mHealth App Usability Questionnaire (MAUQ).	Of the 3 domains of usability, only satisfaction is regularly assessed. There is significant bias throughout the literature, particularly with regards to conflicts of interest.
10	Edward Christopher et al (2019)	The aim of this study was to systematically examine and classify available TBI mobile applications (apps) and critically appraise the literature underpinning mHealth for the management of TBI.	A Systematic Review of the Literature	Not applicable	This study found only a small number of mobile apps for TBI with limited uptake based on download metrics.
11	Kanwal	The purpose of	Survey	(1) cognitive	This

	Yousaf et al (2019)	this comprehensive study is to identify, appraise, and synthesize the existing evidence on the use of mHealth applications (apps) as a healthcare resource for people with dementia and their caregivers.		training and daily living, (2) screening, (3) health and safety monitoring, (4) leisure and socialization, and (5) navigation	review concluded that mHealth based assistive technology has the potential to provide efficient healthcare facility to PwD and support caregivers as this technology provides simple interactive features and promotes independence
12	Katerina Dounavi et al (2019)	The present systematic literature review aimed to identify existing evidence on the efficacy of mobile health technology in facilitating weight management behaviors, such as healthy food consumption and physical activity.	Systematic Literature Review	Weight; BMI; physical activity; dietary intake mainly focusing on fruit and vegetable consumption, take-out meals, and sugar-sweetened beverages; anthropometric data, such as waist circumference, blood pressure, serum lipids, and glucose levels; psychological factors, such as well-being, stress, motivation, and positive or negative affect; alcohol and cigarette consumption; engagement with app; adherence to self-monitoring; and app acceptability.	Conclusion was mHealth applications seem to facilitate weight management across a wide range of measured outcomes. There is sufficient consensus across studies that mHealth apps are acceptable by patients and effective in producing weight loss through lifestyle changes in eating behaviors and physical activity patterns.
13	Frank DeRuyter et al (2018)	This report aims to summarize data from a national	Survey method	Fitness Diet Lifestyle	The survey research data presented here indicate that people

		survey on the experiences, needs and potential solutions for mHealth technology by people with physical, cognitive, sensory and emotional disabilities.		others	with disabilities have substantial unmet needs for mHealth apps and related technology. overall, few respondents reported moderate-to-high levels of satisfaction with their existing mHealth apps, and even fewer reported that finding effective mHealth apps was easy or very easy.
14	Benjamin De Ridder et al (2018)	The objective of this meta-analysis was to evaluate the available evidence on the use of smartphone apps to measure heart rate by performing PPG in comparison with a validated method.	Meta-Analysis	Critical Appraisal Skills Programme (CASP) Diagnostic Test Study checklist	Smartphone apps measuring heart rate by performing PPG appear to agree with a validated method in an adult population during resting sinus rhythm. In a pediatric population
15	Ryan Nussbaum et al (2018)	To conduct systematic review to better define how medical mobile applications (apps) have been used in environments relevant to physical medicine and rehabilitation.	Systematic Review	Not applicable	Apps were shown to have good psychometric properties when being used to replace some paper-based data collection tools and to measure some physical activity or gait parameters. When used as an intervention, they had positive effects on some medical and functional outcomes.
16	Dror Ben-Zeev et al	mHealth approaches that	Randomized Controlled Trial	smartphone-delivered	Both interventions produced significant

	(2018)	use mobile phones to deliver interventions can help improve access to care for people with serious mental illness. The goal was to evaluate how mHealth performs against more traditional treatment.		intervention (FOCUS) versus a clinic-based group intervention (Wellness Recovery Action Plan [WRAP])	gains among clients with serious and persistent mental illnesses who were mostly from racial minority groups.
17	M.T. Sánchez Rodríguez et al (2016)	The aim of this study was to conduct a systematic review of published information on apps directed at the field of neurorehabilitation, in order to classify them and describe their main characteristics.	Systematic Review	'healthy lifestyle', 'information', 'assessment', 'treatment', 'specific	The evidence suggests that for some neurological diseases, certain apps are effective and reliable when used as complementary treatment alongside rehabilitation, especially those apps designed to promote a healthy lifestyle, retrain balance, assess disorders, and let patients and their therapists communicate in real time.
18	Jorunn L. Helbostad et al (2016)	This paper reviews the literature on mobile technology, in particular wearable technology, such as smartphones, smartwatches, and wristbands, presenting new ideas on how this	Review of literature	of Daily physical activities	Thus they concluded that by mobile technology by wearable increases the active lifestyle and it may be useful for the further usage in the active healthy lifestyle. Further need is there for the old population for the usage of such

		<p>technology can be used to encourage an active lifestyle, and discusses the way forward in order further to advance development and practice in the field of mobile technology for active, healthy ageing.</p>			<p>technology.</p>
19	Osama Salameh (2012)	The system is designed to be a long term health companion for the patients with diabetes.	Survey based	SMS based analysis	The system is very useful for long term type 1 diabetes self management where the patient feel connected to their physicians at all times which increases the sense of security

