MOBILE HEALTH APPS FOR PERSONAL HEALTHCARE: CHALLENGES AND PROSPECTS IN NIGERIA

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ABSTRACT
This paper discusses mobile health apps for personal healthcare in modern healthcare practices and the beginning of mHealth technology use in the health care industry in an unhurried process but it is capable of revolutionizing health care, particularly in developing countries which Nigeria is inclusive, the types of mhealth apps, certain factors to be considered when using mhealth app, barriers to m-health apps implementation, challenges of m-health apps use, it goes on to discuss the evaluation of m-health apps and prospects of m-health, as well as the conclusion.

Key Words: Mobile health apps, types of mhealth apps, factors to be considered when using mhealth app and challenges of m-health apps use

INTRODUCTION
Mobile health apps in modern healthcare practices vary according to the speck ease of use capacity, geographic conditions, communication network availability, practice settings, regulation and resource on board. Advancements in technology have played a major role in enabling individual person/patient to acquire, develop and mould their personal skills to interact freely at will with their healthcare providers/professionals at any point in time from different locations in order to get safe and effective patient-centred care. For an individual person to keep up with the progress and support of technology, he/she requires skills to evaluate the pros and cons as well as the value of different mHealth apps options with proper advice from an expert/healthcare professional before putting them to use (USAID, 2017). VanAnh and Lola, (2019) states that in a recent classification of mHealth apps, six main reasons were defined for using these apps: consulting medical information and references, communicating and/or sharing information, fulfilling a contextual need, obtaining educational tools, managing health professionals’ activities, and facilitating health-related management of patients. And that the beginning of mHealth technology use in the health care industry was an unhurried process but it is capable of revolutionizing health care, particularly in developing countries which Nigeria is inclusive (Goel, Bhatnagar, Sharma & Singh, 2013). However, health care apps seem to be frequently underused after being downloaded (Becker, Mironshatz, Schumacher, Krocza, Diamantidis & Albrecht, 2014). It is certain that some of the cardinal solutions to these challenges are proper awareness and involvement of stakeholders (patients, patients’ relatives, healthcare providers at different levels of both private and public, policy makers and NGOs) in the implementation of mobile health in our health care system.
TYPES OF mHEALTH APPS

mHealth apps are of different types that are available in use worldwide and appear in different devices across a large continuum. These mHealth devices are mobile applications pre-loaded with information available at the touch of a fingertip. While others require additional devices to be “clipped” or “fitted” onto the mobile phone to become a diagnostic instrument. A lot of commercially available mHealth apps developed by manufacturers and other stakeholders for personal healthcare use and clinical care services can also be found in some developing countries of Africa. There are currently many mobile apps that aid healthcare providers and individual person in enhancing healthcare services which include medicines management apps, Electronic Health Records apps (EHR), Reference apps and diagnostic or practical apps in supporting day-to-day practices. Such apps provide medical advices and link individual patient to General Practitioner(s)/personal healthcare provider. Reference apps are used by healthcare providers to provide quick and accurate evidence-based medical information which are updated regularly. Diagnostic apps allow healthcare providers to provide information to patient and other healthcare providers for collective decision about critical care and as well gather data from their patients about their health and to formulate differential diagnoses in providing self-care solutions to individual or group of individuals. Diagnostic or Practical apps also provide logistical support to healthcare providers. EHR apps enhance patient’s records linkage and interoperability among community of practice in improving quality of care while medicines management apps reduce cost in workflow management and enhance effective, efficient and prompt streamline communication between patients, caregivers and healthcare providers for proper management of patient’s health conditions 24hrs round the clock.

Mobile healthcare apps usages are making good remarks on the way small practices are delivering care by unfettering that care from a particular location or time without hindrances. This is to say that, remote distance is no longer a barrier or an excuse for not rendering services or receiving health care provision from healthcare providers. The inability of healthcare providers to provide urgent patient care during emergencies or unable to track the patients’ health information as to facilitate healthcare provisions from any location at any time shows him/her of being obsolete in experiences of mHealth apps usage. So health care providers being able to complete tasks on-the-go and having access to real-time information has become a necessity in healthcare practices this day. Therefore, deploying software that integrates mobile technology like mobile patient portal or mobile electronic health records (EHR) app can bring the practice up to pace. Beaton (2019) identifies top 10 healthcare mobile apps which are: 1. AirStrip, 2. iTriage, 3. CareAware Connect, 4. MyChart Mobile, 5. Marbella, 6. Ambulatory EHR, 7. PatientKeeper, 8. PatientTouch, 9. Spok Mobile, 10. DSS Inc.

AirStrip: This offers a mobile and interoperable platform which permits care coordination between multiple devices along with multiple care settings. Data from an electronic health records and health information exchanges, medical devices, and other monitoring solutions can be accessed between smartphones, tablets, and computers from hospitals, post-acute care centers, and community-based care organizations. With the AirStrip platform healthcare providers can compact all these data into one platform that can be accessed via telemedicine as well as integrating them with other vendor systems.

ITriage: This app enables patients to directly find information on their health conditions and gives them step-by-step guidance on how to treat conditions in the most effective possible manner. iTriage gives patient directions on whether their conditions require a visit to the emergency room and turn-by-turn navigation to the appropriate provider including a map of facilities in their Innovation Health insurance network. The app also permits patients to review previous claims and securely store health information.

CareAware Connect: This app offers providers a mobile solution to complete workflows and manage clinical communications on a single device. Multiple teams (from care teams to ancillary staff) can collaborate and communicate for the purpose of improving care coordination. Users can also view patient data from a list that includes vital measurements, allergies and orders on medication and care services. CareAware can be used with bar codes to manage medication administration and similar tools to associate patients in a mobile directory.
DSS Inc.: This Company produce app that gives providers a suite of EHR-based mobile features that boost care coordination and patient care, safety and provides interoperable workflows aimed at reducing administrative costs and inefficiencies. DSS provides both clinical and administrative tools to facilitate emergency room and home health mobile care management including automatic billing systems and scheduling tools.

MyChart Mobile: It allows a patient to confirm appointments from healthcare providers, pay their healthcare bills to the appropriate authority and enables individual to upload patient-generated data like fitness metrics from a wearable health device. Through the app, patients can directly message their providers and confirm/schedule appointments. The app can download either from the App Store or Google Play. This gives patient quick access to health data from previous in-office visits to providers. Viewable data from the app use includes test results, immunizations, medication, and health conditions indicated by a provider.

Marbella: The Marbella app platform enables providers, nurses, and other caregivers within a health system to use their smartphone in managing patient rounding. Marbella can be used to specify patient data collection outside of general rounding including safety and quality audits. The app integrates with other vendor systems and offers users real-time alerts and tracking to mitigate manual follow-ups. Marbella can be used in clinics, hospitals, and waiting rooms on any mobile device.

Ambulatory EHR: The Ambulatory EHR allows providers to access complete web charts concerning patient conditions, thereby giving them instant access to patient records across healthcare organizations on a single mobile device. Providers can tap on a patient’s record to view test results and order prescriptions, schedule appointments and procedures, and furthermore link the records to ascertain the progressiveness of patient’s health conditions.

PatientKeeper: The mobile app edition of the PatientKeeper Computerized Patient Order Entry (CPOE) system allows healthcare providers to order for laboratory investigations, radiology, medications and similar services for their patients across all hospital departments. Catalogues for procedures and medications are kept in the mobile CPOE so that providers are not required to rebuild lists for new patients. In hospitals, PatientKeeper acts as an alternative to telephone orders that may cause organizational inefficiencies and allows providers to keep track of allergies, test results, patient vitals and related health data for proper care management procedures.

PatientTouch: This app is a provider to executive facing mobile app that connects clinical communication with enterprise management. Healthcare providers use the app to connect departments and other parts of the healthcare continuum together. Care teams use the app to connect clinical workflows and clinical communication along with coordinated care under an umbrella to improve healthcare efficiency in the organization. PatientTouch usually comes with enterprise software that centralizes the assignments of all users and their roles and groups in a health system including an analytics dashboard that tracks user adoption, aggregated data, and high-risk patient populations.

Spok Mobile: The Spok mobile app gives providers a unified place to coordinate clinical care and improve clinical communication. Spok updates providers with “delivered/read” messaging from several different devices. Healthcare providers can also organize messaging by priority, and securely message members of the care team. Other features of the Spok app include integration with current EHR systems, provider preferences for certain procedures or care responsibilities, and hospital-wide scheduling. Healthcare providers can access the app from their preferred devices like smartphones or watches.

According to Kumar, R. (2018), the following are typical examples of mHealth apps and ways which they can be use for personal health care/patient care improvement.
1. **PrognoCIS patient portal mobile app adapted from Kumar, R. (2018)**

With PrognoCIS patient portal mobile app, the individual/patient will be able to exercise the below functions instantly from anywhere at any time with ease: (1.) will easily connect with the practice and healthcare providers using smartphones to schedule appointments and even in any emergency case that occur. (2.) Will track medications they are supposed to be taken including setting up of reminder notifications to make sure that the patients do not miss their medications and follow-up advices. (3) Will have access to medical resources and other health-related educational information provided by the healthcare practitioners from any location and at any time via mobile device at ones’ convenient. The patient portal mobile apps empower patients/persons to take more responsibility regarding their individual personal health and enhance engagement of health and allied health professionals notably when they are in need.
2. **kareo mobile EHR app adapted from Kumar, R. (2018)**

Using Kareo mobile EHR app for charting has numerous advantages which include: (a) it proffer one searchable access to full patient/personal health histories. With charting competences, a single touch of any of the fingers does the work exceedingly perfect. (b) Individual person can hold numerous chart templates in ones’ pocket and practice medicine from any location at any time without hindrances if the network clement. (c) individuals/patients will enjoy lower waiting times since physicians can easily access their documents and charts with the patient(s) through mobile EHR apps. This reduces stress, cost and enable patients to plan well along with other of her/his engagements. (d) mHealth patient charts are give-and-take approach in the sense that, patients enjoy improved healthcare providers’ commitment and the practice enjoys higher rates of patient retention. In addition, if patients are well taking care of and they are satisfied with the quality of care they got, there is the tendency that, they will keep fate in the institution and healthcare providers and as well propagate the good will message of the services provided to others in need who will in turn make the facility as their continuous healthcare visit center.

Most health/medical practitioners require actual image of patient’s problem area or injury marks for proper, counselling, diagnosis and therapy, a mobile EHR app with image capturing functionality that can securely take photos at anything from a simple skin rash to a complex injury mark is the right solution for quality care delivery either by healthcare providers to patient(s) or personal healthcare practices by individual.
3. **Office EHR App** adapted from Kumar, R. (2018)

From the above office EHR App, the image capture feature connects the mobile EHR app with the device’s camera and securely uploads the image into the EHR under the patient’s medical history section. The merits one will derive from using this app includes: (i) the healthcare provider will have accurate and lucid visual details about the patient’s problem which outcome will enhance quality of patient and personal health care. (ii) Time and energy will be saved. In as much as many practices depend upon a separate camera to capture images, which thereafter is transferred to the EHR system, capturing images directly to a mobile EHR apps circumvent this process. (iii) Peace of mind for the patient and speed of process for the practice makes implementing a mobile healthcare app vital. With the implementation of this app, lost, misplacement of patient’s case-note/clinical information is often things of the past since patient’s information can be access at anytime at any location by authorized persons.
Kareo EHR Mobile App for e-prescribing process adapted from Kumar, R. (2018)
E-Prescribing via a mobile app allows physicians and other healthcare providers to handle prescription requests quickly as well as helping both patients and practices. More so, healthcare providers can monitor medication adherence by patients more effectively from any location at any time thereby increasing the quality of care and good reputation to care givers and systems involved. E-Prescription permits prescription requests to go directly from a physician’s/CHEW’s or healthcare provider’s mobile device to the concerned pharmacy electronically, and the physician/CHEW/healthcare provider instantly receives an automated confirmation from the pharmacy about the request being received, in so doing keeping all statues up-to-date in real time and asymmetric manner when mobile phone not active due to network inefficiency or when the garget is turn off.

mHealth apps play a great role in service delivery in different health settings functions. These gargets are fit onto smartphones and convert them into a diagnostic instrument. A typical example is that, a clip-on device or garget converts a smartphone camera into an otoscope. As soon as the otoscope gargets are used, patients/individual concern can have a photograph view of their ear canal after they have been examined by the healthcare provider(s). Some of the gargets include wireless blood pressure monitors and pulse oximeters. mHealth apps allow healthcare professionals to provide real-time results to their patients. Through frequent updates and “end-to-end” encryption, mHealth apps will increasingly be safe for handling sensitive personal data which in a manner that is comparable to face-to-face dealings. Global mHealth instruments use...
all of this information to provide healthcare in hard-to-reach areas, suburbs and densely populated areas with inadequate professional manpower. In same vein provide information on personal health care, personal safety, prevention of diseases and disease surveillance and to maintain, sustain the process, every mHealth app/garget developed must be updated regularly to ensure best practice (Kumar, Santosh et al., 2013).

CERTAIN FACTORS TO BE CONSIDERED WHEN USING mHEALTH APP

There are certain factors that should be considered when developing and utilising mHealth apps for patient and personal healthcare in any health setting of the country. These factors could include: proportion of people with a mobile phone in a population in the region and internet accessibility, power supply stability, purposes/functionality, mHealth apps authorship and maintenance, climatic/environmental conditions, data security and literacy level of the people. When the population of people that owns and use mobile devices are few, it makes it difficult for it to be implemented for universal usage for healthcare delivery in the region. Poor network and internet services hinder progressive usage of mHealth apps for care delivery and if rely on it may worsen the healthcare status of the people as well jeopardizes communication links between healthcare providers-patients and healthcare providers-healthcare providers.

Stability of power supply allows the garget’s batteries to be charge frequently for adequate functionality. But, when there is epileptic power supply and the garget battery runs down, it makes the garget not functional thereby hinders the entire e-systems causing harm to patients, healthcare providers and the populace that may need the services. Climatic condition often affects the use of mobile devices especially if the environment factor (winter, summer, solstices and autumn) of the country/geographical location is not taken into consideration during manufacturing devices. Similarly, authorship, maintenance and data security are paramount importance for ease of usage and sustainability of the devices to achieve the goals of the organization. Throughout the stages of development for mHealth apps use in practice, mHealth gargets should be evaluated for benefits to patients, healthcare providers and the institution. mHealth apps developers should focus on developing gargets that can also be used by the world population without internet access or provide alternative source of power supply for 24hrs operation without limitations both in remote distance areas, suburbs and densely consumers cities. More so, the need to identify software and hardware that enforces users’ privacy preferences, protection of the garget contents use and user automation is pivotal.

BARRIERS TO M-HEALTH APPS IMPLEMENTATION

The mHealth apps could be misused or misinterpreted by individual person as he/she being empowered to be more proactive in her/his health care. Therefore, health care providers and other experts in the field of care provision are presented with an immediate opportunity to step in and ensure the appropriate use of mHealth apps for what care it is meant for. These cares includes: preventive care, treatments and personal self-management, informative and educative health indices awareness. mHealth apps also poses a privacy issue because personal health information is available on some mHealth apps in which unauthorized person can use for their selfish gain. Data breaches are of huge concern in countries with lower income earners because mobile phones are often shared between members of the community.

CHALLENGES OF M-HEALTH APPS USE

With the enormous progressiveness mHealth smart devices have made into society and the medical/health field in recent times, researchers and knowledge seekers have begun to evaluate the quality, efficacy, safety and ease of prompt use of these apps. Some of the initial reports of scholars suggested that there were many benefits in using mHealth apps for clinical and personal health practices (Musa, Yoo & Sheets). One of the most infuriating issues that pose the most significant risk to the public is apps that falsely claim to help cure or modify a disease that surfaced in early 2011, when a company created an app meant to cure acne by emitting a blue light from the screen of a smart-phone (Buijink et al, 2013). In 2002, the Institute of Medicine likened the Internet to the “Wild West” stating “it has vast amounts of unregulated territory and no one in charge” (NRC, 2002). In many ways, the growing scenery of mobile health apps and the concerns regarding
the quality of information, corresponding to Wild West mentality. Therefore, adapting and applying the criteria for evaluating internet resources to mobile apps will be essential (Lawis, 2013).

EVALUATION OF M-HEALTH APPS
Mobile medical apps come in a variety of forms and speck with each its own unique purposes. Wherefore, evaluation of mHealth apps do vary based on the specific product in question. For instance, an app designed to provide antibiotic recommendations for the treatment of pneumonia is different from the one designed to measure a patient’s blood glucose levels. With the antibiotic app, one may have interest in evaluating the clinical references used to support treatment recommendations; but in evaluating the blood glucose app, the healthcare provider might be solely interested in evaluating the aspects that relate to operability. On the other hand, most apps can be evaluated based on several common philosophy including their usefulness, accuracy, authority, objectivity, timeliness, functionally, design, security, and value (WHO, 2018).

Even though there is little formal guidance on evaluating mobile apps, in 2012 the mobile health technology division of the Healthcare Information and Management Systems Society (HIMSS, 2012) released their standards for evaluating app usability where they discuss several tenets that health care professionals should consider when selecting and designing mobile apps. mHIMSS recommends that the interface of the app should be simple and easy to learn, with minimal or no training involved. Buttons should be easy to understand and data should be presented in a clean, orderly arrangement. Furthermore, the graphics, layout, and terminology should be consistent and unified across the app.

PROSPECTS OF M-HEALTH
Mobile health apps are internet technology that has come to stall the traditional way of medical treatment in developed and developing nations at this present era. These technologies have a lot of benefits in the administration of medical care in real time and on the go along with its teething challenges too. Although there are problems/challenges that are still affecting its’ implementation and smooth usage, the future of it shows a great potentials as stated in many literatures by different scholars. In line with this, Okoroafor, Chukwuneke, Ifebunandu, Onyeka, Ekwueme and Agwuna (2017) opined that with mobile phone technologies, healthcare providers in hard-to-reach and suburb areas can update and retrieve patients’ records from anywhere within a network coverage and individual persons can use it for their personal healthcare in getting information regarding how they can navigate or manage their health challenges in a better way. It makes patients’ medical records to always be current, accurate and timely accessible. Although it enhances the quality of patient care, the adoption of E-Prescription apps through the purging of redundant paperwork, also facilitates more efficient and effective delivery of patient care at any where (WHO,2015).

In Africa, e-prescription is becoming universal with increasing cost of health care, poor infrastructural development, unreliable power supply, poor road network, and inaccessibility to specialist health centers. Applications and use of phone prescription if well designed will provide accurate billing method and also eliminate the number of prescription errors as well as facilitate real-time access to medical records, thereby decreasing back and front office inefficiencies associated with script writing (Sweeney, 2011 as cited by Okoroafor et al 2017). The applications could be designed to support functionality that automatically alerts the healthcare provider if the medication prescribed will react adversely with other medications (Anita, Maria & Gunvor).

In Nigeria, the National Agency for Food and Drug Administration Control (NAFDAC) has devised a means through which the public is alerted about a fake drug by simply instructing the patient to copy a specified pin number attached to the particular drug and the individual thereafter text the pin number to the NAFDAC drug regulatory center which will confirm whether the drug is fake or genuine. This if done well with regularly awareness advocacies of fake drug alertness will curtail rate of death due to fake drug and adverse drug reactions, prescription errors and other health consumables and process foods. Similarly Ikhu-Omogbe and Azeta (2010) at the Department of Computer and Information Sciences, Covenant University, Ota, Ogun State, Nigeria, suggested the adoption of voice based mobile applications (vbmopa) in health care as a means of getting rid of some of these errors because they allow prescription information
to be captured and heard through voice response rather than in the physician’s handwriting alone. According to them, many of such errors involve the administration of the wrong medication or dosage by caregivers to patients due to indecipherable handwritings, drug interactions, perplexing drug names. This method could be of help to alleviate, stress, negligence, costs and improve life savings in healthcare facilities across the world, most importantly in developing countries where treatment processes are usually cumbersome and in traditional paper-based formats. mHealth apps succinctly holds a lot of prospect to achieving health care delivery with the view that most African countries live in poor setting environment in the presence of high burden of diseases (Bok, S. 1988 in Okoroafor et al, 2017).

CONCLUSION
mHealth apps are relatively new and emerging technologies embedded in smart phones and other devices that are currently being used and increasingly integrated into the everyday lives of many people in different organisations worldwide. mHealth apps provide some appealing possibilities for optimizing health systems, improving care and promoting health, and as well as reducing health disparities. mHealth apps can provide patients with medical and health-related information that are generalized or personalized and even both for: educational purpose, improve patients’ compliance with treatment, help patients or individual manage her/his own health through monitoring of diagnostic activities and improving their knowledge about her/his state of health or illness. These premises help in enhancing personal and clinical health care delivery both in developing and developed nations.

Recommendation
1. The users should be able to control access to their personal health information (PHI) at any moment.
2. Users should be able to define when and under what conditions the app will be used (WHEN): many of patients have basic handsets that can accommodate only voice and SMS text messaging, our option was to provide this first mHealth interaction during clinical consultation, using the physician’s mobile device.
3. An mHealth app help patients or their relatives, health care professionals, or even to healthy people looking for disease prevention.

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