Evaluation of Mobile Health Technology in Healthcare Sector

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ABSTRACT: The innovative application of modern smartphone and wearable health applications and sensor technology (mHealth) has the ability to reduce health care expenses and in other respects enhance well-being. These apps are being developed in a number of areas, but there is a need for comprehensive research to investigate the possibilities and complexities of utilizing mobile devices to enhance health outcomes. Currently data for mHealth's efficacy is scarce. While such innovations can be enticing and apparently innocuous, work is required to determine what, when, and for whom successful mHealth tools, applications, and systems are. This paper demonstrates mHealth Technologies in the following categories: assessment of interventions; assessment of evaluations; and reshaping the collection of proof utilizing mHealth. To describe an approach to the production of evidence in the mHealth domain that will ensure work is carried out on a robust methodological and theoretical basis. This paper draws together these principles to explain existing expectations of assessment, address potential prospects, and set an ambitious target for the developing area of mHealth science.

KEYWORDS: Innovative Technologies, Mobile Health Technology, mHealth Service, mHealth Evaluation.

INTRODUCTION

Mobile health (mHealth) technologies assists in monitoring the health of an individual continuously, promote healthy behaviours to decrease the health problems and prevent from various diseases, improve the knowledge of the provider, support chronic disease self-management, decrease health care visits, and provide localized, customized, and on-demand interventions in unimagined ways. Mobile technology can be described as wireless devices and sensors (which include mobile phones) which are meant to be transported, carried, or accessed by person throughout regular activities which are carried out daily [1].

As illustrated in Fig 1, mHealth is the usage of users or organizations of such devices to track the health condition or improve health quality, including help for online treatment and clinical decision taking. Applications for mHealth are being designed and tested in a number of areas, including obesity, diabetes, hypertension, smoking reduction, stress control and treatment of depression. However, it is still undetermined whether mHealth results in improving overall health outcomes and reducing the burden of disease. Latest reports notice that health initiatives focused on short messaging service (SMS) have not been properly checked for efficacy.

There is a need for comprehensive research which explores the potential and difficulties of utilizing mobile technologies to enhance health outcomes. mHealth apps, devices, and systems might be inefficient or, at worst, have adverse effects on health quality or cost outcomes. In a healthcare environment already burdened with sub-optimal results and unsustainable expenses, rapid implementation of untested mHealth technology will distract from what is required for real public health change, rather than contributing to it [2].

Evaluating Assessment:

Mobile Health innovations are promoting modern ways of gathering biological, behavioural, or environmental evidence and the effects of treatments. Which involve sensors that track anomalies with greater precision, increased sampling frequency, less lost details, greater simplicity and, in certain situations, lower cost than conventional interventions. Sensor data and self-reporting algorithms provide for inferences regarding social, physiological, emotional and environmental factors, like mobile sensor module for psychological tension or smoking [3].

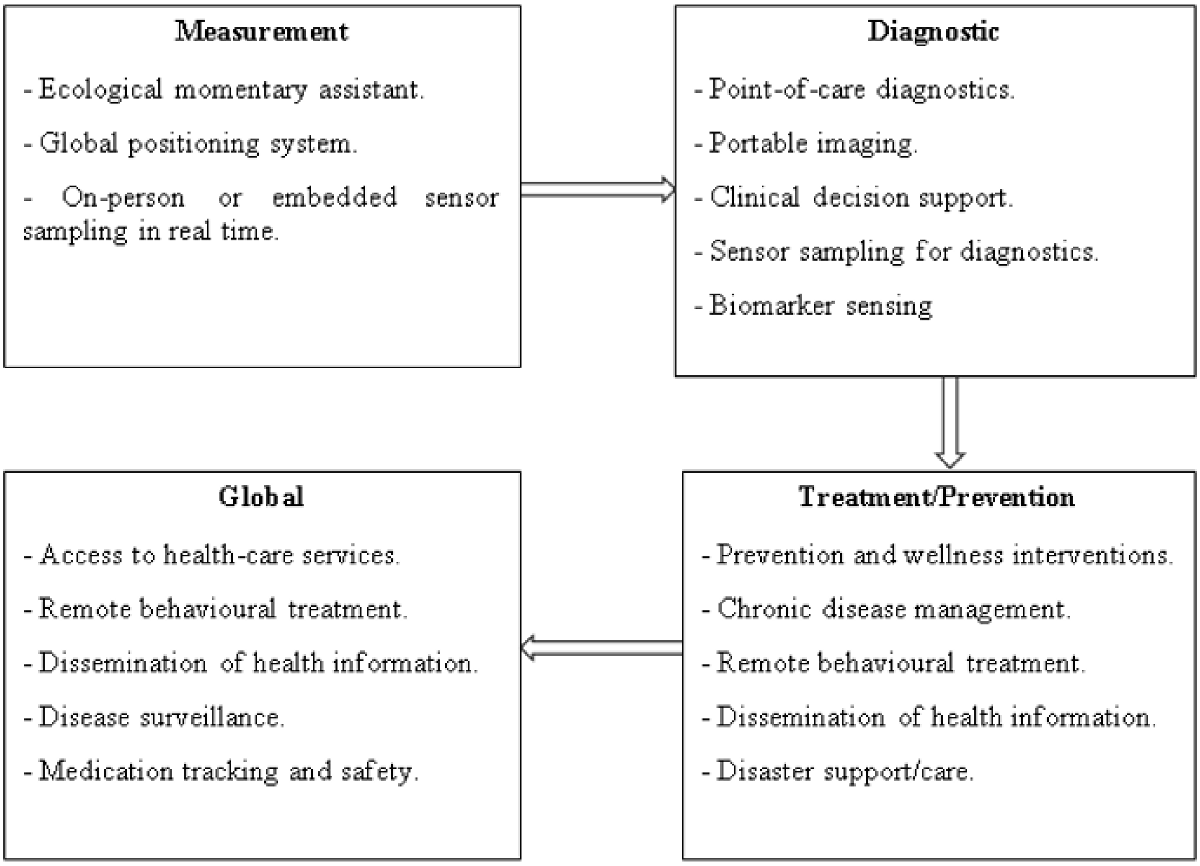

Fig 1: Continuum of mHealth Tools

Validity and Reliability:

As for any test, their reliability and relevance have to be identified before mHealth evaluation measures can be suggested. Table 1 illustrates the priorities and obstacles of achieving validity and reliability in mHealth evaluations, not least of which is the increasing advancement of system technology which that influence the accuracy of the data they generate and therefore influence their validity and reliability. The very essence of reliability testing in free-living samples-through topics, daytimes, or weekdays-questions the accuracy of reliability assessments obtained from experiments in regulated laboratory environments. Research Work is required to further understand the impact of the variation on time-consuming data collection in real-world settings. mHealth tools are sometimes used for individuals with limited experience, or in conditions where security and ease are of utmost importance. Placement of Wearable device may need to be negotiable as it may impact the accuracy of the results. New methods are required to establish reliability that address considerations such as the effect of adjustments in location and data collection models that may not provide the same pure information flows that might be gathered in the laboratory (e.g., use a cell phone microphone to measure sound) [3].

Establishing authenticity typically includes gold benchmarks being in effect that evaluate the same or identical structures. mHealth also allows us to apply common measures across the community and around the world, ensuring that there may not be one gold standard in a particular building. For e.g., in an elderly person walking does not have the same data signature as in an infant. The gold standard for walking would also have to be focused on calculations that take into account variation within the environment and the community [4].

Table 1: Reliability and Validity in mHealth

	Compose	mHealth Challenge	Examples
Reliability - Reliability alludes to a measure of consistency. A test is considered to be highly accurate, if stable findings are obtained under standardized conditions.			
Inter-method reliability	The degree of consensus among the different methods of evaluation.	No challenges identified and can be very suitable for mH ealth.	2 kinds of accelerometers worn at the same wrist.
Test–retest	The degree of accuracy of the evaluation principles as replicated.	Can be a task when collecting temporal variation is the target.	Self-reported mood gathered daily through momentary ecological assessment.
Validity - The degree to which an appraisal tests what it seeks to test is known as validity.			
Divergent validity	To what extent the new measure deviates from measurements of other phenomena	It noted no challenges.	Wireless measurements aren't height related.
Concurrent validity	On what point the current test varies from previous hypothesis tests.	It noted no challenges.	Wireless measurements aren't height related.
Predictive validity	How effectively the test will forecast a potential result.	No defined problems and extensive data collection will boost predictive efficiency.	Mobile electrocardiogram suspected Myocardial infarction.

Requirements for justification for new health care treatments are well defined. Experiments are carried out to determine the feasibility and efficacy of experimental therapies and preventive programs. The RCT has traditionally been the scientific gold standard for studies done to assess the efficacy of health treatments. RCTs, though, have a long time lag (i.e., on average 5.4 years) from the start of subject recruitment to the release of the test. Additionally, RCTs face potential difficulties due to expense, randomization of care assignment and/or the degree of commitment needed for treatment. This time period is important in mHealth, as the equipment will be obsolete before the trial is done [5].

In certain situations, the constantly changing complexity of all mHealth systems and their adoption in community and healthcare environments may imply that certain components of mHealth approaches that continue to evolve continually through a study. This disparity will cause developers to switch rapidly from pilot to deployment or altogether miss outcome tests to prevent a full-scale RCT, risking awareness of mHealth's long-term importance. Recent progress in mHealth, and the data "revolution" it ultimately reflects, implies that the technologies of mHealth may improve the shortcomings, strengths, and viability of current testing methods and could even enable fresh, more effective prototypes to be created [6].

To fix the above-noted issue of mHealth innovations being redundant before they are thoroughly evaluated, researchers may need to periodically have updates. However, this goes contrary to science standards, where modifications to an experiment challenge intrinsic legitimacy during a research trial. "Continuous evaluation of emerging interventions" (CEEI) was suggested as one tool for evaluating emerging therapies in mHealth to tackle this issue. In CEEI, along with the previous release dramatically new versions are introduced, with users randomized to usable models. The more effective variant is maintained, depending on a priorities of criterion [7].

While the CEEI allows for a fine-grained degree of inference and testing on particular implementation elements, the conventional RCT will also be extended to mHealth interventions whether the degree of inference is focused on a set of comprehensive intervention features or functions, the distribution of which would automatically respond to shifting technical environments and expectations over time and in various circumstances during di Integrating assessment and intervention approaches in mHealth also has the ability to render continuing and continuous assessment practical and cost-effective, as well as enhancing architecture.

mHealth Model-based Designs:

One hope for mobile devices is the ability to use them for real-time tailoring and customizing interventions. This will contribute to innovative strategies that reduce duplication, improve commitment and raise an intervention's potency. However, to do this, a better understanding of the variations within the context and the impact of the potential moderating variables on outcomes will be needed. Statistical methods are therefore needed which better specify effects between and within subjects. For example, understanding whether mood changes are related to health habits like eating, drinking, or exercise can be crucial to tailoring and personalizing treatments [8].

Latest advances in medical science have started to tackle tailoring and design of treatments. During a screening process, successful elements of an intervention are defined in the "Multiphase Optimization Strategy" (MOST) by either factorial or fractional factor analysis of the variance architecture. Then, these successful components may be tested in a randomized confirmatory analysis. "Sequential Multiple Assignment Randomized Trial" (SMART) can be used to refining the intervention in cases where participants are randomly allocated over time to different intervention choices [9].

Reshaping Generation of Evidence by mHealth:

This newly emerged technology of mHealth often have new potential for evaluating the efficacy of both conventional and mHealth approaches while growing the time and energy needed. In conjunction with the mathematical advancements, like simulation and machine learning, some of these (described below) would allow for improvements in effectiveness and measurement pace. These advantages represent fundamental science questions which distinguish mHealth from conventional approaches [10].

Mobile Health technologies has the capability of offering the data at very large sampling rates (e.g. 20–600 times per second) to promote the quantification of any type of phenomena (e.g. physical activity), which was initially not understood clearly due to limited and intermittent measurement. The large density of data in combination with the evaluation of the time series will improve any experimental design's discriminative capacity. High-density data could also promote the development of subtle patterns or "fingerprints" that could better explain the impacts of its involvement or treatment at very short intervals than previous methods. High density of data includes methods of storing data which are not widely utilized in health science. The methods of Machine-learning which make classification decisions based on data characteristics could be applied to data segments to make judgements about individuals like form of stress level, physical activity, or pain severity. For both measurement and action purposes, providing reliable metrics for high-frequency data obtained in mHealth applications is key [11].

Electronic Health Records:

Using the computers, the “Electronic Health Records” (EHRs) were only linked to the hospitals they operated, enabling staff of the hospital to view medical information. But the introduction of mHealth has redefined the limits of the EHR; today, health professionals may record the services they deliver online and send check reports to mHealth applications to verify medical records from the field. Remote health workers at the point of treatment (for example, in remote clinics or at the home of the patient) may connect and add to history of health data, thereby providing for quality of care that was already unavailable in non-hospital settings [12].

Server-side algorithms to detect treatment deficiencies or patterns in main metrics, like weight loss or changes in blood glucose, move the onerous task of pattern recognition and produce leads to action away from human reviewers. Open MRS, a common mHealth-improved EHR, enables health workers on front line to view details from a patient's health report via a mobile device and add information to the health record-for example, on field-based TB care. Other systems, like Child Count or Rapid SMS, may not be connected to a clinical file but may still retain longitudinal client history, like records of child growth, documentation of antenatal care, and child growth [13].

Ensuring the commitment of caregivers to standards is a critical obstacle for the application of complicated care guidance. More particularly, shifting tasks from physicians to frontline health staff, such as screening duties, frequently entails applying practices designed for healthcare employees to cadres with insufficient academic preparation. mHealth programs integrating point-of - care decision support systems with automatic algorithms or rule-based guidance help to maintain continuity of treatment in these task-shifting situations by reminding health workers at the front line to obey established guidelines [14].

Electronic decision analysis tools are utilized to prioritize and recognize health care clients with the high risks, targeting intercessions in resource-limited settings. For example, e-IMCI (Electronic-Integrated Childhood Illness Management) offers cell phone, step-by-step assistance to community health professionals for triage and care of children according to WHO guidelines for the diagnosis and treatment of certain childhood diseases. In addition to this, many other groups are developing the checklists accessed with the help of the mobile device to help minimize clinical errors or at the moment of service delivery to ensure the health-care quality.

Provider-to-Provider Communication:

Voice contact - one of cell phone's easiest technological capabilities - is one of the most disruptive technologies in a mHealth program bundle that allows clinicians to connect with each other or through professional competence hierarchies. Once a key feature of tele - health strategies, mobile phone provider-to - provider communication could be used to assist healthcare and provide advisory services to health care personnel, whenever and wherever it is needed. Current instances of provider-to - provider connectivity include the development by the NGO Switchboard of "Closed User Group" networks, in which representatives of each cell phone party can connect with each other at extremely reduced rates, or free of charge. A mHealth input system between remote hospitals and diagnostic laboratories decreases the processing time between HIV diagnosis and recording of tests to promote timely treatment and comparison [15].

Besides through testing productivity by architecture and technical capability, mHealth technology will boost science efficiencies by developing flexible systems for exchanging knowledge and standardizing and organizing data collection. The digital architecture, focused on the Internet environment, determines that comprehensive interfaces between the software and hardware components in the digital mHealth program will be unified and decided upon by co-operation between stakeholders. A transparent approach to mHealth also states that frameworks will be published and rendered freely available.

mHealth Security:

There are some questions regarding confidentiality, privacy, and protection of mHealth services as such details may disclose extremely specific information such as social connections, place, mood, and other potentially sensitive health conditions. In the past two decades, there has been a social shift of embracing the gathering of personal data for the general benefit, like the utilization of community-wide video monitoring for public safety purposes. Nonetheless, the science group in mHealth is now forced to establish strategies that protect the confidentiality and privacy of the researchers when fulfilling study needs. Recent research indicates that this may be achieved utilizing privacy-conserving procedures that tackle data security, reliability, and honesty, as well as unlinking several data transmissions. This final component – unlinking is important as the failure of one data point / transmission is always not sufficient to establish inferences that can undermine the identity of an entity, but several intervention. This is particularly in the case of inclusion of location data [13].

Unlinking includes a special key that scrambles every data packet's linking attributes, to which only the sender and recipient have access again. For study groups with the highest healthcare needs, like elderly people and low income or vulnerable communities, these concerns could be especially important. mHealth also poses challenges to the privacy of those not enrolled in the research. Examples of this problem involve utilizing cell cameras or microphones to capture details, but often picking up non-participant sounds and pictures. Similar to the concerns posed at the level of the researchers, approaches are required to resolve these problems, not just at the research design stage, but also by the use of methods that can derive knowledge from raw data that abstracts the details while maintaining privacy [16].

CONCLUSION

The technologies embodied in mHealth represent a modern model for the production of data in health science, offering, maybe more than every recent surge of advances in clinical technology, to further minimize the period from development of treatments to implementation. To do that, the several analytical issues described above would need fixing. While these technical problems pose fascinating new possibilities for scientific progress, there is little requirement of science validity on the industry and customers. This paper promoted the need for prompt and expanded efforts in mHealth studies and for a modern trans-disciplinary academic field that encompasses medicine, architecture, public health, psychology, social science, and computing. mHealth can promote the recruiting of remote testing and eventually rising the duration and therefore the pressure of face-to - face interactions. mHealth's versatility allows for study to take place at the house, office, and culture of a patient, rather than on visits to an institutional testing centre. Besides minimizing travel, mHealth often has the ability to reduce the strain by growing the necessary self-report, which can be improved and often supplemented by non-invasive sensing. Finally, it is feasible to quickly scale other mHealth devices.

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