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International Journal of Advance Research in Medical Science 2025; 1(1):1-6

(Review Article)

Mobile Application in Medical Science: An Overview

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Received: 01/01/2025/ Revised: 10/01/2025 / Accepted: 15-01-2025
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Conflict of interest: Nil

Abstract

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. The surge in demand for digital medical solutions has been accelerated by the need for new diagnostic and therapeutic methods in the current coronavirus disease 2019 pandemic. This also applies to clinical practice in gastroenterology, which has, in many respects, undergone a recent digital transformation with numerous consequences that will impact patients and health care professionals in the near future. MHAs and MAs are considered to have great potential, especially for chronic diseases, as they can support the self-management of patients in many ways. Despite the great potential associated with the application of MHAs and MAs in gastroenterology and health care in general, there are numerous challenges to be met in the future, including both the ethical and legal aspects of applying this technology. 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.

Keywords: Mobile health, Health applications, Medical applications, Technology, Telemedicine, Mobile applications, Smartphone, eHealth, mHealth, Digital biomarker, Electronic health records

INTRODUCTION

The first smartphone, Apple's iPhone, was introduced in 2007, only 13 years ago. Since then, the widespread adoption of smartphones and digital innovations, such as tablets, wearables, smartwatches and other devices, has tremendously changed everyday life and consumer behaviour in many ways. The introduction of modern information and communication technologies (ICT) has been one of the most disruptive technological innovations in recent decades. The ubiquitous availability of smartphones, wearables and tablet computers and the widespread internet connectivity have led to a significant change in human-technology interaction. At the same time, the exponential development of computer performance and storage capacities, cloud computing and the application and improvement of artificial intelligence (AI) methods have opened new possibilities for the design of ICT. 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. This also applies to clinical practice in gastroenterology, which has, in many respects, recently undergone a digital transformation that will have numerous consequences for patients and health care professionals in the near future. The functionalities and intentions of MHAs and MAs use in gastroenterology are extremely diverse. They range from electronic health record (EHR) and workflow management systems to specific mobile apps for the management of chronic or acute pain or the management of specific diseases in specific settings. MHAs and MAs are considered to have great potential, especially for chronic diseases, as they can support the self-management of patients in many ways. Let's delve into the fascinating world of mobile applications in medical science. These apps play a pivotal role in healthcare, aiding both professionals and students. Here are some key insights:

Mobile Applications in Medical Education:

•A systematic review and meta-analysis evaluated the effectiveness of smartphone applications in improving academic performance and clinical practice among healthcare professionals and students.
•The study included 52 research articles with a total of 4057 learner participants.
•Findings revealed that mobile applications were effective tools in enhancing both knowledge and skills.
•These apps facilitate online and offline learning, offer simulation, and provide flexible learning features [1].

Areas of Impact:

Evidence-Based Medicine: Medical applications make smartphones useful tools for evidence-based medicine at the point of care.
Patient Education: Smartphones play a crucial role in educating patients and promoting disease self-management.

Remote Monitoring: Mobile apps enable remote monitoring of patients, enhancing healthcare delivery [2].

Regulatory Considerations:

Some mobile medical apps are classified as medical devices by regulatory bodies.
These apps incorporate device software functionality that meets the definition of a medical device.
Regulatory guidelines ensure safety, efficacy, and proper usage of such apps.

Mobile Health Applications (mHealth):

•mHealth refers to medical and public health practices supported by mobile devices such as smartphones, patient monitors, and personal digital assistants.
•These apps play a crucial role in patient education, disease self-management, and remote monitoring of patients.
•Digital technologies have become integral to the health sector, transforming how healthcare services are delivered.

Types of Mobile Application in Medical Science

1. Medical Education Apps:
•These apps are designed for healthcare professionals, students, and interns.
•They enhance knowledge and skills through features like online and offline learning, simulation, and flexible learning.
•Notable examples include apps for drug information, guidelines, health parameter calculators, and disease diagnosis1.
2. Clinical Decision Support Apps:
•These assist healthcare professionals in making evidence-based decisions at the point of care.
•They provide quick access to clinical guidelines, drug databases, and diagnostic tools.
3. Patient Education Apps:
•Aimed at educating patients about their conditions, medications, and self-management.
•Features include symptom tracking, medication reminders, and wellness tips.
4. Telemedicine Applications:
•Enable remote consultations with healthcare providers.
•Facilitate video calls, chat, and virtual visits.
5. Wellness and Fitness Apps:
•Promote healthy lifestyles through exercise, nutrition, and mental well-being.
•Useful for both patients and healthcare professionals.
6. Remote Monitoring Apps:
••Vital for managing chronic conditions and post-operative care.

Digital Biomarkers

Biological markers quantify observations that refer to an interaction between a biological system and a potential hazard. Valuable biomarkers are objectively measured and change in response to changes in therapy or condition. Pulse, blood pressure and blood test outcomes are examples of objective and quantifiable biomarkers. The association between biomarkers and relevant clinical endpoints is used for research and treatment decisions. In recent years, digital biomarkers have been described and measured. Digital biomarkers are defined as characteristic quantifiable measurements made by means of digital devices. They are objectively measured and evaluated as an indicator of normal or pathologic biological processes or biological responses to a therapeutic intervention. There are various sources from which digital biomarkers can be collected, including body sensors, image processing, health platforms and EMR as well as smartphones, wearables or other digital devices. Digital biomarkers are increasingly important sources of data in health care. Related to the field of neurodegenerative diseases, Kourtis et al pointed out different reasons why digital biomarkers collected from mobile devices and wearables present a unique opportunity for collecting data. There is widespread usage of these technologies in society and immediate access to information due to our inherent connectivity. Moreover, the sensitivity and plurality of on board sensors is increasing, and such mobile devices are uniquely equipped with sensors; thus, the burden on the health care system is low because large segments of the population are already using such devices. From these devices, a broad range of different data can be collected actively or passively. Biomarkers measured via smartphones can be movements and geo positioning, speech and language or sleep patterns. A systematic survey of apps listed in international curated health app libraries focused on mobile health apps using built-in smartphone sensors for diagnosis and treatment. After excluding 762 apps according to the applied inclusion and exclusion criteria, 18 apps remained. One-fourth of those apps were aligned with the diagnosis of health conditions. One half was exclusively treatment oriented. Thirty-nine percent of the apps used the camera as a mobile phone sensor. Thirty-three percent of them used the touch screen. In the identified apps, microphones, mobile phone speakers and accelerometers were used more rarely. None of the included apps used GPS.

Quality of Apps

The main challenge regarding smartphone health apps is the disparity between their proclaimed benefits and their objectively proven and evidence-based benefits. This is a challenge for apps in all fields of health care. The limited evidence demonstrating the quality of apps has been a research topic for apps in mental health self-management of asthma, self-management of diabetes management of postoperative pain and sleep management. A systematic review conducted by Vilardaga et al on smartphone applications to support smoking cessation suggested that the majority of the studies in

this field have been performed in early stages of app development, such as user-centred design studies, and the vast majority of the apps use only a limited number of theoretical mechanisms of intervention delivery. Furthermore, the study revealed that the vast majority of apps were not tested in well-designed randomized controlled trials, which leads to only limited evidence regarding possible benefit. In another review, Alessa et al aimed to describe and assess apps in to support the management of hypertension available in different app stores. The authors included 186 apps in their analysis and identified that only a small number of the included apps were likely to be effective. This is because most of the included apps were missing an underlying theoretical foundation in behavioural theories or even basic strategies relating to self-management interventions. The one major single function of most of the apps was to provide educational information, and just a few apps included comprehensive functionalities, which are probably more effective than just a single functionality. Related to the field of gastroenterology, a systematic assessment of apps for the self-management of IBD identified similar problems. From the 238 identified apps in the major app stores, the investigators included twenty-six apps in the final analysis of the app content. A major result was that the overwhelming majority of the apps for IBD suffered from a lack of involvement of medical and health professionals and had only limited coverage of international consensus guidelines for IBD. Currently, there are no generally accepted criteria for the qualitative evaluation of apps. In a systematic review to identify and summarize criteria for the assessment of the quality of apps, the authors reported large heterogeneity of different criteria for evaluating the quality of an app. They identified thirty-eight classes of assessment criteria for the quality of health-related apps. Later, they were able to aggregate these thirty-eight criteria into seven main categories with thirty-seven subclasses. The seven main categories were design, information/content, usability, functionality, ethical issues, security and privacy, and user-perceived value of the app. Although various methods have been developed in recent years to improve the quality of smartphone apps, these methods have not been applied in many studies. One of the most widely established methods for evaluating the quality of apps is the Mobile Application Rating Scale (MARS). By using the MARS, a score is calculated with four multi-item sections: Engagement (5 items), functionality (4 items), aesthetics (3 items), and information quality (7 items); additionally, there is a subjective section (4 items). MARS is a validated scale and is now available in different languages, such as German and Spanish.

Synthesis of App Evidence

One of the central research topics regarding digital health tools is the evaluation of the effectiveness and efficiency of such digital interventions. There is currently only little evidence, and only a few randomized controlled trials exist. The question is which level of evidence is necessary prior to widespread use of digital health apps. A systematic literature review of the evidence-based evaluations, conducted by Emma et al, revealed that a lack of standardization of eHealth interventions is a substantial barrier to assessing the full potential of eHealth interventions. Standardization could significantly improve the quality of intervention studies and, furthermore, could also ease the implementation of eHealth interventions. To generate evidence in the field of digital interventions, it is important that trials are carried out according to standardized procedures, evaluation models and theoretical frameworks. In the field of telemedicine, standardized methods are available, such as the model for the assessment of telemedicine, which is an evaluation framework for telemedicine that focuses on the measurement of effectiveness as well as the quality of care. The MAST includes three domains including assessment, multidisciplinary assessment and transferability of the results. Kidholm et al conducted a scoping review of studies in which the MAST was used. They included twenty-two studies and summarized that, in the predominant number of studies in which the MAST was used, a single domain was used rather than the complete framework. The authors emphasize that the MAST was developed to be used as a complete framework and to the use of single domains was not recommended. The overall conclusion in the context of the MAST is that the model is not stringently used, which leads to a lack of standardization and comparability between trials on digital interventions. The discussion about the evidence base of digital interventions has intensified with the publication of the evidence standards framework for digital health technologies from the National Institute for Health and Care Excellence of the National Health Service.

Advantage of Mobile Application in Medical Science

1. Enhanced Medical Education:
•Knowledge Enhancement: Mobile apps provide a wealth of medical information, enabling students, professionals, and interns to access resources conveniently.
•Skill Development: Interactive apps offer simulations, case studies, and quizzes, enhancing clinical skills and decision-making1.
2. Improved Patient Engagement:
•Appointment Reminders: Apps help patients remember appointments, reducing no-shows.
•Medication Tracking: Patients can manage medications, set reminders, and track adherence.
•Telehealth Services: Mobile apps facilitate virtual consultations, making healthcare accessible from anywhere.
3. Efficient Clinical Practice:

•Clinical Decision Support: Apps assist healthcare professionals with evidence-based recommendations during patient care.
•Point-of-Care Tools: Access drug databases, guidelines, and diagnostic aids on the go.
•Remote Monitoring: Apps enable real-time monitoring of patients' health3.
4. Cost-Effective and Versatile:
•Low Expense: Developing and maintaining mobile apps is cost-effective compared to traditional educational resources.
•Flexible Learning: Apps work both online and offline, allowing continuous learning regardless of location.
•Reduced Dependency: Mobile apps reduce reliance on regional or site-specific resources.

CONCLUSION

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. In particular, patients with chronic diseases and health care professionals will benefit from these interventions in many different ways. Sufficient proof of benefit, however, depends on high-quality evaluation, which must be based on the standards of evidence-based medicine. This issue is complicated for digital interventions for many reasons, and to date, the specific standards for development and evaluation are generally missing. In this context, it should be clearly emphasized that frameworks of standardization, at least in many parts, can harmonize the research in the field of digital interventions. Continuous work on standardization with a clear focus on the rules of evidence-based medicine would lead to a better understanding and interpretation of the actual evidence. Moreover, this is also necessary for the assessment of the reimbursement of such digital interventions. This would be particularly useful in guiding health care professionals in almost all health care systems worldwide to apply comparable criteria to better evaluate the reimbursement of digital interventions. Currently, the inclusion of the users concerned, in the sense of user-centred design, does not take place. In addition to the characteristics of this research field mentioned so far, no uniform quality criteria have yet been established that would allow affected users to adequately assess the quality of a medical app. This can lead to patients using an app of insufficient quality or, in the worst case, with the potential to harm the patient and to cause damage or even death. On the basis of this, a strengthening of eHealth literacy must be a central concern of society as a whole and for persons with health-related professions in particular.

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