

Mobile Applications in Clinical Practice: What is Needed in the Pharmacy Scenario?

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Abstract

Pharmacy informatics is demonstrated to have a positive effect on pharmacy practice. The incorporation of pharmacy informatics in academic programs is a common feature in the pharmacy curriculum. This work aims to provide an overview of the current and potential role of mobile applications (apps) in pharmacy education and practice. Mobile apps are the most common informatics tools used by medical and pharmacy practitioners as well as students. Both students and practitioners have overall positive perceptions toward using mobile apps in their daily clinical training and practice although the fact that the number of pharmacy apps is still small relatively in comparison with other medical-related apps. There are many potential roles for mobile apps in pharmacy practice and education. The future efforts of educational uses of mobile apps in pharmacy should target playing a role in the provision of customized tools for clinical pharmacy education.

Keywords: Clinical practice, mobile applications, pharmacy education, pharmacy informatics and smartphones

INTRODUCTION

The incorporation of information technology has affected positively the way by which the health-care providers are practicing and responding to their patients' needs.^[1] The revolution of mobile devices (MDs) use has extended to clinical practice. Nowadays, there are many customized MD applications (MD apps) in a diverse of medical specialties and subspecialties.^[2-5] The same scenario of increasing trend of using MD apps is noticed also in nursing practice and education.^[6] The use of MDs has introduced beneficial changes on pharmacy practice due to the fact that many pharmacist's daily activities can be accomplished using MDs.^[7] According to vision statement of the American Society of Health-system Pharmacists regarding the proposed role of informatics and technology in pharmacy practice, there are many attributes by which the involvement of technology can improve pharmacists' overall performance.^[8] Advantages and disadvantages of MD apps have been studied with an overall perceived positive impact on most health-care providers' practice.^[9] However, this increasing trend of using MD apps as tools to better manage health information needs further education to users and in some cases may need also putting some regulations.^[10] The

aim of this review is to make an overview of the current scenario of using MD apps in clinical practice in general, and then, we will focus on their current and proposed roles in both pharmacy education and practice.

METHODS

A search was made encompassing Scopus, ProQuest, EMBASE, and MEDLINE for full-text articles written in English. The following keywords were used: Pharmacy informatics, pharmacy education, pharmacy practice, medical apps, mobile applications, smartphones, and medical informatics. Total articles found were 115. Exclusion of many articles that have repetitive content was made. A further selection of relevant reference articles was made at the discretion of the authors to end up with the inclusion of 33 articles to achieve the objectives of this review. The selection process of the included articles is illustrated in Figure 1.

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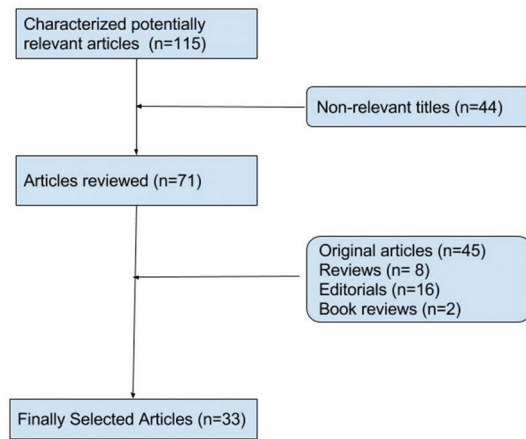


Figure 1: Flowchart describes the selection process for the articles included in this review

MOBILE DEVICE APPLICATIONS IN MEDICAL CLINICAL PRACTICE

MD apps use in medical clinical practice has been evolved markedly with many apps for masses of medical practitioners. Identification and choice of the credible app among thousands of medical apps available on the internet or app stores is a key factor in ensuring the effectiveness of these tools.^[11] Proper consultation of different websites of medical professional bodies, major medical publishing authorities, and medical social media is a requirement to select the most useful tool with high-quality content applicable to clinical practice.^[12] It can be said that incorporation of MD apps into clinical practice is not often as easy as only browsing app stores. It needs further careful inspection of available options in terms of their relevancy, credibility, and quality of presented information.^[13]

MOBILE DEVICE APPLICATIONS IN DIFFERENT CLINICAL SPECIALTIES

According to a systematic review of health-care, apps for smartphones that have reviewed 55 articles and overall 83 apps have been identified.^[14] Table 1 presents a summarized review of available MD apps.

From Table 1, majority of MD apps were designed to health-care professionals, and then patients and the least number of apps were directed to medical students' use. Among apps targeting clinical practitioners, a significant number of apps were concerned with disease diagnosis. Whereas a major part of apps that were targeting patients' use were designed to help patients to manage their chronic diseases.

Cardiology

In a detailed insight into mobile apps related to certain clinical specialty, one comprehensive review of mobile apps related to cardiology has been identified. A total of 406 papers with overall 710 apps were reviewed. From the distribution of

Table 1: Summarized overview of the work on mobile device apps per target group

Target users	Number of applications	Types of category applications
Health-care professionals	57	Disease diagnosis (21) Drug reference (6) Medical calculator (8) Literature search (6) Hospital information system (4) Medical training (2) General healthcare (7)
Medical students	11	Medical education (11)
Patients	15	Chronic disease management (6) Ear-, nose-, and throat-related (4) Fall-related (3) Others (2)

mobile apps in the specialty of cardiology, it can be underscored that majority of apps were focused on heart monitoring, electrocardiogram education, and interpretation while few concerned with the management of cardiac conditions.^[15]

Ophthalmology

In ophthalmology, MD apps can help in many aspects such as tools for clinical examinations and educational resources for both ophthalmologists and their patients. Both app stores, iTunes and Android, have many apps that constitute a potentially helpful role in ophthalmology daily practice, research, and education.^[4]

Neurology

In neurology, the use of MD apps is not only well established but also has experienced paramount advances in the integration of apps in many neurologists' activities ranging from reference resources, academic journals, and communication tool.^[2] Further, the point of care model for many neurology patients has been improved dramatically by the use of neurology apps which facilitating many patient care-related functions such as the process of examination, documentation, monitoring, and advising.^[2,16]

Dermatology

According to Brewer *et al.*, a total of 229 MD apps were identified in the specialty of dermatology. More than 50% of these apps were developed for patients with skin disorders as a disease guide, educational aid, and management recommendations.^[3]

Plastic surgery

A relatively different scenario is seen in the use of MD apps in the specialty of plastic surgery where the total number of apps is relatively smaller than the parallel number in other medical specialties. In addition, unlike dermatology apps, the majority of plastic surgery apps were designed for surgeons and trainees.^[5]

MOBILE DEVICE APPLICATIONS IN NURSING CLINICAL PRACTICE

Nursing practitioners, as well as nursing students, have recognized the important role of MD apps in their daily nursing practice in terms of providing a point of care resources for boosting clinical decision-making ability, proper use of medical references, medical calculations, and clinical diagnoses.^[17]

According to the Technology Informatics Guiding Education Reform initiative that was developed primarily to provide a framework for the required informatics competencies that a current nurse practitioner should have, the informatics were thought to have many roles which involve easing access to educational materials, clinical skills videos, data analysis tools, and communication solutions.^[18] The outlines of the initiatives to be taken for the proper implementation of nursing informatics in nursing education institutions were also discussed.^[19] Although a recent report highlighted the integration efforts of nursing informatics education in different US nursing faculties, it also showed that the outcomes are yet to be improved and more work is needed to identify the gap between education and practice requirements and then implement corrective strategies accordingly.^[20]

Independent upgrading of one's knowledge, point-of-care access to clinical information, on-site medical calculations, and further enhancement of safe-practice behaviors are among the current patterns of MD apps integration in nursing clinical practice and education.^[21] After recognition of the informatics role in clinical practice, nursing practitioners and educators may have to further promote the optimal utilization of MD apps. Similar to medical practice, the critical evaluation of MD apps is crucial to sustaining benefits of informatics integration into nursing practice and to assure that only high-quality resources with authoritative content will be entertained.

MOBILE DEVICE APPLICATIONS IN PHARMACY PRACTICE AND EDUCATION

Pharmacy informatics

Pharmacy informatics is concerned with mastering the systematic processing of data, information, and knowledge through making use of emerging technologies to achieve better patient care outcomes.^[22] The introduction of pharmacy informatics education to pharmacy undergraduate academic programs has been highlighted in many pharmacy schools syllabi.^[23,24] The knowledge, skills, and resources for pharmacy informatics education have been described in the literature to guide the emerging role of pharmacy informatics among future pharmacy practitioners.^[22] The integration of pharmacy informatics in clinical practice has proven to improve pharmaceutical care process and optimize the use of clinical information technologies in the form of customized clinical decision support (CDS) tools.^[25]

Clinical decision support tools

CDS tools are classified as the most eminent pharmacist activities involving the use of medication technology.^[22] Informatics skills such as the capability of using various query tools become an integral part of today's pharmacist training programs.^[26] Decision support tools can offer an extremely rapid access to clinical information, a helpful guide to the preferred therapeutic choices in certain cases, while minimizing medication-related errors.^[27] Two main categories of decision support tools have been identified, one that helps individuals involved in patient care process to have access to clinical information and treatment algorithms and the other one is integrated into the whole hospital information system to give alerts about drug allergies, incorrect doses, and drug interactions.^[27] Despite the availability of some examples of both categories of decision support tools, the deficiency in designing and performing specialized clinical knowledge apps is still one of the major barriers to technology adoption in clinical practice.^[27]

Pharmacy apps, a more is needed

The use of MDs is common in hospital settings where health-care professionals generally use MDs to perform multiple tasks during their professional practice.^[28] MD apps will help pharmacists during their clinical practice by enhancing their access to medical information from trusted sources for point-of-care treatment. It has been reported that the most common use of medical apps among hospital pharmacists is for responding to drug information inquiries, especially those related to dosage recommendations, adverse drug reaction, and drug interactions.^[29]

In a study involved ninety pharmacists from eight different hospitals to evaluate the impact of smartphone integration into clinical pharmacy practice, it has been found that smartphones have been accepted in clinical pharmacy practice with a positive perception about their use, they have improved pharmacists' efficiency in their response to drug information inquiries, and their appropriate incorporation in clinical pharmacy practice will represent significant part of daily pharmacists' practice routine.^[30] However, there is still a little focus on apps that are generally beneficial for pharmacists.^[31]

Realizing the little number of medical apps focusing on therapeutic management by within certain medical specialties such as cardiology, the shortage of medical apps targeting pharmacists' role in hospital setting, pharmacists' acceptance of using MD apps, and the positive impact of MD apps on pharmacists' efficiency, it is proposed that developing MD apps aiming to improve pharmacists' knowledge regarding clinical pharmacy specialties may have a positive impact on clinical pharmacy practice. Figure 2 summarizes factors affecting the potential need for more pharmacy apps in experiential education and practice.

The use of clinical pharmacy apps should start from experiential education by modulating clinical knowledge educational materials as MD apps to be easily accessed in

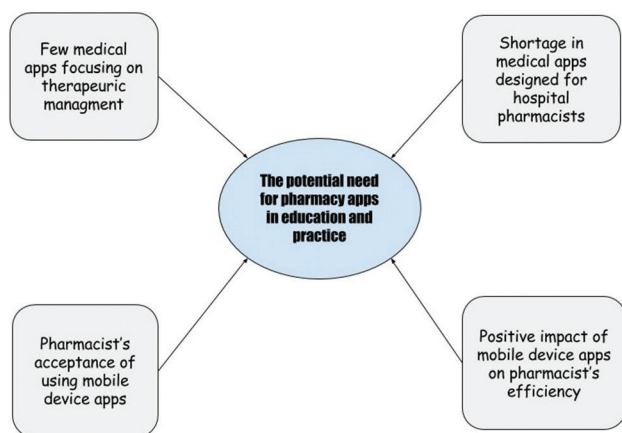


Figure 2: Factors that can affect the potential need for further pharmacy apps

clinical settings. These clinical pharmacy apps can help maximize students' efficiency because MDs have been proven to allow better pharmacists' participation in clinical activities and also efficiently access drug information.^[32] Moreover, smartphone apps have shown to improve the efficiency of pharmacists' communication with the health-care team.^[33] Further, studies have shown that pharmacy students perceived positively the use of their smartphones for clinical tasks.^[34] Smartphone apps in health-care education have a greater expectation for the future potential role to enhance pharmacist learning experiences.^[35] In addition, it has been shown that pharmacy students can realize the important role of informatics tools such as mobile app in their future practice, and the ability to maximize their benefit from mobile apps can be further enhanced by dedicated mobile apps' training sessions.^[36]

CONCLUSION

There are many potential roles for MD apps in pharmacy experiential education and practice. The future efforts of educational use of MD apps in clinical pharmacy should target the provision of customized clinical pharmacy education based on the actual needs of pharmacy students during their experiential clinical placements. There may be a potential need to design MD apps for each pharmacy specialty or each clinical rotation to help in enhancing the needed integration between the clinical knowledge and professional practice, especially for the new practitioners.

Future strategies need to be directed toward addressing the knowledge of students about the appropriateness and regulations of technology use in their education and upcoming professional practice. Moreover, forthcoming research studies are expected to highlight the major barriers toward app use.

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Conflicts of interest

There are no conflicts of interest.

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