

Evolving Frontier: A Review of the Role of Mobile Medical Application Prescribing

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Abstract

Objective: To describe the continuum of medical app prescribing. **Data Sources:** A review of literature was conducted using PubMed and MEDLINE. Search terms included *medical app*, *prescribing*, *healthcare apps*, *medical phone apps*, and *mobile medical apps*. Studies published in English from 2005 to December 2015 were included. **Study Selection and Data Extraction:** A total of 2264 articles were uncovered in the initial search. The publications included studies conducted in the United States and Europe within the past 10 years. Studies with a mobile app intervention were preferred. However, studies lacking a mobile app intervention were also included. No restrictions on the type of health application discussed in studies were chosen. Non-English language publications were excluded from the review. A total of 15 articles were selected based on the inclusion criteria and reviewer screening. **Data Synthesis:** The literature review identified that this is an area that requires further study to analyze the extent to which prescribers recommend apps for their patients. A concern over the lack of evidence in the effectiveness of the apps still remains. Prescribing mobile apps by providers to help keep track of their patients' symptoms and provide real-time advice on treatment and medication can be beneficial to control costs, reduce errors, and improve patients' experiences. **Conclusion:** The presence of mobile technology has enabled patients to become more engaged in the decision making regarding their health care. Additional resource allocation can be recommended to increase the quantity and quality of medical apps recommended by prescribers for their patients.

Keywords

medical app, prescribing, health care apps, medical phone apps, smartphone apps, mobile phone and mobile medical apps

Introduction

Mobile medical applications have enhanced the productivity of the health care field through the use of systems by health care professionals and patients. A mobile medical application (app) is defined as medical software programmed to be used on smartphones or other mobile devices, which may or may not require Food and Drug Administration (FDA) review.¹ Mobile medical apps allow consumers to input personal health data to manage their disease states, promote healthy lifestyles, or receive additional medical information. Health care professionals may use medical apps to gain immediate access to specific patient health information or other pertinent health knowledge. It is projected that 50% of smartphone owners will have at least 1 mobile health application by 2018.¹ A study by Franko and Tirrell² concluded that 56% of physicians, residents, and fellows use medical apps in their clinical practice.

The health care field is changing its outlook on treating patients, shifting its focus on quality of care. Instead of insurers paying solely for the quantity of services provided, they are rewarding health care professionals for providing high-quality services.³ Revisions in reimbursement rates

are beginning to occur starting with the biggest insurer company, Centers of Medicare and Medicaid Services. In 2012, Medicare started to provide incentives such as high reimbursement rates to providers based on value-based purchasing.³ Value-based purchasing provides effective health care to patients while reducing health care costs. Continuous monitoring of the health of patients, communicating with patients in regard to their health, managing medication adherence, and providing quick and easy access to patient profiles can help providers deliver quality care to their patients. All this can be done with the use of mobile medical applications. One example of an application utilized by physicians is the Agency for Healthcare Research and Quality electronic preventive services selector to determine which preventive screenings a certain patient needs.⁴ In

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addition, physicians utilize apps to access drug formularies, identify billing codes, and look up diagnostic guidelines using the International Classification of Diseases (ICD-10) app.

Many applications are being utilized for health monitoring by providing an alternate path to retrieving patient records remotely and securely. This helps provide data collection to enable patients to be managed adequately. Mobile medical applications are being prescribed in addition to helping patients manage their care at home efficiently. A few assets that medical applications have are pictures, photos, and videos that provide information to patients, record entered data, display graphic data that the patient entered to monitor progress of health, send reminders to alert the patient to take medications or enter data, and most important, increase communication between providers and patients.⁵ The relationship between the patient and provider is strengthened because providers are now more involved in their patients' health management with the use of medical applications. Currently, there are many health apps to choose from; however, research showing the benefits of medical apps in regard to patient health outcomes is lacking. The primary objective of this article is to review and summarize the current literature surrounding medical application prescribing by health professionals.

Methods

Studies included in this review were selected through a literature search utilizing 2 databases, PubMed and MEDLINE. The search strategy was completed using combinations of the following search terms: *medical app*, *prescribing*, *healthcare apps*, *medical phone apps*, *smartphone apps*, *mobile apps*, *pharmacy apps*, and *health apps*. Search results were limited to studies published from 2005 to December 2015 and were also restricted to the English language and human studies.

Two reviewers independently screened article abstracts and only selected those articles perceived as relevant that contained at least 1 of the search terms stated above. If disagreement in the selection of journals between the 2 reviewers arose, the rest of the research team was consulted to allow for consensus among the authors.

Studies with a mobile app intervention were included in the selection process. However, studies lacking a mobile app intervention were also included in this review. There were no restrictions on the type of mobile health application discussed in studies that were chosen. Non-English language publications were excluded from the review.

Results

There were a total of 2264 articles uncovered in the initial search from PubMed and MEDLINE using individual

keywords outlined above. The search was further narrowed to 1393 articles by combining the keywords above with the term *mobile medical application*. A total of 61 articles were related to medical app prescribing, and 43 of these articles were related specifically to consumer use of these health apps. Based on the inclusion criteria and reviewer screening, a total of 15 articles was selected finally (Table 1).^{2,6-19}

The literature review identified that this is an area that requires further study. Many published articles in this domain are reviews and lack robust study design. Mobile medical applications discussed in journals did not always relate to the prescribing of apps to consumers. Such apps include mobile health apps that assist physicians in their clinical practice. Another issue with the selected studies is that many articles do not indicate whether a particular medical app was found to be clinically effective, such as having improved lab values with use. Instead, the articles primarily focused on consumer download of health apps and how mobile health apps can benefit patient outcomes.

The use of medical apps continues to grow. A survey of 2000 patients conducted by Digitas Health identified that 90% of patients were willing to accept an offer of a mobile app from their provider rather than a written paper prescription.²⁰

Research Now, a company that collects and provides data about the health care field to consumers, surveyed 500 health care professionals regarding their views of mobile health apps. More than half of the respondents believe that utilizing health apps will increase patients' knowledge and allow increased patient responsibility toward their own health. However, less than half believe that health apps will improve patient-physician relationship or increase efficiency of treatment.²¹ Mobile app prescribing will evolve to become a more widespread practice because of the benefits the physicians are detecting as well as better health data being captured.²²

According to the Centers for Disease Control and Prevention, 86% of the US health care costs are a result of chronic diseases such as diabetes, cancer, asthma, and cardiovascular disease.²³ Prescribing mobile apps by providers to help keep track of patients' symptoms and provide real-time advice on treatment and medication can be beneficial to control costs, reduce errors, and improve patients' experiences.²⁴ One app from WellDoc, Inc, called BlueStar Diabetes was approved by the FDA for patients with type 2 diabetes. The app provides patients with feedback and direction on medications and lifestyle/self-management techniques.⁵ The BlueStar app helps patients keep track of blood glucose levels, medications, diet, and exercise while sharing their progress with their health care provider. A study was done to compare a control group (n = 13) versus an intervention group (n = 13) with type 2 diabetes. The control patients were asked to submit their blood glucose books every 2 weeks to their providers. Intervention patients

Table 1. Summary of Key Articles Pertaining to Mobile Medical Application.

References	Year Published	Primary Assessment	Place of Study	Specific Apps Discussed
Aungst ⁶	2013	Clinical reference tools for pharmacists	United States	App not specified
Case et al ⁷	2015	Physical activity	United States	Moves, Health Mate, Fitbit
Dayer et al ⁸	2013	Medication adherence	United States	MyMedSchedule, MyMeds, MedSimple, Dosecast, MediMemory, PillManager
Dennison et al ⁹	2013	Health-behavior change for young adults	United Kingdom	App not specified
Franko and Tirrell ²	2012	Prescribing use	United States	App not specified
García-Gómez et al ¹⁰	2014	Management of type 2 diabetes, obesity, and breastfeeding	Spain	Diab_Alert, Lactation, LactMed, MyFitnessPal, Calorie Counter, CardioTrainer
Laakko et al ¹¹	2008	Application framework for mobile app designers	Finland	App not specified
Lippman ¹²	2013	Physician prescribing use	United States	Anxiety: Breathe2relax, Relaxation Techniques <ul style="list-style-type: none"> • Headache: iHeadache • Medication management: myPill, My OC, GoodRx Menopause: BioDesk, myPause Weight Loss: MyFitnessPal, Calorie Count
Majeed-Ariss et al ¹³	2015	Management of chronic disease for young adults	United Kingdom	App not specified
Middelweerd et al ¹⁴	2014	Physical activity	United States	Runkeeper—GPS Track, GymPush, hubbub health, SoFit, Fit FRIENDzy
Quinn et al ¹⁵	2008	Management of type 2 diabetes	United States	WellDoc, BlueStar
Singh et al ¹⁶	2014	Health care communication for teens and caregivers	United States	App not specified
Slabodkin ¹⁷	2014	Medication adherence	United States	Medisafe
Spring et al ¹⁸	2013	Management of chronic disease	United States	ENGAGED: weight loss app on android
Tuck and Sheets ¹⁹	2014	Wellness tools for school nurses	United States	Relax Melodies, Life Positive, MyFitnessPal, LIVESTRONG, QuitNow

received a Bluetooth-enabled One Touch ultra BG meter, with test strips and lancets, a cell phone equipped with WellDoc, Inc, proprietary DiabetesManager software that had logbooks sent electronically to their providers by the software every 4 weeks, or sooner if needed. Patients in the intervention group experienced a greater decrease in hemoglobin A_{1C} values (2.03%) compared with the control group (0.68%) at 3 months.¹⁵ Similarly, with the use of mobile technology, trial data from Accenture showed an average of 15% to 20% reduction in hospital days and 30% fewer emergency room visits. These data demonstrated that mobile health technologies could potentially save the United States more than \$23 billion by targeting patients with chronic diseases.²⁵ Furthermore, Mayo Clinic found that 20% of patients who participated in the smartphone study and recorded their blood pressure and weight on a daily basis were readmitted within 3 months compared with

60% of patients who did not participate in the program and were readmitted.²⁶ Moving to electronic systems for service delivery will provide cost savings, improve access, and provide higher levels of quality.²⁴ Improving patient results while minimizing health care costs is an incentive to providers from CMS in regard to value-based purchasing.

The IMS Institute for Healthcare Informatics released a report identifying the top apps that consumers use based on classification of patient journey.⁵ In 2013, there were more than 14 000 health apps utilized by patients. The vast majority (>50%) of these apps were categorized as “prevention/healthy lifestyle.” For prevention and healthy lifestyles, Calorie Counter and Diet Tracker was utilized the most. The app provides a large calorie counting database and features such as food tracking, exercise and weight goals, and links to friends. Another top app in that category is Quit It 3.0-Stop Smoking, which is a stop smoking motivational

program that supports and encourages smokers to quit smoking, helps ex-smokers maintain their status, keeps track of the cigarettes not smoked, and provides cost savings. Consumers also utilize apps to locate a health care professional or facility by using healow, which allows patients to communicate with their doctor's office and access up-to-date health records, visit summaries, and appointment reminders. In addition, for patients to receive clear, concise, and useful information covering thousands of medical symptoms, diseases, conditions, procedures, medications, and drugs, the top download app is iTriage. Ultimately, patients need a prescription reminder that alerts the user every time they need to take a prescription. An app called Pill Monitor Free allows users to enter all prescriptions, set up reminders, and track when they have been taken.⁵ Prescribers can also look at patient demographics to better understand which apps can benefit a specific population. There are 1440 apps categorized as being intended for specific demographic groups: women's health, children's health, and senior health. Additionally, The IMS Institute for Healthcare Informatics also investigated the demographics of apps for specific target groups. Results showed that the largest target groups include senior health, followed by women's health, and pediatric health. Within women's health, approximately 80% of the apps are related to pregnancy care.⁵ The app Ovulation Calendar Ladytimer Free is utilized by women and tracks and predicts menstrual cycle days to help women become pregnant or avoid pregnancy. The app also allows the patient to enter and track symptoms, moods, notes, weight, and intimacy. Likewise, Pregnancy Tracker is another popular app among expecting women to help guide them through their pregnancy day by day. A woman enters her due date and can expect to receive personalized information, parenting news, and network connections to other expecting women. Many of these apps allow users to record their information and permit information exchange with their health care providers.

Discussion

As technology continues to advance, many physicians are beginning to prescribe medical apps to their patients as ways to help them better monitor a patient's health. Health care providers prescribe apps to help diabetics monitor blood glucose levels or fitness and exercise apps to help patients monitor weight loss.²² Additionally, providers prescribe apps to patients diagnosed with psychiatric conditions to help maintain behavior coping skills by providing a Skill of the Day behavioral technique or audio message that the user can access when experiencing increased anxiety.²⁷ For asthma patients, AsthmaMD helps patients track their inhaler use, the number of asthma episodes experienced, and user symptoms at the time of an attack or environmental triggers. Also, the app creates a journal for the user to

Table 2. Health Conditions and Associated Health Apps.

Condition	Relevant Mobile Medical Application
Addiction	QuitNow, Quit It 3.0-Stop Smoking
Anxiety	Breathe2Relax, Relaxation Techniques®
Asthma	AsthmaMD
Breastfeeding	Lactation, LactMed
Diabetes	Diab_Alert, BlueStar
Headache	iHeadache
Menopause	BioDesk, myPause
Nonadherence with medications	myPill, My OC, GoodRx, Medisafe, MyMedSchedule, MyMeds, MedSimple, Dosecast, MediMemory, PillManager, Pill Monitor Free
Overweight/Physical inactivity	MyFitness Pal, Calorie count, Calorie Counter and Diet Tracker, CardioTrainer, Runkeeper, GymPush, hubbub health, SoFit, Fit FRIENDzy, LIVESTRONG, Life Positive
Pregnancy	Pregnancy Tracker, Ovulation Calendar Ladytimer Free
Psychiatric disorder	Skill of the Day, WellWave

track the progression of disease, shows a visual graph of peak flow meter readings to determine severity, creates an action plan for guidance in terms of managing the disease, alerts patients to take their medications, and sends patient results to physicians.²⁸

The use of mobile medical apps may cause a concern for some physicians and patients in regard to cost. In each category of apps, there are apps that are free to download and some that have a fee. Common apps such as MyFitnessPal for patients to monitor their fitness and health and AsthmaMD are free of charge. BlueStar Diabetes is also free of charge and helps patients monitor their diabetes. However, Diabetes Tracker with Blood Glucose/Carb Log by MyNetDiary is available to download at \$9.99. Also, Calorie Counter PRO by MyNetDiary costs \$3.99 to download, whereas Calorie Counter and Diet Tracker by Calorie Count are free of charge. It is important for physicians to be aware of what types of apps are available for their patients to monitor their health, so as not to impose a financial burden on them.

On a similar note, new medical apps are arising that offer unique health services (Table 2). In a few years, consumers will be able to wear sport wristwatches that can record blood pressure and vital signs without the need to press a button.²⁹ Other wearable sensor tools now being developed include necklaces that can monitor heart function, contact lenses that can track glucose levels or eye pressure to manage glaucoma, and headbands that can capture brain waves for Parkinson's disease patients.²⁹ Also, there are apps specifically for chronic kidney disease patients that allow patients to enter their medications and alert them if the medication is

safe or unsafe and if it has been dosed correctly based on renal function.³⁰ Furthermore, IMS Health and QuantiaMD are working on AppScript, an app that allows providers to electronically send prescriptions to the patient's phone, pick a specific app for the patient, and monitor the app's use by the patient over time.³¹

With the growing number of mobile medical applications, there is concern about patient privacy. In addition, there is the inherent concern over accuracy of the medical apps in their ability to perform or monitor like a medical device.²² The FDA and Medical and Healthcare Regulatory Agency issued a guidance document in 2013 that explains the agency's oversight concerning medical apps and focuses on apps that possess certain risk levels to the patient.²⁷ For apps that pose minimal risk to patients and consumers, the FDA will not implement premarket approval requirements under the Federal and Cosmetic Act for use of mobile apps intended to cure, mitigate, treat, or prevent diseases. The FDA evaluates medical apps in regard to a device that is intended to be used as an accessory to a regulated medical device or transform a mobile platform into a regulated medical device.²⁷ The FDA has indicated apps that are safe for patient use without requiring premarket approval.²⁷ Such mobile medical apps are applications that help patients self-manage their disease or conditions without providing specific treatment suggestions. A recent update by the FDA describes the types of apps for which it intends to exercise enforcing discretion. These apps organize and track patient health information, allow easy access to information relating to health conditions or treatments, and help patients document or communicate potential medical conditions to their health care providers.²⁷ Furthermore, patients who smoke can download motivational guidance apps to help quit smoking, or there are apps available for pregnant patients who need educational support throughout their pregnancy. While monitoring for safety and effectiveness of medical apps, the FDA promotes the continuous development of mobile medical apps to help expand health care and deliver appropriate health information to consumers and health care professionals.¹ By encouraging policy makers to help support the use of mobile devices for health care, it may stimulate the adoption of mobile health apps and could improve the way medical care is delivered.²⁴

Medical applications will continue to be downloaded and used by patients, and it is likely that physicians will continue to recommend health apps to patients. However, there still remains a concern over the lack of evidence regarding the effectiveness of the apps. Physicians can be hesitant to prescribe mobile health apps because there is not enough clinical data to support their use. In a recent interview with the Institute of Health Technology Transformation, Dr Steinhubl, Director of Digital Medicine at the Scripps Translational Science Institute stated, "There is no true clinical trial-level evidence for the value of mobile health. We think the value is there, but we don't have the data yet."³² A

small pilot study investigated the use of an app, WellWave, to promote psychiatric and physical well-being. The authors describe positive patient outcomes and indicate that "smartphone applications can be useful as research tools in the development and testing of theories and practical strategies for encouraging healthy lifestyles."³³ iMedicalApps is a team of physicians, health care professionals, medical trainees, and health analysts that provide online publications of reviews, research, and commentary regarding mobile medical technology for medical professionals, patients, and analysts. They have developed iPrescribeApps that will allow medical professionals to prescribe health apps to their patients. iPrescribeApp assists physicians in determining which app to select for the right patient by using evidence-based criteria. It also instructs patients on how to use the app by providing notifications and detailed instructions.³⁴

A limitation of this study was that the inclusion criteria were broad. The articles uncovered were more descriptive in nature, and the search excluded articles that did not contain an intervention with the use of medical applications. The literature search was completed using 2 key databases; this may have limited the exposure to other articles regarding medical app prescribing. However, authors screened for articles separately to avoid bias in selection and used pre-defined key terms to ensure consistency of the search.

Conclusion

Medical application use is rising exponentially as health care professionals recognize the benefits of prescribing apps to their patients and consumers continue to download apps to track their health. Smartphones and tablets are growing in the technology market. Investing more money into the development of health apps is highly recommended by health care professionals and consumers. Mobile medical apps will be a modern avenue for patients to monitor all aspects of their health. The presence of mobile technology has instructed patients to become more engaged in the decision making regarding their health care. With the most commonly used category of medical apps being those that provide preventive health measures, there exists an opportunity for more practical medical apps targeting diagnosis, general education, and compliance. Further studies should be conducted to investigate mobile health apps, specifically targeting patient outcomes related to major chronic disease states, such as hypertension, dyslipidemia, diabetes, chronic obstructive pulmonary disease, and congestive heart failure. These are areas where more research would be of great benefit because preventive medicine and monitoring have a significant impact on patient outcomes.

Declaration of Conflicting Interests

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