

The Promise of Improving Asthma Control Using Mobile Health



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Asthma affects 22 million persons in the United States and cost more than \$50 billion in 2012.¹ Asthma is the most common chronic pediatric disease, affecting almost 7 million US children, and its prevalence has been increasing over the past 3 decades.² Exacerbations from asthma account for substantial and preventable morbidity and health care costs and missed school days, and disproportionately affect racial and/or ethnic minority and low-income children.³ Despite effective asthma treatment options, medication nonadherence is high, especially among poor and minority groups, causing exacerbations and disparities in health outcomes.⁴ Nonadherence among children reflects parents' and children's knowledge, attitudes, and beliefs concerning the efficacy, safety, and appropriate use of asthma medications.⁵

Despite comprehensive national asthma management guidelines, asthma continues to cause major burdens, in the form of direct costs and indirect costs from missed school days and workdays, to the individual, the family, and greater society.² According to the national guidelines for asthma, the 4 components of asthma management are measures of assessment and monitoring that include asthma self-management, education for a partnership in asthma care, control of environmental factors, and pharmacologic therapy.⁶ Some local interventions to improve asthma management, such as home visits,⁷ school-based treatment,⁸ and educational programs to teach self-management,⁹ have been successful, but none can be disseminated broadly and quickly. More effective strategies are needed to assist asthma sufferers who remain without appropriate care between health care provider visits.

Mobile health, also known as mHealth, refers to mobile computing, medical sensor, and communications technologies that can enhance chronic disease care, and includes applications, or "apps" that run on mobile phones.¹⁰ With more than 285 million wireless phone subscribers in the United States, mHealth has the potential to transform health care.¹⁰ The number of medical apps has exploded over the past couple of years with more than 13,000 health care apps available to Apple iPhone users and more than 6,000 medical apps available at the Android

store.¹¹ The ability to create apps has become easier in recent years, contributing to the continued exponential increase in the number of apps available in the marketplace.

Because of the many and varied apps available to help manage certain health conditions, patients are now turning to health care providers to help them choose medical apps, and physicians (and patients) need to know which apps are accurate and effective. When searching Apple and Android stores, 180 asthma-related apps are available.¹¹ However, the quality of these apps ranges greatly, which may not be evident to the typical patient. Selecting and relying on an inferior app can have adverse medical consequences. Thus, studies such as the proof-of-concept study by Cook et al in this issue of *Journal of Allergy and Clinical Immunology: In Practice*¹² offer promise that a properly designed app for asthma can be effective in improving asthma-related outcomes.

Cook et al share the results of their proof-of-concept study that enrolled 60 adults with a mean age of 50 years (range 17-82 years) with poorly controlled asthma to test the usability and efficacy of a smartphone asthma app that provides support to patients with asthma over a 4-month period. Designed by the Scripps Clinic Division of Allergy, Asthma, and Immunology, the app, the Scripps Asthma Coach, provides individualized coaching and sends medication reminder messages, has extensive evidence-based educational materials, and is minimally intrusive. The app is highly innovative as it has the ability to give the user personalized content in "real time," by compiling and analyzing patient data from Asthma Control Test (ACT) survey results, patient knowledge queries, usage of educational content, medication lists, and peak flow values to create individualized interventions and proactive alerts.

The researchers enrolled individuals with poorly controlled asthma and used a prospective single arm, treatment only, 4-month study design. The researchers found that ACT scores and lung function measures including changes in percent of predicted forced expiratory volume in 1 second improved significantly over the 4 months of the study. Moreover, patients were highly satisfied with the app.

This proof-of-concept study demonstrates the great promise of apps for asthma self-management and provides the foundation for future studies. There are 4 areas for future evaluations of asthma apps, and many of these areas are acknowledged by the researchers. First, enrolling a larger, more diverse population would help assess the generalizability of the results to diverse patient populations. The average age of subjects in this study was 50 years, yet younger patients are more likely to use mobile resources¹³; thus, this app may be more appealing to and possibly more effective in improving asthma-related outcomes in a broader population that includes younger individuals. Furthermore, racial and/or ethnic minority populations suffer a disproportionate share of the burden of asthma, while cell phone

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ownership does not differ by race and/or ethnicity.¹⁴ Therefore, assessing the efficacy of an asthma app in minority populations is important in trying to decrease this racial and/or ethnic inequity.

Second, future studies could address the question of whether individuals tire of using an app after a relatively short time period. This study supports the idea that individuals with asthma will use this app for at least a 4-month period of time, but the question of long-term engagement remains. A study of long-term engagement with a mobile app for type 2 diabetes found that 10 of 12 participants significantly decreased their app usage over time.¹⁵ When interviewed, subjects noted that decreasing usage seemed to occur after gaining a sense of mastery over diabetes. Similarly, it is possible that patients could decrease usage of asthma apps over time when feeling that they have mastered educational material about asthma; it is important for app developers to specifically focus on motivating individuals to continue using apps for the long term.^{14,15} Because asthma often is worse during certain seasons for individuals, it is possible that individuals with asthma could use an asthma app during seasons when asthma is worse and take a hiatus when asthma exacerbations are less frequent. Future studies could assess whether an asthma app could be more useful if only used during certain seasons, when asthma is most active.

Third, the possibility of communicating content entered in the app, such as the result of serial ACTs, peak flow values, and usage of educational content, to providers is an exciting feature that can be explored in future studies. Exploring this feature was beyond the scope of this study by Cook et al. The app also includes each individual's current medication list; if the individual's provider were able to enter medications or check the medications included in the list, adherence to medications may be increased as individuals can be more certain which medications they are supposed to be taking.

Fourth, this proof-of-concept study demonstrates the potential of asthma apps in improving outcomes, suggesting the need for randomized control trials comparing 2 arms—use of asthma apps and standard practice—to more definitively study the efficacy of the app. A randomized trial would also avoid the problem of subjects serving as their own comparison.

In summary, Cook et al used a proof-of-concept study to demonstrate that an asthma app may improve asthma control in a cohort of individuals with uncontrolled asthma by providing individualized teaching and treatment support. This study provides encouragement for the field of asthma mHealth and

suggests that future larger studies to further assess the efficacy of this approach to asthma management are warranted.

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