

Physicians' perceptions of mobile technology for enhancing asthma care for youth

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Abstract

This study assessed physicians' receptivity to using mobile technology as a strategy in patient care for adolescents with asthma. Understanding physicians' perceived barriers and benefits of integrating mobile technology in adolescents' asthma care and self-management is an initial step in enhancing overall patient and disease outcomes. We conducted in-depth interviews with second- and third-year pediatric residents and attending physicians who oversee pediatric residents in training ($N = 27$) at an academic medical center in the southeastern United States. We identified both benefits from and barriers to broader use of mobile technologies for improving asthma outcomes in adolescents. Resident physicians demonstrated greater readiness for integrating these technologies than did attending physicians. Prior to adoption of mobile technologies in the care of adolescent asthma patients, barriers to implementation should be understood. Prior to widespread adoption, such systems will need to be evaluated against traditional care for demonstration of patient outcomes that improve on the current situation.

Keywords

Adolescent, care, chronic illness, qualitative approaches, technology

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Background

With an estimated 235 million individuals affected worldwide (World Health Organization, 2013), asthma is a global health concern. Peak rates occur in the United Kingdom and Ireland (16.1%), North America (11.2%), South America (9.9%), and Caribbean nations (Masoli et al., 2014). Asthma occurs more frequently among children and adolescents, making it the leading chronic disease at this age (Masoli et al., 2014; Wildhaber et al., 2012). Uncontrolled asthma results in emergency room and clinic visits as well as school absenteeism (Chan et al., 2007). Whereas adolescents seek independence in their lives, many are uninvolved in their disease management (Clark et al., 2010); and their lack of knowledge and self-management skills inhibits asthma control (Hennessy-Harstad, 2013). Experts agree that better knowledge and self-management minimize the risk of adverse outcomes (Global Initiative for Asthma, 2012; National Heart and Asthma, 2007).

Whereas research documents the preference for greater engagement of youth in treatment, most remain 'under-engaged' (Carpenter et al., 2013; Newbould et al., 2008). Yet new technologies for improved patient engagement exist (Mosnaim et al., 2012; Huckvale et al., 2012), and interviews with adolescents and parents highlight opportunities for developing tools that address their needs (Panzera et al., 2013). Nevertheless, the readiness of health-care providers to adopt communication channels such as mobile devices in pediatric care remains understudied (Martinasek et al., 2011). Despite the dearth of data, mobile phone technology may be a mechanism to increase asthma care compliance (Ryan et al., 2005). Some authorities note that the primary barrier is a time chasm between early adopters and early majority adopters and assert that comfort with technology will become ubiquitous over time (Pinnock et al., 2006). Opportunities to leverage technologies are underscored by the ubiquity of cell phones. There were over 140 billion smartphone owners worldwide in 2013; in the United States, 90% of Americans 14 to 17 years old own a mobile telephone, more than one-third of which have Internet access (Amanda, 2012). Nearly half of American adults own an Internet-enabled mobile phone (Aaron, 2012). Such technology diffusion suggests an avenue for enhancing pediatric patients' interactions with health-care providers. Through downloaded applications ('apps'), mobile devices offer providers a portable, convenient, immediate, and dynamic platform for communication (Mirza et al., 2008).

There are potential uses such as appointment reminders and tailored health messages to strengthen self-efficacy and knowledge of self-care practices (Klasnja and Pratt, 2012; Mosnaim et al., 2012; Patrick et al., 2008; Smith and Schatz, 2010). Although evaluations note the feasibility of mobile-based interventions (Chen et al., 2012; Hung et al., 2007; Pinnock et al., 2007; Ryan et al., 2005), providers' acceptance and perceptions of such interventions remain unclear. Our study identifies potential benefits and barriers related to providers' use of mobile devices for improving pediatric asthma self-management. Specifically, we examine the feasibility of integrating mobile devices into asthma care among pediatricians and their vision of the contents, features, and measures to include in a mobile asthma self-management app.

Methods

Sample and data collection

This study involved purposive sampling from one pediatric group in an urban academic medical center in Florida during 2010. Participants were residents and attending physicians. All second- and third-year residents (6 males and 12 females, aged 27–32 years) participated; of the 14

attending physicians staffing the center, 9 (ranging in age from mid-30s to mid-40s) participated in interviews. The role of attending physicians included supervision of the residents, rotation through pediatric and pulmonary clinics, and direct care to adolescents with asthma. To accommodate schedules, we collected data from attendings through one focus group ($n = 4$), one dyadic interview, and three individual interviews. Attendings had ≥ 10 years of experience. Fourteen individual and two dyadic in-depth interviews were conducted with residents during their pediatric clinic rotation.

Graduate students conducted the interviews. Interviewer instruction included experiential training regarding the interview guide and audio-recorded feedback.

Interview content

Questions examined physicians' views on patient-provider communication with their adolescent asthma patients, mechanisms for relating better with patients, their use of mobile technologies, and willingness to integrate technologies into patient care (Table 1). We told physicians of a hypothetical intervention offering patients the option to document and share asthma measures with them and receive recommendations, alerts, and reminders, indicating that this system would include a platform for delivering asthma education (Figure 1). Describing the system enabled interviewees to envision a tangible solution and provide ideas for overcoming asthma self-management barriers.

Data analysis

We audio recorded and transcribed interviews and focus groups. We used NVivo 8.0 (QSR International Pty Ltd, 2008) to assist data management and coding. We drafted a codebook from constructs that capture the perceived barriers and benefits of mobile technology use in asthma care. We applied the constant comparative method using a priori codes to identify themes. Intercooder reliability ranged from .4 to .85; coding inconsistencies were addressed and codebook revisions were made accordingly. Upon completing the codebook, three interviewers reviewed and recoded transcripts until achieving 100% agreement. The theme 'crisis management' originally had low intercooder reliability and required the most discussion to resolve. We compared notes on each topic for consistency and agreed on statements for inclusion in our findings.

Results

Physician interviews yielded several themes regarding the introduction and use of mobile devices to augment communication. We report existing communication approaches and technology applications, potential benefits and barriers concerning adopting enhanced mobile technology for patient care, and recommendations about message content and strategies for incorporating messages into patient-provider exchanges to enhance asthma care.

Current communication and technology use

Physicians agree that communication is vital in conveying asthma education and self-management skills that influence outcomes such as emergency room visits and school absenteeism. They stated that current communication with adolescent patients is limited, given demanding schedules, the brevity of most clinic visits, and the protracted intervals between consecutive visits. During clinic visits, physicians mainly interact with caregivers but agree there is need for direct communication with the patient. Improved patient engagement in developing treatment plans would enhance their

Table 1. Example of health-care providers' interview questions related to the coding categories.

Coding categories	Example interview questions
Current communication	1. In an ideal environment, one without any constraints, what would you do to help them manage their asthma? a. What would you not do? 2. How do you currently monitor your patient's peak flow readings? a. How often do you tell a patient take their readings? Record them? b. What time of day? 3. What makes it difficult to monitor your asthmatic patients? 4. What could make it easier to monitor them? 5. Regarding your asthmatic patients, how often do you communicate with them? 6. Outside of normal office/clinic visits/hours? 7. How do you typically communicate with them? i. Probe: e-mail, landline, cell phone, landline text 8. Regarding the caregivers of your patients, how often do you communicate with them? a. How often do you communicate with them outside of normal office visits/hours? b. With which family member do you usually communicate with? i. Why do you communicate with this person? ii. What is the most important role you believe this person plays in controlling asthma in the patient? iii. For what types of issues do you contact them? c. How do you typically communicate with them? i. Probe: landline, e-mail, cell phone, text 9. Is there any type of information that is necessary (or you would like to be able to talk about) to share with a patient outside of normal clinic hours? a. Probe the ones of highest importance? b. Why are these important? 10. What could make it easier to communicate with them?
Use of technology	1. What types of technology do you currently use for personal use? With colleagues at work? With friends? a. Probe: landline, cell phone, the Internet, social media sites 2. What types of social media are you aware of that could be used to improve medical management of asthma? a. Probe: types of users b. What type of information shared? c. Is it medically managed?

(continued)

Table 1. (continued)

Coding categories	Example interview questions
The following questions were presented to participants after introducing a hypothetical mobile device-based system	
Suggested features of the hypothetical system	1. If patients uploaded their peak flow data to a central database, how often could someone in your practice [need to?] review the database to see who is getting in trouble? a. Probe: who (nurses, residents, nurse practitioners) b. What type of schedule would they rotate on (daily, weekly) c. Who should be able to access this information i. Probe: friends, family, whoever patient gives access to? ii. What time of day iii. What if it sent alerts to that person? iv. How would you prefer to review this information? 2. What is the best way to get feedback/information to teens regarding their peak flow measure (PFM) readings for that day? a. Who else should receive this information? b. What would the message say? c. What action should the teen take regarding the information sent?
Recognized benefits and perceived barriers	1. What advantages do you see in this system (sending a PFM reading message)? 2. How willing would you be to monitor this information sharing? a. What would you see as the benefit of doing this? b. What would make it difficult for you to do this? c. What could make it easier?
Types and content of messages (alerts, reminders, and empowering messages)	1. What do you think about sending health reminders to asthmatic teens periodically? a. What messages would be most important for them to receive?

understanding and responsibility for care. After-hours communication presently occurs as telephone conversations with caregivers about emergencies, test results, and prescription refills. Physicians believe that mobile technology could improve communication by reaching adolescents directly.

“... teenagers are busy and communication is limited and I think using technology will improve communication. They’ll listen more. I mean, I think they read their texts, you know, and I think reading a short text is much more beneficial and reminder systems on an everyday, I mean, doing something the same way for 2 weeks makes it a habit.”

“Where they have things that can be on the phone. I think a lot of kids are doing a lot of texting. They’re using their phone’s Internet and that’s probably going to be the most likely place where they’re looking at every day and that’ll be like quick to enter information.”

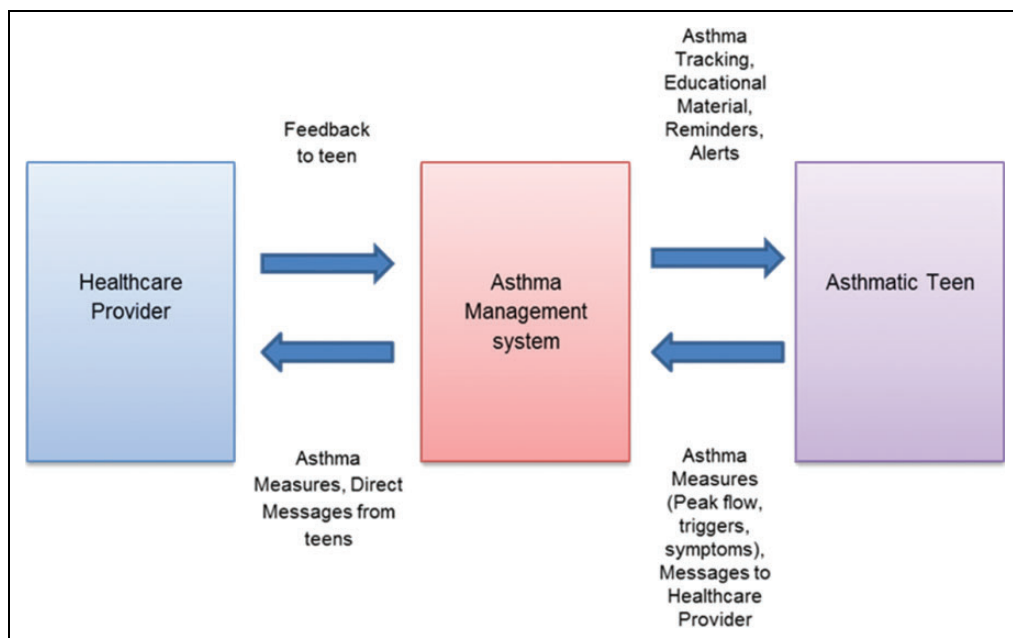


Figure 1. Features of suggested mobile-based intervention.

Physicians report using mobile phones and laptop or desktop computers, both professionally and personally. They note that use of iPads or other tablet-style computers is increasing, primarily among residents. They perceived text messaging and e-mails as efficient and preferred communication channels to connect with patients as these quotes illustrate.”

“I am a big fan of texting. I would love to just get everything texted. If I could just text data to people all day I would save hours of time.”

“No, a text, some type of an attachment or text or—with all the information there, not log on to your Facebook page and see this, that, or the other thing. It should be right there. You should be able to see it immediately.”

Benefits

Participants identified advantages of integrating mobile technology with asthma care. The use of mobile technology by physicians and patients turns this platform into a feasible, accessible, and acceptable outreach mode. Transmitting disease management information this way can increase interaction and facilitate follow-up between appointments. Physicians perceive the use of this platform as an opportunity to assist patients in developing self-management skills and as a consultation channel. Lastly, physicians believe this platform can convey accurate and credible information. These uses of the suggested technology promote interactive, two-way communication to engage adolescents in disease care with greater likelihood for improved outcomes. These quotes typify physicians’ enthusiasm for augmented technology.

“Teens probably most of them it would have to be some type of an e-mail or text messaging ‘cause I feel like most of our teen patients have access to that type of information. That, I think, is definitely a patient population who may be more willing to respond to you.”

“Well, you have the potential ability to stop an asthma exacerbation that would result in missed school, missed work, ER, hospital, steroids by mouth.”

Barriers

The aforementioned benefits and the convenience of mobile technology notwithstanding, physicians also enumerate barriers to implementation of an information database system. They expressed concerns surrounding the Health Insurance Portability and Accountability Act (HIPAA) that protects personal medical information and recognizes the rights to relevant medical information of family caregivers and others providing or paying for care (U.S. Department of Health and Human Services). Sharing medical information electronically or by the Internet potentially creates security risks.

Physicians also raised reimbursement of services outside their routine responsibilities as a barrier. After-hours communication, in general, and text messaging, in particular, were noted as being difficult to quantify, code, and compensate. Attending physicians were more likely than residents to question their level of comfort integrating modern technologies. Their demanding daily agenda leaves little time to assume additional responsibilities; however, they concur that the availability of another staff member to address this patient care component is valuable. Lastly, physicians were skeptical about system preparedness and the feasibility of a mobile information share system. These quotes underscore their concerns.

“The biggest thing is . . . a time issue, lack of reimbursement . . . for adding additional duties.”

“Oh, I would love to do it by electronic means. The problem is that then you run into all the HIPAA problems.”

Providers’ liability in cases of patient emergencies was raised as another barrier; physicians are concerned that adolescents may develop dependence on the system to direct them how to treat asthma exacerbations in progress. Given that the hypothetical system would not be an emergency hotline, physicians’ intervention during a serious episode may be insufficient to avoid adverse outcomes.

Message types and content

We asked physicians to suggest message types and content they perceive as important for their patients. The following three categories emerged: *reminders*, *alerts*, and *empowering messages*.

Reminders. Suggested reminders emphasize administering maintenance medications, refilling prescriptions, and scheduling physician visits as well as performing peak flow readings. Physicians believe that repeated reminders assist adolescents in practicing and routinizing their asthma action plan and developing self-management skills. Furthermore, they believe text messaging is suitable for conveying the aforementioned messages; however, adolescents may vary in their preferences for how and when messages are delivered as well as their specific content (Panzera et al., 2013). Therefore, physicians believe that tailoring messages responsive to preferences about delivery mode, time, and content would increase youth’s receptiveness to the intervention.

“Y’know, to use the Aero Chamber with it, y ’know, or something. But I think the best reminders will be, maybe, during cold season or something, to remember—just a reminder that said, y ’know, to use your—“These are the symptoms. Remember to use your Albuterol.” So, I think just reminders are going to be best for, maybe, just a little blurb related to the symptoms and for follow-up appointments. It might be for acute follow-up visits or it might be for routine visits.”

“Don’t forget to pretreat before you go out for soccer practice, or football practice,” specific for that patient’s sport I think would be even more, you know, something that’s specific for that patient.”

Alerts. Physicians believe that alerts regarding a worsening asthma condition and the need for follow-up are crucial for reducing the number and severity of exacerbations. They also report that having patients practice action plans designed for exacerbations is essential for fostering self-management skills. They suggested messages that warn patients about worsening asthma, that verify proper medication use, or that direct them to professional assistance. These quotes demonstrate physicians’ thoughts about targeted alerts.

“Your peak flow is decreasing, your asthma may not be in control; please contact your doctor for further management; if that’s not too long.”

“I would probably have—probably tie the—maybe a color scheme. If it comes over and the numbers are in the red then a response comes back in the red, too, that’s basically saying, y ’know, instructions. “You need to do this and this and—” kind of like a little triage form. “Do this and this. If not this, then you need to report to the ER.”

Empowering messages. Physicians perceive positive feedback as essential for reinforcing behavior change and encouraging asthma control. Acknowledgment of their autonomous efforts would assure youth that they are making mature and appropriate decisions regarding their asthma and progressing toward self-management.

“I mean if everything is going well, you could give them sort of positive feedback just like: “Hey, keep up the great work.” If not, you could be like: “Are you taking your controller?”

This line of questioning inspired physicians to recommend additional message content to serve, educate, and empower youth: weather updates, pollen counts, asthma informational tips, reinforcement of engagement in physical activity, and smoking avoidance/cessation.

Discussion

Whereas pediatricians had reservations about expanding the use of mobile devices in asthma care, they noted the benefits about implementing technology that could improve communication and enhance adolescents’ responsibility and ownership of their asthma status. Although sharing many similar opinions with attending physicians, residents showed more readiness for integrating mobile technologies into patient care. Our findings indicate that poor communication and non-individualized advice are among additional external factors that contribute to treatment nonadherence. Empowerment through knowledge and skills along with support from specialists favorably influence adherence (Stewart and Dearmun, 2000). Similarly, our study reflects the importance of patient–provider interactions in patient care. Given the limited time afforded for such interactions, participants saw mobile technology as a potential solution to education and empowerment as well

as a viable platform for improving communication and promotion of self-management skills, aligning with youth's own perceptions (Panzera et al., 2013).

Despite the importance assigned to patient–provider relationships in the development of self-management skills and preparation for the transition from pediatric to adult service, getting adolescents' participation in the consultation process during clinic visits is challenging. Moreover, parental involvement in adolescents' disease management, decision making, and communication with the health-care provider dominates (Newbould et al., 2008).

Adolescents' use of mobile technology to gather and share disease information with physicians may facilitate involvement in improved collaborative disease care and prevention education (Klasnja and Pratt, 2012). Physicians emphasize that such technologies, if implemented in clinics, must provide tailored supportive education that accounts for several variables relevant to adolescents' asthma experience and social environment, including weather, time of day, location, and other exposures. Previous studies have shown that youth desire greater engagement in their disease management between clinic visits; they perceive mobile technology as an accessible and convenient option to receive support, education, and connection through their health-care providers (Carpenter et al., 2013; Panzera et al., 2013).

The demand for health-related mobile apps grows with increasing use (e.g. smoking cessation and nutrition improvement). To date, assessments of this market, as well as content analysis of apps related to smoking cessation, have occurred (Abroms et al., 2011; Hasman, 2011). However, evaluations of the effectiveness of these apps and their daily use, long-term use, and effect on asthma health outcomes are needed. Similar investigations must assess asthma-specific mobile apps for effectiveness and sustainability.

Other gaps about the utility of health care mobile apps (i.e. mHealth technology) emerged that future research can address. Given the widespread adoption of mobile technology among adolescents, actual working models specifically tailored to this age-group should be developed and tested for their impact on health behavior and health outcomes. Moreover, there are limited data regarding adoption of such a communication system by providers and youth and little knowledge concerning its sustained use (Mirza et al., 2008; Ozdalga et al., 2012). A survey of over 400 US physicians revealed that utilization of mobile tools to interact with patients for reporting test results, scheduling appointments, and conducting follow-up care occurs in less than 20% of practices that meet meaningful use of electronic health record (EHR) criteria and as low as 5% of non-EHR clinics (Deloitte Center for Health Solutions, 2013).

To enable the use of mobile technologies, clinics need to be equipped with appropriate technical equipment as well as training for providers to execute this expanded communication role. Facilities must develop monitoring and reimbursement mechanisms for nontraditional services during and after clinic hours. Additionally, systems must secure personal medical information for HIPAA compliance and alleviate patient, caregiver, and health-care provider concerns. Fortunately, secure text messaging systems now exist, and protection is possible to an extent not previously available (TigerText Pro, 2011).

Limitations

These data came from a small group of physicians; however, they provide a valuable perspective from both attending physicians and residents. Our data came from a single site and geographic area and may not be generalizable. Thus, the representativeness of the range or depth of opinions presented by these physicians concerning experience or feasibility of expanded patient–provider

communication requires further exploration. Moreover, the research concerned itself with features of a hypothetical mobile application; without additional specificity about capability, cost, and other features, physician comments provide only initial guidance. A further limitation may be the relatively young age of participants, as younger individuals may be more technologically savvy. Finally, the possibility of a method effect emanating from data collection formats is unknown; interviews were not conducted identically—some one-on-one, some in small groups, and some in a dyadic format.

Conclusion

Whereas the literature reveals that asthma-support apps exist, none provides a comprehensive array of self-management tools, nor a design to accommodate adolescents' desires, values, and interests (Hasman, 2011; Schnall et al., 2013). Whereas efforts to expand the role of mobile technologies in health self-management are increasing (Huckvale, 2012; Kouadio et al., 2012; Mosnaim et al., 2012), we focused principally on the utility and feasibility of a mobile platform for health care and behavioral change. Researchers should continue exploring this technology by conducting large-scale longitudinal studies that meet power requirements for establishing evidence-based practice. Countries including the United States are positioned for innovation involving efficacy, effectiveness, and sustainability dimensions. The readiness of health-care providers in other countries to adopt such technology is unknown but should be a subject of future research. Researchers should explore the utility of consumer-tailored products that satisfy the needs of adolescent patients with asthma and their health-care providers. These initiatives will require pilot testing and randomized control trials comparing traditional communication modes with emerging innovations to determine the feasibility of mobile technology in asthma care, examine its sustainability with caregivers and providers, and evaluate its impact on asthma outcomes.

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