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CONTINUING EDUCATION

Building Patient Relationships

A Smartphone Application Supporting Communication Between Teenagers With Asthma and the RN Care Coordinator

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Smartphone applications used in healthcare are emerging as an adjunct therapy to assist patients in self-management. Often, smartphone technology is not integrated into healthcare delivery and does not build the nurse-patient relationship, an essential mechanism to guide the patient toward health. In a pilot study using smartphones with teenagers with asthma, the application provided a method not only to share health information at the point-of-living, including health assessments, personalized health plans, and disease information, but also to allow text messaging communication between the teenager and his/her RN care coordinator. Twenty-five teenagers piloted the smartphone application and provided feedback about its use. Eighty-five percent of the teenagers responding to the end-of-pilot, semistructured interview indicated a positive change in the nurse-patient relationship. Teenagers perceived that they could ask more questions along with having improved access and quicker response times. The RN care coordinators perceived improved ability to contact teenagers and improved accuracy of assessment data. Although the pilot had several limitations, it demonstrates that smartphone technology and text messaging can further the nurse-patient relationship. For this to occur, nurses need to become involved in the development and integration of technology to focus applications on innovative ways to enhance communication in patient care.

KEY WORDS

Asthma • Nurse-patient relationship • Smartphone • Teenager

BACKGROUND

In the past decade, technology growth in healthcare has exploded, and along with the tide of newly emerging technology comes the smartphone and accompanying applications. A smartphone is a cellular telephone with additional features including cameras, video playback, MP3 player, built-in applications, and Internet access for Web browsing and e-mail.[1] Smartphone sales are predicted to reach 1.5 billion by 2016[2] and health applications will be used by 500 million users.[3] More than 17 000 health-related applications exist and half are used by consumers to manage or improve their own health.[3] Trends in smartphone use will revolutionize healthcare delivery in the near future.

Unfortunately, very little information has been published regarding the integration of smartphone technology into patient care. Most healthcare applications for consumers focus on self-management, to assist in monitoring their own conditions.[4] Use of the typical self-management application prompts the patient to log personal health information to assist in monitoring and assessing symptoms, track treatment progress, provide education, and locate resources.[4] The patient can choose to export the information and share with his/her healthcare provider. Therefore, application use is an adjunct to patient care delivery and not necessarily integrated into care delivered by the healthcare provider. To integrate the application into healthcare delivery, two-way communication is essential.

Research is extremely limited focusing on the usability of smartphone applications for text message communication between patient and healthcare provider. Recent studies exploring text messaging within a mobile application with

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a teenage population have used text messages originating from a software system for daily scheduled reminders to encourage either health goals or taking of medications.[5–10] Unfortunately, this use of text messaging provides only unidirectional communication directed to the patient and does not permit individualized patient response directed to the healthcare team. Therefore, this does not support building a communicative, therapeutic relationship between the patient and healthcare provider.

In many nursing theories, including Peplau's Theory of Interpersonal Relations and Watson's Model of Caring, the concerned, caring, therapeutic interpersonal relationship with the patient is the vehicle to guide improvement in health.[11] New technology is often seen as impersonal and impeding this relationship, although technology and the nurse-patient relationship are not at odds.[12] Instead of focusing on new technology, including smartphone applications as a replacement for the nurse-patient relationship, emphasis is needed on the goal of enhancing the therapeutic relationship during care delivery.

DEVELOPMENT OF THE PROJECT

The pilot was developed as a multidisciplinary effort spearheaded by an internal information technology (IT) design group's desire to learn more about smartphone application use in healthcare. The group's preliminary assessments with subspecialty practices determined application needs for chronic disease management, but concerns emerged about the short shelf life of mobile applications. The IT group's interest was to determine whether the smartphone application's shelf life could be extended if the application were linked to the patient's primary care team. Thus, the goal of the project emerged: to develop a smartphone application to connect the patient with chronic disease from his/her point-of-living to a primary care representative. A multidisciplinary team, including IT designers and programmers, a project manager, a systems and procedures analyst, a primary care physician, a patient education specialist, and registered nurse (RN) care coordinators directly working with the patient population, collaborated on the development of a smartphone application.

The multidisciplinary team believed that the patient type best suited for the pilot was a teenager with asthma already enrolled in an asthma management program. The pediatric asthma management program is based on the National Asthma Education and Prevention Program (NAEPP) and uses an RN care coordinator as part of the healthcare team to provide additional support to families with children aged 5 to 18 years diagnosed with persistent asthma. The RN care coordinator contacts the family by telephone call or office visit every 1 to 6 months to assess asthma control. In addition, the RN care coordinator assesses barriers to medication compliance, correct inhaler technique including use of spacer device, environmental control, and educational needs. Age-appropriate patient education is provided to meet individual needs using printed materials, slides, and videos.

Using the Technology Acceptance Model,[13] perceived usefulness in the pilot was established by integration into an already valued connection from teenager to primary care team, and perceived ease of use was overcome by selecting teenagers, who are typically early adopters and enthusiastic about mastering new technology.[14]

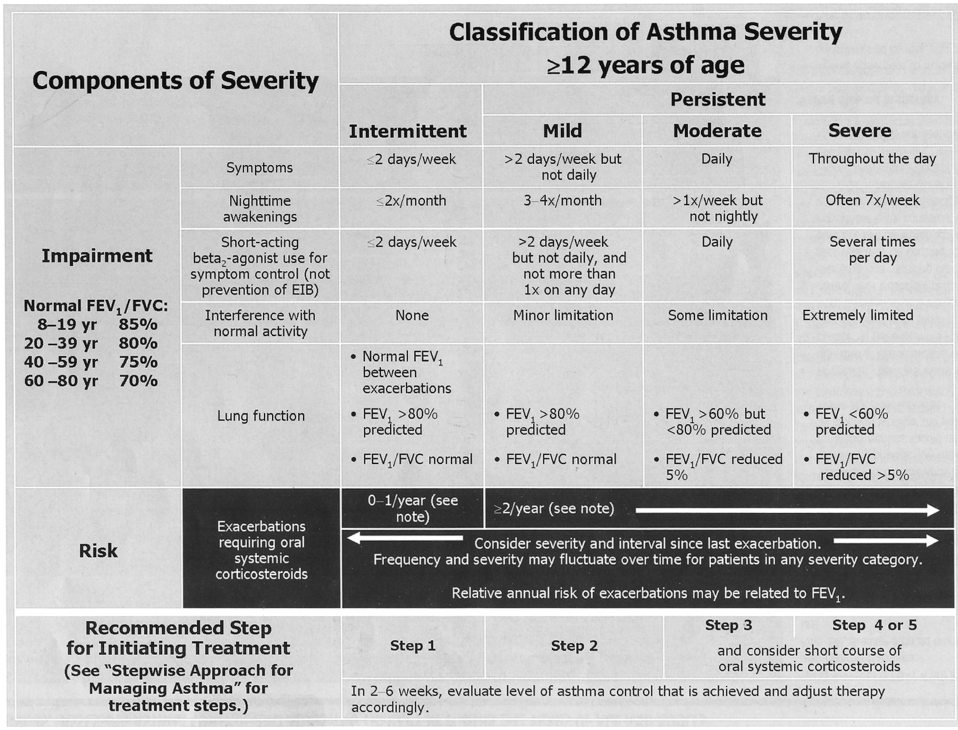
On the basis of their clinical experience, the primary care team decided that the application should target teenagers whose asthma severity was thought to be either mild persistent or moderate persistent based on the NAEPP (Figure 1).[15] Teenagers with persistent asthma have asthma symptoms frequently enough to require a daily controller medication and require more frequent follow-up assessment for symptom control than do those with intermittent asthma. Teenagers with severe persistent asthma were excluded from the pilot as the need to directly connect with primary care to gain and maintain asthma control is essential, and the possibility of delayed communication was seen as too great a risk if technology failed.

The goal of the smartphone application was to offer an alternative communication delivery method to the current asthma management program and not change the program's content. Therefore, a systems and procedure analyst mapped the RN care coordinators' workflow and determined four core areas the application would need to address to add value:

- Health assessment
- Personalized health plan
- Disease-specific education
- Communication for follow-up evaluation

Using this analysis, programmers developed a smartphone application on two platforms, iOS (Apple, Cupertino, CA) and Android (Google, Mountain View, CA), featuring a secure Web-based design with dashboard including these four elements. The patient could complete a questionnaire assessing asthma control in which most recent answers were displayed on the dashboard. The patient could view a personalized asthma action plan. The patient could select to view short education modules of either a slide or a video clip on a selected asthma topic. Education modules were segments of education already used in the existing asthma management program and were stored within the application. Finally, the patient could select to send a text message using short message service. From the dashboard side of the secure Web site, the RN care coordinator could enroll the patient, input patient-specific information, view any patient use of the application, and text message the patient, including links to request that the patient complete a

Assessing severity and initiating treatment for patients who are not currently taking long-term control medications



Components of Severity		Classification of Asthma Severity ≥12 years of age			
		Intermittent	Persistent: Mild	Persistent: Moderate	Persistent: Severe
Impairment Normal FEV_1/FVC: 8–19 yr 85% 20–39 yr 80% 40–59 yr 75% 60–80 yr 70%	Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3–4x/month	>1x/week but not nightly	Often 7x/week
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week but not daily, and not more than 1x on any day	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	• Normal FEV_1 between exacerbations • FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 >60% but <80% predicted • FEV_1/FVC reduced 5%	• FEV_1 <60% predicted • FEV_1/FVC reduced >5%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year (see note)	≥2/year (see note)		
		Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to FEV_1.			
Recommended Step for Initiating Treatment (See "Stepwise Approach for Managing Asthma" for treatment steps.)		Step 1	Step 2	Step 3 and consider short course of oral systemic corticosteroids	Step 4 or 5
		In 2–6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.			

FIGURE 1. Teenagers with mild or moderate persistent asthma based on the National Asthma Education and Prevention Program Expert Panel Report 3 (Figure 14, Classifying Asthma Severity and Initiating Treatment[15]) were selected as the target population for the smartphone application pilot.

control questionnaire or education module within the application.

PILOTING THE CONNECTED CARE APPLICATION

The objective of the beta-testing was to study the feasibility and efficacy of using a smartphone to communicate between a patient with asthma and his/her RN care coordinator. The content of the asthma management program remained the same; the delivery of the content was altered to include the use of the smartphone. Because of the lack of research on smartphone applications directly linked to the patient's primary care site, a pilot study was the method selected to beta-test the application.

The multidisciplinary team identified three spheres to investigate: patient-centric, provider-centric, and system-centric. Questions focused on satisfaction and acceptance by both patients and healthcare staff, determining which application functions were valuable to patients and staff, and on experiences of application use in the healthcare delivery and regulatory arenas. Both qualitative and quantitative data were collected. Data collection methods included data logs from the smartphone application; baseline, bimonthly, and end-of-pilot patient surveys; and post-pilot, semistructured interviews with patients and with RN care coordinators. Time estimates for stages in the episode of contact for both smartphone interactions and traditional method of contacting patient by telephone were also documented by the RN care coordinator. Upon discussion with the institutional review board (IRB), it was deemed that this pilot project represented a quality improvement effort and that formal IRB approval was not required.

Two primary care clinical sites were selected for piloting. Both were similar in size and each had one pediatric RN care coordinator working at the clinical site that was part of the pilot's multidisciplinary team. Each RN care coordinator contributed a list of patients aged 13 to 18 years with mild persistent or moderate persistent asthma who were already enrolled in the pediatric asthma care coordination program. Ninety-six patients were identified for possible participation in the pilot. The goal for enrollment was 25 patients.

Parents of eligible teenagers were mailed information about the pilot, followed by a telephone call from a systems and procedures analyst to determine interest in participation. To prevent the relationship between the RN care coordinator and family from influencing families' willingness to participate, RN care coordinators were not involved in enrolling eligible teenagers. In addition, RN care coordinators wanted to avoid the potential outcome

of harming the relationship already developed with the family. Although most teenagers had cell phones, it was discovered that very few had smartphones. Therefore, the project supplied smartphones with unlimited data service plans to teenagers who did not own one for the duration of the pilot. Six patients used their own smartphone and 19 were provided with smartphones.

RESULTS

Of the 25 teenagers who beta-tested the smartphone application, 20 completed an end-of-pilot, semistructured telephone interview with the application designer. Interview responses were not correlated with demographic information or whether or not respondents were provided a smartphone. One qualitative question asked was "How has the application affected your relationship to your care coordinator?" Seventeen of the 20 responses indicated a perception of positive change in the nurse-patient relationship. Anecdotal patient comments in response to this question included that the communication "felt like friends texting." In addition, some teenagers were more comfortable communicating with text messaging and believed that they were "able to ask more questions" than in verbal phone communication.

In response to the same question, several teenagers indicated that improved access was the reason for an improvement in the relationship with the RN care coordinator. Although the RN care coordinators did not increase shift hours and were not available outside scheduled clinic hours, the teenagers commented that it was easier to contact their nurse and received a quicker response than with traditional telephone communication. No negative comments were made from the teenagers about lack of response to text messaging outside of clinic hours, although all were made aware at enrollment of expected response times. The RN care coordinators noticed that teenagers often responded during the evening and early morning hours to text messages and requests to complete the asthma control questions. This application allowed teenagers to initiate communication to RN care coordinators outside scheduled clinic hours, at the time that was most convenient for them.

One teenager commented that before participating in the pilot, he was unaware that he had an RN care coordinator. A unique attribute to the teenage population is that, often, the nurse must go through a third party, the parent or guardian, to communicate to the teenager about his/her disease. Direct communication with the teenager can be challenging and dependent on many factors, including the teenager's schedule, the parent's perception and knowledge of the teenager's disease, and the parent's relationship with the nurse or primary care team. Use of the smartphone application allowed the nurse a direct pathway to communicate with the teenaged patient.

In the semistructured, postpilot interview responses, the RN care coordinators believed that the teenagers likely responded more honestly about their asthma control. One RN care coordinator commented about face-to-face or telephone verbal exchanges with teenagers: "Some kids say their asthma is fine but fill out the symptom control assessment as poorly controlled." The RN care coordinators believed that the comments sent via text messaging more accurately reflected and addressed the control assessment responses. As an example, when one teenager submitted a control assessment indicating that asthma was limiting activity, an accompanying text message indicated that the issue was most likely related to uncontrolled allergies while at an outdoor activity. This helped the RN care coordinator focus on a plan to control the allergy trigger instead of simply focusing on an exercise trigger. In addition, RN care coordinators commented that patients who were, from past experience, typically less talkative with traditional telephone contact seemed to respond with more detail through text messaging.

Another theme that emerged in the interview was a sense of reassurance for the RN care coordinator that the teenager was consciously thinking about his/her asthma and was actively engaged. Each time the teenager viewed an education clip, looked at his/her asthma action plan, or completed a symptom control assessment, the RN care coordinator received electronic notification. Notification included dashboard highlighting of new messages and an e-mail message to alert the RN care coordinator to check the dashboard for patient activity. The RN care coordinators believed it beneficial to know when the patient was actively using the application. If the teenager was actively using the application, the RN care coordinator knew the teenager was available for contact with current access to his/her cell phone. The RN care coordinator could then call the teenager to ask more questions, reverting to synchronous communication.

Several limitations were present in the pilot that could lead to inaccurate predictions or assumptions. There was no control group for comparison to determine if perceptions were similar between those using smartphones for communication and those using traditional methods of contact. Validated tools were not used for semistructured interviews or smartphone surveys. The challenge of teenagers not possessing their own smartphone required adaptations that were not anticipated. Some teenagers were provided smartphones, which may affect their level of engagement in using the smartphone. Moreover, they may perceive a greater obligation to use the application and respond to the RN care coordinator. In addition, because of time spent trying to secure smartphones for patient use, the length of the pilot needed to be extended from the initial plan of 2 months to participation from 3 to 6 months.

Teenagers with their own smartphones were enrolled first and were using the application almost twice as long as teenagers later provided with smartphones.

The short duration of the pilot also posed a limitation in predicting any relationship between application use and patient asthma control outcomes. Asthma is a disease with severity that often waxes and wanes related to many factors. A comparison of level of asthma control in a single patient from one month to the next cannot be attributed to application use because too many uncontrolled variables are present. Factors such as the teenager's medication compliance, environmental exposure to triggers, such as pollen counts and humidity levels, and respiratory illness patterns can affect asthma control data from month to month and year to year.

LESSONS LEARNED

This pilot reinforced the strong need for nursing to become involved in the development and utilization of technology to ensure that emerging technologies are used to enhance patient care, not to replace nursing care. The nurse-patient relationship is an important mechanism to guide the patient toward achieving health. Leveraging this and integrating it into a function of the technology could be an important step in maximizing technology's usefulness in achieving improved patient health. Unfortunately, without nursing's voice to advocate for the nurse-patient relationship during technology's development, there is a risk of losing this opportunity.

Emerging technologies need to be adopted and integrated into practice. Two barriers of adoption noted by the RN care coordinators during the pilot were integrating the use of the technology into their current workflow as well as having to use a separate Web site for the smartphone application that does not communicate with the electronic medical record (EMR). In current practice, each patient contact is considered an episode of care; information is collected and responded to in a single day and is documented in a separate clinical note. Using the smartphone texting capability, communication between the teenager RN care coordinator could be a series of messages spanning several days yet be one conversation. Documenting a single text message in a clinical note removed the context of the ongoing conversation and did not allow for a view of the entire communication. Conversely, if EMR documentation did not occur until the RN care coordinator felt that the text conversation was complete, other healthcare providers who might interact with the teenager mid-episode would be unaware of the ongoing communication. A documentation workflow supporting ongoing communication needs to be developed to integrate the technology into practice.

The second barrier noted by the RN care coordinator is the use of two separate electronic systems, the dashboard system for the smartphone application and the EMR, which resulted in decreased efficiency. For example, with each teenager enrolled, the individualized asthma action plan needed to be recopied from the EMR into the application dashboard, and each time medication treatment changed, the RN care coordinator needed to update the plan in both the EMR and the dashboard. In addition, each time the teenager submitted a new asthma symptom control assessment, the form's data needed to be copied from the dashboard to the EMR flow sheet. Consideration should be given during development for communication and transfer of data from smartphone applications directly into existing clinical documentation programs. A more complete integration of the application into existing EMR technology would result in greater efficiency of the RN care coordinator by decreasing redundant documentation workload.

Knowledge needs to be developed to support technology's use in connecting nursing care and the patient experience to ultimately enhance the nurse-patient relationship. For this to happen, nursing needs greater involvement in the creation of the applications used by patients. Further study needs to demonstrate longer term use of smartphone technology in supporting communication between patients and their primary healthcare team and, subsequently, the patient relationship experience and also to establish improvement in patient healthcare outcomes.

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