

Commentary

Integration of mobile health applications into pain intervention on an inpatient psychology Consultation Liaison service

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Pain is a common referral question for Consultation Liaison (CL) programs at children's hospitals (Carter et al., 2003; Piazza-Waggoner et al., 2013) and children and adolescents with chronic pain tend to have longer inpatient admissions and frequent readmissions (Coffelt et al., 2013). As a result, CL psychologists in pediatric settings are often consulted to provide preliminary interventions to assist with pain control and promote progress toward discharge. They are also typically responsible for making recommendations about follow-up pain management intervention on an outpatient basis. Considering these interventions often occur bedside, electronic health (eHealth), which refers to the use of technology designed to increase understanding of health concepts within psychological intervention (Cushing & Steele, 2010), may be particularly valuable for psychologists undertaking the task of providing pain interventions within a hospital setting. Specifically, mobile health (mHealth) technology, a subset of eHealth which is defined as "the use of mobile computing and communication technologies in health care and public health" (Free et al., 2010, p.1), may include portable electronic devices (e.g. tablets, smartphones) that can be used bedside. In addition to the convenience, mHealth technologies often get an enthusiastic response from youth, and tend to be user-friendly. Further, many children and adolescents have access to a mobile device and could continue to use mHealth resources once they are discharged, bridging the gap between behavior interventions learned in the hospital and the

outpatient setting. For instance, 75% of all children under 8 years old have a mobile device at home (Rideout et al., 2013), 37% of American teens have a smartphone, and one in four has a tablet (Madden et al., 2013). The aim of this commentary is to describe the use of mHealth interventions in the pediatric hospital setting. We will illustrate this concept by describing an mHealth technology program focused on pain management, specifically using iPads and mobile applications (also known as apps), which was designed and implemented within a children's hospital inpatient psychology CL service.

Program justification and model

Many smartphone apps that assist with skills used for pain management have been developed, typically without the input of mental health practitioners. In a 2010 review of 33 studies of eHealth programs aimed at management of chronic pediatric illnesses, only those that used behavioral as opposed to educational methods had reasonable effect sizes on health promoting and maintaining behaviors, such as self-monitoring of adherence and diet and exercise behaviors (Cushing & Steele, 2010). Thus, apps that are strictly educational in nature may not be ideal for use in psychological interventions aimed at behavior change. Fortunately, psychologists have already begun the task of reviewing the quality of apps available to assist with pain management. Smith et al. (in press) created a list of child- and adolescent-friendly apps that teach skills consistent with evidence-based interventions

for pain. The apps were independently reviewed by three reviewers with psychological training in pain management, and were chosen based on overall rankings on 5-point Likert scales across the following categories: 1) inclusion of pain-management educational content; 2) inclusion of pain management skills; 3) likeliness of engaging young users; and 4) ease of use. A readability score based on grade level of the written material in the apps was also calculated. Our program used several of the apps suggested by Smith et al. (in press) since they were already vetted by psychology professionals. Our program undertook a similar effort to review apps based on: 1) user friendliness and relevance to be relevant to children/adolescents; and 2) a focus on skills consistent with evidence-based interventions for pain. Free and low-cost apps were prioritized. Apps that were highly-rated using these criteria were distributed across four areas: Relaxation (e.g. Breathe2Relax, Take a Chill, Gaze HD Beach, Relax Melodies, Smiling Mind, Belly Bio, Tactical Breather, Healing Buddies Comfort Kit), Distraction (e.g. Bubble Wrap, Me Moves, Dr. Panda's Hospital), Biofeedback (e.g. Inner Balance, eSense Temp), and Adherence/Behavior Management (e.g. Super Better, Epic Win, iReward Chart).

Using mHealth pain apps in the hospital setting: An illustrative example

C.S. Mott Children's Hospital of the University of Michigan Medical System is a 348-bed children's hospital that treats children with a variety of medical conditions. Our psychology inpatient CL service commonly receives referrals with pain as the presenting complaint. These referrals tend to involve adolescents and often require frequent contact from psychology practitioners, making pain an ideal target for intervention enhanced with mHealth technology. The goal of the project described herein was for the practitioners on the CL service to have demonstration iPads with them when they complete an initial consult in order to demonstrate concepts relevant to the intervention. For instance, almost every pain-related consultation included demonstration of the Breathe2Relax app and/or the biofeedback app Inner Balance. CL practitioners

consider diaphragmatic breathing the most essential skill for children hospitalized with pain to master. If the child and parent were interested, an iPad was loaned to them and they were assigned specific apps to use as homework that the provider would follow up on during their next contact. Parents and nursing staff were encouraged to coach the child/adolescent to use the apps as appropriate.

In order to implement the iPad lending project, our CL service collaborated with several other hospital departments in order to assist with funding to acquire the iPads, develop a storage and lending protocol, identify technological needs and support, as well as implement a plan for loss prevention. Once acquiring funding through an internal hospital grant, 10 iPads were purchased to loan to inpatients receiving CL services. This number of iPads has been ideal for the size of our institution, as it allowed for some iPads to be out of the lending rotation for short periods due to practitioners use for demonstration purposes, cleaning, reimaging, etc. Apps were preloaded onto the iPads and grouped into folders labeled with headers related to the focus of the apps inside (e.g. relaxation). A secure lending station was created in a common area where CL practitioners could store and charge iPads, access loan agreements for parents to complete, track details about to whom iPads are loaned, and clean and reimage iPads after they are returned. The lending station also includes a computer with a master image that is uploaded onto all of the iPads for consistency in content, and this image is reloaded onto each iPad after return to clear any identifiable data between patients. The loan agreement signed by each parent asked for the parent to be in charge of monitoring how their child used the iPad, as our institution has unrestricted wireless internet. A copy of the parent's driver's license and hospital identification badge was also collected and stored with the loan agreement in order to add an extra layer of accountability. In order to minimize iPad loss, a very heavy case clearly labeled as property of the hospital was affixed to each iPad. Further, a GPS tracking app called Find My iPad was installed onto each device to assist with locating it should it leave the hospital. Finally, a notation was made into the belongings section of each inpatient electronic health record

stating that the patient was loaned an iPad which is required to be returned before discharge. It took approximately 8 months to acquire the materials for the project and collaborate with other departments to put the program in place. In order to serve as a

reference for other iPad loaning projects, a summary of preliminary steps are provided in Table 1 and a summary of the cost of materials for the program is provided in Table 2.

Table 1
Example of iPad program implementation process

Step	Hospital Resource	Materials/Programs Needed
Acquisition, storage, and cleaning	Grant funding, storage location (e.g. office, family center)	<ul style="list-style-type: none"> – 10 iPads – locked docking/charging station – disinfecting wipes – screen cleaner
Loss prevention	Security Department	<ul style="list-style-type: none"> – heavy/durable iPad case marked with an assigned iPad number/letter – tracking form to indicate name of person who was loaned iPad, location, staff responsible for pick up, etc. – lending contract for parent to sign indicating terms of agreement (e.g. price if lost, parent address, loan and return date) – Find my iPad GPS tracking app to locate device if it leaves the hospital – documentation in electronic medical chart that iPad was loaned to patient
Technological support and data security	Information Technology	<ul style="list-style-type: none"> – computer at docking station with master image of how each iPad screen should appear – process for re-imaging each iPad to ensure any identifiable data is removed between patients

Table 2
Costs and materials of the iPad program

Product	QTY	Cost (USD)	Subtotal (USD)	% of Total
iPad2	10	\$379.00	\$3,790.00	57.10%
iPad lending station	1	\$1,550.00	\$1,550.00	23.35%
Apps (per iPad)	10	\$50.00	\$500.00	7.53%
iPad cases	10	\$60.00	\$600.00	9.04%
Biofeedback sensors	2	\$99.00	\$198.00	3.98%
		Total	\$6,638.00	

Feedback about the mHealth experience

Anecdotal reports from parents, children, and mental health practitioners who used the mHealth program during the pilot feasibility phase were positive. All agreed that using the iPad apps increased their satisfaction with their/their child’s treatment at the hospital, taught them/their child something new, and encouraged them/their child to practice the coping skills taught by the psychologist. Psychology practitioners using mHealth in their interventions reported that the iPad apps enhanced their ability to teach pain management skills and appeared to improve their patients’ enthusiasm for practicing these skills in between contacts. The iPad lending program also attracted positive attention from other hospital units. Representatives from both the inpatient psychiatry unit and burn treatment unit approached members of the CL team for advice about how to implement a similar iPad lending program within their units.

Based on our experience with setting up the program, we would recommend a few additional program enhancements. The first would be to find a way to track which iPad apps the children/adolescents used and how often they used them. We have yet to develop a straight forward way of tracking app usage on the iPad, but have had

some initial success providing a paper and pencil tracking form along with the iPad and asking patients to log this information. Further, it would be helpful to encourage the children/adolescents to continue to use the apps after discharge by assisting them in acquiring the apps on their own mobile devices. If funding is available, we have found that giving iTunes gift cards to patients at the time of discharge helps to cover the cost of purchasing these apps themselves and hopefully increases the likelihood that they will use the apps at home.

Implications and future directions

We plan to conduct a more formal assessment of the utility of implementing a tablet-based mHealth intervention program to address inpatient pain, including collecting data about the amount of time the iPads are used and which apps are considered most useful. Preliminary feedback is encouraging and suggests that implementation of an iPad lending program within inpatient psychology CL programs is not only feasible, but may also be perceived as helpful by patients, parents, and practitioners. Based upon our experience implementing this program, we offer the following recommendations to other clinicians undertaking such a task:

1. Attempt to make the iPad lending process as time efficient as possible so as not to burden practitioners. Practical ways to do this include using a volunteer to work exclusively on the early stages of implementation, having the docking station conveniently located to inpatient floors, and integrating the iPad lending process into routine care so it does not add more than 5 extra minutes to psychology visits.
2. To minimize loss of the iPads, it is helpful to have a very small team of people who will be responsible for loaning them out. This encourages those individuals to feel a greater sense of responsibility for facilitating their successful return. It also helps to have a backup plan in place for the patient to return the iPad should their first attempt be unsuccessful (e.g. can give to security when leaving hospital if appropriate clinical staff were unavailable).
3. Advertise the mHealth program to staff and patients as much as possible. Provide demonstrations of the apps and keep physicians and other team members informed of supporting data (e.g. patient satisfaction with the program). The more team members on board to promote the program the better.
4. Based on our experience and the previously reviewed research findings (e.g. Cushing & Steele, 2010), it is important that practitioners are: a) integrating the use of mobile devices within an evidence-based treatment model and not using apps as a stand-alone intervention and b) selective about which applications they use to complement their interventions, as any

technology developer can create an application. Considering these points, it would be most appropriate for psychologists to be in charge of vetting the applications, as well as ensuring that they are used within a broader cognitive-behavioral therapy intervention. Psychologists may also want to train other medical staff involved in the child's care (e.g. Child Life, nursing) about how they may play a role in the iPad program by encouraging their patients to use the apps as appropriate (e.g. diaphragmatic breathing before medical procedures).

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