Review Article

mHealth in pediatrics-finding healthcare solutions for the next generation

Alisa L. Niksch

Pediatric Electrophysiology and Cardiopulmonary Exercise Lab, Tufts University Medical Center, Boston, MA 02111, USA

Correspondence to: Alisa L. Niksch, MD. Tufts Medical Center, 800 Washington St. #313 Boston, MA 02111, USA. Email: aniksch@tuftsmedicalcenter.org.

Abstract: Mobile health (mHealth) technologies have begun to transform the way clinicians deliver healthcare, with goals of greater patient engagement and improved health outcomes. However, the unique needs of pediatric populations are commonly neglected when novel technologies are designed. Constantly changing size and evolving developmental capabilities present a challenge for development of effective mHealth solutions for children. Parents and the greater healthcare community have a greater role in child health, placing demands on new technology to provide connected models of care. This summary provides the landscape of challenges and opportunities presented by the growing population of children who could be optimal candidates for properly tailored mHealth solutions.

Keywords: Mobile health (mHealth); pediatrics; medical home; mobile app; self-management; gamification; telehealth

Received: 02 March 2015; Accepted: 12 March 2015; Published: 25 March 2015.

doi: 10.3978/j.issn.2306-9740.2015.03.09

View this article at: http://dx.doi.org/10.3978/j.issn.2306-9740.2015.03.09

Introduction

The world of mobile health (mHealth) technology has opened up unprecedented possibilities for patient and provider access to diagnostic, monitoring, and chronic management tools. mHealth, defined by the National Institutes of Health as the use of mobile and wireless devices to improve health outcomes, health care services, and health research, seems primed to serve a young, forward thinking population. However, still, the pediatric patient population presents significant challenges for developers of mHealth solutions, and as in previous experience with pharmaceuticals and medical device manufacturers, this population has a risk of being underserved.

Current pediatric epidemiologic studies have documented that over 1 in 4 children are living with a chronic disease, be it asthma, cancer, diabetes, sickle cell disease, obesity, or learning and behavioral disorders (1). It has been the theory set forth by the American Academy of Pediatrics (AAP) that these patient populations would optimally benefit from the concept of the patient centered medical home. In this setting, care would be maximally accessible, comprehensive, continuous, and coordinated (2). However, logistical challenges of geography, institutional resource limitations, family structure and financial limitations have led to the imperfect execution of this theory. With the entrance of mHealth technologies, including the spectrum of telehealth, wireless medical devices, and health apps, many of the disconnected services of the medical home could have potential solutions.

The role of parents

It is clear to any pediatric practitioner that parents are one of the most engaged groups in the healthcare ecosystem. It is also clear that in pediatric chronic disease management, parents are asked to perform extraordinary duties and make acute clinical decisions on a weekly or even daily basis. A study by Enspektos in 2012 found that 82% of mothers will go online to get a second opinion on their child's medical diagnosis (3), and 40% of those owning smartphones have downloaded at least one health or wellness app. A study conducted in inner city Brooklyn revealed that 59% of adult caregivers of children were somewhat or very interested in medical apps for pediatric health issues, and that 66.9% had

looked up medical information using their smartphones (4). What can be concluded from this behavior is that mothers and caregivers in general want to be equipped with information about their child's illness to be able to respond effectively to their various health needs. mHealth tools have been deployed to improve disease specific education, assist in real time decision making, goal-setting and tracking, which is key to the process of self-management as prescribed by the chronic care model (5). Parents play a very large role in pediatric self-management, and technology has allowed for more streamlined communication of data (especially in diabetes where there is very granular data). Case studies have also shown better guided decision support from clinicians, either through secure patient portals or via telemedicine visits associated with a mHealth tool (5).

It is important to note that approximately 20% of parents with diseases such as type I diabetes have increased levels of stress years after the initial diagnosis. Increased levels of parental stress are associated with higher reports of child stress and depressive symptoms, behavioral disruption, and self-reported lower quality of life scores (6). Parents are also asked to account for a population of children and adolescents who have a track record of less than 50% compliance with medical treatments (7). There has been some initial evidence that telemedicine can replace a large percentage of acute care visits (8). However, while apps have been developed to try to address certain specific disease states, the industry is too young to prove that these various mHealth tools have impacted compliance in pediatric patients.

mHealth and pediatric self-management

Given the growing financial burden of pediatric chronic disease, self-management of pediatric chronic disease states has become a greater priority. In 2010, California passed a law mandating that health maintenance organizations institute coverage for self-management programs for children with asthma, recognizing the costs associated with emergency department visits and hospitalizations for this condition (9). mHealth tools have become more developed in specific areas such as asthma, diabetes, and obesity, although studies continue to be performed examining the optimal content of these platforms.

There are two main challenges to design mHealth solutions for pediatric self-management. First, mHealth has yet to fully recognize the uniqueness of the pediatric self-management model. In this population, self-management operates within individual, family, community, and health care system domains. mHealth and digital health tools in general have focused on the low hanging fruit of individual health education and tracking of personal data. However, there has been a struggle to connect the child as a subject of disease management with their caregivers at home and in school as well as their clinical team. Secondly, as is always the case in pediatric care, an app, device, or communication interface must be adaptable to developmental capabilities of the patient, unless it requires no active intervention by the user or is fully operated by a caregiver. Pediatric behavioral change models are particular features which have not been fully explored through mHealth. Evidence based behavior change techniques adaptable for adolescents have been marginally incorporated into apps for fitness and dietary modifications, but content employing motivational techniques for children are still lacking (10).

The future challenges of mHealth for pediatrics

mHealth technologies have only scratched the surface at addressing this growing patient population. While children and adolescents are the most comfortable with mobile devices and are natural explorers of apps and other platforms, both initial and continued engagement are even more difficult challenges than in adult populations. Children have no qualms about expressing their dislike of any given product for the most minor flaw. Toy developers have started to recognize the value of mobile devices to empower children with multi-touch screens, microphones and accelerometers (11). Collaborative interactions with other children have been integrated with digital toys, where children can narrate their own outcomes—an intriguing application in health management and disease specific therapies. In addition, children have shorter attention spans and generally are averse to repetition. Varying the pathway to achieve the same health related outcome is often a must within a mHealth app or software platform. Gamification is a major tool to achieve this, but requires more sophisticated coding for the product. Games have already been shown to achieve greater degrees of relaxation in preoperative patients, and decrease levels of nausea in children receiving chemotherapy (12). Social media and even virtual mentorship are other possible enticements for continued engagement and motivation for goal setting and treatment adherence, as well as psychological support for older children and teens (13). Adherence to treatment plans has been shown to deteriorate through adolescence, and providing a positive and stimulating mobile platform

to promote further education and healthy behaviors is key (14,15). mHealth apps and devices have the potential to overcome significant obstacles in achieving better outcomes for pediatric patients with chronic disease, as well as decrease healthcare costs for individuals and the medical system as a whole.

As pediatricians have preached for decades, children are not "little adults" in either physical or psychological terms. While chronic disease is becoming more prevalent in children, "adult centric" design principles for software algorithms or medical devices have not be effective for this population. This experience is not expected to change with the expansion of mHealth solutions. To overcome this, apps must be creative and adaptable to capture short attention spans and change with different developmental and physiologic stages. Devices must be durable, unobtrusive, and have a passive use model, especially for infants and small children. mHealth platforms must also overcome the concerns over accuracy and data security, remaining a significant obstacle to adoption for healthcare consumers (16). Lastly, all of these tools must be translatable to the needs of families and clinicians in terms of data communication and tracking, leading to meaningful interventions when needed. With these guidelines, mHealth can provide better awareness, better management, and better outcomes for pediatric disease.

Acknowledgements

None.

Footnote

Conflicts of Interest: Dr. Alisa L. Niksch is on the Advisory Boards of mobile health companies AliveCor, Inc., Sproutling, Inc., and VerbalCare.

References

1. Van Cleave J, Gortmaker SL, Perrin JM. Dynamics of obesity and chronic health conditions among children and youth. JAMA 2010;303:623-30.
2. Cooley WC, McAllister JW, Sherrieb K, et al. Improved outcomes associated with medical home implementation in pediatric primary care. Pediatrics 2009;124:358-64.
3. Digging Beneath the Surface: Understanding the Digital Health Mom. Available online: http://www.slideshare.net/fjohnmar/digging-beneath-the-surface-understanding-the-digital-health-mom
4. Singh A, Wilkinson S, Braganza S. Smartphones and pediatric apps to mobilize the medical home. J Pediatr 2014;165:606-10.
5. Siminerio LM. The role of technology and the chronic care model. J Diabetes Sci Technol 2010;4:470-5.
6. Whittemore R, Jaser S, Chao A, et al. Psychological experience of parents of children with type 1 diabetes: a systematic mixed-studies review. Diabetes Educ 2012;38:562-79.
7. Winnick S, Lucas DO, Hartman AL, et al. How do you improve compliance? Pediatrics 2005;115:e718-24.
8. McConnochie KM, Conners GP, Brayer AF, et al. Effectiveness of telemedicine in replacing in-person evaluation for acute childhood illness in office settings. Telemed J E Health 2006;12:308-16.
9. Modi AC, Pai AL, Hommel KA, et al. Pediatric self-management: a framework for research, practice, and policy. Pediatrics 2012;129:e473-85.
10. Brannon EE, Cushing CC. Is There an App for That? Translational Science of Pediatric Behavior Change for Physical Activity and Dietary Interventions: A Systematic Review. J Pediatr Psychol 2014. [Epub ahead of print].
11. Russell A. 3 Ways to Design Toys That Boost Kids' Creativity. May 23, 2012. Available online: http://www.fastcodesign.com/1669691/3-ways-to-design-toys-that-boost-kids-creativity
12. Patel A, Schieble T, Davidson M, et al. Distraction with a hand-held video game reduces pediatric preoperative anxiety. Paediatr Anaesth 2006;16:1019-27.
13. Cantrell K, Fischer A, Bouzaher A, et al. The role of E-mentorship in a virtual world for youth transplant recipients. J Pediatr Oncol Nurs 2010;27:344-55.
14. Jónasson G, Carlsen KH, Mowinckel P. Asthma drug adherence in a long term clinical trial. Arch Dis Child 2000;83:330-3.
15. Steele RG, Grauer D. Adherence to antiretroviral therapy for pediatric HIV infection: review of the literature and recommendations for research. Clin Child Fam Psychol Rev 2003;6:17-30.
16. Top health industry issues of 2015: outline of a market emerge. Available online: http://www.pwc.com/en_US/us/health-industries/top-health-industry-issues/assets/pwc-hri-top-healthcare-issues-2015.pdf

doi: 10.3978/j.issn.2306-9740.2015.03.09
Cite this article as: Niksch AL. mHealth in pediatrics-finding healthcare solutions for the next generation. mHealth 2015;1:7