CE **1.0 ANCC Contact Hour**

Deborah Winders Davis, PhD,
M. Cynthia Logsdon, PhD, WHNP-BC, FAAN,
Krista Vogt, BSN, Jeff Rushton, BS, MBA, John Myers, MSPH, PhD,
Adrian Lauf, BE, MS, PhD, and Felicia Hogan, BSN, RN

Parent EDUCATION is CHANGING:

A REVIEW OF SMARTPHONE APPS

Abstract

Purpose: The purpose was to critique existing parenting apps using established criteria and health literacy guidelines.

Study Design: Descriptive methodology was used.

Methods: The Apple App Store was searched using the terms parenting, child health, and infant health. To be included, the apps had to have relevant content (parenting, child health, or infant health), be in English, and contain parent education. After eliminating apps that failed to meet inclusion criteria from the original 203 apps, 46 apps were reviewed. The Patient Education Materials Assessment Tool was used to evaluate the health literacy subscales called Understandability and Actionability. Content analysis included Authority, Objectivity, Accuracy, Timeliness, and Usability.

Results: The majority of the apps (70%) were in English only. The price ranged from free to $4.99. The purpose, target audience, and topics varied. Although all included apps were for parents, some were for more targeted groups of parents. The source of the information was not presented in 26% of the apps. Most apps took the user to a Web site or an article to read. Functionality of the apps was limited, with none of them providing a customized experience.

Clinical Implications: Much development and research is needed before mobile health (mHealth) solutions can be recommended by nurses caring for new parents. It is critical that consumers and interdisciplinary professionals be involved in the early design phase of the product to ensure that the end product is acceptable and usable and that it will lead to healthy behaviors.

Key words: Child health; Health promotion; Mobile applications; Parenting.

More than 98% of all births in the United States occur in hospitals (MacDorman, Matthews, & Declercq, 2014) and it can be assumed that the majority of postpartum education about infant care is provided to new parents at, or before, hospital discharge. There are professional guidelines for educating new parents about caring for their infants during pregnancy and the postpartum period (American Academy of Pediatrics & American College of Obstetricians and Gynecologists, 2012; American College of Obstetricians and Gynecologists, 2014; Association of Women's Health Obstetric and Neonatal Nurses, 2006). As new modalities are rapidly emerging, it is critical to assess the quality of the content and function, as well as the acceptability, usability, and efficacy of various methods for delivering health information.

Providing postpartum education only during the immediate hospitalization is suboptimal as receptivity and recall may be reduced (Logan, Hill, Jones, Holt-Lunstad, & Larson, 2014). Some new parents have reported not receiving or understanding needed health information (Davis, Jones, Logsdon, Ryan, & Wilkerson-McMahon, 2013). Findings of recent studies indicate that new parents do not retain information that is only taught once (Logsdon, Davis, Stikes, et al., 2015) and that they return to Web sites to revisit information when available (Logsdon, Davis, Eckert, et al., 2015). Providing timely information in smaller, more manageable "chunks" is consistent with national health literacy guidelines (DeWalt et al., 2011) because it improves the intake and retention of health information as does providing opportunities for ongoing and repeated exposure to information.

Many parent educational materials have been shown to not adhere to health literacy guidelines (Ryan et al., 2014). Simple educational materials can be very effective in increasing health knowledge and changing health behavior (Logsdon, Davis, Stikes, et al., 2015). Women with lower levels of income or education are at greatest risk for adverse outcomes and have been shown to have more difficulty reading and understanding traditional written and verbal health communication (Davis et al., 2013; DeWalt & Pignone, 2005).

Traditional modalities for health communication are less relevant to newer generations of young parents (Manganello, Gerstner, Pergolino, Graham, & Strogatz, 2015, 2016). Recent research demonstrated that new mothers prefer to use the Internet to access health information, which is most often done with cell phones (Logsdon et al., 2014; Logsdon, Mittelberg, & Myers, 2015). It has also been shown that learning is enhanced when hospital discharge instructions were delivered using an iPad to access YouTube videos compared with written materials (Logsdon, Davis, Stikes, et al., 2015).

Mobile apps are a promising vehicle to deliver health information to new parents and to overcome previously identified barriers as information is consistently available. Suitability, readability, and evidence base of existing parent education apps are unknown. Therefore, our purpose is to critique apps that provide parents with information about infant and child health using established criteria and health literacy guidelines.

Background

Mobile devices are ubiquitous (Smith, 2015), almost as powerful as personal computers and, generally, connected to the Internet. Many mobile applications are available to address healthcare issues. A report from the IMS Institute for Healthcare Informatics (2013) evaluated over 40,000 healthcare apps that were available for download from the U.S. Apple iTunes App Store. Most apps focused on diet and exercise and had limited functionality. The IMS Institute recommended an evaluation of the apps for appropriate use and an integration of the app with other aspects of healthcare.

Populations of pregnant and parenting women have indicated a strong interest in monitoring health with mobile phones (Waring et al., 2014). Mobile apps have been used to diagnose and manage preeclampsia, to advise new mothers after early discharge (Danbjørg, Wagner, & Clemensen, 2014; Dunsmuir et al., 2014), and to educate new mothers about nutrition and when to seek professional care (Entsieh, Emmelin, & Pettersson, 2015).

Although the number of mobile apps is increasing, including health information apps for new parents, a review of available apps is needed to evaluate the characteristics of such apps. For example, are the apps evidence-based and up-to-date, does the content adhere to national health literacy recommendations, and what type of functionality is available? This information may be helpful for nurses who are guiding families in finding health information or to researchers developing interventions to advance the delivery of health information to parents.

Methods

Selection of Apps for Review

All apps were selected from the iTunes App Store using the following search terms, "parenting" (52), "child health" (127), and "infant health" (24). To be included, the apps had to have relevant content (parenting, child health, or infant health), be in English, and contain parent education. Apps were excluded if they were tools only (34), pregnancy only (31), not in English (8), not related (32), duplicates (17), and games (9). An additional 25 apps were excluded after initial review because the target audience was professionals rather than parents. The final critique included 46 apps.

Review Criteria

The apps were reviewed based on two sets of criteria. First, national health literacy guidelines were addressed using the Patient Education Materials Assessment Tool (PEMAT) (Shoemaker, Wolf, & Brach, 2013), which evaluates, separately, if health information is *understandable* and *actionable*. The PEMAT was developed by national experts under the direction of the Agency for Healthcare Research and Quality and was shown to demonstrate content validity, internal consistency, and reliability (Shoemaker, Wolf, & Brach, 2014). The Understandability subscale consists of 19 items that address six topic areas (Content, Word Choice and Style, Use of Numbers, Organization, Layout & Design, and Use of Visual Aids). Each item is scored as follows: Disagree = 0; Agree = 1. Additionally, eight items can be scored N/A if items, such as visual aids or tables, are not included. An Understandability subscale score is obtained by adding up the points and dividing by the number of points possible and, then, multiplying by 100 to get a percentage score. Similarly, the Actionability subscale consists of seven items that are scored as Disagree = 0; Agree = 1; or N/A (two items). The Actionability subscale score is calculated as above.

Second, the content was evaluated based on the criteria recommended by a national consortium called *Trust it or Trash it*. The group recommends that the following questions be asked when evaluating technology to ensure that the resource is valid, current, and unbiased (Access to Credible Genetics Resource Network, The National Center on Birth Defects and Developmental Disabilities, and Centers for Disease Control and Prevention, 2013): 1) *Who said it?*; 2) *When did they say it?*; and 3) *How did they know?* Similarly, others have recommended that Web sites be reviewed for accuracy, authority, objectivity, timeliness, and coverage or related criteria (e.g., United Nations Framework Convention on Climate Change, 2014; UC Berkley and Johns Hopkins University Milton Libraries). Although these criteria were developed for Web sites rather than specifically for apps, no other criteria are available. A data table was created with the following headings and subheadings.

1. Authority (author or creator)
2. Objectivity (purpose, criteria for including information, intended audience)
3. Accuracy (opinionated or factual; references; errors)
4. Timeliness (creation date; date of last update)
5. Usability (available languages; compatibility; size of data file; rating on iTunes [1–5 stars]; Are there ads?; cost)

Results

Of the 46 apps that were reviewed, 33 (70.2%) were in English only; 5 (10.6%) were in English and Spanish; and 9 (19.1%) were in 2 or more languages, which may or may not have included Spanish. The data files ranged in size from 1.3 MB to 350 MB. The apps ranged in price from no charge to $4.99. The apps were created between 2009 and 2016 and last updated between 2010 and 2016. Eleven (23.4%) did not list a source for the information provided in the app. Six apps (12.8%) contained commercial ads within the app. After review, six apps were eliminated from the table because the last update occurred before or during 2012. Only minor typographical or spelling errors were noted.


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No empirical evidence exists related to the most effective teaching vehicle for postpartum discharge education for new parents or outcomes of that teaching.

Content of the apps varied. One app was strictly a social networking site focused on fertility, pregnancy, and parenting with no factual information or references. The majority of the apps provided a link to a Web site or to articles on specific parenting topics. The purpose, target audience, and topics included in the apps are presented in Table 1. The table describes what is known about the apps. Of particular interest for nurses is whether references are provided, who created the app (authority), and whether the information is factual. Also important is the date when the information was last updated, but we only included recently updated apps in Table 1.

Thirty out of 43 apps received an Understandability PEMAT score between 76% and 100%, whereas 13/43 received a score of 51% to 75% (Table 2). For Actionability,

Table 1. Description of Apps for Parent Education: Last Updated 2013–2016

	Author and/or Creator	Purpose	Intended Audience	Opinion or Factual?	References	Device	iTunes Rating (1–5 Stars)	Ads?	Cost
Baby +	Health & Parenting Ltd.	Track baby's development	Family members of an infant	Factual	Yes	iOS 8.0 or later; iPhone, iPad, iPod touch	3.5	No	Free
Born to Move	Microcare Technologies Ltd.	Advice, tops and games to play with child to support development	Parents and caregivers of children from birth to preschool age	Factual	Yes; Active Learner Project, Kent Community Health NHS Foundation Medway Health Informatics	iOS 6.0 or later; iPhone, iPad, iPod touch	None	No	Free
Fertile Thoughts	Fertile Authority LLC	Social networking site focused on fertility and infertility	Prepregnant or expecting; current parents	Opinion	No. All infomation is from other users' posts.	iOS 7.0 or later; iPhone, iPad, iPod touch	None	No	Free
Kidfolio Pro Baby Tracker and Digital Scrapbook	Alt12 apps, LLC	Tool to track baby's health and a digital scrapbook	Parents	Both	None	iOS 7.0 or later; iPhone, iPad, iPod touch	4.5	No	Free
My Preemie	Graham's Foundation	Complete toolkit and information for the unique practical and emotional needs of families of premature babies	Anyone interested in premature babies	Factual	Preemies: The essential Guide for Parents of Premature Babies (book)	iOS 6.1 or later; iPhone, iPod, iPod touch	None	No	Free
My Pregnancy Baby	Zooba Quarks	To educate mothers on what to expect during pregnancy day by day and to give tips on parenting	Parents	Both	None	iOS 6 or later; iPhone, iPad, iPod touch	None	Yes. One bar.	Free
Parenting Pediatric Oncall	Pediatric Oncall Private Limited	Integrated medical information and education tool with an extensive network of doctors as registered members of the site	Parents	Factual	Yes. Physicians from Wadia Hospital for Children, Mumbai India.	iOS 7.0 or later; iPhone, iPad, iPod touch	None	No	Free
Breastfeeding Timeline	Allison Dixley	Breastfeeding information for birth to 2 years	Mothers	Factual	Yes; Alpha Parent blog, many reliable sources	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	$0.99
Have a New Kid by Friday	Mmotio llc	Book: 5-day action plan to improve parenting skills with children's behavior problems	Parents	Both	Dr. Kevin Leman	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	$1.99
American Academy of Pediatrics	American Academy of Pediatrics	Latest authoritative information from the AAP to provide the best care for children and teens	Anyone interested in child health	Factual	60,000 physicians specialized in pediatrics	iOS 7.0 or later; iPhone, iPad, iPod touch	None	Yes	Free
Baby Milestones plus Early Childhood Development Guide	Daniel Martinho	Child development guide for birth to 6 years	Parents	Factual	None noted	iOS 5.1.1 or later; iPhone, iPad, iPod touch	4.5 stars	None	$0.99
Car Seat Helper	MediaKube, LLC	Advice for selecting right car seat for a child	Parents	Factual	Phoenix Children's Hospital Injury Prevention Center; Based on AAP guidelines	iOS 5.1 or later; iPhone, iPad, iPod touch	None	No	Free
Child Health Tracker from Healthy Children.org	American Academy of Pediatrics	Gives parents the power of an on-demand access to their children's health information, needs, and providers	Parents	Factual	Children's Tylenol Educational Grant	iOS 7 or later; iPhone, iPad, iPod touch	1 star (crashes)		$2.99

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Table 1. Description of Apps for Parent Education: Last Updated 2013–2016 (*Continued*)

	Author and/or Creator	Purpose	Intended Audience	Opinion or Factual?	References	Device	iTunes Rating (1–5 Stars)	Ads?	Cost
Healthy Children	American Academy of Pediatrics	General information about child health and guidance for parents	Parents	Factual	60,000 physicians specialized in pediatrics	iOS 7.0 or later; iPhone, iPad, iPod touch	1.5 stars. Problems loading.	None	Free
Kids Health Info	Royal Children's Hospital	Quality, up-to-date health information from an encyclopedia-like fact sheet	Parents and adolescents	Factual	Royal Children's Hospital	iOS 6.0 or later; iPhone, iPad, iPod touch	None	None	Free
Sick Child Advisor	Smart Caring AS	Fast, reliable, and actionable guidance for child well-being. Features a collection of videos of how children look and act during sickness and injuries.	Parents	Factual	Advice is monitored and vetted by physicians from the Harvard and Dartmouth Medical Schools	iOS 4.3 or later; iPhone, iPad, iPod touch	None	None	Free
21 Children Health Issues That Every Parent Must Know	Anjoice Malabo	Suggestions for parents if their child suddenly becomes seriously ill	Parents	Factual	None noted	iOS 6.0 or later; iPhone, iPad, iPod touch	None	None	$2.99
HANDi Pediatric	Musgrove Park Hospital	Expert support and guidance for common childhood illnesses	Parents, caregivers, and providers	Factual	Pediatric team at Musgrove Park Hospital	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	Free
East TN Kids	Brainflo.com	Physical, educational, and emotional needs of children	Parents or caregivers living in specific region	Factual	East Tennessee Children's Hospital	iOS 6.0 or later; iPhone, iPad, iPod touch	2 stars	None	Free
Alabama WIC	OCV, LLC	Several resources needed when applying for or participating in the Alabama Women, Infant and Children (WIC) Nutrition Program	Women applying for and/or in the Alabama WIC Program	Factual	Medicaid, WIC, SNAP, AL Department of Public Health, adph.org/WIC, Loving Support	iOS 8.0 or later; iPhone, iPad, iPod touch	4 stars	None	Free
Baby Care Master+	Nguyen Van Hung	Best tips and guidelines on baby care	Parents of newborns	Both	None	iOS 6.0 or later; iPhone, iPad, iPod touch	None	Yes. One bar of ads.	Free
Autism Smart App	Takamul Smart Technology LLC	Infomation necessary to stimulate early diagnosis of Autism Spectrum Disorder	Anyone interested in Autism Spectrum Disorder	Factual	CDC.gov, aap.org, psychiatru.org, Child Autism Survey; Developed and published by Dr. Diana Rose	iOS 6.0 or later; iPhone, iPad, iPod touch	None	None	Free
Child Heart Surgery	Stanford Children's Health	In this interactive 3D animation, our doctors compare a healthy heart to one with a complex congenital condition (tetralogy of Fallot with pulmonary atresia and major aortopulmonary collateral arteries)	Parents of children with complex congenital heart conditions	Factual	Lucile Packard Children's Hospital, Stanford Medicine, and Stanford Children's Health	iOS 7.0 or later; iPad only	None	None	Free
Learn About BA	The Hospital for Sick Children	Learning and teaching app that helps users understand all aspects of biliary atresia from anatomy to treatment using illustrations and animations	Parents, patients, and healthcare providers	Factual	SickKids	iOS 7.1 or later; iPhone, iPad, iPod touch	None	None	Free
My Asthma Pal	Children's Medical Center	Educates families about asthma and empowers them to take charge of theirs child's asthma care	Children with asthma and their parents	Factual	NHLBI, Nemours Foundation, Glaxo Smith Kline, CDC, Booster Shot Comics, U.S. EPA, NIH	iOS 7.0 or later; iPhone, iPad, iPod touch	1 star. App freezes.	None	Free

Table 1. Description of Apps for Parent Education: Last Updated 2013–2016 (*Continued*)

	Author and/or Creator	Purpose	Intended Audience	Opinion or Factual?	References	Device	iTunes Rating (1–5 Stars)	Ads?	Cost
How to Deal with Depression	Sathish BC	Useful infomation for how to manage depression	People with or those who have children with depressive symptoms	Factual	Yes. Many throughout the text.	iOS 6.0 or later; iPad only	None	None	$0.99
Its Bedtime	Penguin Random House Group Editorial, S.A.	A tool to guide parents in creating good bedtime habits	Parents	Both	Professionals: Sleep Clinic at the Institute Dexeus in Barcelona, Spain	iOS 7.0 or later; iPhone, iPad, iPod touch	5 stars	None	$2.99
Our Journey in the Doctor's Office	Net-Craft.com Inc.	Tool to help families of sick children identify potential needs at home before leaving the doctor's office	Parents	Factual	Emily Center: Phoenix Children's Hospital	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	Free
Our Journey with Diabetes	Net-Craft.com Inc.	Tool for families of children newly diagnosed with diabetes to identify needs prior to hospital discharge	Parents	Factual	Emily Center: Phoenix Children's Hospital	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	Free
Our Journey with Heart Surgery	Net-Craft.com Inc.	Tool to help families of children needing heart surgery identify their needs before leaving the doctor's office	Parents	Factual	The Emily Center at Phoenix Children's Hospital	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	Free
Symptoms Checker	Vaibhav Kavathekar	Pinpoints possible causes of your medical symptoms	Adults and children	Factual	None noted	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	$4.99
Grow on the Go	EMD Inc.	Educational tool for parents and kids living with growth hormone deficiencies (GHD) and Turner syndrome. Covers real-world topics and helps you understand different options that are available.	Parents of kids living with GHD and Turner syndrome	Factual	None	Requires iOS 6.0 or later; iPhone, iPad, iPod touch	None	None	Free
Caregiver Village	Child Adolescent and Family Mental Health	Help parents and caregivers find resources that can help them in the development and caregiving of their children	Parents and caregivers	Both	Yes. Many references and further Web sites for each topic.	Requires iOS 8.3 or later; iPhone, iPad, iPod touch	None	None	Free
CFGC tips	DWNLD Inc.	Provides daily parenting tips and advice	Parents	Factual	Child and Family Guidance Center, a nonprofit to create wellness through mental health services, prevention, and early intervention	iOS 8.0 or later; iPhone, iPad, iPod touch	None	None on app. Ads on links to full articles.	Free
Healthy Mother and Child-instant self-help with Chinese Massage Points	Dr. Jakob Bargak	Relieve common women and child diseases on your own without	Women and mothers	Both	Physician for 30+ years	iOS 5.0 or later; iPhone, iPad, iPod touch	None	Many ads	Free
Sleep Baby	Steve Ballou	Advice on how to help their baby sleep better	Tired parents	Both	Physician at University of Ottawa, Canada	iOS 5.0 or later; iPhone, iPad, iPod touch	None	None	Free

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Table 1. Description of Apps for Parent Education: Last Updated 2013–2016 (*Continued*)

	Author and/or Creator	Purpose	Intended Audience	Opinion or Factual?	References	Device	iTunes Rating (1–5 Stars)	Ads?	Cost
Parents2B	Minke den Heijer, Babykennis	Focuses on the emotional health of the mother, father, and baby	Parents	Both	Babykennis (professional organization specializing in pregnancy and infant psychology)	iOS 7.0 or later; iPhone, iPad, iPod touch	None	None	Free; upgrade is $2.99
Kids' Skills	Lyhytterapiainsituutti Oy	Instructions on how to help children overcome minor and major difficulties and problems	Parents and other child caregivers	Factual	Psychiatrist & renowned expert on solution-focused psychotherapy and problem-solving	iOS 8.0 or later; iPhone, iPad, iPod touch	None	None	Free
The Gift of Motherhood	Customized Communications Inc.	App to build confidence in the areas of healthy pregnancy, birth, breastfeeding, and adjustment to parenting	Mothers	Factual	None mentioned	iOS 8.0 or later; iPad only	None	None	$1.99

Note: All were error-free except for minor typos; AAP = American Academy of Pediatrics; CDC = Centers for Disease Control and and Prevention; NIH = National Institutes for Health; NHLBI = National Health, Lung, and Blood Institute; Additional information available upon request for these apps & for apps last updated prior to 2013.

Table 2. PEMAT Scores by Percentile Quartiles

	Number of Apps by PEMAT Scores Quartiles (Potential Range 0–100%)			
	≤25%	26–50%	51–75%	76–100%
Understandability	0	0	13	30
Actionability	3	6	15	19

Note: Based on total number of apps that were deemed to be patient education (n = 46) minus 3 that could not be scored because they failed to load.

the scores were as follows: 3/43 scored equal to or less than 25%, 6/43 scored 26% to 50%, 15/43 scored 51% to 65%, and 19/43 scored 76% to 100%.

Discussion

Robust research methods are needed to address limitations of published research, to improve knowledge of effective use of mobile apps, and to advance the science of mHealth technology. Proponents of family-centered care and health literacy suggest that patients should be involved in development of educational materials so that the content and vehicle of delivery are appropriate for the population (Brach et al., 2012; Yin et al., 2012). An innovative approach of partnering with consumers, especially women with lower socioeconomic status, design experts, engineers, media specialist, and scientists has the potential to fill an important gap of designing a mobile app that is acceptable and usable by parents who face the greatest barriers to accessing and understanding health information and that will, ultimately, result in improved long-term outcomes for both parents and their children.

Although development of mHealth technologies is progressing at a rapid pace, little data exist on the quality or scientific basis of such applications (Boulos, Brewer, Karimkhani, Buller, & Dellavalle, 2014; Powell et al., 2016). These technologies are not always developed in collaboration with healthcare professionals, especially nurses, and scientists who can provide critical knowledge to enhance the value and improve relevant outcomes. One systematic review of apps to support self-management of diabetes found that 54% offered just one function (Arnhold, Quade, & Kirch, 2014), which is common among other health-related apps. Although some apps were created by professionals, it is not clear whether input was sought from consumers, whether parents are using such evidence-based sources, or whether any of these apps have resulted in behavioral changes or improved outcomes. Clearly, more research is needed.

User-friendliness, convenience, and effectiveness of healthcare apps in monitoring and delivering healthcare interventions have been reported (Baig, GholamHosseini, & Connolly, 2015), but more work is needed. Mobile apps can provide information, track individual and location, and interact with the user to provide personalized feedback. Change in knowledge and/or behavior is more likely to occur when measurement of the targeted behavior occurs and the information received by the recipient is personal (Damen, 2007). However, none of the apps that we reviewed provided that type of targeted information.

The current project provides new and helpful information regarding apps that are currently available for parent education. However, the study has limitations. Only apps that are compatible with Apple devices were reviewed.

Clinical Implications

- Nurses play a significant role in identifying and communicating health information to new parents (Schmitt, Sims-Giddens, & Booth, 2012).
- Nurses and other healthcare professionals are increasingly using mobile devices in acute care settings to improve communication and decision-making processes (Farrell, 2016; Mosa, Yoo, & Sheets, 2012), and are likely to be comfortable in critiquing and recommending technologies to new parents.
- Nurses should partner with new parents and interdisciplinary professionals to create parent education apps that are evidence-based, acceptable to new parents, and that incorporate national education and technology guidelines.

Different apps may be available for Android and other devices. Generally most apps are made for both platforms, but we did not determine if there were additional ones designed only for other platforms.

Future directions must include partnering with the recipient (e.g., new parents) and interdisciplinary professionals in the early design phase of the app to ensure that the end product (e.g., app) is acceptable and usable and that it will likely promote healthy behaviors and/or improve knowledge retention. Once consumer-centered apps are developed, additional research is needed to determine if, when, and how the apps are used; whether they result in healthy consumer behaviors; and whether they have an impact on long-term child outcomes. Ongoing research and development is needed to stay in tune with the ever-changing mHealth environment. ✣

Deborah Winders Davis is a Professor, Department of Pediatrics, Child & Adolescent Research Design & Support (CAHRDS) Unit, University of Louisville School of Medicine, Louisville, KY. The author can be reached via e-mail at deborah.davis@louisville.edu

M. Cynthia Logsdon is an Associate Chief of Nursing for Research, University of Louisville Hospital/James Brown Cancer Center, and Professor, School of Nursing, University of Louisville, Louisville, KY.

Krista Vogt is a Research Assistant, School of Nursing, University of Louisville, Louisville, KY.

Jeff Rushton is the Director of Digital Media, University of Louisville, Louisville, KY.

John Myers is a Professor, Department of Pediatrics, Child & Adolescent Research Design & Support (CAHRDS) Unit, University of Louisville School of Medicine, Louisville, KY.

Adrian Lauf is an Assistant Professor, J.B. Speed School of Engineering, University of Louisville, Louisville, KY.

Felicia Hogan is a Staff Nurse, University of Louisville Hospital, Louisville, KY.

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