Introduction to the Coordinated Special Issue on eHealth/mHealth in Pediatric Psychology

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Introduction to the Special Issue: eHealth/mHealth in Pediatric Psychology

Ten years ago, the *Journal of Pediatric Psychology* published its first special issue on the eHealth in pediatric psychology (Ritterband & Palermo, 2009). The issue reflected the nascent stage of the field with reports focused on willingness to use the internet for health promotion, the development of internet interventions with a focus on feasibility and usability, a limited number of efficacy trials, and some of the first forays into the mHealth space using PDAs and cell-phones. The issue also reflected the emphasis in pediatric psychology at the time to develop, validate, and disseminate more intervention technologies. In many ways, this focus served to realize the important vision that eHealth/mHealth approaches might reduce barriers to getting “what works” to the most vulnerable and difficult to reach youth.

The field has matured in the intervening decade since the last special issue on eHealth/mHealth. To be sure, there is still a long way to go before meeting the vision of Ritterband & Palermo (2009) that eHealth/mHealth interventions might, “. . . reach more children and their families than would otherwise be served through more traditional forms of care.” However, more protocols have reached the efficacy phase, and move into a dissemination phase. In other words, the roadmap for porting what works in the face-to-face space into a digital medium is clearer (Ritterband et al., 2003). The field is poised to take on the three-fold task of: (a) fully translating face-to-face interventions into digital media, (b) using eHealth/mHealth

technologies to develop or test innovative theories that may optimize future interventions, and (c) designing and testing interventions that fully leverage the adaptive capabilities of digital platforms.

The goal of the current special issue is to provide a snapshot of the progress toward the three objectives above, and to coordinate with a companion issue of *Clinical Practice in Pediatric Psychology*, which highlights both feasibility trials and specific clinically-focused translational or dissemination work. The issue contains a series of commentaries serving as an organizing document (i.e., the current paper), a state of the funding picture at the National Institutes of Health (Riley et al., 2018), and a commentary on the ability of eHealth/mHealth approaches to usher in a new way of thinking about scientific psychology (Cushing, Monzon, Ortega, Bejarano, & Carlson, this issue). Beyond these commentaries, the current issue can be subdivided into three types of articles: (a) innovative approaches using mobile methodologies to collect data, develop theory, and model psychological processes; (b) techniques for designing or refining eHealth/mHealth studies and interventions; and (c) descriptions of outcomes in pediatric psychology clinical trials that leverage eHealth components.

Investigators are grappling with the opportunities presented by collecting dense *in situ* data from mobile devices. For example, in this issue, Mangelsdorf, Mehl, Qiu, & Alisic (2019) leveraged very temporally dense audio data to unobtrusively monitor the family environment following a pediatric injury. Using a novel application of the Electronically Activated

Recorder (Mehl, 2017) the authors sampled 30 s of sound every 5-min for 2 days following discharge from the hospital. The study yielded important information about how parents respond to their children after an acute traumatic injury and had an added benefit of characterizing father as well as mother behavior given the common difficulties of getting fathers to participate in research. While this paper used relatively well-used multilevel models, Armstrong, Covington, Unick, & Black (2018) broke new ground for pediatric psychologists by publishing the first ever dynamic structural equation model (DSEM). The subject of study itself was the bidirectional effects of objectively (i.e., accelerometer) measured sleep and sedentary time. We are particularly excited to highlight Armstrong *et al.* in the student journal club selection for this issue because they articulate how DSEM has many advantages over other techniques that attempt to understand bidirectionality and are popular in pediatric psychology (e.g., cross-lagged panel models, lagged data, and simply reversing the order of the IV and DV in a univariate model). In another first for the journal, the current issue contains a machine learning paper that highlights how computational power and advanced statistics offer solutions to basic clinical problems such as therapist client interactions (Carcone *et al.*, 2019). Carcone *et al.* have taken the first step toward a fully automated eHealth/mHealth intervention by developing a promising approach to offloading the behavioral coding of patient-provider communication. Such technology may make a future human-computer interaction possible that *both* utilizes the patient's natural description of their experience and computerized guidance through an intervention. This would represent a significant advancement over the forced choices that are common to many eHealth/mHealth interventions. In an innovative incorporation of ecologically momentary assessment and multiple sensors (i.e., actigraph, pulse oximetry) into sickle cell disease pain assessment, Valrie *et al.* (2019) used multilevel models to establish a cyclic relationship between sleep quality and daily pain. This work provides an illustrative example of how to leverage concurrent streams of intensive longitudinal self-report and sensor data to further elucidate biopsychosocial processes in a pediatric chronic illness population. Transactional relationships between parent and child psychosocial processes is a long-time interest in pediatric psychology. Lopez Yang, Belcher, Margolin, & Dunton (2019) demonstrate the importance of dynamic parenting practices in predicting 8–12 years olds' engagement in physical activity in an innovative ecological momentary assessment study. This work reflects the ways that research questions can expand across multiple ecological systems once a research methodology (i.e., combining EMA and

objective MVPA data from sensors) have reached maturity.

Several papers in this issue provide a case example or potential framework for approaching research design and intervention development within eHealth/mHealth. Fedele, McConville, Moon, & Thomas (2018) provide a commentary on how the IDEAS framework can be used to systematically design, construct, and test mHealth interventions in pediatric psychology. This paper reviews current best practices during the iterative development of mHealth intervention design and highlights several examples of mHealth interventions in the extant pediatric literature. Two papers in the current issue began the process of intervention design with a systematic review of the literature. One report was conducted with the goal of benchmarking the quality of commercially available apps for adherence not necessarily with the goal of designing an app as an investigatory team, but rather helping to guide industry efforts to develop effective behavior change efforts targeting the consumer marketplace (Carmody, Denson, & Hommel, 2018). Such efforts are important because consumers are likely to have to rely on commercial offerings for some time, while science endeavors to produce disseminable pediatric products (Riley *et al.*, 2018). In another example, Stiles-Shields *et al.* (2018) set out to design an app for spina-bifida. The authors avoided the temptation to start only from theory or to use a purely exploratory process. Instead, they identified chronic health conditions similar to spina-bifida that also had reports of mHealth interventions. Following the literature review, the authors used a published framework for designing mHealth interventions to translate the features of existing interventions into something that might work in their population of interest. The article serves as an excellent example for other teams to approach mHealth intervention design for conditions or problems that have little empirical guidance directly relevant to the condition.

Finally, three articles present data from randomized controlled trials that examined the efficacy of eHealth interventions. eHealth interventions offer promise in overcoming some of the well-known challenges that frequently arise during in-person trials, namely low session attendance, variable intervention fidelity, and limited downstream scalability. Murry, Berkel, Inniss-Thompson, & Debreaux (2019) highlight that their modification of an existing family-based preventive intervention for adolescent risk behaviors to a computer-based delivery format aimed for rural African American families was efficacious in improving parenting outcomes and adolescent risk behavior. Consequently, their eHealth intervention may be an ideal candidate for scaling preventive interventions to underserved areas. Connelly *et al.* (2018) report on

outcomes of a rigorous eHealth trial where adolescents with Juvenile Idiopathic Arthritis were randomized to receive either an online self-management program or an online disease education program for 12 weeks. Contrary to hypotheses, adolescents with JIA from both groups reported modest improvements in pain and health-related quality of life. These findings perhaps suggest that even “low dose” eHealth interventions may be beneficial and deserve future consideration for recommending to families at the point of care. Wade et al. (2018) assess how participant preferences of intervention delivery modality are linked to study outcomes in a sample of families of youth with a recent traumatic brain injury. Families were randomly assigned to one of three problem-solving intervention conditions: in-person, therapist-guided online, or self-guided online. Parents and adolescents were asked to provide their treatment preferences before randomization. Interestingly, adolescents who were not assigned to their preferred group were more prone to attrition, underscoring the importance of assessing participant preferences in the context of delivering eHealth interventions.

Conclusions

The field appears to be headed in an exciting direction for realizing the potential of eHealth/mHealth if the content of the current special issue is an indication. The manuscripts featured here highlight the coming potential of sensor technologies and advanced methodologies that hold the potential to drive innovation in efficacy studies in pediatric psychology. Harkening back to the history of the field, it is encouraging to see the diversity of studies that use digital technology to unobtrusively gather rich datasets for understanding interrelationships between health behaviors and their multisystemic influences.

As was the case in the first special issue on this topic, there are a number of gains to be made in the future. Perhaps most challenging (and also most exciting depending on one's perspective) is the need to develop theory and data models of the dynamic interrelationships between variables over time that can be captured using recent technological advances. Much of what is of interest as dependent variables in pediatric psychology are fluctuating behavioral, perceptual, or affective states (i.e., adherence, physical activity, pain, mood). However, most of our research methodologies and statistical approaches do not fully consider the impact of these fluctuations. Indeed, grappling with the implications of time and time scales appears to be one of the major challenges for conceptual models in the field.

As it relates to intervention, the current issue suggests that pediatric psychology may lag behind other corners of behavioral medicine with respect to mHealth

interventions. While there are some of note (Devine, Viola, Coups, & Wu, 2018; Fedele et al., 2017; Hilliard et al., 2018) few have made appearances in the pages of the *Journal of Pediatric Psychology*. Moreover, there continues to be an untapped power in eHealth/mHealth approaches that is easy to articulate but often elusive to implement. Specifically, most psychologists can easily imagine that a technology could “know” when a user is in need of support, select the right kind of support for a context, and deliver it in a way that would be useful and valued by the user. Currently, we have good examples of interventions that succeed in answering Ritterband et al. (2003) call to translate “what works” into a digital medium. However, less progress has been made toward getting an intervention platform to effectively adapt to the changing needs and contexts of its user.

Conflicts of interest: None declared.

References

- Armstrong, B., Covington, L. B., Unick, G. J., & Black, M. M. (2018). Bidirectional effects of sleep and sedentary behavior among toddlers: A dynamic multilevel modeling approach. *Journal of Pediatric Psychology*, 44, 275–285.
- Carcone, A. I., Hasan, M., Alexander, G. L., Dong, M., Eggly, S., Hartlieb, K. B., . . . Kotov, A. (2019). Developing machine learning models for behavioral coding. *Journal of Pediatric Psychology*, 44, 289–299.
- Carmody, J. K., Denson, L. A., & Hommel, K. A. (2018). Content and usability evaluation of medication adherence mobile applications for use in pediatrics. *Journal of Pediatric Psychology*, 44, 333–342.
- Connelly, M., Schanberg, L. E., Ardoin, S., Blakley, M., Carrasco, R., Chira, P., . . . Stinson, J. (2018). Multisite randomized clinical trial evaluating an online self-management program for adolescents with juvenile idiopathic arthritis. *Journal of Pediatric Psychology*, 44, 363–374.
- Cushing, C. C., Monzon, A., Ortega, A., Bejarano, C. M., & Carlson, J. A. (2019). Identifying opportunities for pediatric eHealth and mHealth studies: Physical activity as a case example. *Journal of Pediatric Psychology*, 44, 269–274.
- Devine, K. A., Viola, A. S., Coups, E. J., & Wu, Y. P. (2018). Digital health interventions for adolescent and young adult cancer survivors. *JCO Clinical Cancer Informatics*, 2, 1–15.
- Fedele, D. A., McConville, A., Graham Thomas, J., McQuaid, E. L., Janicke, D. M., Turner, E. M., . . . Abu-Hasan, M. (2017). Applying Interactive Mobile health to Asthma Care in Teens (AIM2ACT): Development and design of a randomized controlled trial. *Contemporary Clinical Trials*, doi:10.1016/j.cct.2017.09.007.
- Fedele, D. A., McConville, A., Moon, J., & Thomas, J. G. (2018). Topical review: Design considerations when creating pediatric mobile health interventions: Applying the IDEAS framework. *Journal of Pediatric Psychology*, 44, 343–348.
- Hilliard, M. E., Eshtehardi, S. S., Minard, C. G., Saber, R., Thompson, D., Karaviti, L. P., . . . Anderson, B. J. (2018).

- Strengths-based behavioral intervention for parents of adolescents with type 1 diabetes using an mHealth app (type 1 doing well): Protocol for a Pilot Randomized Controlled trial. *JMIR Research Protocols*, 7, e77. doi:10.2196/resprot.9147.
- Lopez, N. V., Yang, C. -H., Belcher, B. R., Margolin, G., & Dunton, G. F. (2019). Within-subject associations of maternal physical activity parenting practices on children's objectively measured moderate-to-vigorous physical activity. *Journal of Pediatric Psychology*, 44, 300–310.
- Mangelsdorf, S. N., Mehl, M. R., Qiu, J., & Alisic, E. (2019). How do mothers and fathers interact with their children after an injury? Exploring the role of parental acute stress, optimism, and self-efficacy. *Journal of Pediatric Psychology*, 44, 311–322.
- Mehl, M. R. (2017). The electronically activated recorder (EAR). *Current Directions in Psychological Science*, 26, 184–190. doi:10.1177/0963721416680611.
- Murry, V., Berkel, C., Inniss-Thompson, M., & Debreux, M. (2019). Pathways for African American success: results of a 3-arm randomized trial to test the effects of a technology-based delivery for rural African American families. *Journal of Pediatric Psychology*, 44, 375–387.
- Riley, W. T., Oh, A., Aklin, W. M., Sherrill, J. T., Wolff-Hughes, D. L., Diana, A., ... Campo, R. A. (2018). Commentary: Pediatric Digital Health Supported by the National Institutes of Health. *Journal of Pediatric Psychology*, 44, 263–268.
- Ritterband, L. M., Gonder-Frederick, L. A., Cox, D. J., Clifton, A. D., West, R. W., & Borowitz, S. M. (2003). Internet interventions: in review, in use, and into the future. *Professional Psychology: Research and Practice*, 34, 527–534. doi:10.1037/0735-7028.34.5.527.
- Ritterband, L. M., & Palermo, T. M. (2009). Introduction to the special issue: eHealth in Pediatric Psychology. *Journal of Pediatric Psychology*, 34, 453–456. doi:10.1093/jpepsy/jsp008.
- Stiles-Shields, C., Crowe, A. N., Driscoll, C. F. B., Ohanian, D. M., Stern, A., Wartman, E., ... Holmbeck, G. N. (2018). A systematic review of behavioral intervention technologies for youth with chronic health conditions and physical and intellectual disabilities: Implications for adolescents and young adults with spina bifida. *Journal of Pediatric Psychology*, 44, 349–362.
- Valrie, C. R., Kilpatrick, R. L., Alston, K., Trout, K., Redding-Lallinger, R., Sisler, I., & Fuh, B. (2019). Investigating the sleep-pain relationship in youth with sickle cell utilizing mHealth technology. *Journal of Pediatric Psychology*, 44, 323–332.
- Wade, S. L., Cassedy, A. E., Sklut, M., Taylor, H. G., McNally, K. A., Kirkwood, M. W., ... Kurowski, B. G. (2018). The relationship of adolescent and parent preferences for treatment modality with satisfaction, attrition, adherence, and efficacy: The coping with head injury through Problem-Solving (CHIPS) study. *Journal of Pediatric Psychology*, 44, 388–401.