

Directly observed therapy to promote medication adherence in paediatric heart transplant recipients

Brief Report

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Abstract

Medication non-adherence causes poor outcomes in paediatric organ transplantation. COVID-19 pandemic has led to an exponential use of mobile health approaches for patient care. Herein, we describe a pilot intervention study using mobile video directly observed therapy building on emerging trends in research and clinical practice pertaining to medication adherence in paediatric organ transplantation.

Due to the COVID-19 pandemic, there is an extraordinary need to develop and examine tele-medicine and mobile health approaches to patient care, especially those addressing critical health outcomes in vulnerable patient populations.¹ This brief report on the protocol of our pilot project details efforts to generate evidence of feasibility and effectiveness of a mobile health intervention focused on adherence with immunosuppressant medication in a sample of adolescent heart transplant recipients.

Challenges with medication adherence remain a significant predictor of poor post-transplant outcomes for children including late acute rejection, number and frequency of hospitalisations, and mortality.^{2,3} This is particularly the case during adolescence during which non-adherence rates are as high as 40–60%.^{2,4,5} Few appropriate interventions are available to target medication adherence,^{3,6} and this study addresses the urgent need to develop and expand effective mobile health approaches in adolescent patients.

Mobile video directly observed therapy

emocha Mobile Health Inc. has developed a mobile video directly observed therapy application enabling users to track dose-by-dose medication adherence asynchronously. In mobile video directly observed therapy, patients record videos of themselves taking their medication on a mobile device and submit the videos for review. Nurses monitor the videos and may either “accept” or “reject” each video based on patients taking the correct medication and dosage. During submission of videos, patients can see their progress, report any symptoms and side effects of the medication, message the reviewing nurse, or communicate with a transplant team member.

The nurse monitoring patient behaviours may escalate concerns to the patient's transplant care provider. Importantly, emocha's application allows for greater patient engagement, interaction, and encouragement than other mHealth interventions. Nurses reviewing videos may message patients to build rapport, offer encouragement, and interact with patients. Nurses are trained to assess submitted videos for potential concerns, each with an associated method of detection during video review, a response to the patient, communication with transplant team, and communication to study staff. The application allows evaluation of adherence, medication side effects, administration or drug problems, and patient health and safety issues. Based on the identified issue, the mode and frequency of communication with the patient and care team can be customised (email, phone call, or chat message).

Current study and procedures

We developed a pilot study to examine this 12-week asynchronous, mobile video directly observed therapy intervention with 10 adolescent heart transplant recipients who are at least 6 months post-transplant and experiencing difficulties with medication adherence. Adolescents aged 11–21, demonstrating difficulties with medication adherence (medication level variability index³ > 2.0, recommendation of transplant team), and who are otherwise medically stable are eligible to participate. Medical stability will be determined by mutual agreement between the transplant social workers, attending physicians, transplant nurse practitioners, and other members of the transplant teams.

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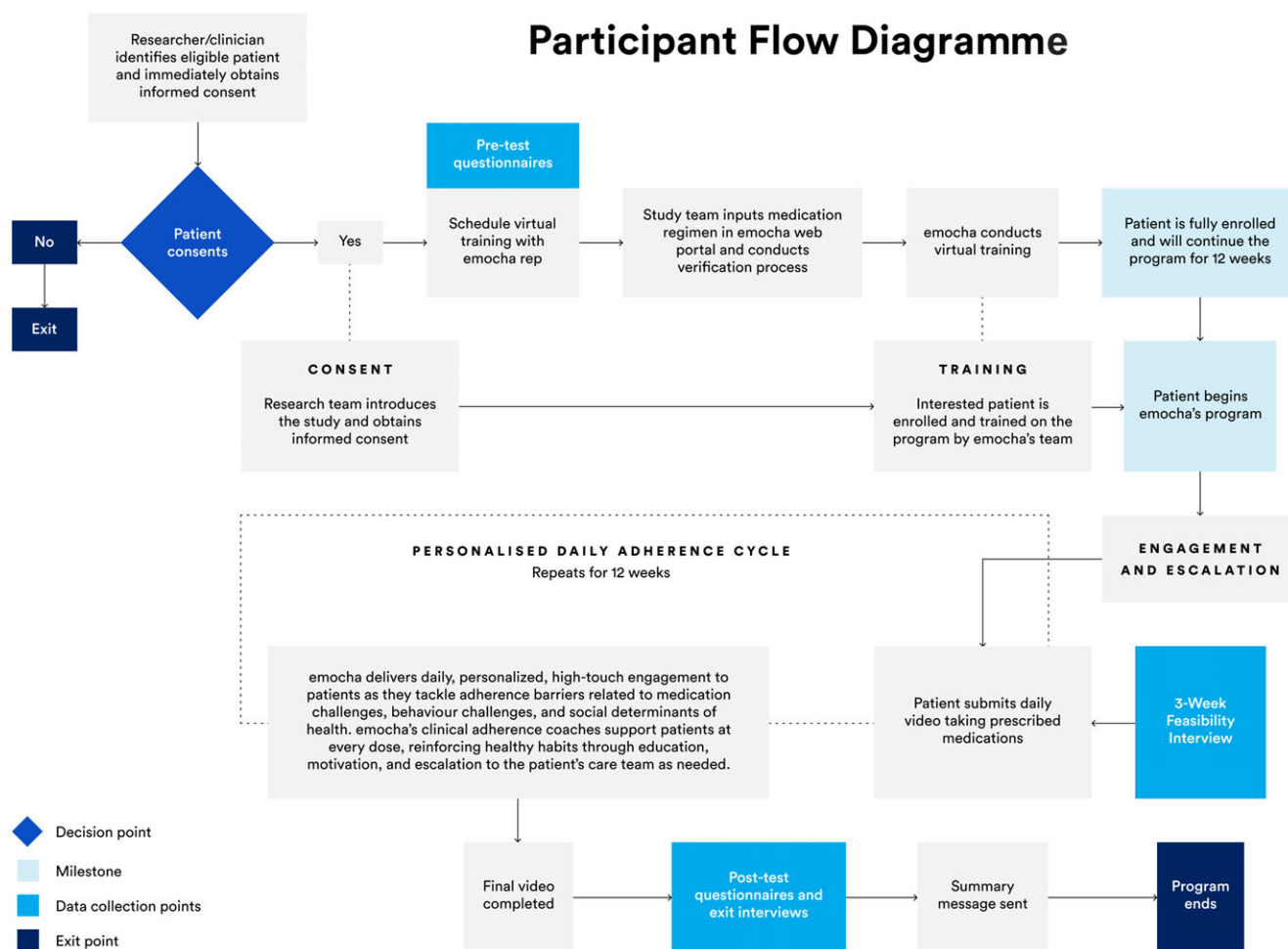


Figure 1. Participant flow diagram.

The consenting of patients will be done entirely virtually over the phone and documented using eConsent via RedCap. No research-specific clinic visits are required which contributes to patient safety, especially during the COVID-19 pandemic. Once consented, patients and parents will complete a pre-intervention survey to assess baseline health-related quality of life and adherence barriers. Patients will be given materials supporting their initial setup with the emocha app and walked through the process by a study team member. Study personnel will assist with downloading the mobile video directly observed therapy application and explain its functionalities. A transplant provider/coordinator on the study team will enter the participant's prescribed medications and times in which they are scheduled to take the medications. A phone interview at 3 weeks will be performed by the study team to assess feasibility. At 12 weeks, patients will complete a post-intervention survey and exit interview. A flow chart explaining the training procedure, measurement points, study staff response to patient events, and emocha's involvement over the course of the intervention are detailed in Figure 1.

Measurement

Data used to evaluate the intervention will be collected from several sources. Basic adolescent and family demographic and medical information will be collected from the electronic health record

and parent questionnaire. We will collect data on post-intervention rejection episodes and hospitalisations, thus examining potential longitudinal impacts of the therapy. Medication adherence will be measured as a percentage of videos submitted by the participant and accepted by the study nurse. A medication level variability index score is a standard deviation value for the medication concentration level calculated from each patient's immunosuppressant medication tacrolimus (i.e., Prograf or FK506) blood levels. Higher SD scores across multiple blood tests indicate greater variability in these values and decreased consistency with medication taking.³ Medication level variability index scores both 6 months before and 6 months after the intervention will be calculated to examine long-term medication adherence.

Adolescent patient and parental questionnaires will be completed with study staff at baseline and at the completion of the intervention. These measures include general and disease-specific measures of health-related quality of life (PedsQL 4.0 Generic Core Scales and PedsQL 3.0 Transplant Module)^{7,8} as well as the Adolescent Medication Barriers Scale and Parent Medication Barriers Scale to assess perceived barriers to medication adherence.⁹ The 3-week feasibility and 12-week post-intervention participant interviews include the Post Study System Usability Questionnaire,¹⁰ a validated measure used in the development of technological applications, to assess the usability of and experience with the emocha application.

Metrics of intervention feasibility will include consent rate and use of the mobile video directly observed therapy (emocha) application by patients during the first 3 weeks, ease of implementation into clinical workflow, and time spent by nurse coordinators each week.

Discussion and conclusion

The current study represents an advancement in mHealth research and efforts to translate these resources into clinical care of paediatric organ transplant patients. Firstly, we will actively recruit difficult to reach patients who often are experiencing adherence challenges and increase their likelihood of participation. A strength of the study is the assessment of adherence through direct observation via submitted videos and through patient medication level variability index values. Lastly, we will aid in the translation of this type of mHealth intervention into clinical care through the examination of feasibility indicators. This research has implications for the clinical impact, sustainability, and integration of care for these adolescents and their families.

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Conflicts of interest. The authors have no conflicts of interest to report.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national guidelines on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008, and have been approved by the University of Florida Health Sciences Institutional Review Board with additional approval from the Florida State University Human Subjects Committee.

References

1. Patel PD, Cobb J, Wright D, et al. Rapid development of telehealth capabilities within pediatric patient portal infrastructure for COVID-19 care: barriers, solutions, results. *J Am Med Inform Assoc* 2020.
2. Oliva M, Singh TP, Gauvreau K, Vanderpluym CJ, Bastardi HJ, Almond CS. Impact of medication non-adherence on survival after pediatric heart transplantation in the U.S.A. *J Heart Lung Transplant* 2013; 32: 881–888.
3. Shemesh E, Bucuvalas J, Anand R, et al. The Medication Level Variability Index (MLVI) predicts poor liver transplant outcomes: a prospective multi-site study. *Am J Transplant* 2017; 17: 2668–2678.
4. Dew MA, Dabbs AD, Myaskovsky L, et al. Meta-analysis of medical regimen adherence outcomes in pediatric solid organ transplantation. *Transplantation* 2009; 88: 736–746.
5. Killian MO, Schuman DL, Mayersohn GS, Triplett KN. Psychosocial predictors of medication non-adherence in pediatric organ transplantation: a systematic review. *Pediatr Transplant* 2018; 22: e13188.
6. Duncan S, Annunziato R, Dunphy C, LaPointe Rudow D, Shneider B, Shemesh E. A systematic review of immunosuppressant adherence interventions in transplant recipients: decoding the streetlight effect. *Pediatr Transplant* 2018; 22: e13086.
7. Varni JW, Burwinkle TM, Seid M, Skarr D. The PedsQL 4.0 as a pediatric population health measure: Feasibility, reliability, and validity. *Ambul Pediatr* 2003; 3: 329–341.
8. Weissberg-Benchell J, Zielinski TE, Rodgers S, et al. Pediatric health-related quality of life: feasibility, reliability and validity of the PedsQL™ transplant module. *Am J Transplant* 2010; 10: 1677–1685.
9. Simons LE, Blount RL. Identifying barriers to medication adherence in adolescent transplant recipients. *J Pediatr Psychol* 2007; 32: 831–844.
10. Lewis JR. Psychometric evaluation of the post-study system usability questionnaire: the PSSUQ. Paper presented at: Proceedings of the Human Factors Society Annual Meeting, 1992.