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Developing Mobile Health (mHealth) Tools for Long-Term Medication Adherence in Transplant Patients—Invited Commentary

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Due to the impact of immunosuppression nonadherence in transplant patients, there is significant interest in tools and technologies that can be used to support patients with their medication regimen. Geramita and colleagues present “Impact of a Mobile Health Intervention on Long-Term Nonadherence After Lung Transplantation: Follow-up After a Randomized Controlled Trial,” (in press this issue) describing long-term sustained effects of a mobile health (mHealth) application on immunosuppression adherence among lung transplant recipients.¹ The following narrative provides an overview and perspective on their important research.

As noted in Geramita et al., mHealth for medication adherence has primarily been studied for short-term outcomes, and the efficacy of mHealth tools on long-term medication adherence has yet to be empirically established.² With only short term evidence supporting the use of mHealth for the long-term problem of medication nonadherence, the present study is both very relevant and timely. The Pocket PATH app facilitates posttransplant adherence through a combination of alerts/tracking features and decision-support mechanisms when patients require medical assistance. The current study explores long-term adherence outcomes beyond the original RCT follow-up period which assessed medication adherence in lung transplant recipients after one year of utilizing the app.³ Long-term follow-up averaged approximately 4 years posttransplant. While patients were allowed to retain their smartphones and continue using the tracking and reminder functions on the Pocket PATH app, decision support mechanisms were disabled. Their results show that, while the Pocket PATH app led to lower odds of nonadherence in the majority of the areas measured within the first year of the initial RCT, those differences between the intervention and control group were not sustained for the most part at the 4-year follow-up.

The difference in nonadherence between the initial RCT and the long-term follow-up gets to a key question about mHealth as a tool for nonadherence: What specific feature of mHealth technologies is the key to optimizing long-term medication adherence in transplant patients? The mitigated difference between the control and intervention group in the long-term

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follow-up is significant for two reasons we wish to explore further. This calls to question elements of mHealth medication adherence tools and apps that support habit-formation, and highlights the importance of decision-support mechanisms contained within these tools.

mHealth technology is often touted for its habit-formation capacity.⁴ However given the lack of observed sustained effects of the app on immunosuppression adherence in this study, the ability for the intervention to actually help support habit formation must be further evaluated. Geramita et al. leverage classical learning theory to explain why tools such as Pocket PATH might not create long-term adherence owing to an absence of ongoing reinforcement of the desired behavior. However, one outlet for the short-term effectiveness of mHealth interventions like Pocket PATH might be to target them towards patient populations that require more stringent short-term monitoring. Populations to consider include HCV positive organ recipients during the course of HCV therapy, and adolescent patients who are transitioning into adult care and/or leaving their parents' home. Indeed, mobile technology-based health education has been shown to hold great potential among adolescent and young adult transplant recipients.⁵

A question remains: Can mHealth provide support towards mitigating nonadherence in the majority of solid organ transplant patients over the long term? Promoting patient activation and engagement has been thoroughly emphasized by the mHealth literature to encourage behavior change in patients.^{6,7} In our own experience, we have consistently received feedback from patients and providers that indicate a demand for active, rather than passive, technology to support medication adherence. Active technology means that patients and providers interact with technology as a way to foster closer more real-time conversation and engagement, over passive assistance (i.e. daily alerts, progress tracking). In the Pocket PATH study, the decision support mechanism that helped patients make decisions at critical moments when medical assistance might have been necessary provided the 'active' quality to the app that was absent in the long-term follow-up. The empirical robustness of the hypothesis that active technology is more likely to sustain adherence than passive technology should be established by future studies. The desire for active features in mHealth adherence tools has been demonstrated through stakeholder surveys, including a recent one in which two-way messaging and motivational messages ranked among the most popular features within an adherence app.⁵

Nonadherence in solid organ transplant recipients is a multicomponent and complex matter, due to the large volume, variety, and lifetime duration of medications. As the international transplant community works to optimize mHealth solutions to support our unique patient population, we need more long-term, high-powered studies of mHealth like Geramita et al. to provide insight into the behavior patterns and needs of the unique transplant patient population.

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