# Mobile Applications in Transplantation

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### • How we got here?

- Transplant Hero Journey
- Studies (small cohorts)
- Other mobile apps
- RPM
- Where are we going? IDK



### Disclosures

- Veloxis Pharmaceuticals
- Sanofi Pharmaceuticals
- CareDx Inc. acquired Transplant Hero



### The original iPhone (2007)







### The Advent of 3G



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### mHealth Ecosystem

- Mobile Applications
- Wearables
- Telemedicine
- EHR Interface
- Remote Patient Monitoring (RPM)



### Rapid Growth in mHealth Space

- 350,000 health and wellness apps available for
- ++ 90,000 app launched in 2020





### mHealth Value Proposition

- Higher Quality Care
- Improved Self- management of Chronic Disease.
- Improved Efficiency of Delivery
- Easier Data Collection
- A Reduction in Healthcare Costs



# Has there been ROI in Transplant?



- Investment is just beginning
- Useful outcome measurements
  - Non-adherence
  - Wellness
  - Cost-saving



### Searches in PubMed



- "Mobile Application ... "
- Wellness dominates this space
  - +10K papers



### Do Mobile Apps Solve a Problem



Everyone needs a helping hand

### Expectation





# Reality





### $\bigcirc \bigcirc \bigcirc \land$

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#### • reiimmune, mishuu93, n1malici0us

transplant\_hero Taking #transplant #medication can be challenging. Try www.transplanthero.com because everyone needs a helping hand.

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#### $\bigcirc \bigcirc \bigcirc \land$

#### • 96 likes

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the\_waitinglist [ From September 14, 2016 ] Been curious lately, thinking about who I might be without these little guys. Would I act differently... more

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# Early Adopters of Technology



- Non-specific apps
- Self-orchestrated alarm systems



### Non-adherence is Problematic





- Non-adherence results in 7-fold increased risk of graft failure
- 22.6% rate of nonadherence
- 36% rate in kidney transplant recipients specifically



Sources: Vlaminck et al AJT 2004, Butler JA. Transplantation 2004, Dew MA. Transplantation 2007

### **Early Wireframes**



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### **Transplant Hero**



Everyone needs a helping hand



## App Users had Significantly Lower CV at 1 Month Mark



Torabi J et al. Och J. 2017

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### Mobile Apps can serve to Educate





Zanetti A. AJS. 2019

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**Kidney Transplantation** 



OPEN

### A Randomized Controlled Trial of a Mobile Medical App for Kidney Transplant Recipients: Effect on Use of Sun Protection

June K. Robinson, MD,<sup>1</sup> John J. Friedewald, MD,<sup>2</sup> Amishi Desai, DO,<sup>3</sup> and Elisa J. Gordon, PhD, MPH<sup>4</sup>





Levine D. AJS. 2019



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Received: 10 May 2018	Revised: 13 July 2018	Accepted: 24 July 2018
DOI: 10.1111/ctr.13362		

WILEY

#### BRIEF COMMUNICATION



Angela Q. Maldonado<sup>1</sup> | Patricia West-Thielke<sup>2</sup> | Mary Amanda Dew<sup>3</sup> | John Devin Peipert<sup>4</sup> | Seth Heldenbrand<sup>5</sup> | Tiffany E. Kaiser<sup>6</sup> | Marie Chisholm-Burns<sup>7</sup> | Lisa M. Potter<sup>8</sup> | on behalf the AST Transplant Pharmacy Adherence Consortium (AST TPAC)



American Journal of Transplantation 2017; 17: 2263–2276 Wiley Periodicals Inc. © 2017 The American Society of Transplantation and the American Society of Transplant Surgeons

Minireview

doi: 10.1111/ajt.14225

### Mobile Health in Solid Organ Transplant: The Time Is Now

#### J. N. Fleming<sup>1,</sup>\*, D. J. Taber<sup>2,3</sup>, J. McElligott<sup>4</sup>, J. W. McGillicuddy<sup>2</sup> and F. Treiber<sup>5</sup>

 <sup>1</sup>Department of Pharmacy Services, Medical University of South Carolina, Charleston, SC
<sup>2</sup>Department of Surgery, Medical University of South Carolina, Charleston, SC
<sup>3</sup>Department of Pharmacy, Ralph H Johnson VAMC, Charleston, SC
<sup>4</sup>Center for Telehealth, Medical University of South Carolina, Charleston, SC
<sup>5</sup>Technology Center to Advance Healthful Lifestyles, College of Nursing, Medical University of South Carolina, Charleston, SC FDA, U.S. Food and Drug Administration; FEV<sub>1</sub>, forced expiratory volume in the first second of expiration; HgA1c, glycosylated hemoglobin; HR, hazard ratio; IRD, increased risk donor; mHealth, mobile health; OR, odds ratio; QOL, quality of life; RCT, randomized controlled trial; SBP, systolic blood pressure; SOT, solid organ transplantation; tMBSR, telephone-adapted mindfulness-based stress reduction; tSupport, telephone-adapted structural support group

Received 28 October 2016, revised 24 January 2017 and accepted for publication 04 February 2017

### Long-Term Follow-up of a Randomized Controlled Trial Evaluating a Mobile Health Intervention for Self-Management in Lung Transplant Recipients

Emily M. Rosenberger, PhD<sup>1</sup>, Annette J. DeVito Dabbs, RN, PhD<sup>2</sup>, Andrea F. DiMartini, MD<sup>3</sup>, Douglas P. Landsittel, PhD<sup>4</sup>, Joseph M. Pilewski, MD<sup>5</sup>, and Mary Amanda Dew, PhD<sup>6</sup>



### Mobile medication manager application to improve adherence with immunosuppressive therapy in renal transplant recipients: A randomized controlled trial

Ahram Han 💿, Sang-il Min 💿, Sanghyun Ahn, Seung-Kee Min, Hye-jin Hong, Nayoung Han, Yon Su Kim, Curie Ahn, Jongwon Ha 🔟

Published: November 5, 2019 • https://doi.org/10.1371/journal.pone.0224595



# The Promise of mHealth

- Pre-Transplant
  - Waitlist
  - Living Donor Advocacy
- Post-Transplant
  - -QOL
  - Adherence
  - CCM





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# One Size Doesn't Fit All

### AlloCare

- Comprehensive app
- Highly customizable models
- For highly engaged or those who are interested in more analytics
- Biometrics
- Community platform

### **Transplant Hero**

- Simple
- Fun way to track medications – earn rewards, upbeat graphics & behavioral nudges
- Additional accountability with caregivers following







## AlloCare

- Customizable to the patient and their current health needs
- Makes managing complicated medication regimes easier
- Puts tracking of important health metrics in one place
- Helps identify important health trends and allows easy communication of these trends to care providers
- Enables a patient to stay educated and stay connected to other patients



### **Current Functionality at a Glance**



#### **Medication Management**

- Medication schedule
- **Reminders**
- **Recorded adherence**



### **Transplant**

- Content Customizable to transplant center
- Event reminders Discharge
- Helpful articles

#### **Test Adherence**

- Connect to PCMs Test
- Schedule blood-draw result
- Lab visit reminders

binders



- Water intake, steps, mood, etc.
- Activity goals
- Wearable supported



Connect to the transplant community

### **In Development Functionality at a Glance**



- Communicate with Care Team
- Keep friends & family informed



- Earn points by using the app
- Redeem points for rewards
- Donate points for the community

# Rapidly Growing Marketplace for Mobile Apps

- Industry estimates purport that by 2025
  - 1 billion people worldwide will be using a mobile app geared toward supporting health and medicine



# Can RPM Help?

- Readmission Rates
- Reduce Adverse Events
- PCM highlight trends
- Real time assessment



Early optimization may impact the current allograft loss at 5 years:









### **RPM is Moving Clinic to Home**



## AlloHome RPM



# Potential Benefits of AlloHome



## AlloHome Summary



Provides remote engagement and vital sign monitoring to improve continuity of care across the transplant journey Utilizes existing CPT codes with coverage by Medicare, Medicare Advantage, Medicaid and private payers

Utilization is at minimum cost neutral to transplant center

### AlloHome Summary



Does <u>NOT</u> require patients to have cellular data plan, WiFi, or even a smart phone



AlloHome service has the potential to reduce hospital readmission rates, improve immunosuppressive adherence, and enhance both in-clinic and telehealth visits



# ISS/IES Technology



FOR YOU

2. 5. 10. 15. 20. 30 mg





ABILIFY MYCITE is a prescription smart pill with built-in technology the size of a grain of sand. The sensor is made entirely of ingredients found in most diets. It passes through your body naturally.

#### More questions about the pill?







### EDITORIAL

### Leveraging the Coronavirus Disease 2019 Pandemic: Is It Time to Consider Incorporating Mobile Applications Into Standard Clinical Management of the Liver Transplantation Patient?



### Real Time Assessment





# Active Technology

#### PATIENT







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### The Future

- Active (less passive) technology
- Habit-formation capacity?







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### mHealth Provides Transparency

- Outcomes data has facilitated better understanding of best practice (SRTR)
  - Organ Access
  - Disparity





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### **Hypothesis:** The combination of AlloCare and molecular testing with AlloSure will lead to:

- Decrease readmissions
- Better medication adherence (time in therapeutic range)
- Fewer immunosuppressio n-related complications
- Improved patient and provider satisfaction at 90 days

### TEAMMATE



# The Possibility



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# **Collaborative Approach**

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