

Policy Learning with High Dimensional Actions

Min Qian

Department of Biostatistics, Columbia University

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BIRS: Use of Wearable and Implantable Devices in Health Research

IntelliCare for Depression and Anxiety (Lattie et al. 2016)



Thought Challenger



My Mantra



Day to Day



iCope



Purple Chill



Slumber Time



Daily Feats



Aspire



MoveMe



Boost Me



Worrv Knot




Social Force



IntelliCare Hub

IntelliCare Hub - App Recom. (Cheung et al. 2018)


- Make weekly recommendations for new app to encourage app usage and exploration



Day to Day
Recommended!
Day to Day delivers a daily stream of tips, tricks, and other information throughout the day to boost your mood.

Work on a particular theme each day, and every week, learn more about how to effectively cultivate gratitude, activate pleasure, increase connectedness, solve problems, and challenge your thinking.

[INSTALL](#)



MoveMe
Recommended!
MoveMe is an app designed to boost your mood through bursts of activity.

It's based on science that tells us 10 to 15 minutes of regular bursts of activity can improve your mood and well-being. MoveMe helps you select the best exercises to improve your mood.

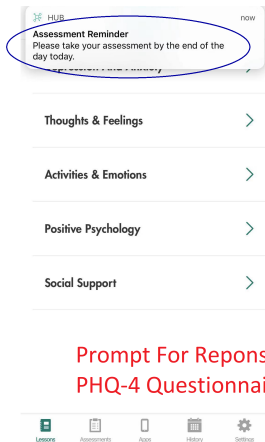
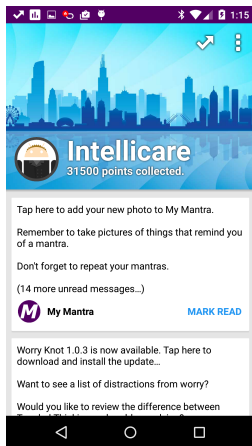
Results

When compared to non-Hub users in adjusted analyses, Hub users had a lower risk of discontinuing IntelliCare (hazard ratio = 0.67, 95% CI, 0.62-0.71), higher loyalty (2- to 5-fold), and higher regularity (0.1-0.4 day/week greater). Among Hub users, Hub recommendations increased app-specific loyalty and regularity in all 12 apps.

Hub users: How to recommend apps so as to enhance overall app usage and possibly translate into clinical benefits?

IntelliCare Hub - Push Notification

- Manage messages and notifications from the other clinical apps



Prompt For Reponse to
PHQ-4 Questionnaire

What's the best time to send out push notification to maximize response rate?

Data Structure

For each hub user at the t -th decision point:

- $S_t \in \mathcal{S}$: usage pattern (lag K information), weekday, etc (could be exogenous or endogenous);
- $A_t \in \mathcal{A}$: Apps to recommend for the week / Time for sending out prompt
- $Y_t \in \mathbb{R}$: Outcome of interest (e.g. app usage, response rate, clinical outcomes).
- m : number of observed follow-up periods varying across app users.

Goal: Develop a policy $\pi : \mathcal{S} \rightarrow \mathcal{A}$ so as to optimize the expected outcome of interest $E[Y(\pi)]$.

Challenges

- High dimensional action space: 12 individual apps, recommend at most 2 apps per week, with sparse action observations.
- High heterogeneity across users.
- Limited amount of information for each user.
- Limited number of follow up periods, quickly declined response/app usage.
- Immediate rewards vs long term rewards.