Duke University School of Medicine

Longitudinal Trajectories of an ACT Mobile Intervention for Smokers with Serious Mental Illness

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Disclosures

- This study was funded by a grant from National Institute of Drug Abuse

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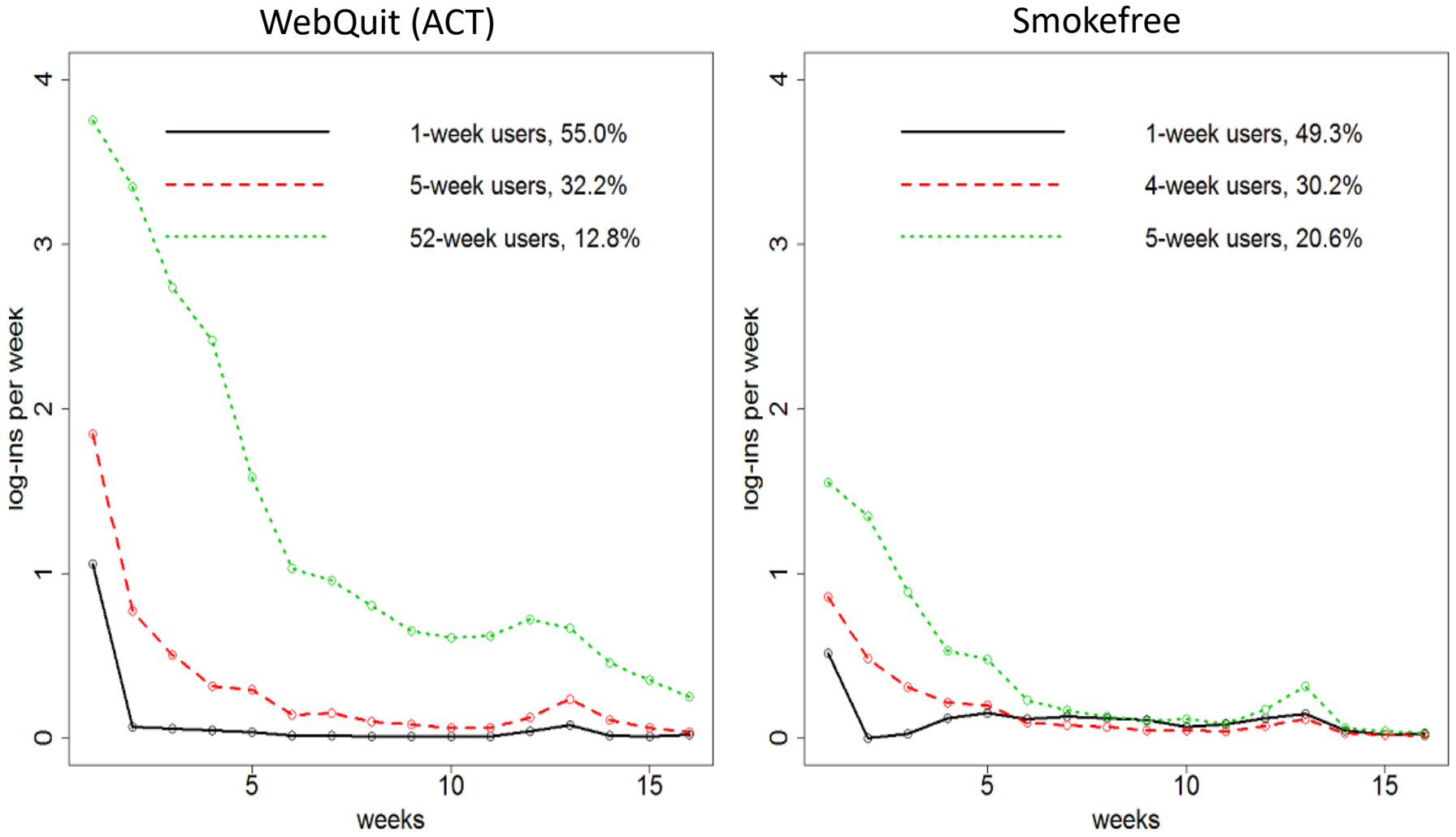
- None of the authors have received any commercial support related to this presentation or the work presented in this presentation.

NIH National Institute on Drug Abuse
The Science of Drug Abuse & Addiction

User Patterns of Engagement



Bricker et al., 2018

Average weekly log-in trajectory for each cluster from the (left) WebQuit (n=1240) arm and (right) Smokefree (n=1309) arm for first 16 weeks of use.

Smoking, SMI & Mobile Technology

- 88% of people with SMI smoke cigarettes (Cook et al., 2014)
- Smoking at 3-4x the rate of the general population (Cook et al., 2014)

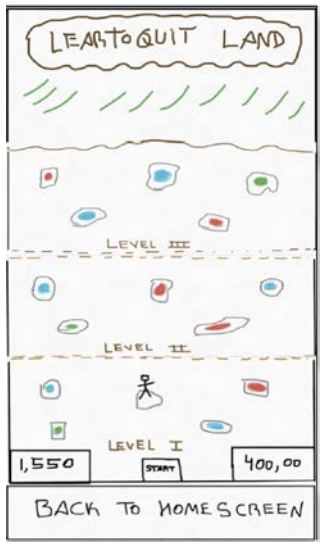
- 81.4% of those with SMI currently own a mobile phone (Ben-Zeev et al., 2015)

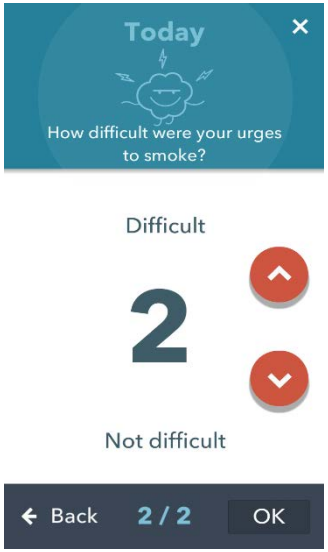
Designing for Engagement

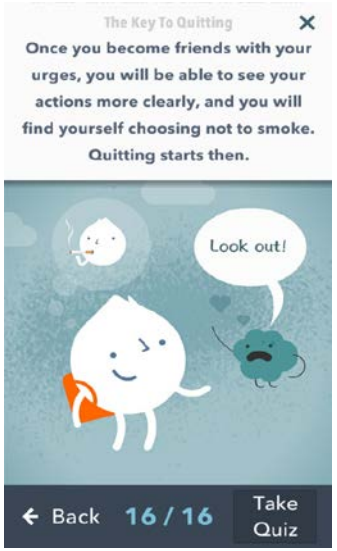
Vilardaga et al., 2015
Vilardaga et al., 2018

<u>Contextual Behavioral Principles</u>

- Successive Approximations
- Self-Perspective Taking
- Multiple Exemplar Training
- Expanding Relational Repertoires
- Positive Reinforcement
- Antecedent, Consequential Control

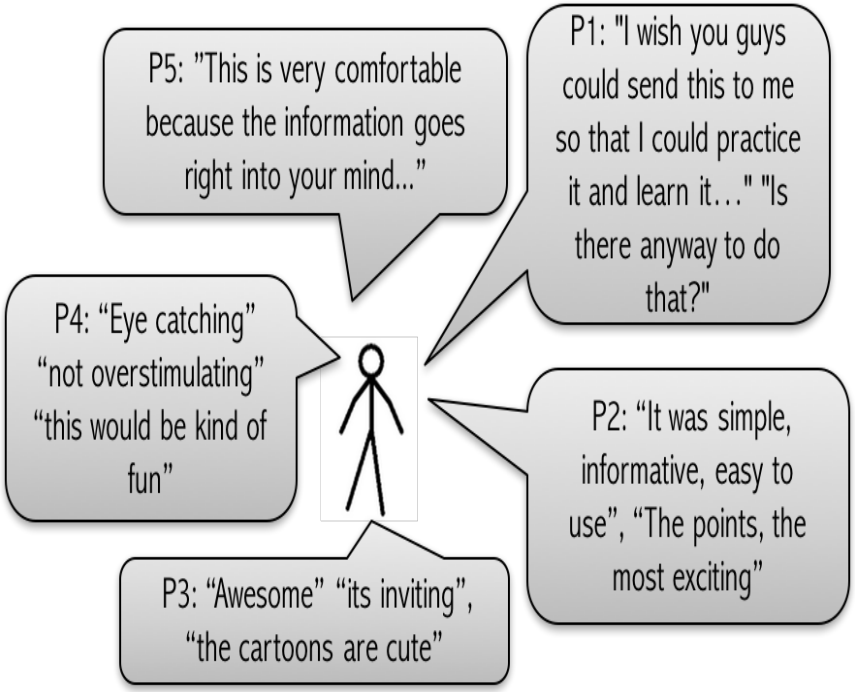




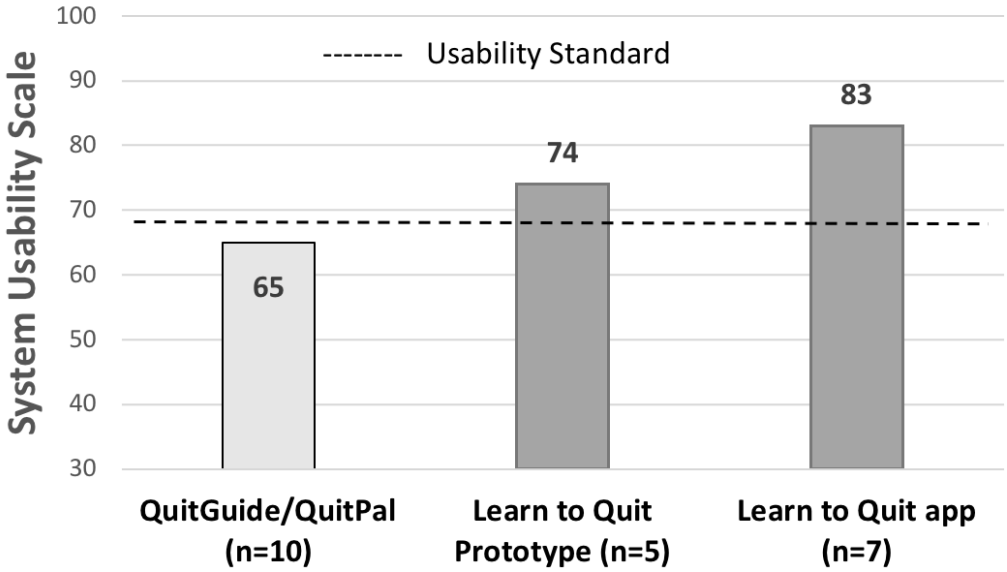


Case Studies of LTQ

User Experience



Usability Ratings

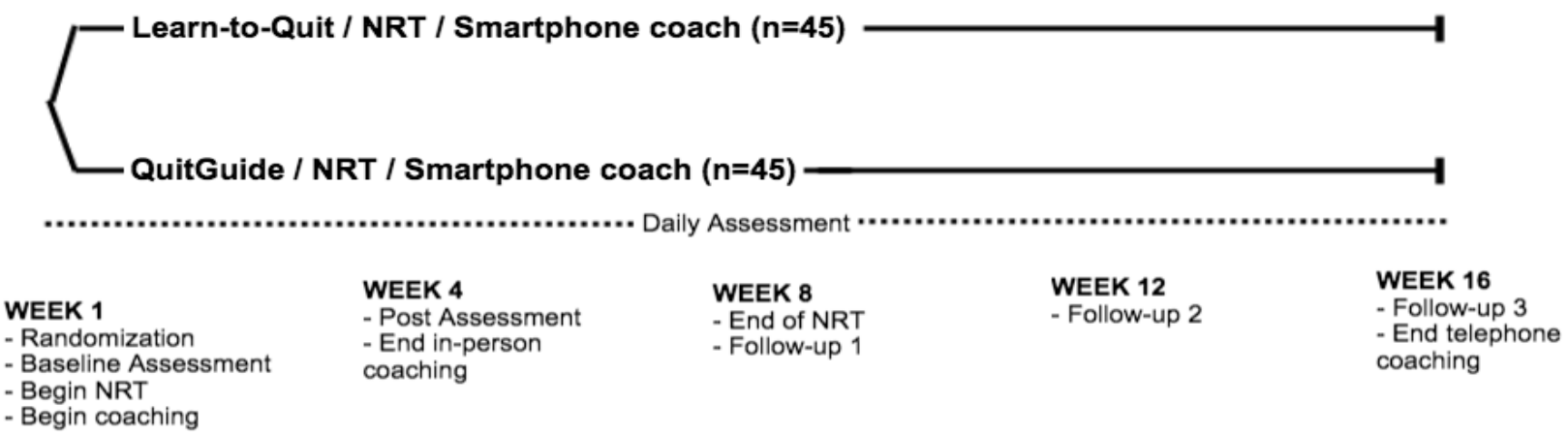


Objectives

- #1: Provide descriptive analysis of daily app usage trajectories
- #2: Examine the relationship between group assignment and trajectories of use
- #3: Examine the relationship between group assignment and trajectories of use by key factors:
  - Smoking-Related Experiential Avoidance
  - App Usability Ratings
  - Reduction in Cigarettes Per Day at Trial Endpoint

Methods

‘Quit on the Go’ Pilot Trial



Procedures

- Recruiting from Research Triangle NC area mental health and primary care clinics
- Study participation lasting for 4 months
  - Monthly follow-up visits

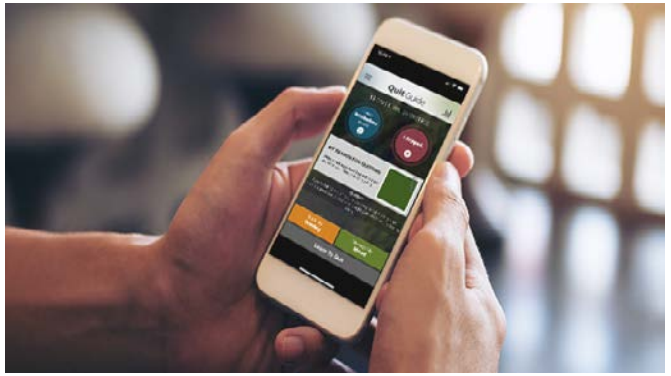
Eligibility Criteria

- SMI diagnosis
- Smoking 5+ cigarettes daily
- Receiving mental health treatment
- Motivated to quit smoking

NCT # 03069482

Study Interventions

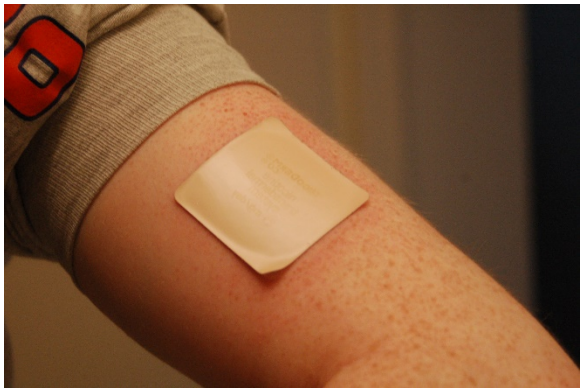
- **Smoking Cessation Apps**
  - Learn to Quit (ACT)
  - QuitGuide



Smokefree.gov

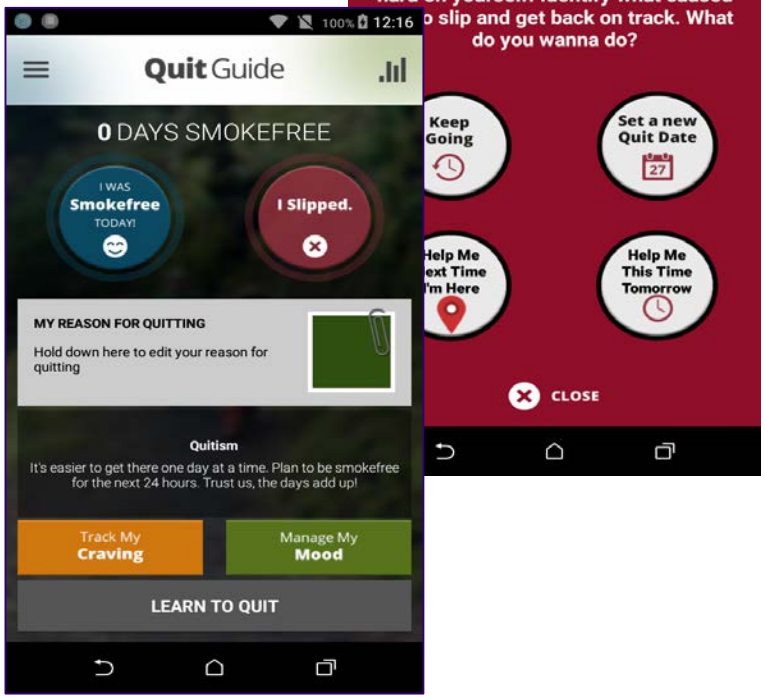
- **Technical Coaching**
  - Brief weekly sessions (15') during the 1st month of study participation

- **Nicotine Replacement Therapy (NRT)**
  - Patches & lozenges



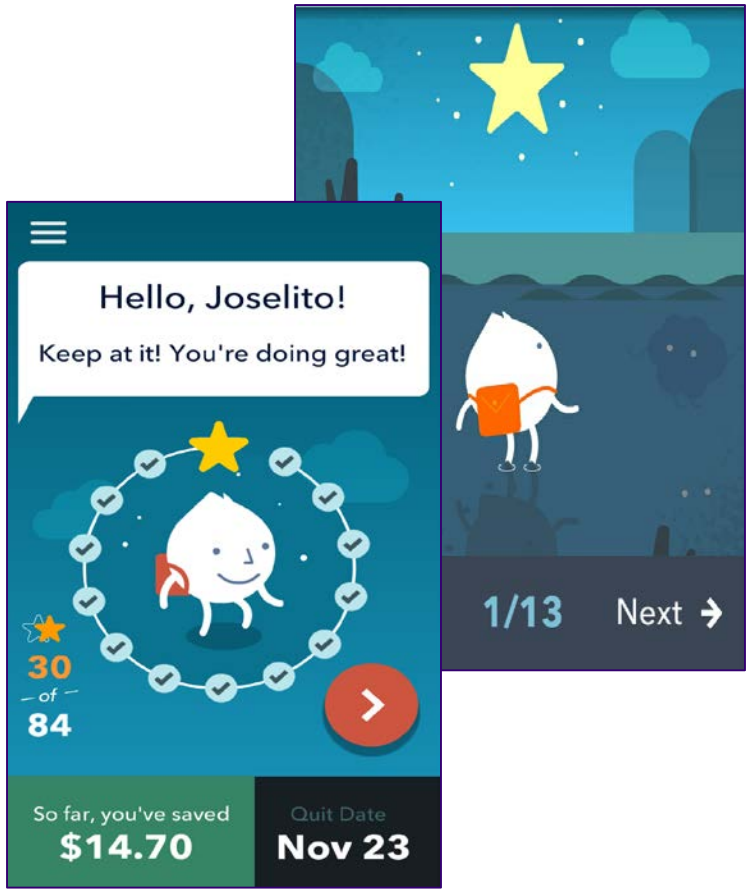
Smartphone Apps

Quit Guide



Smokefree.gov

Learn to Quit



Measures

Measures

Independent Variable:

- Treatment Assignment:
  - Learn to Quit vs. QuitGuide

Dependent Variable:

- App usage:
  - Counts of interactions per day

Moderating Variables:

- Avoidance and Inflexibility Scale (AIS)
  - Experiential Avoidance
- System Usability Scale (SUS)
  - App usability
- Reduction in Cigarettes Per Day at Trial Endpoint
  - “Low” <5 daily cigarettes
  - “Large” >= 5 daily cigarettes

Analysis

1. **Overall line chart** to display trajectory across app conditions
2. **Nested line charts** by treatment assignment and by levels of users’ characteristics
3. **Simple aggregates** of app engagement over time
4. **Survival Plot**: ’*days to* less than 1 feature per day’
5. **Multilevel regression model** to test the effect of treatment assignment on app usage over time

How Did We Define Interactions?

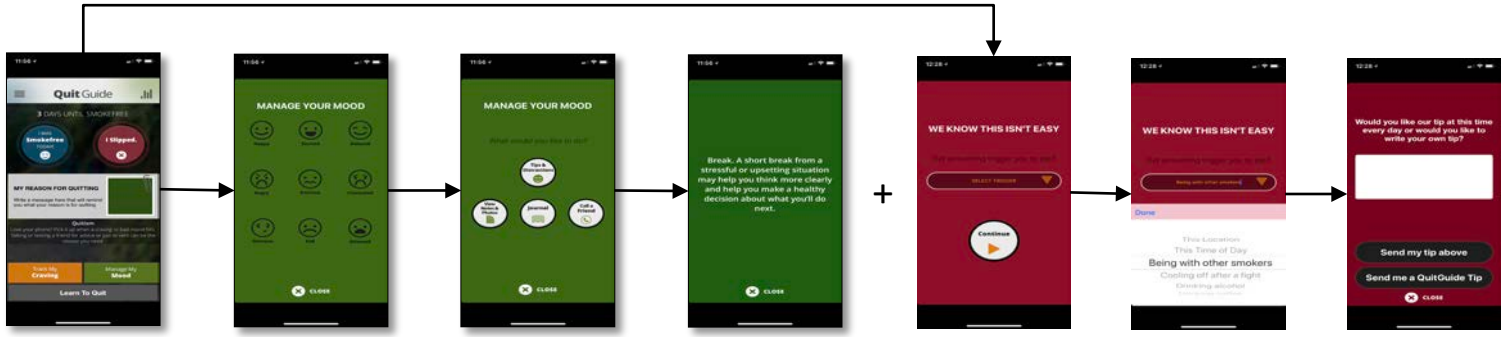
Start of Day

End of Day

Interactions

2 counts

1+ for starting
1+ for completing



2 counts

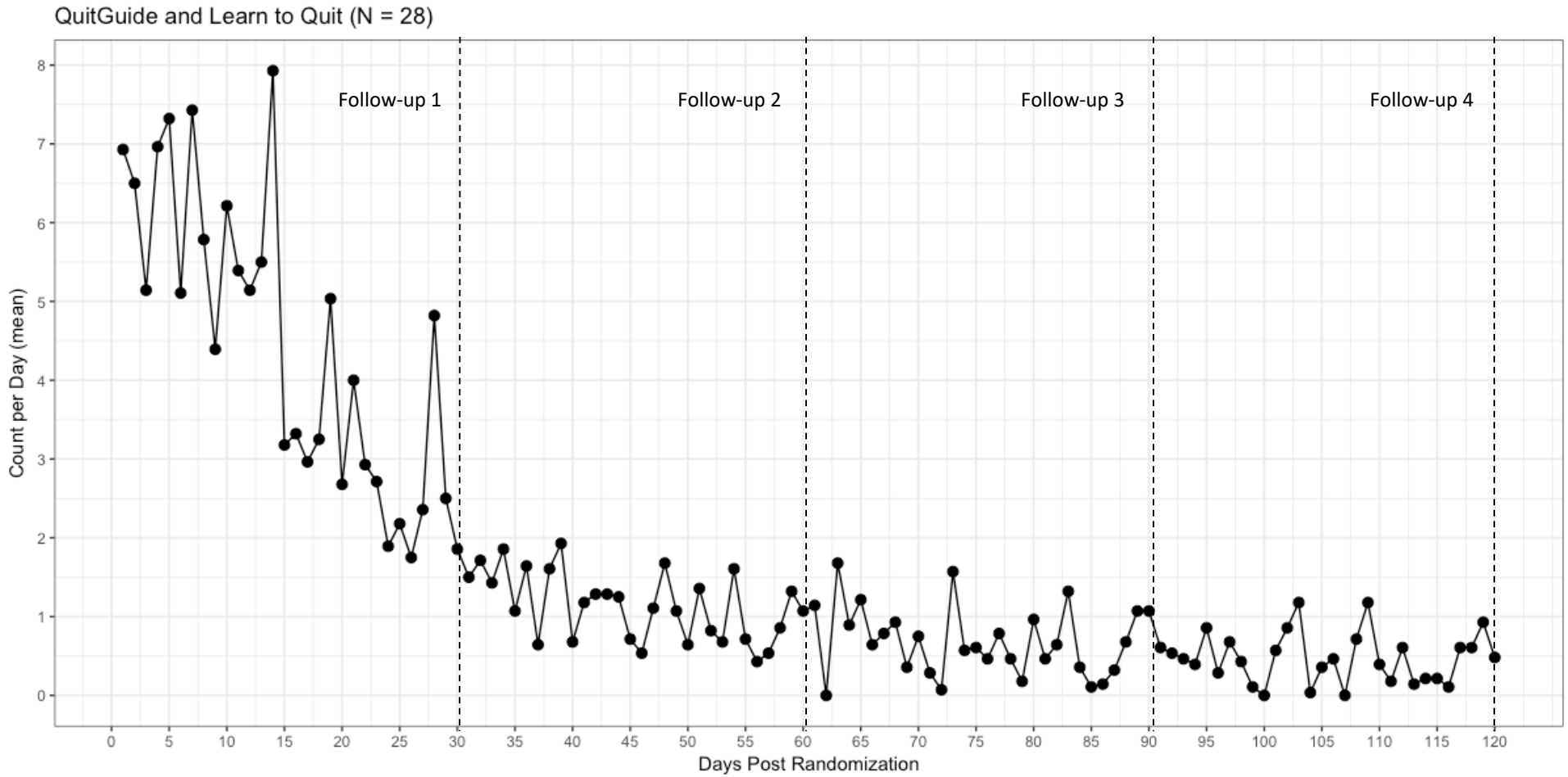
1+ for mood
1+ for slipping

Results

Sample Characteristics

	Learn to Quit (n=12)	QuitGuide (n=16)
Demographics		
Age, mean (SD)	45.4(13.5)	45.3 (10.7)
Sex, n (%)		
Male	6 (50.0)	7 (43.7)
Female	6 (50.0)	9 (56.3)
Race/Ethnicity, n (%)		
White	5 (41.7)	9 (56.2)
Black	6 (50.0)	5 (31.3)
Other	1 (8.3)	2 (12.5)
Household Income (annual), n (%)		
<35K	8 (66.7)	11 (68.8)
≥35K	4 (33.3)	5 (31.2)
Baseline Characteristics		
Psychiatric Diagnosis, n (%)		
Psychosis Present	6 (50.0)	3 (18.8)
Bipolar sans Psychosis	4 (33.3)	4 (25.0)
Recurrent Depression	2 (16.7)	9 (56.2)
Cigarettes Smoked Daily, mean (SD)	21.6 (18.2)	13.9 (5.0)
Years Smoking Cigarettes, mean (SD)	21.4 (12.6)	27.7 (12.0)
Experiential Avoidance (AIS), mean (SD)	50.5 (9.4)	47.2 (8.1)
App Usability Rating (SUS), mean (SD)	85.6 (11.1)	77.5 (16.1)
Nicotine Dependence (FTND), mean (SD)	5.6 (2.6)	4.8 (1.6)

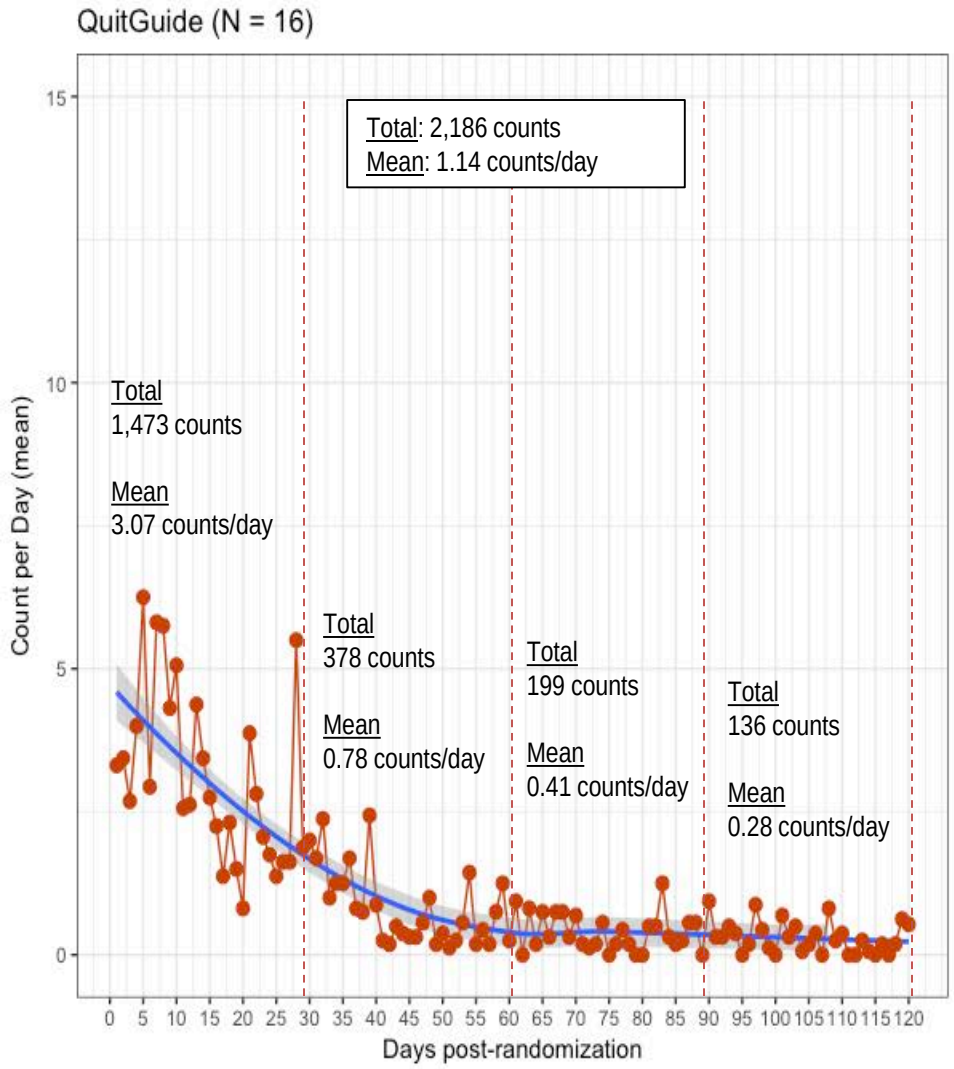
Overall App Engagement

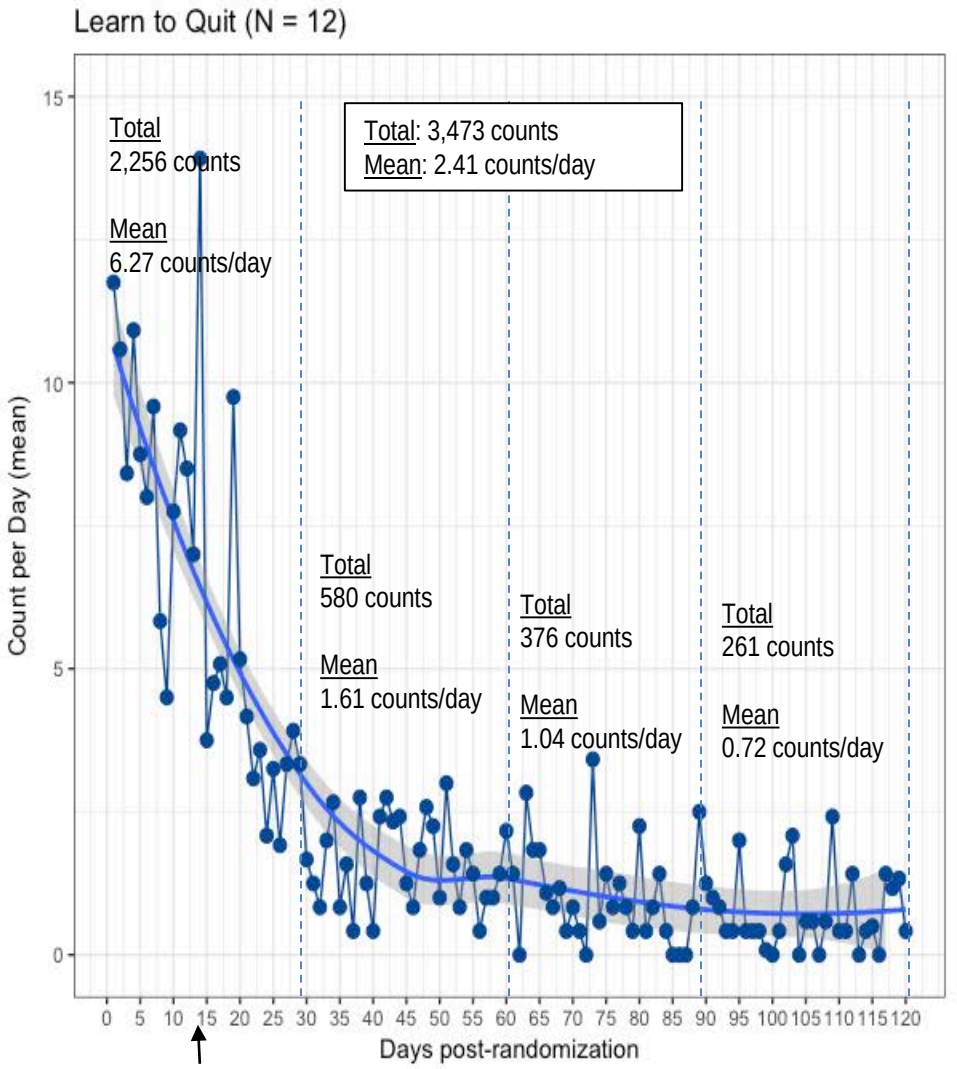


Mean Count of Interactions Per Day = 1.68

Total Count of Interactions Over 4-Month Period = 5,659

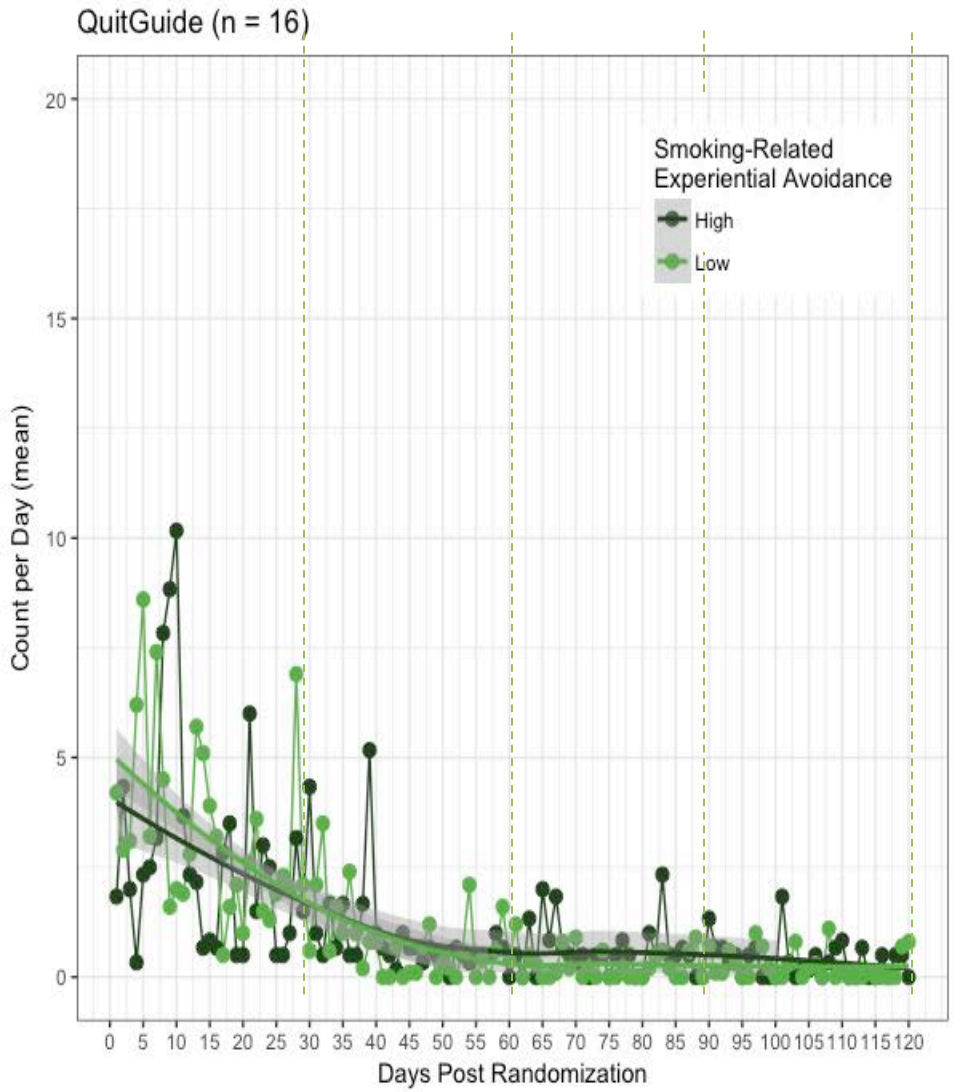
Nested Trajectories – by App Condition

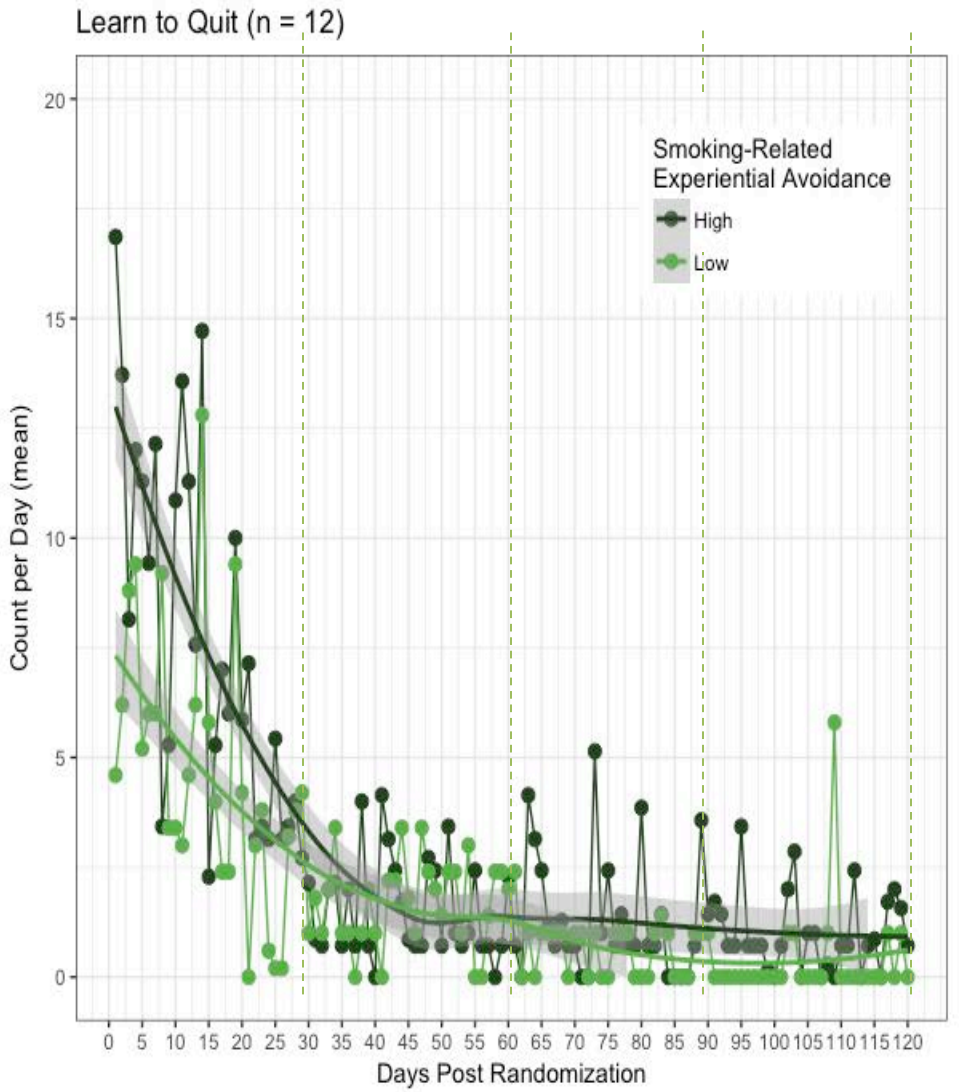




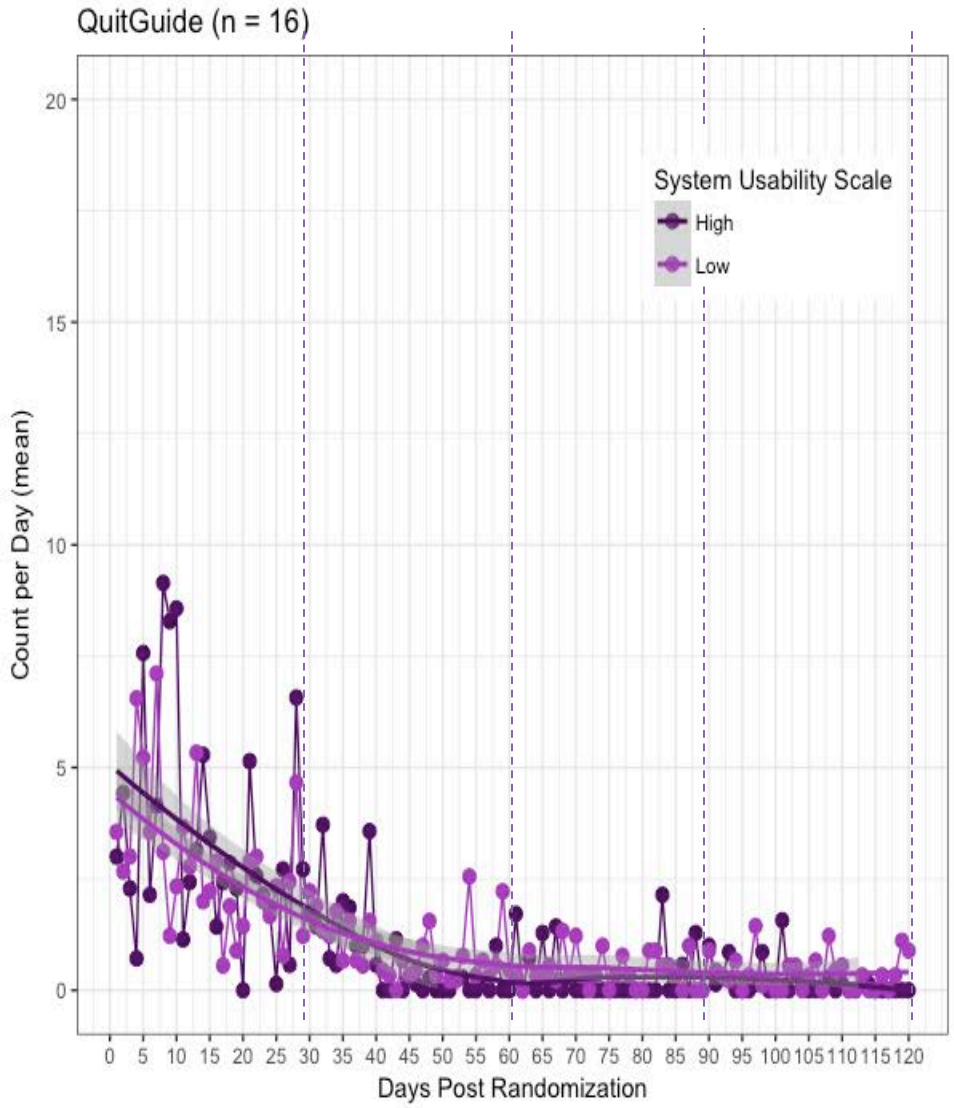
Day 14: Minimum days to complete learning modules

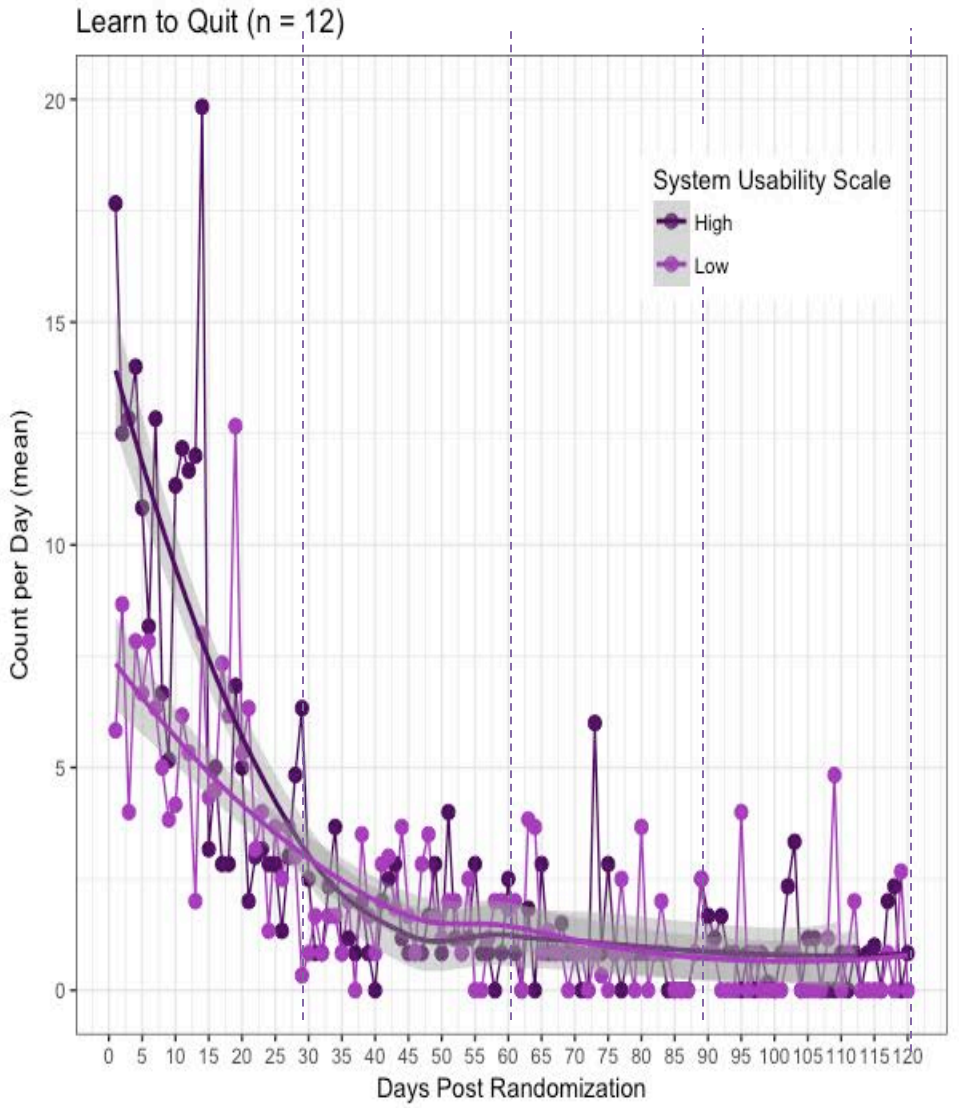
Nested Trajectories– by App and EA



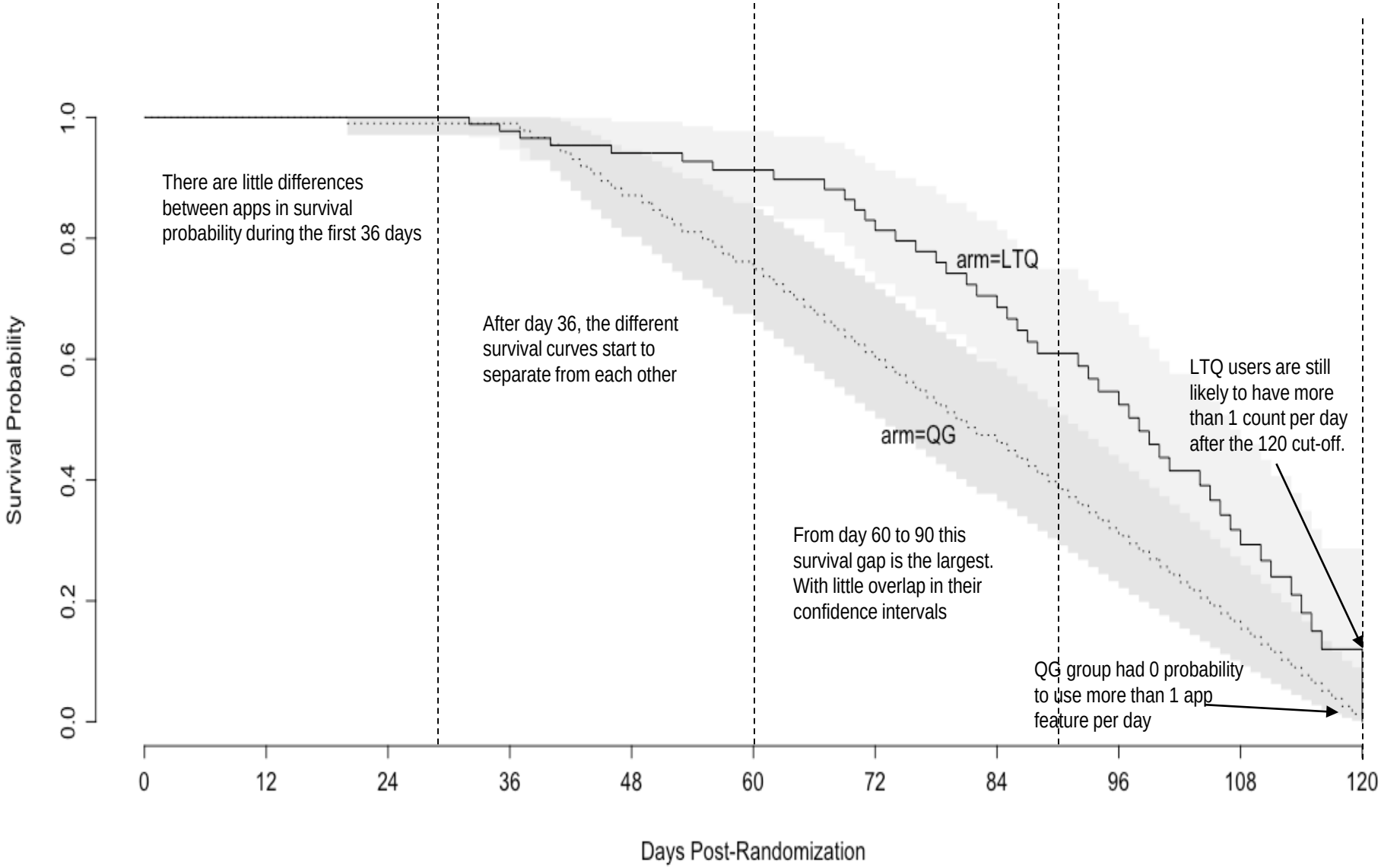


Nested Trajectories– by App and Usability

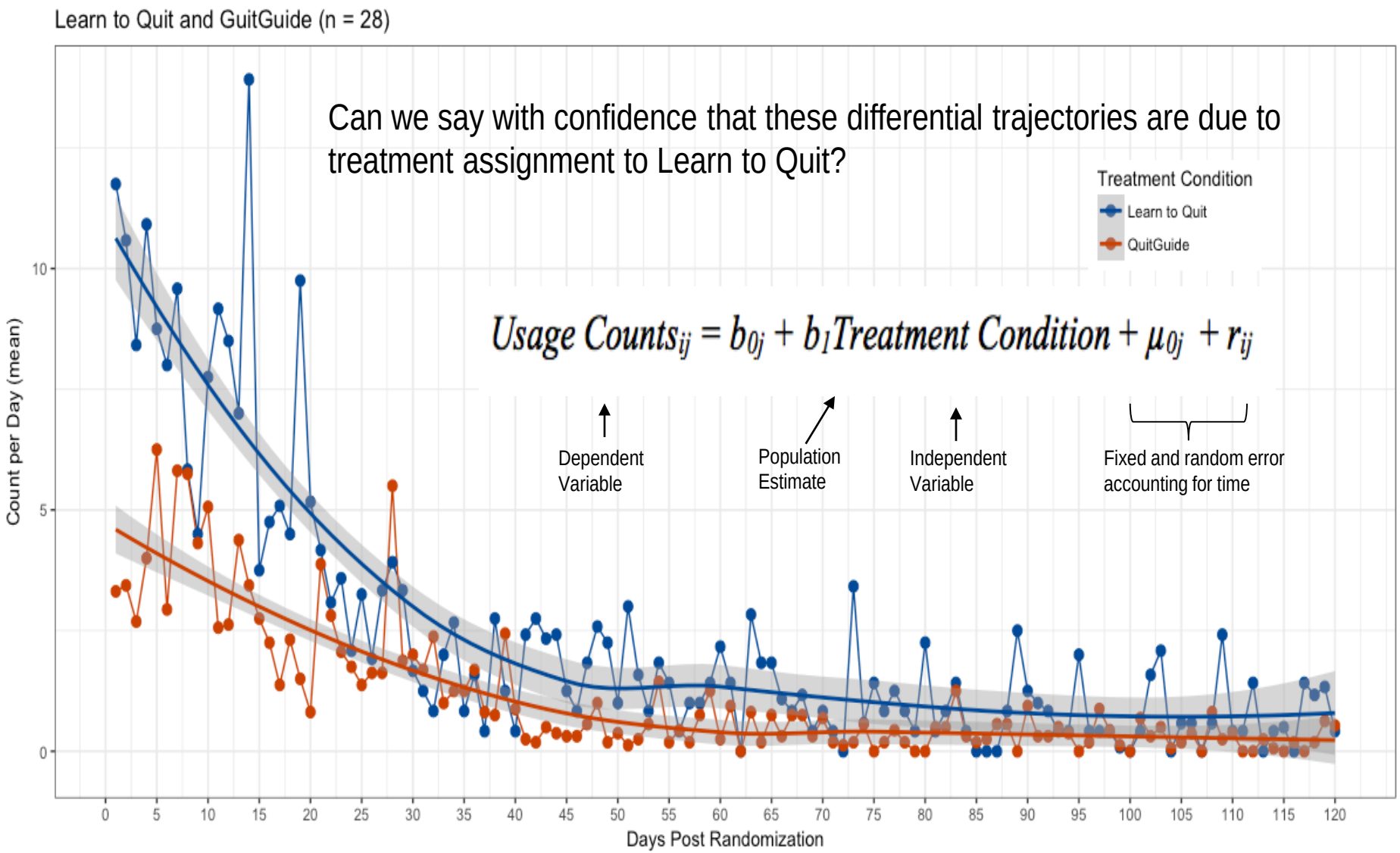




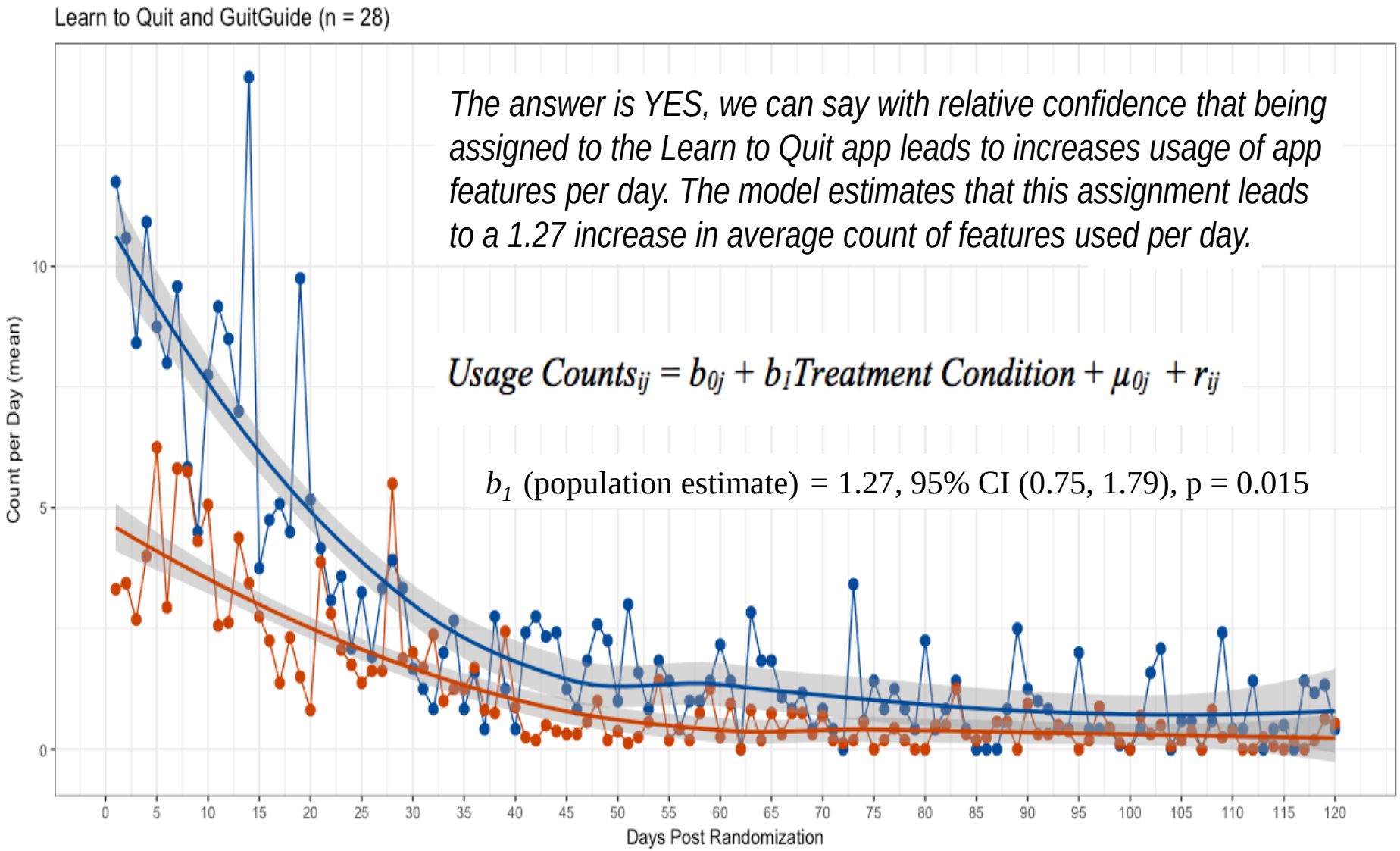
Survival Analysis: ‘days to’ less then 1 count per day



Multilevel Linear Model - Treatment Condition to App Features Over Time



Multilevel Linear Model - Treatment Condition > App Features Over Time

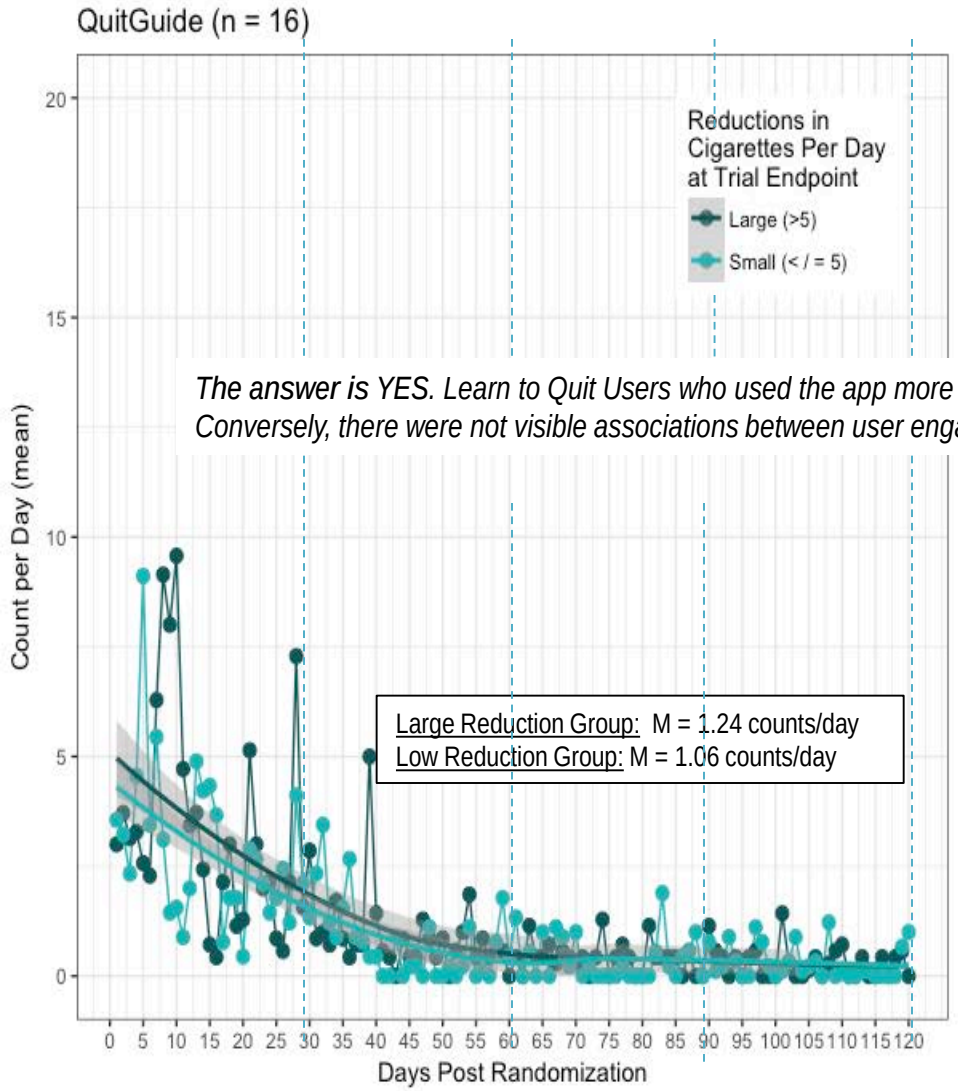


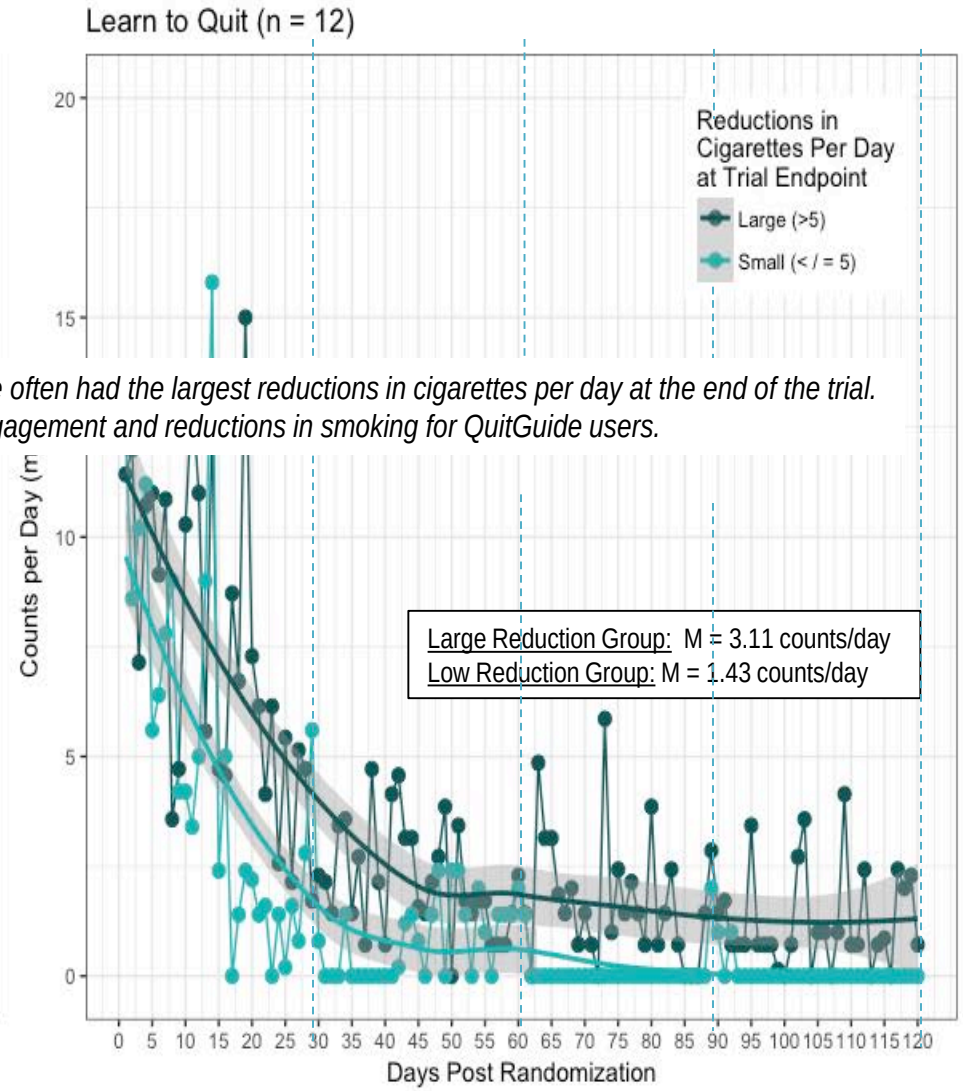
The answer is YES, we can say with relative confidence that being assigned to the Learn to Quit app leads to increases usage of app features per day. The model estimates that this assignment leads to a 1.27 increase in average count of features used per day.

$$Usage\ Counts_{ij} = b_{0j} + b_1 Treatment\ Condition + \mu_{0j} + r_{ij}$$

b_1 (population estimate) = 1.27, 95% CI (0.75, 1.79), p = 0.015

Does it make a difference to use the app more often?





The answer is YES. Learn to Quit Users who used the app more often had the largest reductions in cigarettes per day at the end of the trial. Conversely, there were not visible associations between user engagement and reductions in smoking for QuitGuide users.

Discussion

Main Results

- Consistent with the previous literature, usage trajectories for both apps decline dramatically by the first month
- This experimental study indicates that being assigned to Learn to Quit led to statistically significant improvements in overall longitudinal engagement compared to QuitGuide users
- Participants with high levels of smoking-related experiential avoidance might have found Learn to Quit more appealing than QuitGuide features
- Participants who gave Learn to Quit higher usability ratings, used the app more frequently, however, this doesn't seem to be the case for QuitGuide users
- The probability of using either app after the 30-days mark is much higher for Learn to Quit vs QuitGuide users from months 2 to 4.
- **User engagement appears to be related to smoking reductions in Learn to Quit at trial endpoint**

Future Directions

- Adding user experience interview data to better understand differential trajectories
- Does increased engagement lead to improvements in psychological flexibility?
- Are there additional factors that might influence app usage trajectories? (e.g., psychiatric diagnosis)
- Does user engagement mediate more rigorous treatment outcomes (e.g., abstinence, CO reductions)

Limitations

- Large number of observations (>5,000), however, small number of subjects (n=28) may limit our confidence in our nested analysis
- Exclusion of qualitative data
- Smartphones provided by the research team, which might have influenced engagement

Conclusion

Learn to Quit, appears to be a smoking cessation app that successfully engages users with serious mental illness, appeals to patients with higher levels of experiential avoidance, and leads to larger smoking reductions at trial endpoint.

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