Integration of Wearable Sleep Trackers into Cognitive Behavioral Therapy for Insomnia for People Aging with Schizophrenia

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Disclosure of Conflicts of Interest

- The presenters, Junhua Ma and Jae Min Jeon, both do not have any conflicts of interest.
- The presentation will not discuss any off-label use of medication.

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Introduction

Schizophrenia, Insomnia, Cognitive Behavioral Therapy for Insomnia, and Sleep Trackers

Insomnia and Schizophrenia

Insomnia

Treatable with CBT-i

Primary Sleep disorder

Affects **30%** of adults

Cognitive decline, depression, and poor physical health

Schizophrenia

Severe mental illness

Affects **1%** of population

Hallucinations, delusions, and amotivation

30-40% of people with schizophrenia have comorbid insomnia

Cognitive Behavioral Therapy for Insomnia (CBT-I)

WHAT: Effective first-line treatment for insomnia that has the advantages of no risk for drug dependency and adverse drug effects

HOW: Weekly sessions with trained clinicians typically over 6 weeks

4 Cardinal Rules for Brief Behavioral Therapy for insomnia

Reduce your time in bed	Get up at the same time everyday	Don't go to bed unless you are sleepy	Don't stay in bed unless you are asleep

Sleep Diary

Need to be filled out every day

Require Detailed Information

Essential for sleep prescription

	Sample Mon 1/1/12				
Today's date	Mon 1/1/12				
1. What time did you get into bed?	10:30 p.m.				
2. About what time did you fall asleep?	12 a.m.				
3. In total, about how long were you up in the middle of the night?	1 hour				
4. What time was your final awakening?	6:30 a.m.				
5. What time did you get out of bed for the day?	7 a.m.				
6. Time in Bed (#5 minus #1)	8.5 hours				
7. Total Time Asleep (#4 minus #2 minus #3)	5.5 hours				
8. Sleep Efficiency (Time Asleep ÷ Time in Bed)	65%				
9. How would you rate the quality of your sleep?	□ Very poor ☑ Poor □ Fair □ Good □ Very good	□ Very poor □ Poor □ Fair □ Good □ Very good	□ Very poor □ Poor □ Fair □ Good □ Very good	□ Very poor □ Poor □ Fair □ Good □ Very good	□ Very poor □ Poor □ Fair □ Good □ Very good
10. In total, how long did you nap or doze yesterday?	45 min				

How our mobile app tackles the needs

Simplicity in CBT-i	→	**CBT-i based on the 4 cardinal rules**
Simplicity in User Interface	→	**Simple To-do List Structure**
Sleep diary support	→	**Automatic sleep diary generation**
Ready and easy for clinical use	→	**Patient management website**

Sleep Tracking Technologies

Fitbit
(Charge 5)

Withings
(Sleep Mat)

CBT-i Get Up Time
7:00

Get Up
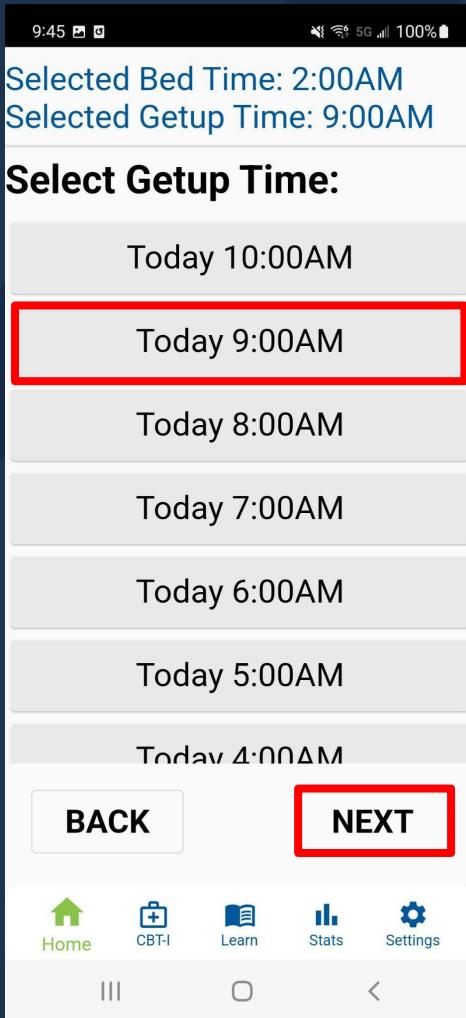
Last Night's Sleep

Initial Bed Time

◀◀ | 1:36 AM | ▶▶

Initial Fall Asleep Time

◀◀ | 2:46 AM | ▶▶

Final Wake Up Time

◀◀ | 9:14 AM | ▶▶

Final Get Up Time

◀◀ | 9:16 AM | ▶▶

Number of Awakenings

◀◀ | 0 | ▶▶

Awake in Bed Duration

◀◀ | 72 | ▶▶

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CBT-i: Sleep Review

Calculated Sleep Efficiency
82%

Sleep Efficiency is low, please try to use bed only for sleep and leave bed if can not fall asleep.

Final Get Up Time
9:16 AM

You did not get up on time, please try go to bed earlier tonight if feeling sleepy.

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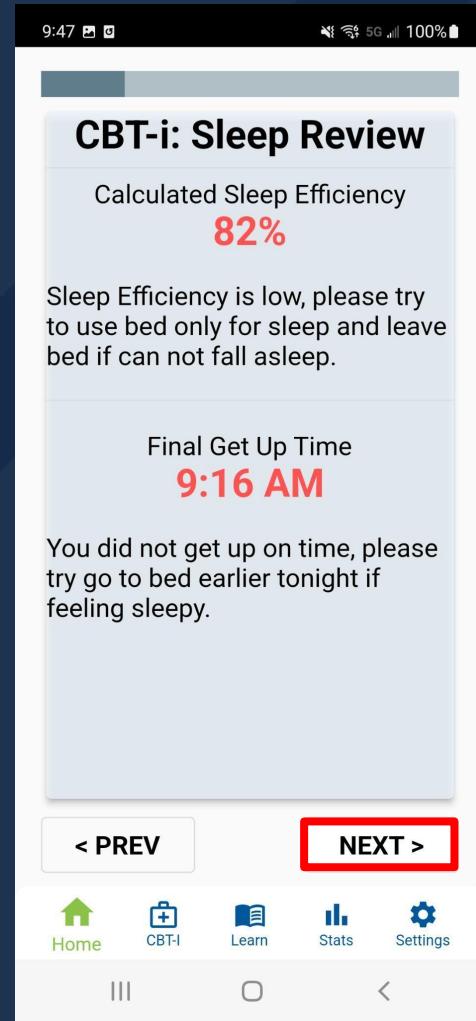
$$Sleep\ Efficiency = \frac{Time\ asleep}{Time\ spent\ in\ bed}$$

CBT-I: Sleep Diary

Rate last night's sleep:

0 1 2 3 4 5 6 7 8 9 10

Very Bad

Very Good
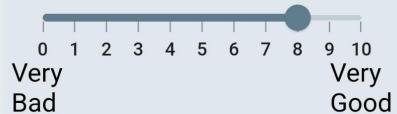
Rate yesterday's fatigueness:

0 1 2 3 4 5 6 7 8 9 10

Very Fatigue

Not Fatigue
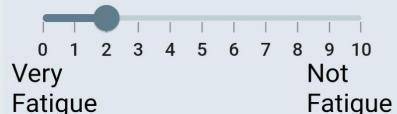
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CBT-i: Stimulus Control Questions

Did you have trouble falling asleep in bed last night?

◉ Yes   ○ No

Did you leave bed after not falling asleep for about 30 minutes?

○ Yes   ◉ No

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CBTi: Review Yesterday's Naps

Number of Naps

◀◀ 0 ▶▶

Total Duration of Naps (minutes)

◀◀ 0 ▶▶

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2023-02-27
Completed!

✓

Fitbit: Active ✓

Withings: Active ✓

Withings Entries

Restart App

Web Application

Home

Connect

Participants

Tags

Notifications

Tags: EPRP TEST

Fitbit	Withings	Mobile

Device Information

Time Frame

Currently showing 30 days

Last 7 Days   Last 14 Days   Last 30 Days   Last 60 Days

Start Date
2022-12-19

End Date
2023-01-17

Data: Sleep (Classic) ▾

Charts

Type: Daily ▾

■ TimeAsleep   ■ TimeInBed
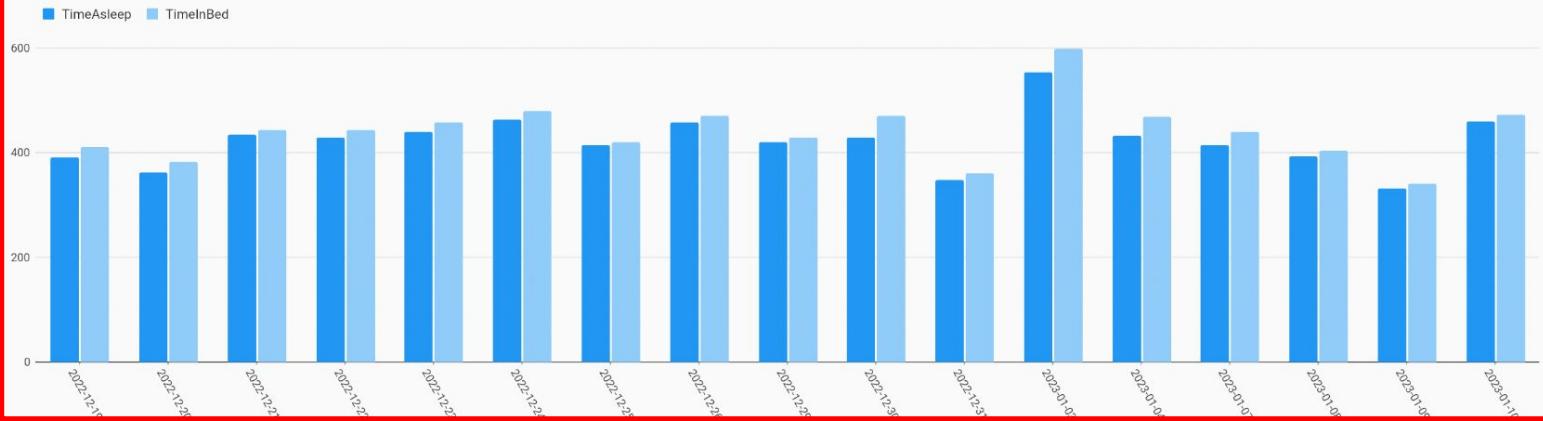
Date ↑	Minutes Asleep	Time in Bed	Efficiency
2022-12-19	391	410	95
2022-12-20	363	382	95

Participant ID: TEST11 ✏️

🗑️

Tags: EPRP TEST

Fitbit	Withings	Mobile

Current CBT-i Session Start Date: **2022-08-20 (Week 22 Day 7)**
Participant Goal Get Up Time: **7:00 AM**

Download Session Sleep Diary   End Session

Daily ▼

AUG 20 SAT	AUG 21 SUN	AUG 22 MON	AUG 23 TUE	AUG 24 WED	AUG 25 THU	AUG 26 FRI	AUG 27 SAT	AUG 28 SUN	AUG 29 MON	AUG 30 TUE	AUG 31 WED	SEP 1 THU	SEP 2 FRI	SEP 3 SAT	SEP 4 SUN	SEP 5 MON	SEP 6 TUE	SEP 7 WED	SEP 8 THU	SEP 9 FRI	SEP 10 SAT	SEP 11 SUN	SEP 12 MON	SEP 13 TUE

Participant checked in

↖️ selected date

Sleep Questionnaire →

CBT-i Data
Compliance to Set Getup Time: **no**
Answer to Stimulus 1: **yes**
Answer to Stimulus 2: **yes**
Sleep Rating: **8**
Fatigue Rating: **5**

Sleep Diary →

Sleep Data
Sleep Diary
Bed Time: **1:44 AM**
Fall Asleep Time: **2:00 AM**
Wake Up Time: **8:44 AM**
Get Up Time: **8:46 AM**
Number of Awakenings: **0**
Time Awake: **18**
Time Asleep: **404**
Time in Bed: **422**
Efficiency: **96%**

Naps
No Naps

Beta Tests

1st Beta Test - Feasibility

Timeline

- September 6th - 16th, 2022

Aim

- Validate sleep log generation from Fitbit and Withings
- Obtain feedback on user experience

Takeaway

- Need to fully set up the smartphones and devices before deployment

2nd Beta Test - Usability

Timeline

- October 7th - 17th, 2022

Aim

- How effective are the written instructions at helping the participant use the app and the devices

Takeaway

- Real time tech support is needed to both mirror/troubleshoot the phone

TeamViewer

3rd Beta Test - Reliability

Timeline
- November 9th - 15th, 2022 (Devices only)
- November 15th - November 25th, 2022 (Devices + Survey)

Aim
- Validate sleep diary generation from the mobile app

Results

# days Fitbit recorded data	**15/15 (100 %)**
# days Withings recorded data	**13/15 (87 %)**
Mobile Sleep Diary Entered by patient	**4/9 (44 %)**
Server Sleep Diary Saved	**4/4 (100 %)**

Takeaway
- Device adjustment period is helpful for patients
- Sleep diary was recorded on our server successfully

Challenges

Practicality
Access to Wi-Fi   Remote Device Management

Dealing with Subjectivity
Objective vs Subjective Data

Difficulties in Development
Lack of Patient Feedback   Sleep Trackers Issues

Designing for Simplicity
Users with limited tech experience

Next steps

Bug Fixes

IRB Approval

Launch more beta tests

Summary

- People with Schizophrenia have high rate of comorbid insomnia that impacts health and functioning
- CBT-i is an effective treatment but sleep diaries can be difficult for people with schizophrenia to complete
- Creating a mobile app that integrates commercially available sleep trackers can facilitate accurate sleep diary generation and support CBT-i treatment
- Beta testing has allowed us to refine the app to improve usability and replicability, reduce participant burden, and increase consistency/accuracy of data
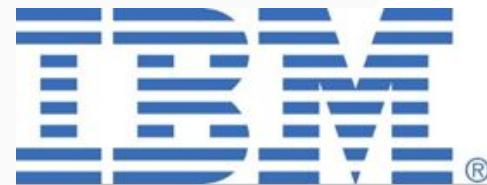
Thank you

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	All the beta-testers