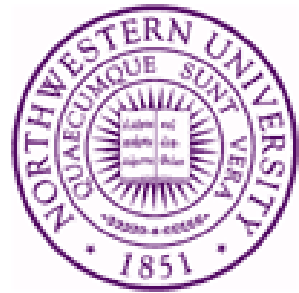
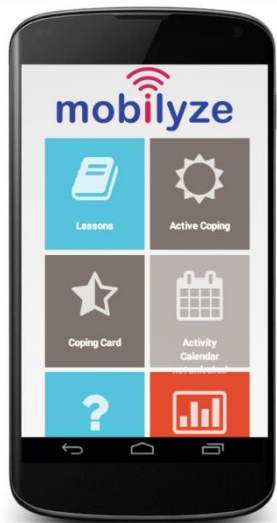


# Behavioral Intervention Technologies for Depression in Youth

David C. Mohr  
Northwestern University



# What's a Behavioral Intervention Technology?



mobile phones



computers



tablets

[www.cbits.northwestern.edu](http://www.cbits.northwestern.edu)



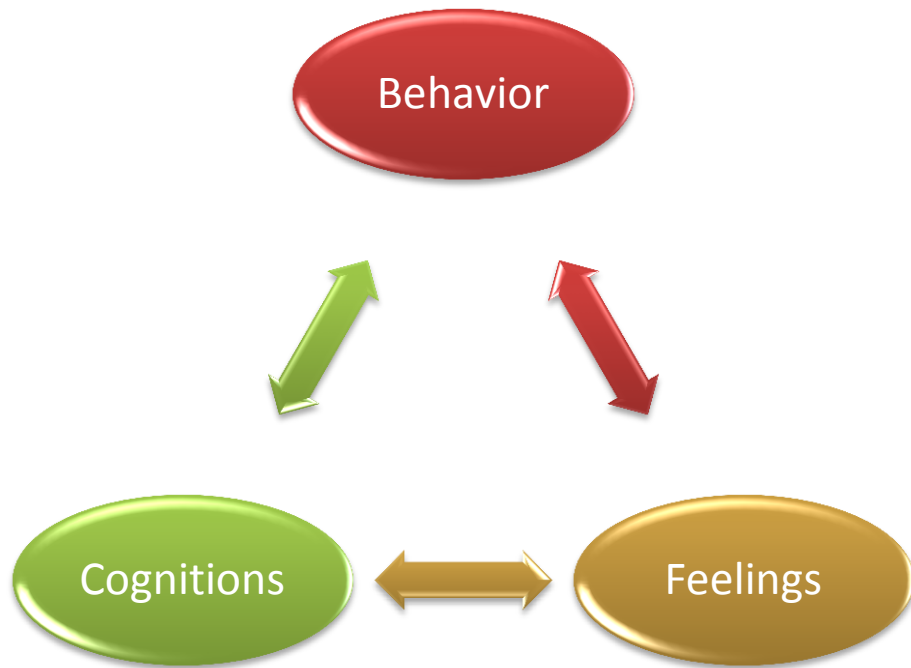
sensors

# Why do we need BITs?

- 12- month prevalence of diagnosable mental illness
  - 26% of Americans (approximately 60 million)
  - 21% of youth
- Far more have subthreshold symptoms that deserve treatment.
- There will never be enough mental health professionals to treat these problems.

# What do we know?

We know some things...



but not others.



# MoodGym: Prevention of Depression

*O'Kearney, Depress Anx 2009;26:65-72*

- 157 girls randomized to
  - MoodGym
  - Attention Control
- No difference ( $p=.75$ )
- Only 30% used more than 2 of 6 modules



# Text Messaging (SMS) in Youth

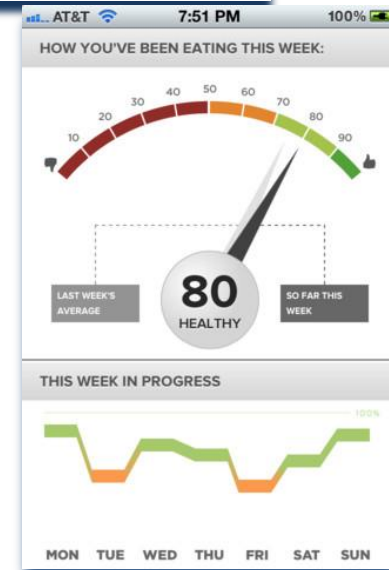
*Preston, K.E. Amer J of Lifestyle Med. 2011;5;247*



- SMS alone has been investigated mainly for health behaviors.
- Generally well accepted
- Not consistently effective at improving health behaviors (physical activity, smoking cessation).
- May be useful for providing reminders (medication, appointments)

# Smartphone Applications

- There are ~40,000 health apps available
  - 1,980 health apps for specific conditions
  - Most are free
- But
  - Most are of poor quality, no clear evidence base
  - Virtually none have been evaluated
  - Use is low. Of 189,770 downloads:
    - Non-Use – 86.4%
    - Tried a few times – 11.0%
    - Used > 10 times - 2.6%



# Humans are Important!

*Cuijpers Cogn Behav Ther, 2009;38:66-82; Richards, Clin Psych Rev, 2012;32;329-42)*

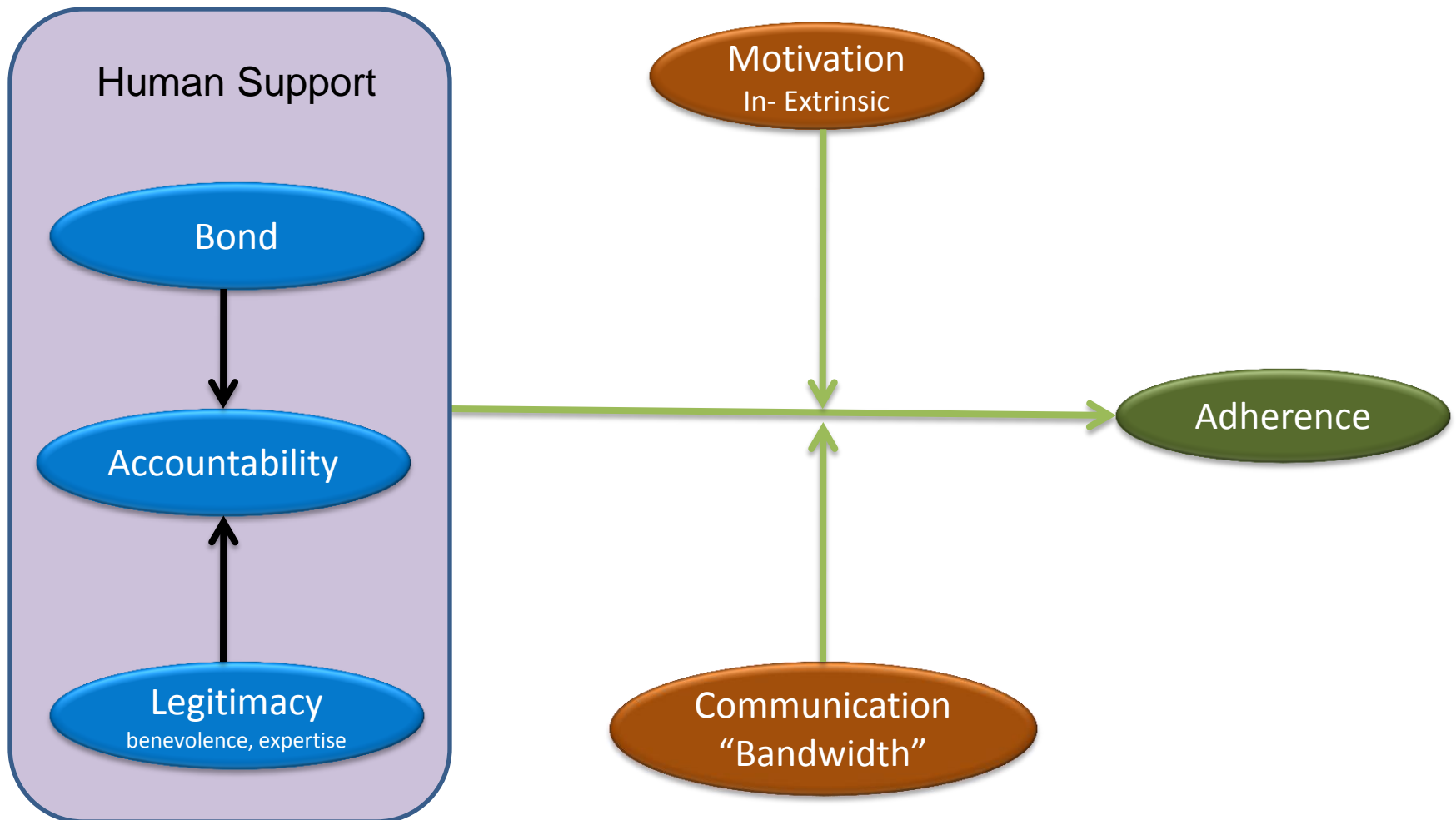
- Standalone web-based treatments
  - $ds=.18 - .36$
  - <2 logins
- Coach-supported web-based interventions
  - $ds=.56 - 1.08$
  - ~9 logins





# TeleCoaching Model: Supportive Accountability

*Mohr DC, et al. Journal of Medical Internet Research. 2011;13:e30*



# moodManager Adherence

## 101 Primary Care Pts with MDD

*Mohr DC, et al. PLoS One. 2013;8(8):e70086*

## Coach time

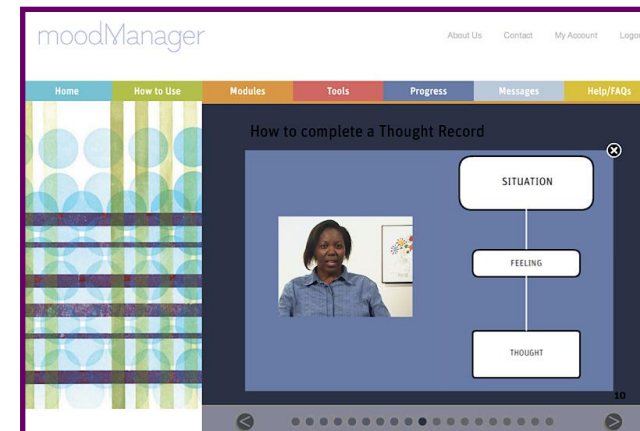
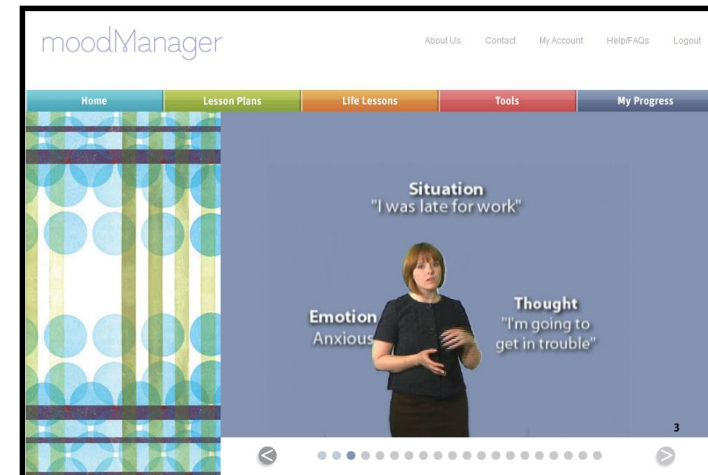
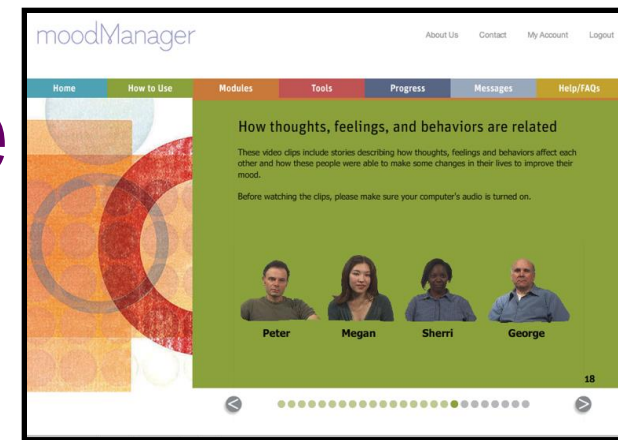
- Mean = 43 min per participant

## Improvement in Depression

- Significant reduction in depression

## Adherence to Web-Site

- Coached adherence significantly greater than uncoached



# Peer Networking

# Peer Networking

**Collaborative Learning:**  
Lessons and tools

**Intervention support:**  
Blinking tiles

**Peer network**

**Accountability:**  
Buzz feature

**Intervention support:**  
A page tour explains components

**Peer support & prosocial behavior:**  
Daily group activities


The screenshot shows the ThinkFeelDo website interface. At the top, there is a navigation bar with links for 'ThinkFeelDo', 'Guidelines', 'Contact a Moderator', and 'Page Tour'. On the right side of the navigation bar, there are links for 'Edit your profile' and 'Log out'.

The main content area is a grid of tiles. The first row contains four tiles: 'Road Map' (blue header, blue 'A' icon), 'Today's Lesson' (blue header, lightbulb icon), 'Good' (pink header, pink gauge icon), and a user profile tile for 'J-Dog' (blue header, text: 'Shared a thought', 'Last seen at: Oct 3, 2:47 PM'). The second row contains three tiles: 'Activity Tracker' (orange header, orange calendar icon), 'Think & Feel' (purple header, purple puzzle piece icon), and a user profile tile for 'Fearless Leader' (blue header, text: 'Commented on Joyce's shared activity: 'Get Max to practice piano'', 'Last seen at: Oct 4, 1:56 PM'). The third row contains three tiles: a user profile tile for 'GS2' (dark red header, text: 'No Activity Yet', 'Last seen at: Sep 20, 2:22 PM'), a user profile tile for 'Joyce' (blue header, text: 'Read lesson 'Final Lesson #21: Moving forward...', 'Last seen at: Oct 1, 2:16 PM'), and a user profile tile for 'Ben' (dark red header, text: 'No Activity Yet', 'Last seen at: never'). The fourth row contains four tiles: a user profile tile for 'BuzzHappy' (blue header, text: 'No Activity Yet', 'Last seen at: Oct 3, 4:42 PM'), a user profile tile for 'Marya' (blue header, text: 'Commented on Final Lesson #21: Moving forward...', 'Last seen at: Oct 1, 12:29 PM'), a user profile tile for 'Urba' (dark red header, text: 'No Activity Yet', 'Last seen at: never'), and a 'Summary' tile (green header, green list icon). A tooltip for 'The Activity Tracker' is visible over the 'Summary' tile, showing the text: 'Record activities you've done and plan future activities. Previous | Next'.

Annotations with arrows point to specific features: 'Collaborative Learning: Lessons and tools' points to the 'Road Map' tile; 'Intervention support: Blinking tiles' points to the 'Today's Lesson' tile; 'Peer network' points to the 'J-Dog' user profile tile; 'Accountability: Buzz feature' points to the 'GS2' user profile tile; 'Intervention support: A page tour explains components' points to the 'Activity Tracker' tile; and 'Peer support & prosocial behavior: Daily group activities' points to the 'Summary' tile.

# Didactic Content


Lesson

 **Learn** Today's Lesson

**What is depression?**

You may know what depression is. You may have heard about it, read about it, or known someone dealing with it. But what you might not know is how depression is different from just "having a bad day". You may even have experienced depression in the past, or not. All we know that is, approximately 20% of adolescents will experience depression during their teenage years.

[< Previous](#) [Next >](#)


 1 like this


Comments

Post Comment

# Media

Lesson





**Answer the questions below:**

1. Which videos did you watch?
2. What did you like about the videos, if anything?
3. Did anyone say something that made an impact or that you could relate to?
  - If so, who was it and what did they say?

Comments

Post Comment

# Networking Features

Scheduling/rating  
tool

Peers' activity

Peer comments

The screenshot displays the ThinkFeelDo website interface, which is divided into two main sections: 'My Activities' and 'My Group's Shared Activities'.

**My Activities Section:**

- Calendar:** A monthly calendar for October 2013. Activities are scheduled as follows:
  - Tuesday, October 1st: '5pCafé meeting' (blue bar)
  - Wednesday, October 2nd: '12pWork on grant' (blue bar)
  - Friday, October 4th: A yellow highlighted day.
- Activity Editor:** A pop-up window for creating or editing an activity.
  - Title:** Situation
  - Starts:** 7:00 AM, 2013
  - Ends:** 12:00 PM, 2013
  - Tags:** (max 5)
  - Predicted PLEASURE:** 0
  - Predicted ACCOMPLISHMENT:** 0
  - Sharing:** ☒ Share this
  - Buttons:** Delete, Save

**My Group's Shared Activities Section:**

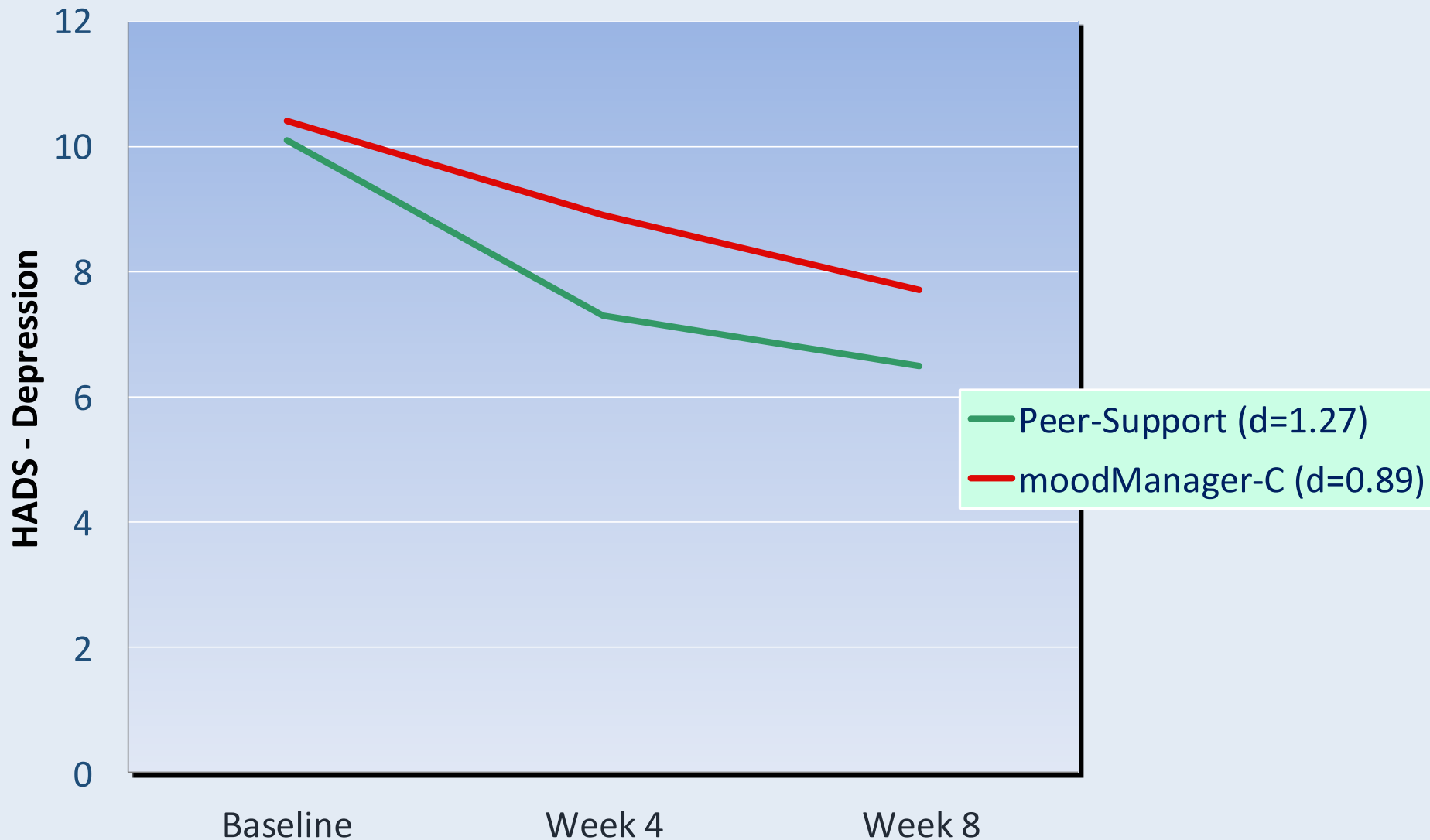
- Activity: Yoga** (Completed on Tue September 24, 2013)
  - Accomplishment:** Predicted 7, Experienced ?
  - Pleasure:** Predicted 9, Experienced ?
  - Engagement:** 0 like this, 1 sounds fun!, 0 sounds important!
  - Comments:** 1 comment by Fearless Leader (Stretch) on 12:37 PM Oct 1, 2013.
  - Post Comment:** Button
- Activity: Test the site** (Completed on Tue September 3, 2013)
  - Accomplishment:** Predicted 7, Experienced 3
  - Pleasure:** Predicted 4, Experienced 7
  - Anger:** A color scale bar ranging from blue (0) to red (5).

# Use Data

- Youth (prevention) – 2 cohorts in 10-week intervention
  - 14 users age 14-18 (6 non-caucasian)
  - Mean # logins: 24
- USE questionnaire (1-7 likert scales)
  - Mean 2.1 (range 1.3 – 3.1)
- Qualitative feedback
  - More interaction with peers
  - Go where they are – mobile & text

# Cancer Survivorship Pilot Trial

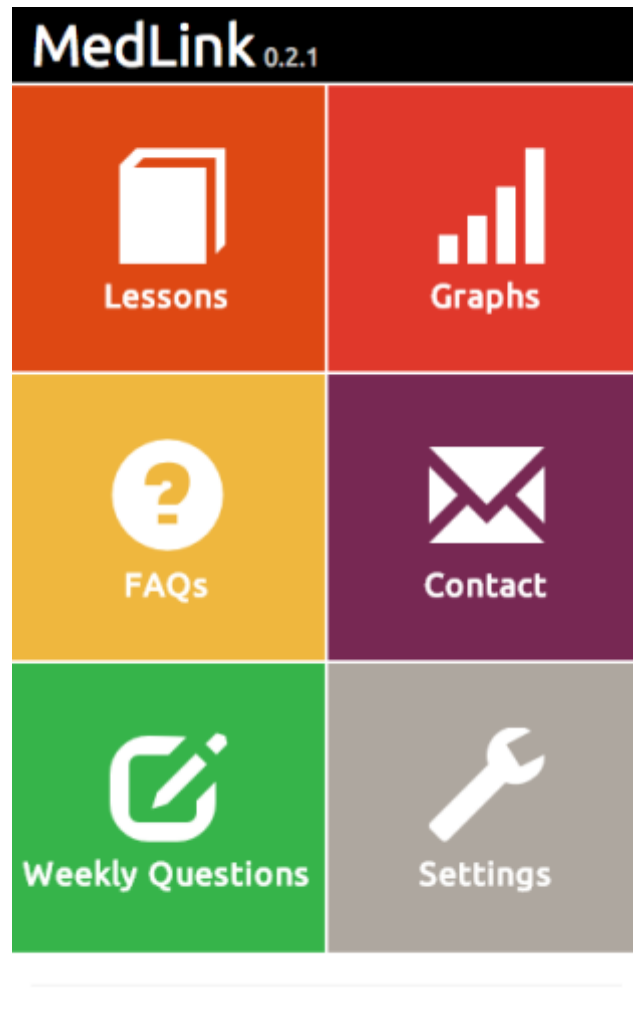
17 cancer survivors with depressive symptoms  
randomized





# Connecting Patients and Providers

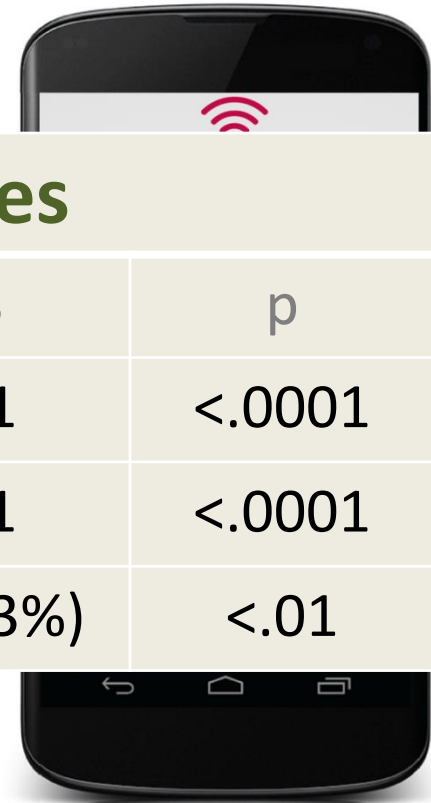
(R34 MH095907)



# Mobilyze

(P20 MH090318)

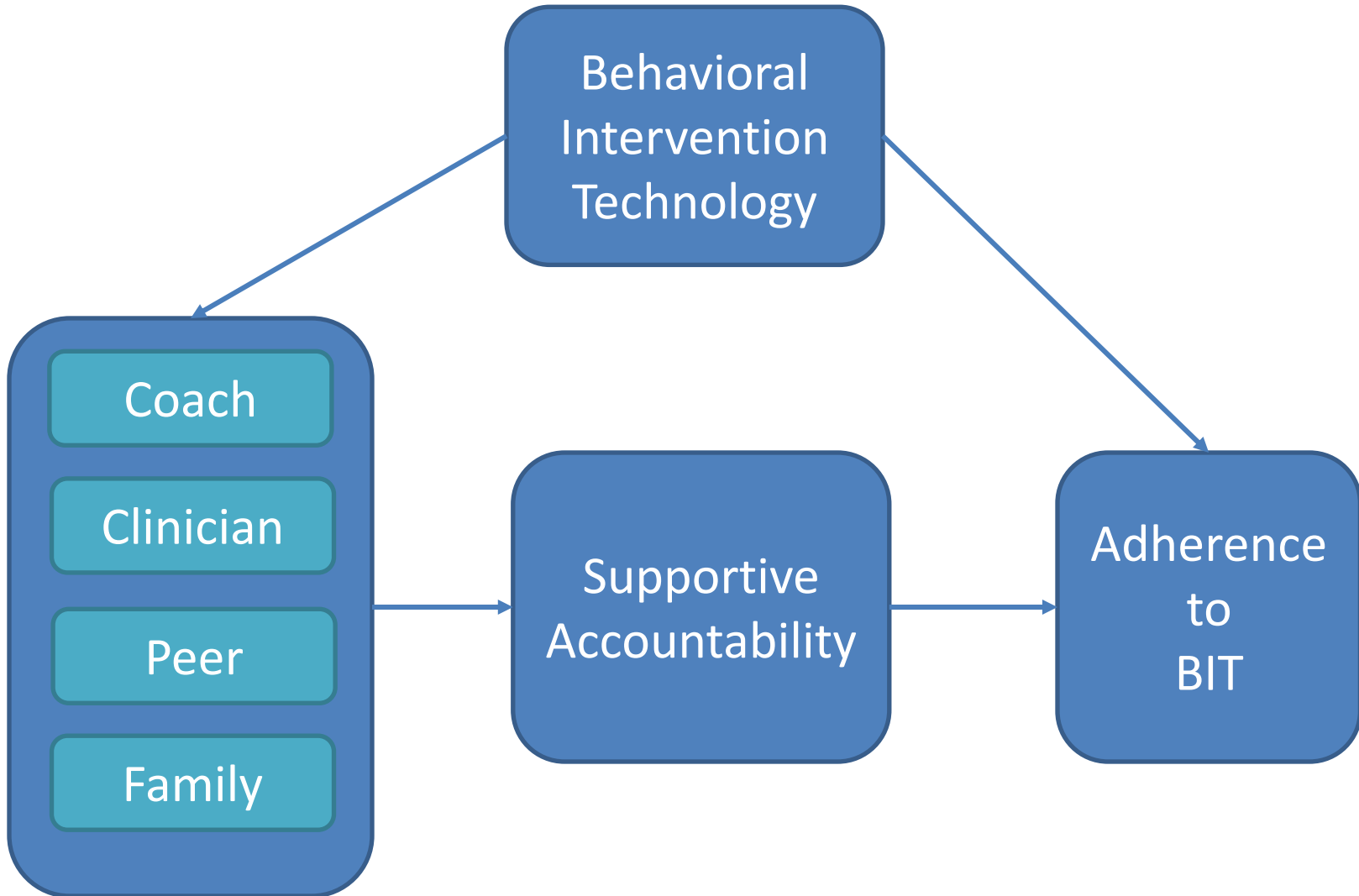
Conducted in an 8-week pilot of a mobile phone app for depression  
that



## Depression Outcomes

	Week 1	Week 8	p
PHQ-9	17.1 ± 3.8	3.6 ± 4.1	<.0001
QIDS	13.8 ± 2.1	3.4 ± 3.1	<.0001
MDE	8 (100%)	1 of 7 (14.3%)	<.01

# Take Home: The System is Important



# How to Get People to Do Things

**Increase  
Motivation**



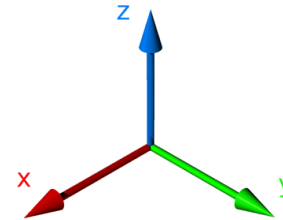
**Decrease  
Effort**



# Mobile Sensing



41.8322 N, 87.6513° W  
250 m, 70% accurate,  
Wifi, Currently Near 4  
Wifi Networks [Linksys,  
VultureWeb, Bob's  
HouseNet], more...



Rotation  
Acceleration  
Velocity  
Gravity  
Gyroscope



Hardware



Called for 3 minutes @ 2:30PM  
Text @ 1 PM  
Email @ Noon  
More...



Device ID: 33:AD:4F:C3:3F:B2:D1:11



Other available information



External Devices

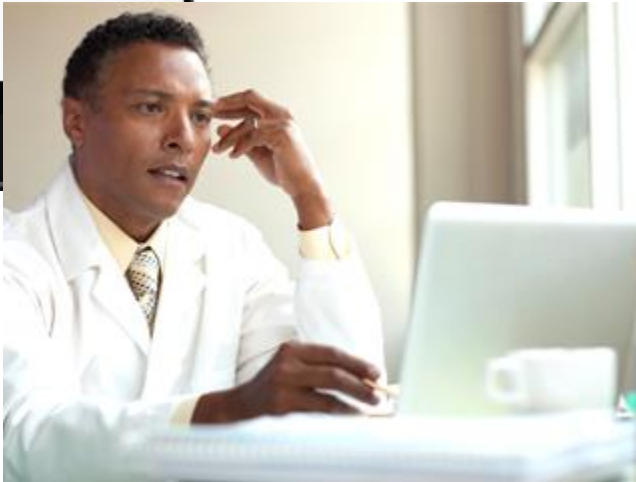
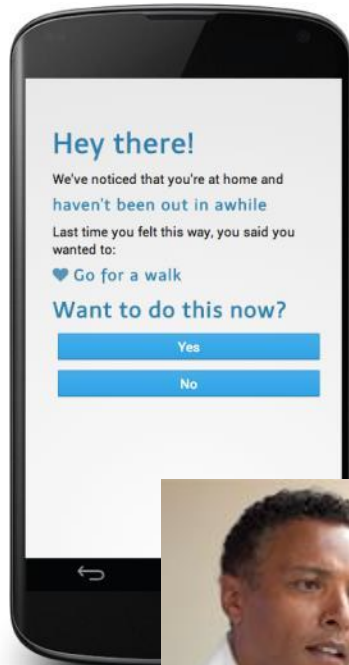
# What would we want to know?



Emotional States:  
Location:

- Medication
- Home
- Workplace
- Work environment
- Stressed
- Friends house
- Happy
- Scheduling & etc.
- Etc
- attendance
- Other...

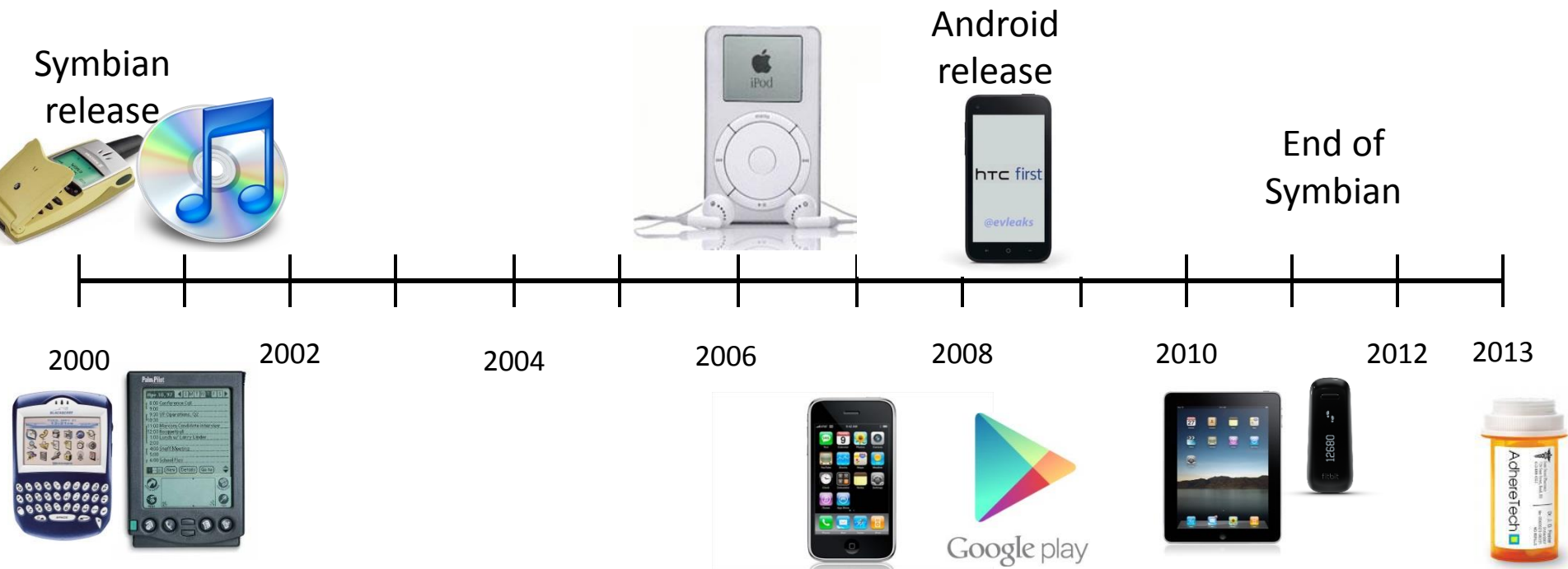
# Coming to an app store near you in What could we do? 2022!



- Feedback, positive reinforcement, suggestions to patients
- Information to clinicians

# Obsolescence

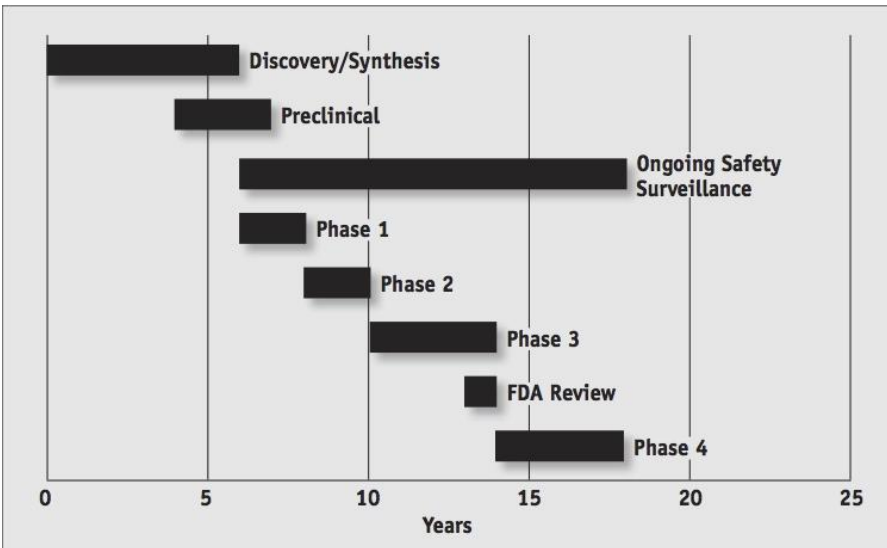
## Timeline for Technology Development



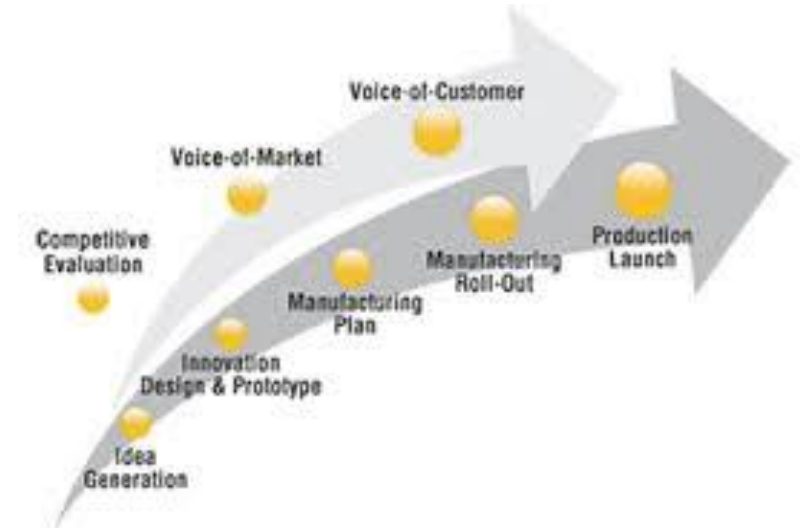


# What are our Models?

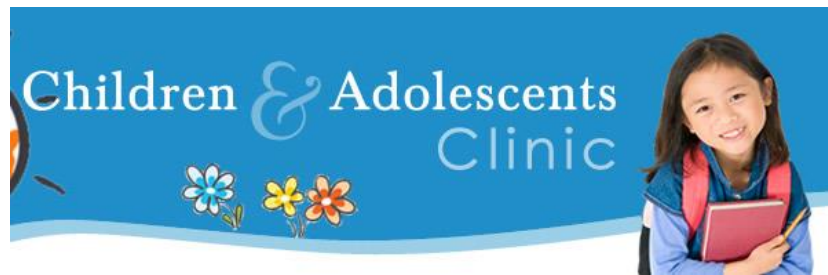
## Academic Model



## Industry Model



## Implementation



# Where do we stand?

- BITs can be effective.
- But they need to be integrated into care systems.
- Everything is changing (technology, culture, environment...) – we need principles, not apps

# What do we need for BITs research?

- Methods to rapidly develop and test.
- Methods to integrate BIT research and implementation.

# Role of Research

- Understand principles
- Greenhouse – Rapid development and testing

## A lot of things can be reused...

### Intervention elements

- Logging tools (assessments)
- Content delivery (information, text, video)
- Visualization tools
- Notification elements
- Sensor collection (Passive Data)

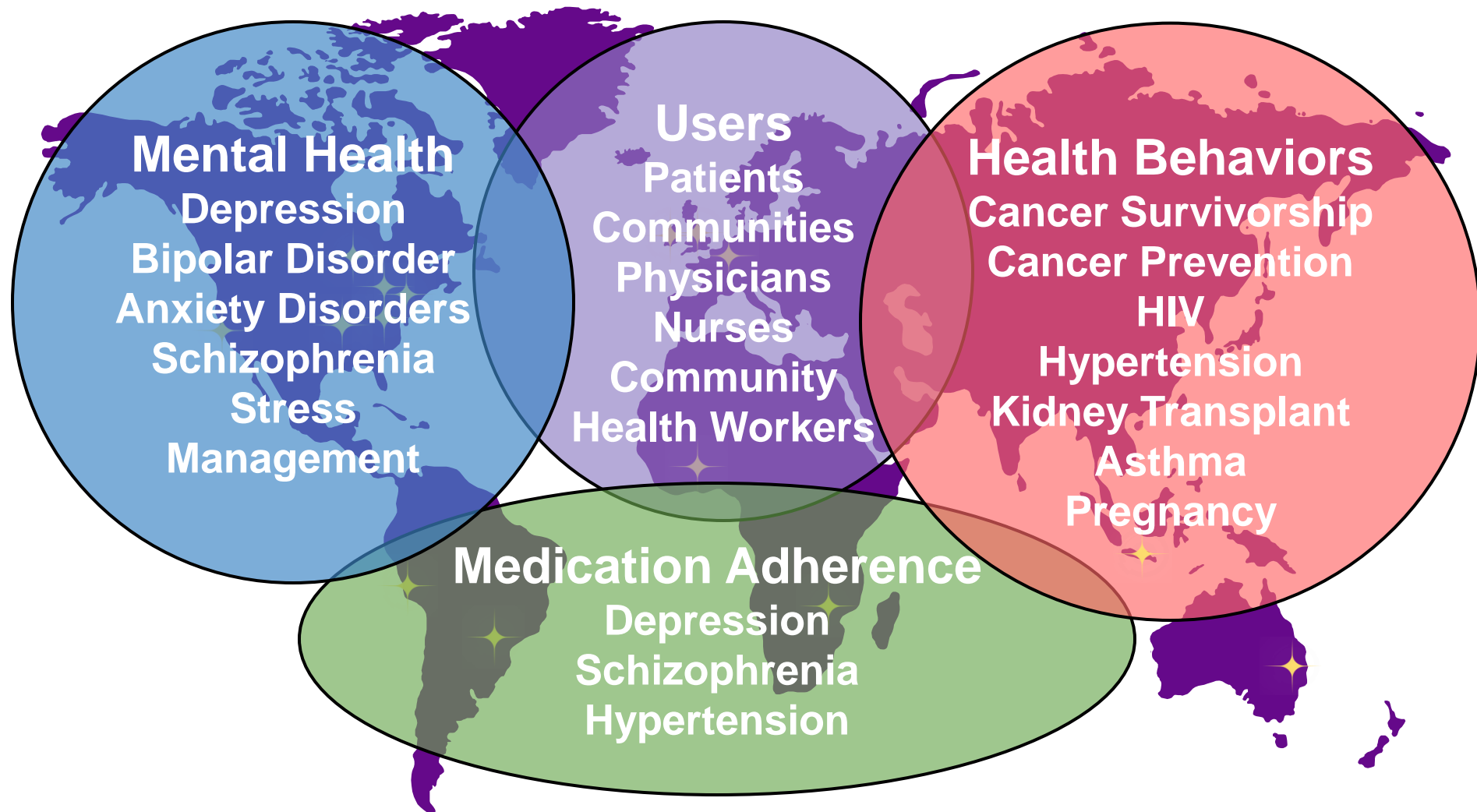
Create infrastructure that supports

- development of BITs
- dissemination of information and expertise
- Collaboration



# CBITs Purple Development Framework

NIMH P20; 50+ projects, 25+ NIH grants





# Where do we go from here?



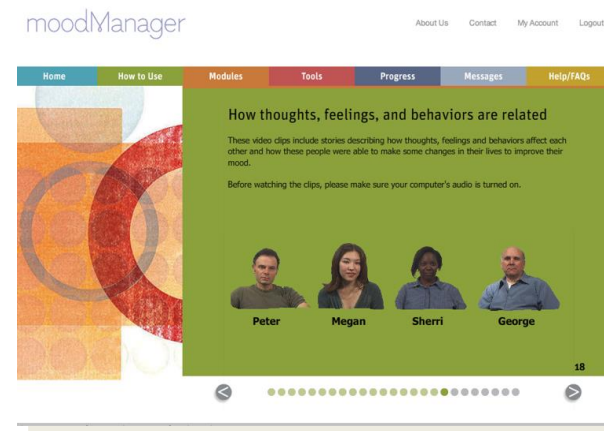
- What research infrastructure is needed for rapid prototyping and testing?
  - What are the needs (use cases)?
- What is the role for academic/industry partnerships?
  - What are possible models?
- How do we integrate research and implementation?



# moodManager Adherence

## 101 Primary Care Pts with MDD

*Mohr DC, et al. PLoS One. 2013;8(8):e70086*



## Logins from previous trials

- Mean number of logins for coached interventions: 2 - 9.1
- Mean number of logins from standalone interventions: <2

Use Variable	Coached mM		mM Only		p
	Median	Range	Median	Range	
Weeks to last use	9	0-12	5	0-11	0.007
Login days	13	0-100	6	1-24	0.01
Lessons used	8.5	0-18	5	0-18	0.03
# Tools Used	159	0-721	39	0-332	0.08