cbits center for behavioral intervention technologies

www.cbits.northwestern.edu

Making Digital Mental Health Work in the Real World

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Feinberg School of Medicine

Disclosures

Honoraria/Consulting fees
- Apple Inc.
- Otsuka Pharmaceuticals
- Pear Therapeutics
- One Mind Foundation

Ownership Interest
- Adaptive Health, Inc

Funding
- National Institute of Mental Health
  - P50 MH119029
  - R01 MH100482
  - R01 MH109496
  - R01 MH111610
  - R44 MH114725

Center for Behavioral Intervention Technologies (CBITs)

- 6 Core faculty (Psychology, Human-Computer Interaction, Communications, Statistics/Data Science)
- Many Digital Mental Health projects in
  - University Settings
  - Eating Disorders
  - At-Risk Youth in Community Mental Health
  - Sensing in Mental Health
  - NIMH P50 ALACRITY Center: projects in Primary Care, OBGYN, and Geriatrics
- NIMH T32 Postdoctoral Training in Postdoctoral Fellowship

Outline

Problem Introduction

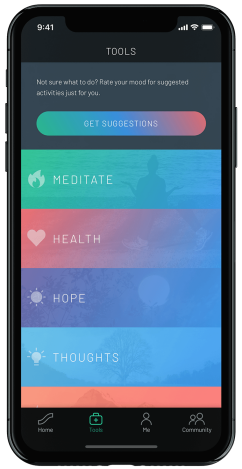
IntelliCare

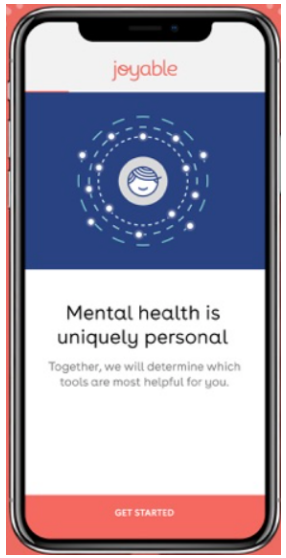
Efficacy & Engagement Data

Implementation

Implications for Digital Mental Health Research

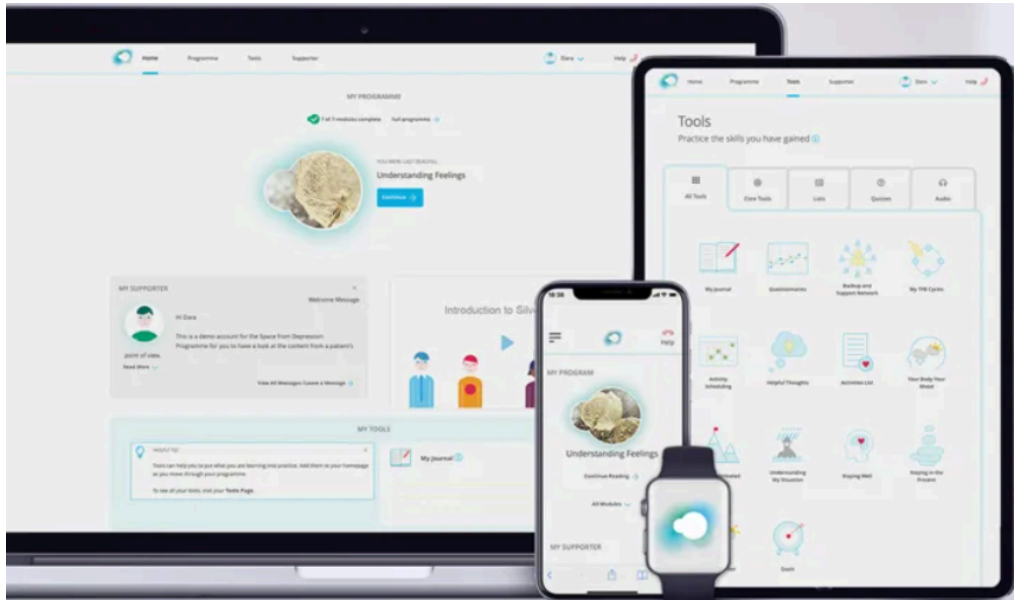
Summary





What is Digital Mental Health?

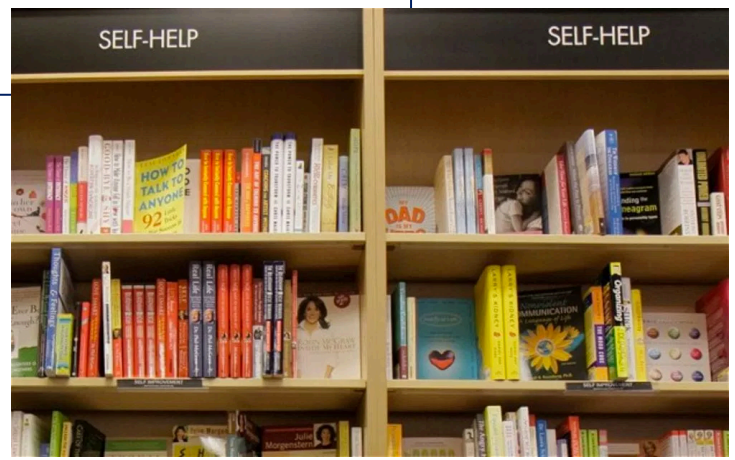
Uses commonly available technologies, such as apps or internet sites, in the treatment or management of mental illness



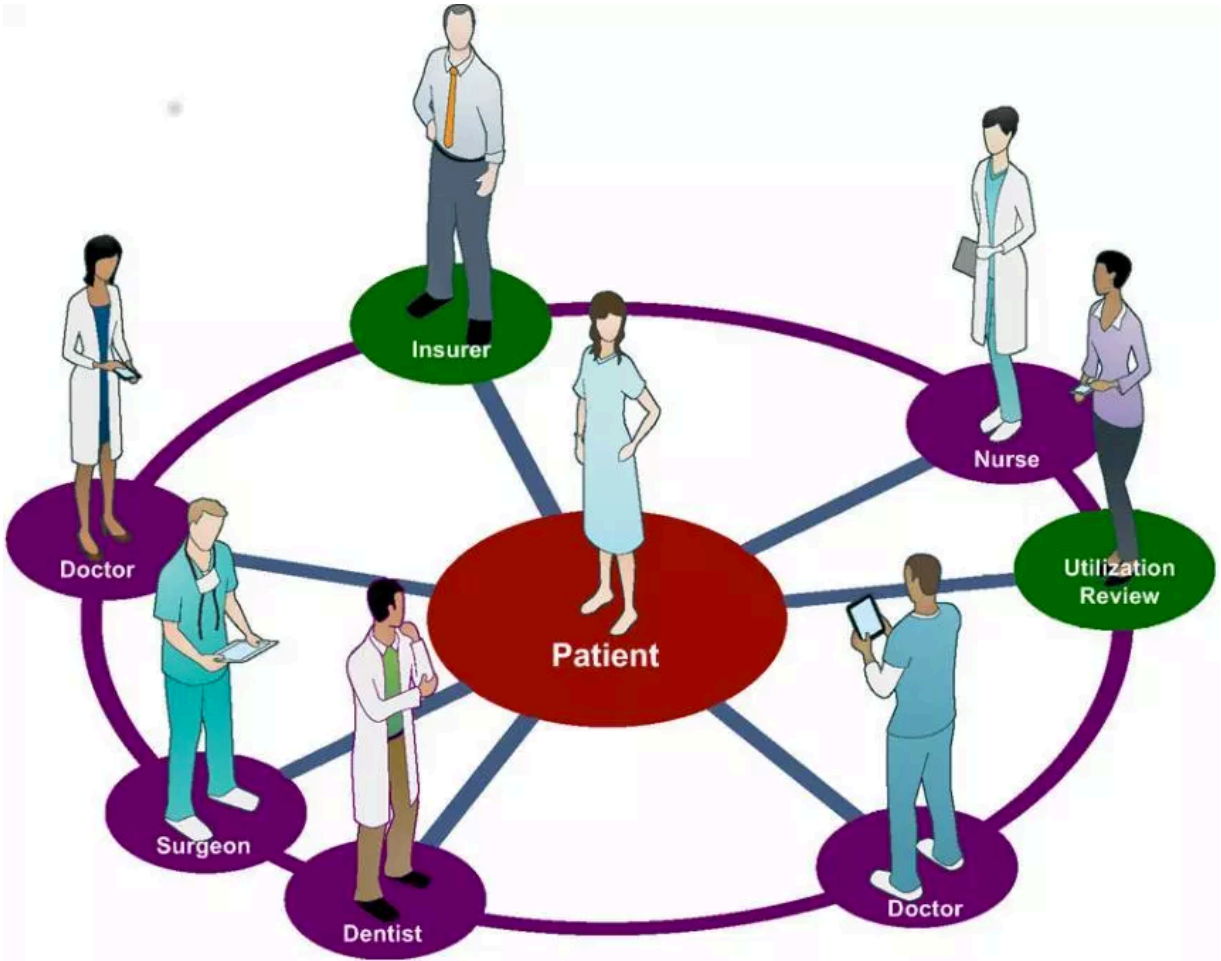
Digital Mental Health

Self Help

10,000+



Technology-Enabled Services



How is Digital Mental Health Doing?

Lots of Validation

100+ of RCTs show

- Self-directed digital treatment treatments at best modestly effective
- Coach-supported digital interventions
  - Appear to be as effective as standard treatments (*d*s=.56 – 1.08)
  - Coaches do not have to be mental health professionals

Karyotaki E, et al. *JAMA Psych.* 2017;74(4):351-359
Richards D, et al. *Clin Psychol Rev* 2012;32:329-342
Alvarez-Jimenez, et al. Schizophr Res. 2014;156:96-106

Real World Implementation

Mohr, et al., Psychiatr Serv., 2017;68:427-9

Contributors to Research-to-Practice Gap

Failure in Design

Failure to design for the patient

Failure to design for the provider

Failure to design for the organization

Design for the Patient

Design based on psychological and medical models

Design that embeds in the fabric of people's lives

Human Computer Interaction & Design

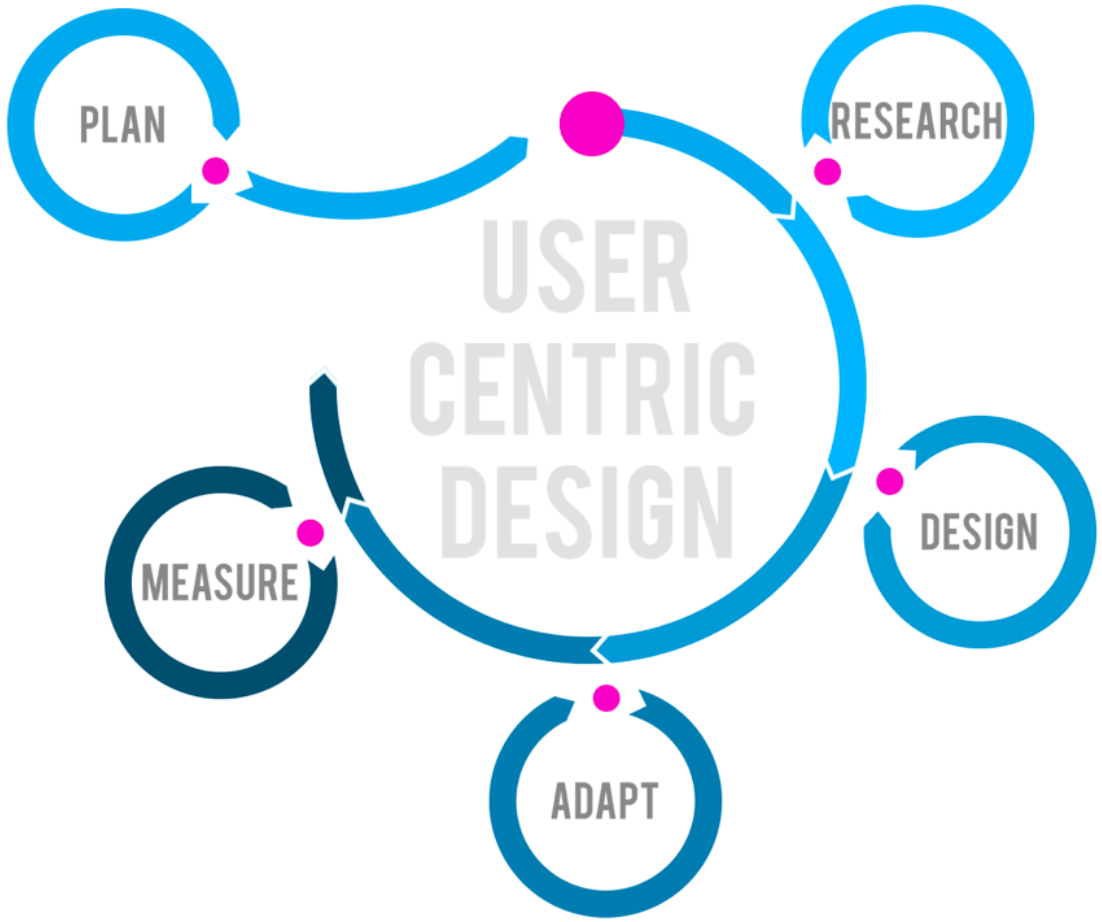
Giving a Voice to End Users

Stakeholders

- Patients
- Clinicians
- Administrative staff
- Leadership

Methods

- Interviews
- Focus groups
- Workflow observations
- Codesign workshops
- Usability testing



Design for Patients

How do people use tech for mental health?

Meng… Mohr, JMIR. 2018;20:e10139
Burgess, CHI, 2019
Eschler. CHI, 2020

- Most have tried mental health apps, but abandoned quickly
- They use technologies in bespoke ways
- Apps
  - Information
  - Mood tracking alone is not helpful
    - Behavior tracking – comparing 2 targets
    - Using non-mental health apps for mental health purposes: e.g. menstrual tracking, meditation
  - Daily tips: inspirational, encouragement, reminders
- **Apps generally have a single purpose**
- **Apps must easy, intuitive, and quick (usually ~30 sec.)**
- **Apps must give something of value back to the user (principle of reciprocity)**

Example: Transportation Needs

Mapping

Parking

Ride Share

Car Rental

ChicagoTaxiApp

Taxi

Public Transportation

Airlines

Challenge for Mobile Mental Health

	Behavioral Strategy								
	Behavioral Activation	Cognitive Restructure	Goal setting	Problem Solving	Affect Regulation	Relaxation	Physical Activity	Positive Psych	etc..

Challenge for Mobile Mental Health

	Behavioral Strategy								
	Behavioral Activation	Cognitive Restructure	Goal setting	Problem Solving	Affect Regulation	Relaxation	Physical Activity	Positive Psych	etc..
App Features									
Didactic									
Text									
Video									
Audio									
Messaging									
Self Tracking									
Logging features									
Feedback									
Reminders									
Sensing									
Geolocation									
Sound									
Etc….									
Camera									
Gamification									
Etc…									

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IntelliCare Platform

www.intellicare.northwestern.edu

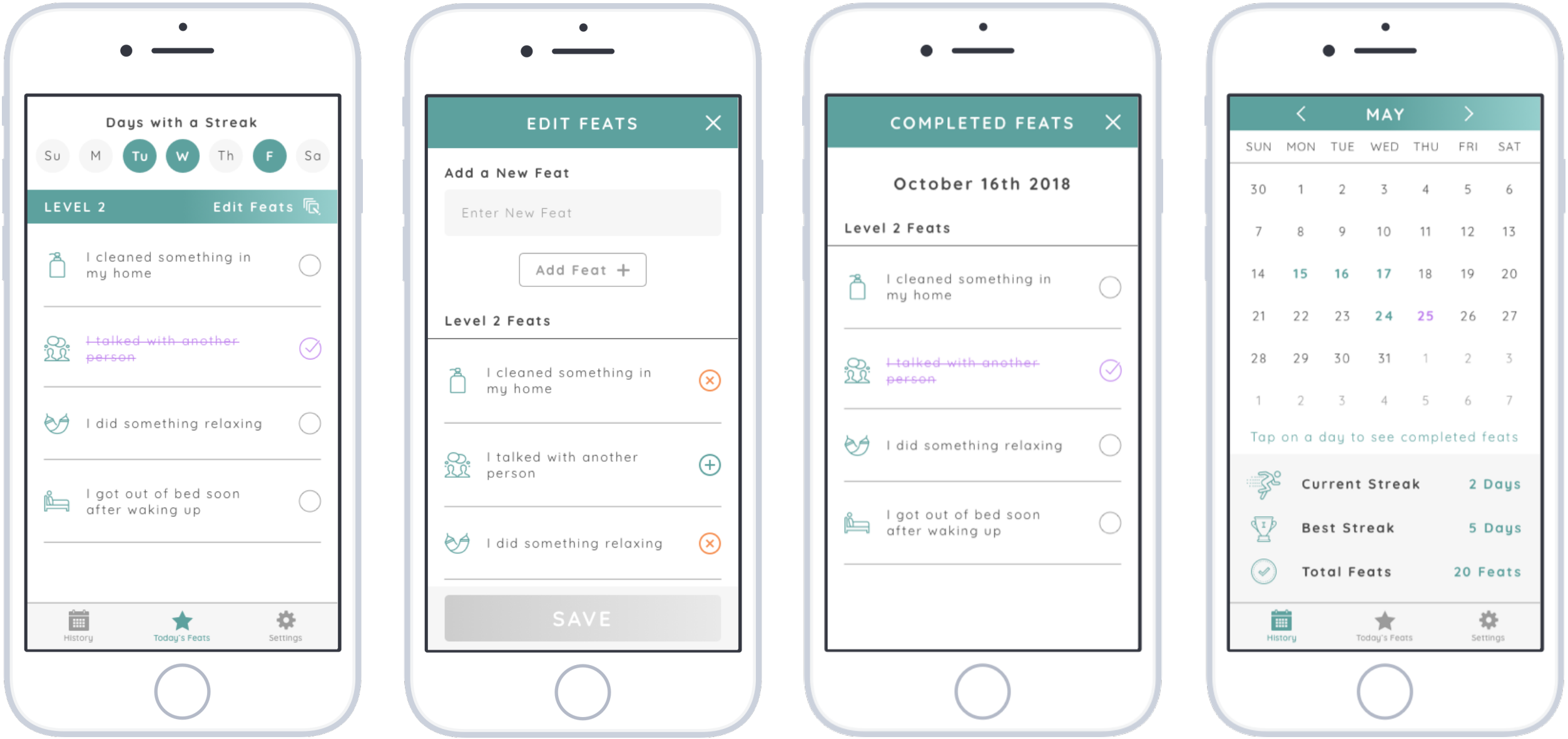
ANDROID APP ON Google play

Available on iTunes

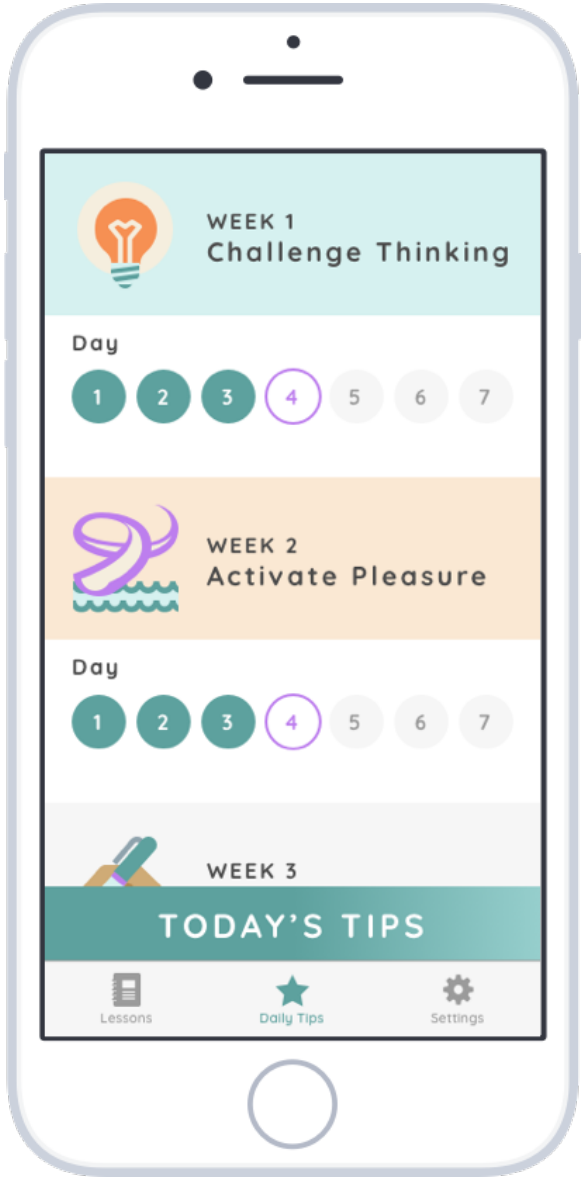
Elemental
Skills-Based
Eclectic

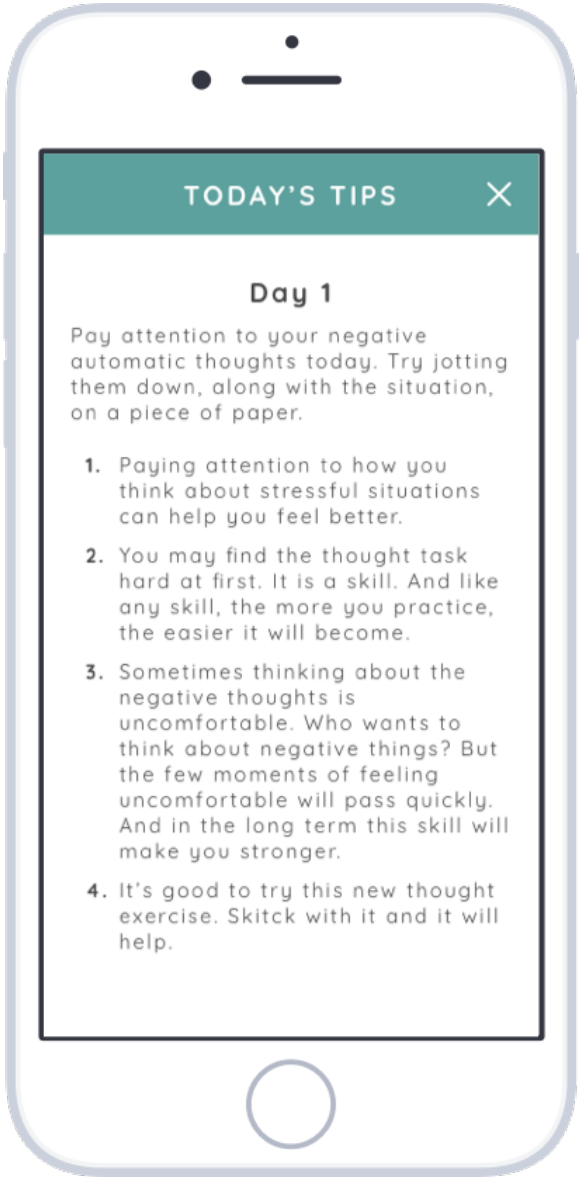
R01 MH100482

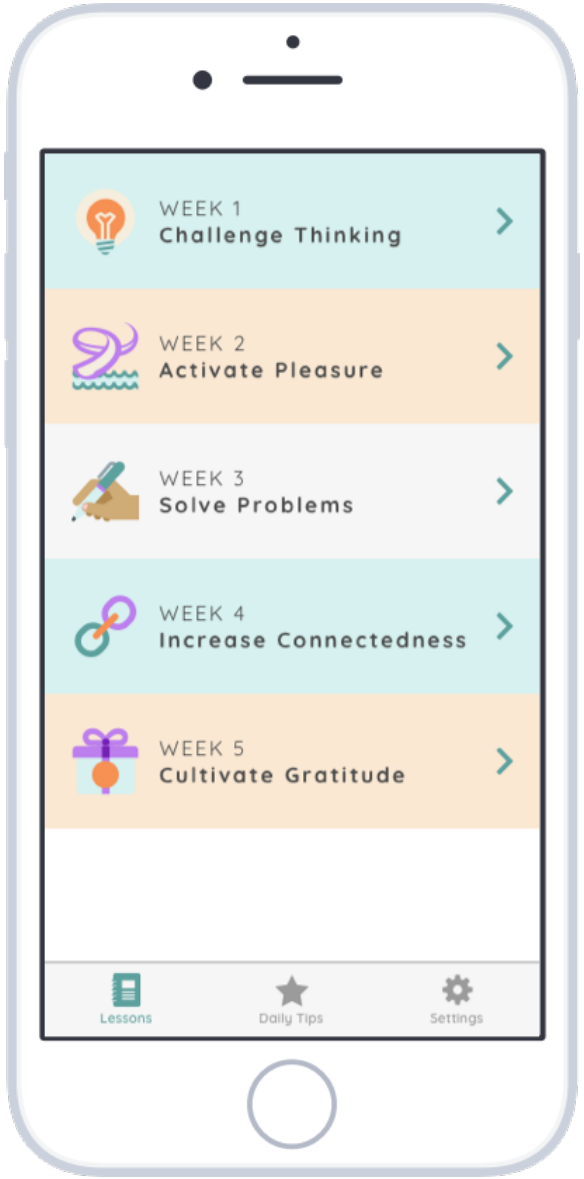
Daily Feats


Days with a Streak
Su M Tu W Th F Sa
LEVEL 2
Edit Feats
I cleaned something in my home
I talked with another person
I did something relaxing
I got out of bed soon after waking up
History
Today's Feats
Settings
EDIT FEATS
Add a New Feat
Enter New Feat
Add Feat +
Level 2 Feats
I cleaned something in my home
I talked with another person
I did something relaxing
SAVE
COMPLETED FEATS
October 16th 2018
Level 2 Feats
I cleaned something in my home
I talked with another person
I did something relaxing
I got out of bed soon after waking up
MAY
SUN MON TUE WED THU FRI SAT
30 1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31 1 2 3
1 2 3 4 5 6 7
Tap on a day to see completed feats
Current Streak 2 Days
Best Streak 5 Days
Total Feats 20 Feats
History
Today's Feats
Settings

Day to Day


WEEK 1
Challenge Thinking
Day
1 2 3 4 5 6 7
WEEK 2
Activate Pleasure
Day
1 2 3 4 5 6 7
WEEK 3
TODAY'S TIPS
Lessons
Daily Tips
Settings


TODAY'S TIPS
Day 1
Pay attention to your negative automatic thoughts today. Try jotting them down, along with the situation, on a piece of paper.
1. Paying attention to how you think about stressful situations can help you feel better.
2. You may find the thought task hard at first. It is a skill. And like any skill, the more you practice, the easier it will become.
3. Sometimes thinking about the negative thoughts is uncomfortable. Who wants to think about negative things? But the few moments of feeling uncomfortable will pass quickly. And in the long term this skill will make you stronger.
4. It's good to try this new thought exercise. Skitck with it and it will help.


WEEK 1
Challenge Thinking
WEEK 2
Activate Pleasure
WEEK 3
Solve Problems
WEEK 4
Increase Connectedness
WEEK 5
Cultivate Gratitude
Lessons
Daily Tips
Settings


AT&T
Unlocked
86%
11:00
Wednesday, October 17
DAYTODAY
now
Day To Day: Tip 1
No matter what happens when you try out your chosen solution, you are learning about what does and doesn't work for you, and what you do and don't want. That's hard work—and the re...
Press home to open

Thought Challenger

NEW CHALLENGE

Step 1 of 5

Catch It

Be careful what you're thinking when you feel bad.

What is your **Unhelpful Thought**?

Enter an Unhelpful Thought

Show Examples

NEXT

NEW CHALLENGE

Step 2 of 5

Check it

Consider if you're being harder on yourself than other people.

What would you say to a close friend in a similar situation who had a similar thought?

Why not treat yourself with the same standard that you would use for a friend?

NEXT

NEW CHALLENGE

Step 3 of 5

Select Distortion

Your Unhelpful Thought

I am inadequate.

Distortions are patters in our negative thoughts. The more you catch your thoughts, the more you might notice that some are very similar. Identifying the distortions in your thoughts will make it easier to develop an effective rational response.

Select the relevant distortion below:

Absolutes: Thinking in extremes, all good or all bad, the best or the worst, perfect or a failure.

Guesses: Making guesses or jumping

NEXT

SAT MAY 9, 2018 - 4:00 PM

Unhelpful Thought
I shouldn't need help.

Distortion
Guesses: Making guesses or jumping to conclusions that are overly negative. e.g. thinking you know what others are thinking (and it's bad).

Rational Response
When my friends encounter problems, I'd help them if they'd ask.

SAT MAY 9, 2018 - 4:00 PM

Unhelpful Thought
I am unlovable.

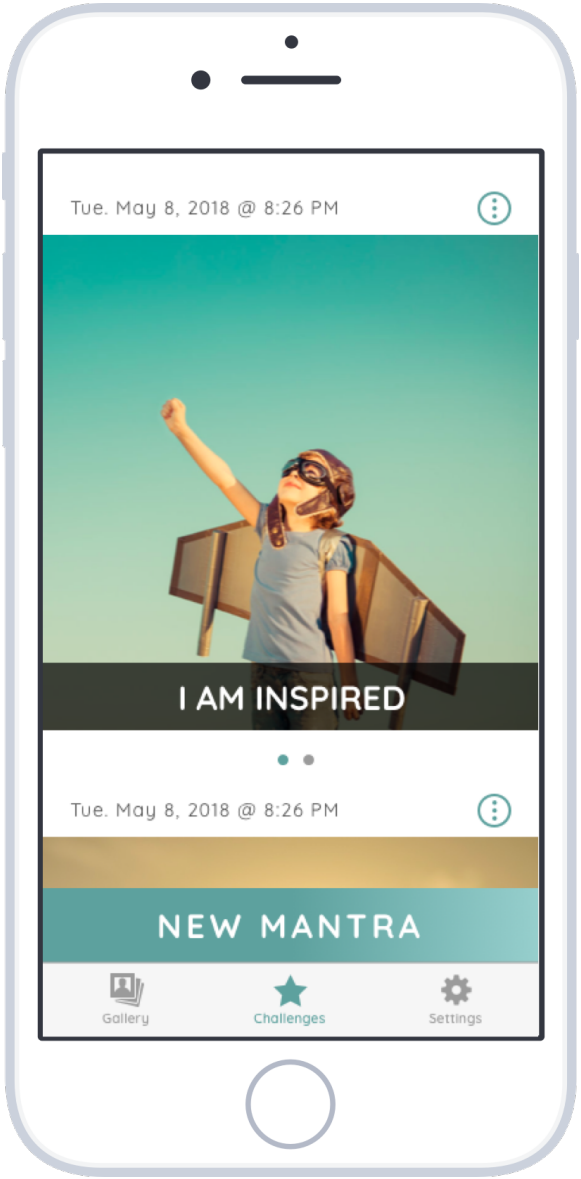
Distortion
Absolutes: Thinking in extremes, all good or all bad, the best or the worst, perfect or a failure.

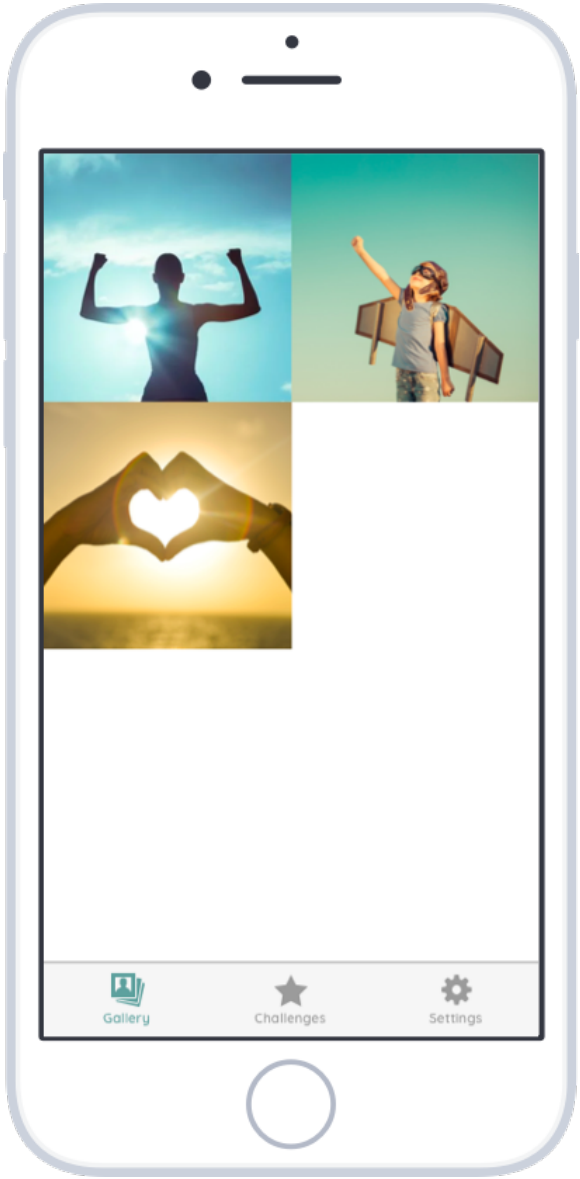
Rational Response

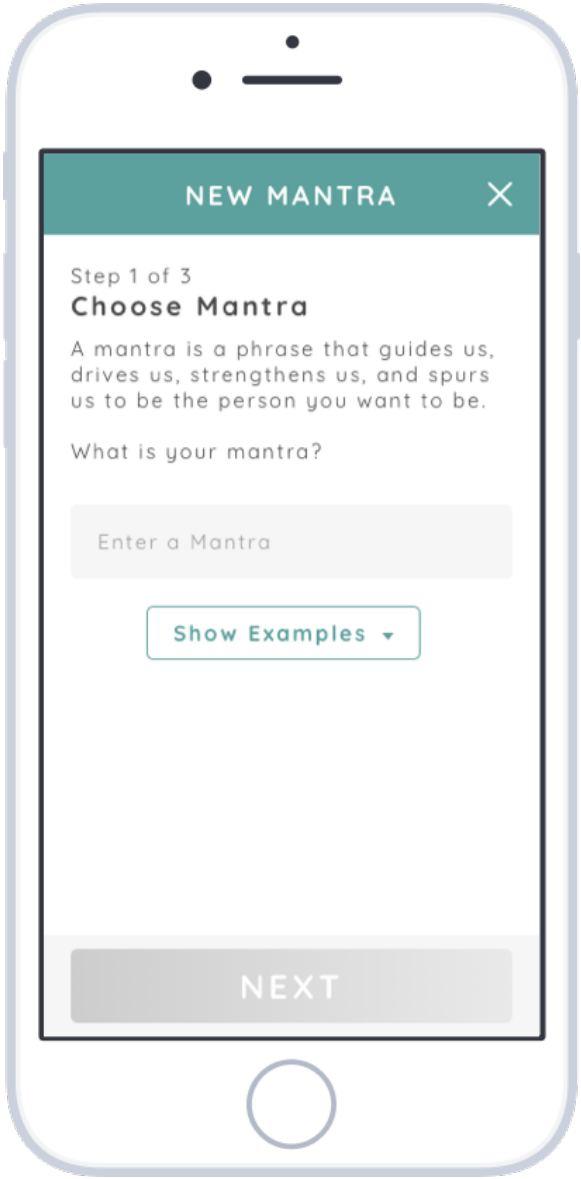
NEW CHALLENGE

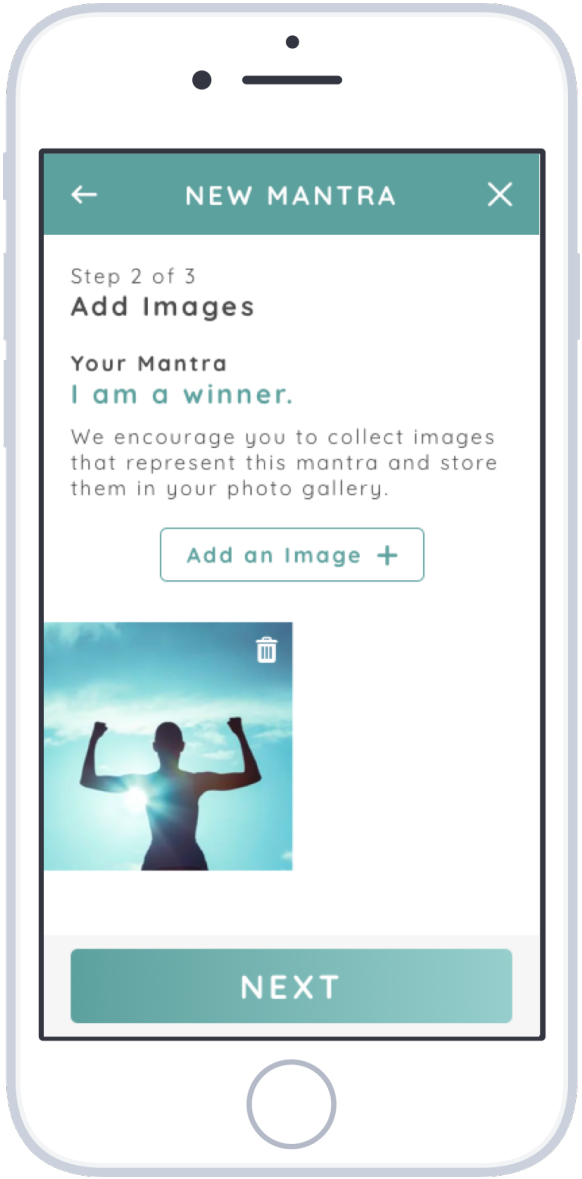
History Challenges Settings

My Mantra


Tue. May 8, 2018 @ 8:26 PM
I AM INSPIRED
Tue. May 8, 2018 @ 8:26 PM
NEW MANTRA
Gallery
Challenges
Settings


Gallery
Challenges
Settings


NEW MANTRA
Step 1 of 3
Choose Mantra
A mantra is a phrase that guides us, drives us, strengthens us, and spurs us to be the person you want to be.
What is your mantra?
Enter a Mantra
Show Examples
NEXT


NEW MANTRA
Step 2 of 3
Add Images
Your Mantra
I am a winner.
We encourage you to collect images that represent this mantra and store them in your photo gallery.
Add an Image +
NEXT

Outline

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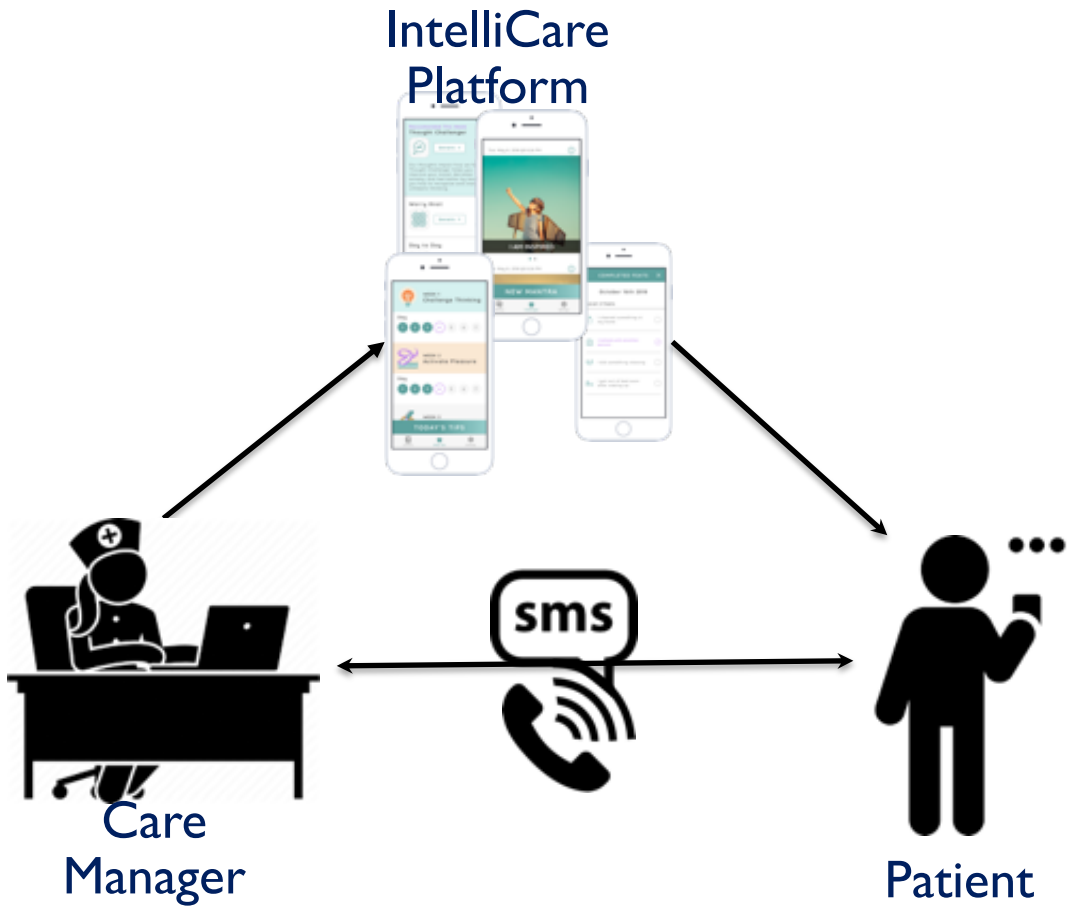
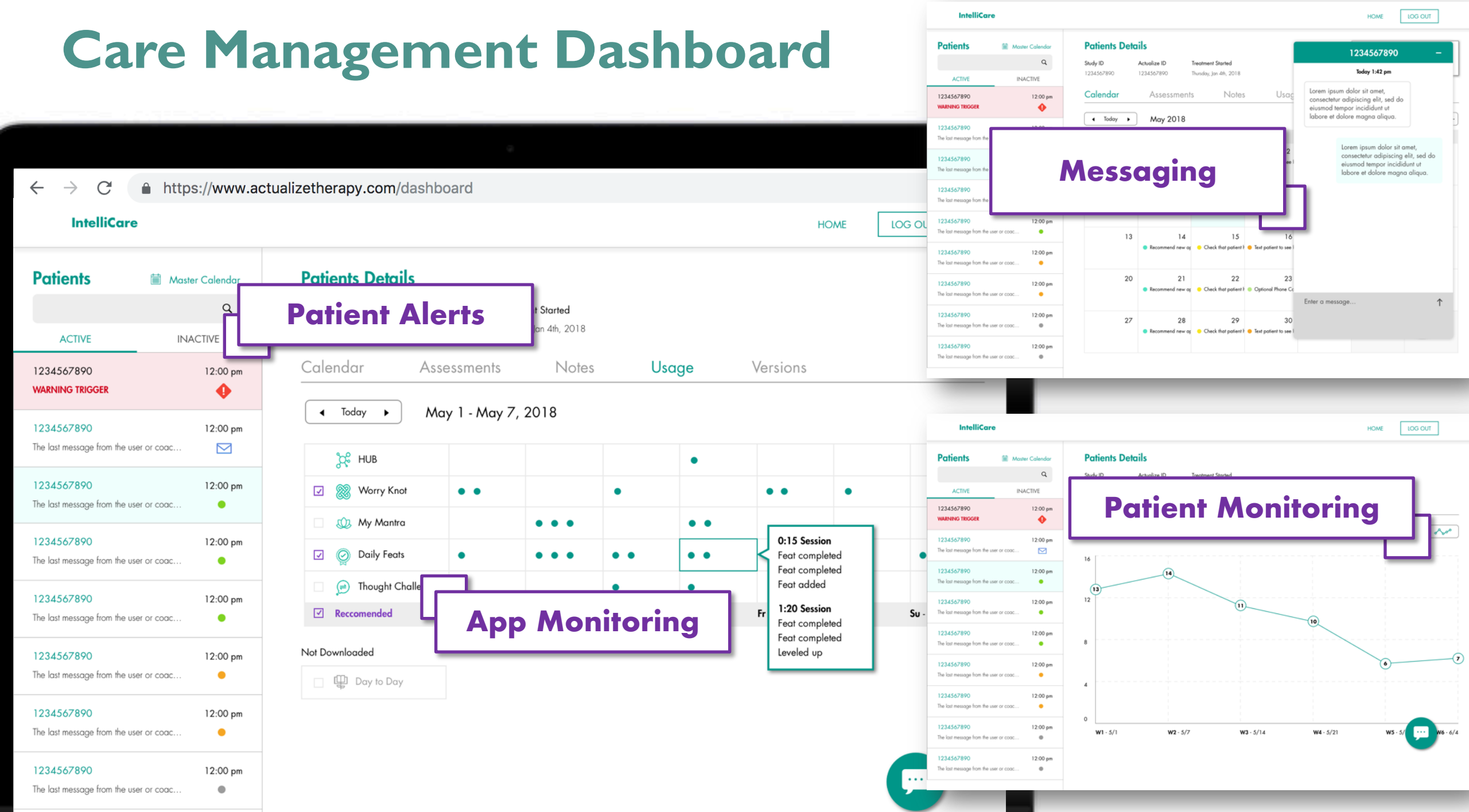
Summary

Trial Treatment Protocols

- 8-week treatment period
- 30 Min Engagement call
- Text message communication
  - CM sends 3 weekly texts
  - Patient can text any time
- Mid point call if desired
- Weekly app recommendations through Hub app



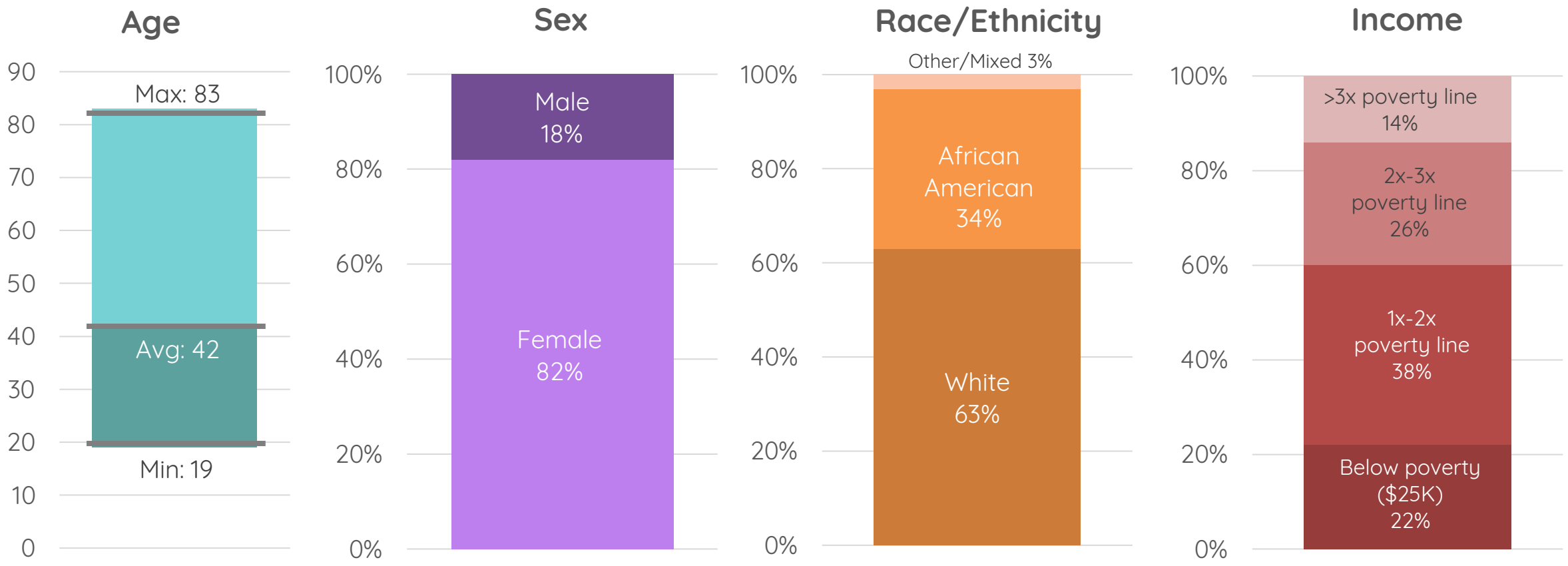
Care Management Dashboard



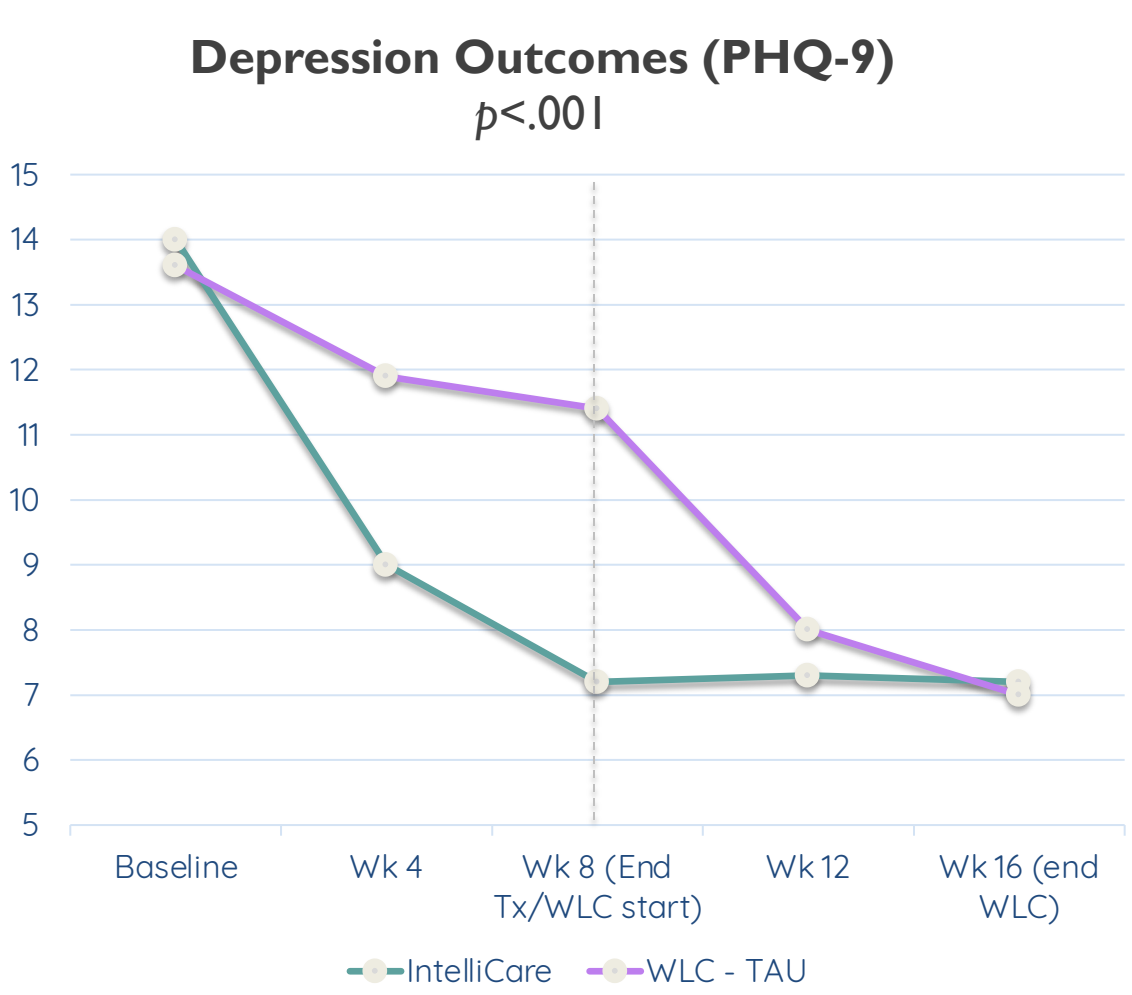
Randomized Controlled Trial University of Arkansas Med Ctr. Primary Care

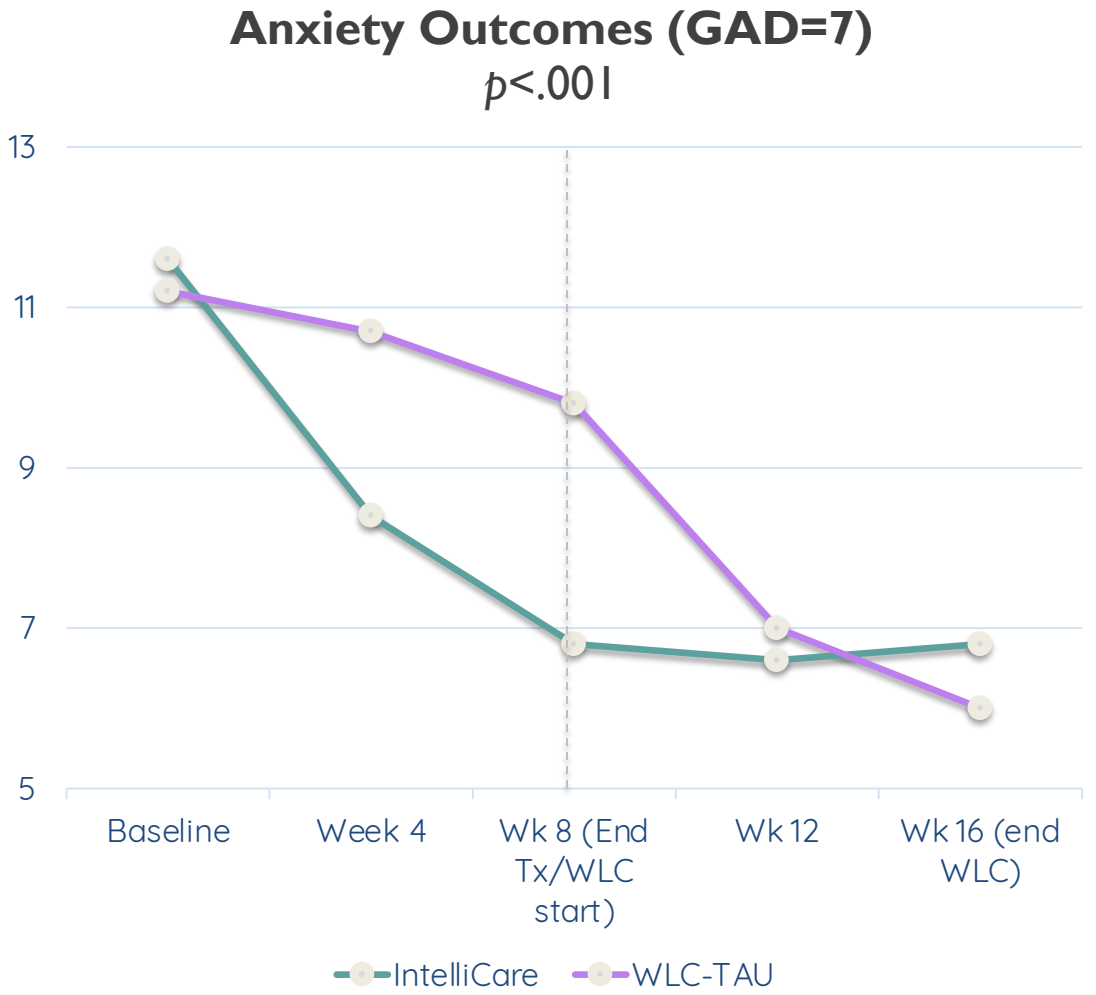
Preliminary Results (do not disseminate)
148 Patients: PHQ-9>10 or GAD-7>8

Graham…Mohr. *JAMA Psychiatry.* 2020;77:906-914

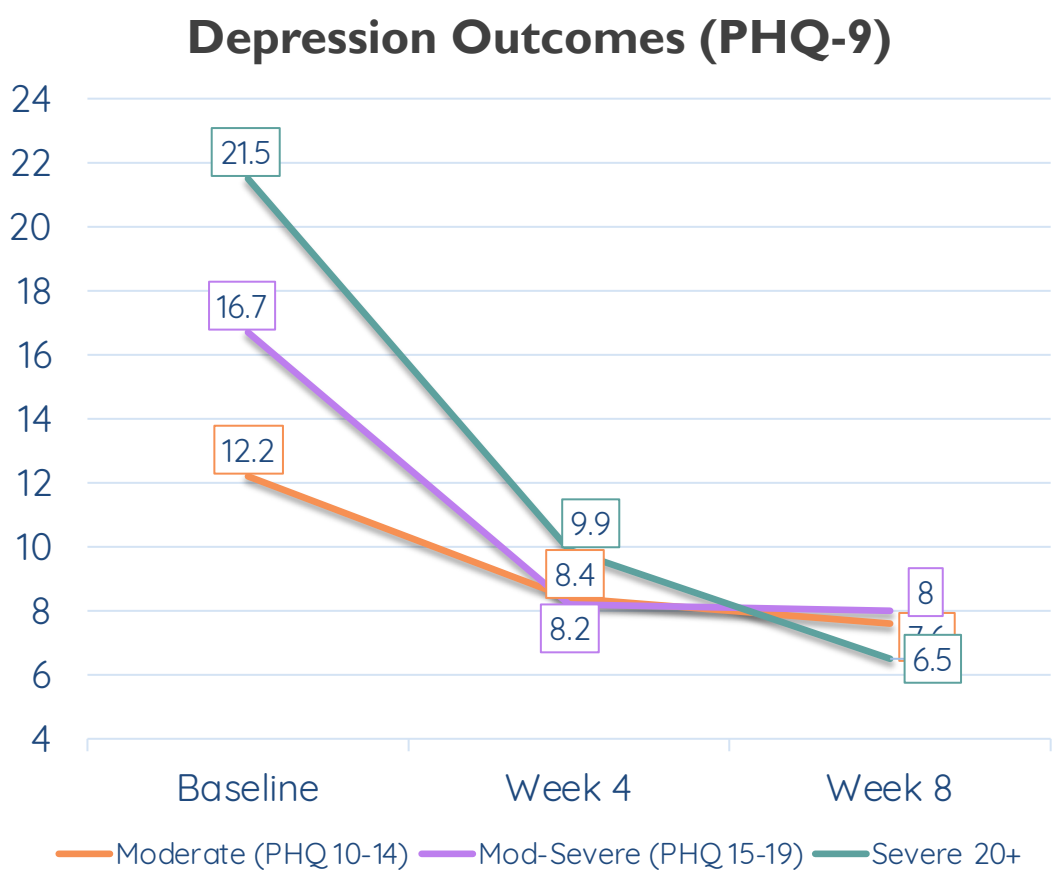


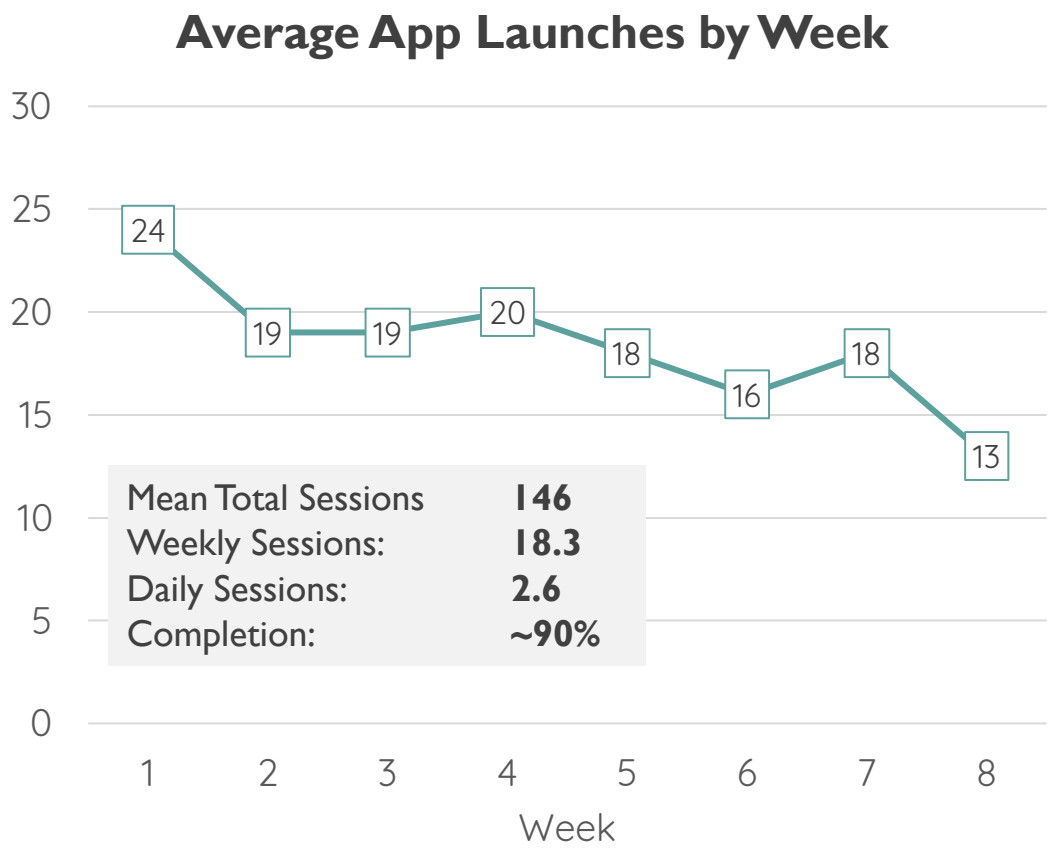
Primary Outcomes





Effectiveness by Severity & User Engagement





Assistance in Bundling Apps

Clusters of IntelliCare App Use

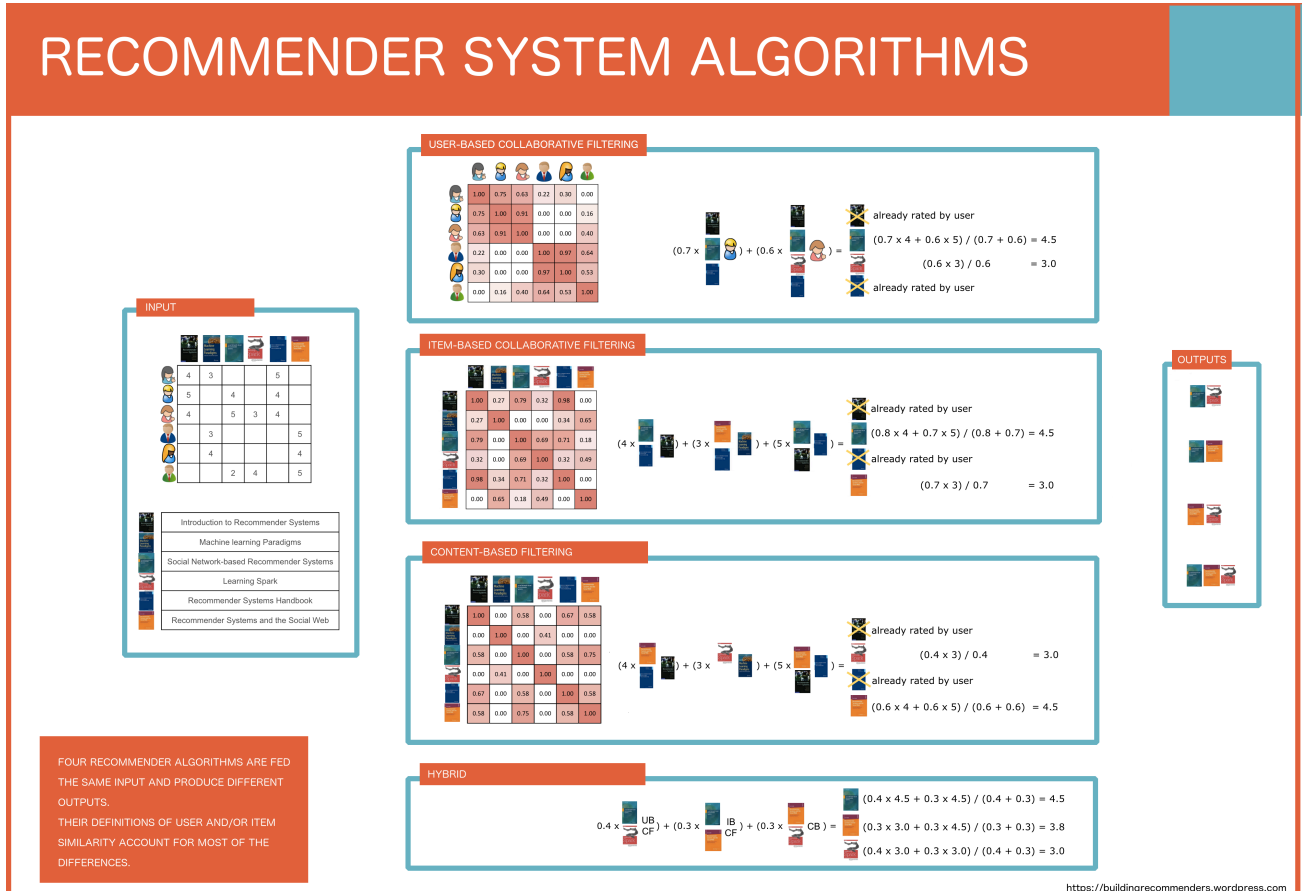
Kwasny, …Mohr. JMIR. 2019;6:e11572

Thinking	Calming	Checklists	Activity	Junky apps
Thought Challenger	Purple Chill	Aspire	BoostMe	MeLocate
Day to Day	Slumbertime	Daily Feats	Move Me	Social Force
iCope				Worry Knot
My Mantra				

Assistance in Bundling Apps
Recommender System

Initial results

- ~30% use of any app in a week
- 55% with commodity recommender engine
- 64% with current stage recommendation algorithms



R01 MH109496

Randomized Trial Evaluating Coaching & Recommender

Mohr, et al. *J Med Internet Res.* 2019;21(8):e13609

302 participants with PHQ-9 ≥ 10 or GAD-7 ≥ 8

Recruited from healthcare systems & Internet

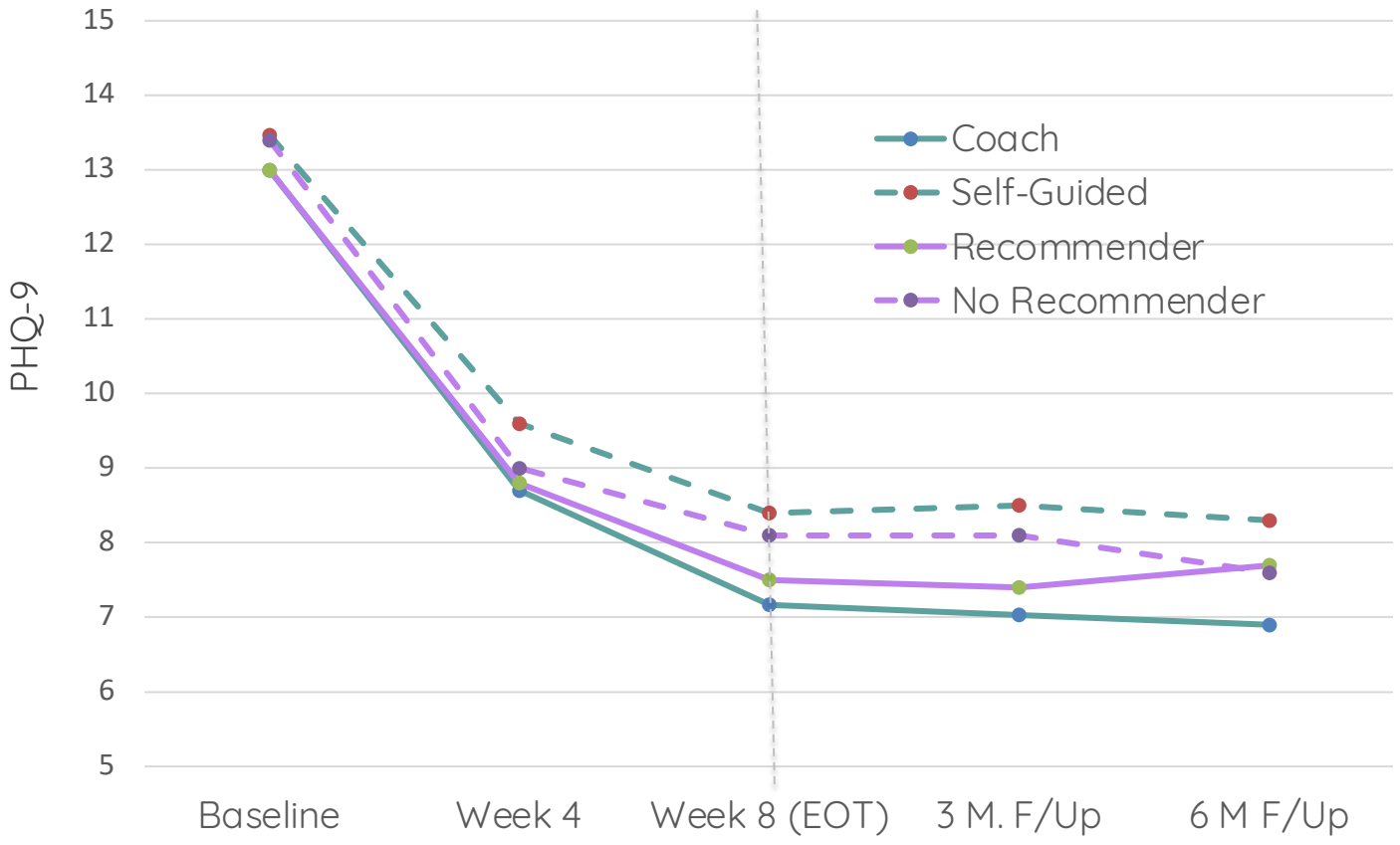
8 weeks of treatment; 6 months follow-up

		Coaching	
		Coached	**Self-Guided**
Recom-mender	**Rec.**	75	75
	No Rec.	76	76

Trial 3

Randomized Trial Evaluating Coaching & Recommender

Significant reductions in PHQ-9 & GAD-7 (ps<.0001)



PHQ-9 (Depression)

- Coached vs. Self-Guided: p=.06
- Recommendations: p=.04

GAD-7 (Anxiety)

- Coached vs. Self-Guided: p=.03
- Recommendations: p=.62

App use:

- App sessions during treatment M=216
- App use per day M=3.8
- Participants continuing after tx 84%
- Days from EOTx to last use M=92

IntelliCare Platform Overview

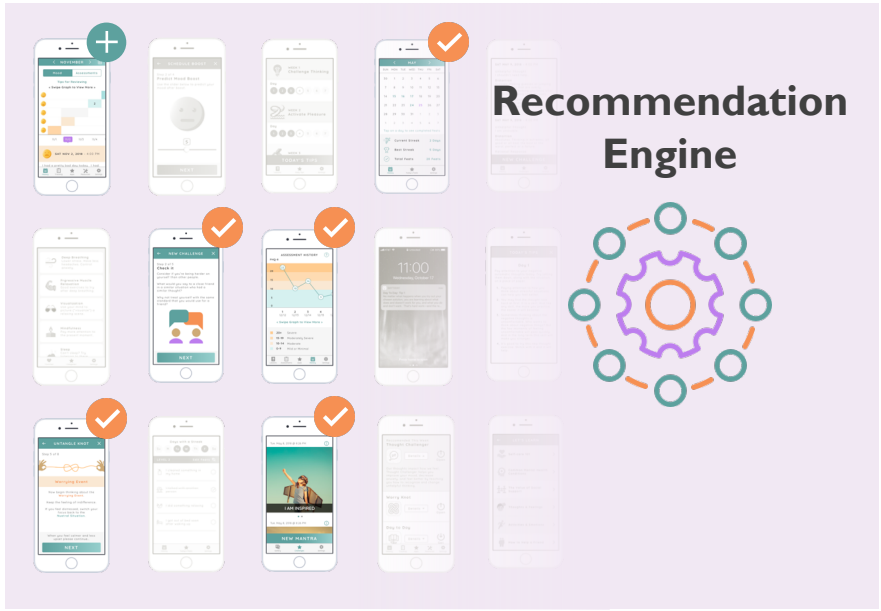
Extensible

Organization

Research

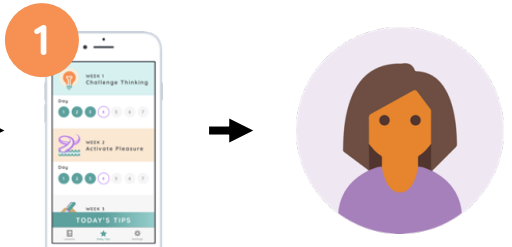
Modular

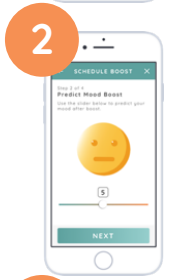
IntelliCare Platform

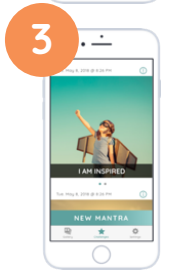


Personalized

Patient







Mohr, Karr, US Patent App. 15/654,245, 2018

Other Published Research

Trials

Open Deployment of IntelliCare from App Stores
Lattie EG, et al. *Internet Interv.* 2016;4(2):152-158.

Coached IntelliCare for Depression/Anxiety
Mohr DC, et al. *J Med Internet Res.* 2017;19(1):e10.

IntelliCare for Distress during Breast Cancer
Chow, et al. *JMIR Cancer,* 2020;6:e16476

Mechanisms

Use Patterns
Kwasny M, et al. *JMIR Ment Health.* 2019;6(3):e11572

User Behavior
Chen AT, et al. *J Biomed Inform.* 2019;94:103187.

Recommendation Engine
Cheung K, et al. *J Am Med Inform Assoc.* 2018;25(8):955-962.

Current Research Projects

Breast Cancer
Chow, R01 CA248434

University of Virginia Health System
UVA Cancer Center

Perinatal Depression
Mohr, P50 MH119029

Northwestern Medicine®

Student Mental Health
Lattie, K08 MH112878

UIC University of Illinois at Chicago
NIU Northern Illinois University

Collaborative Care
McIver, R44 MH114725

RUSH UNIVERSITY MEDICAL CENTER

Outline

Problem Introduction

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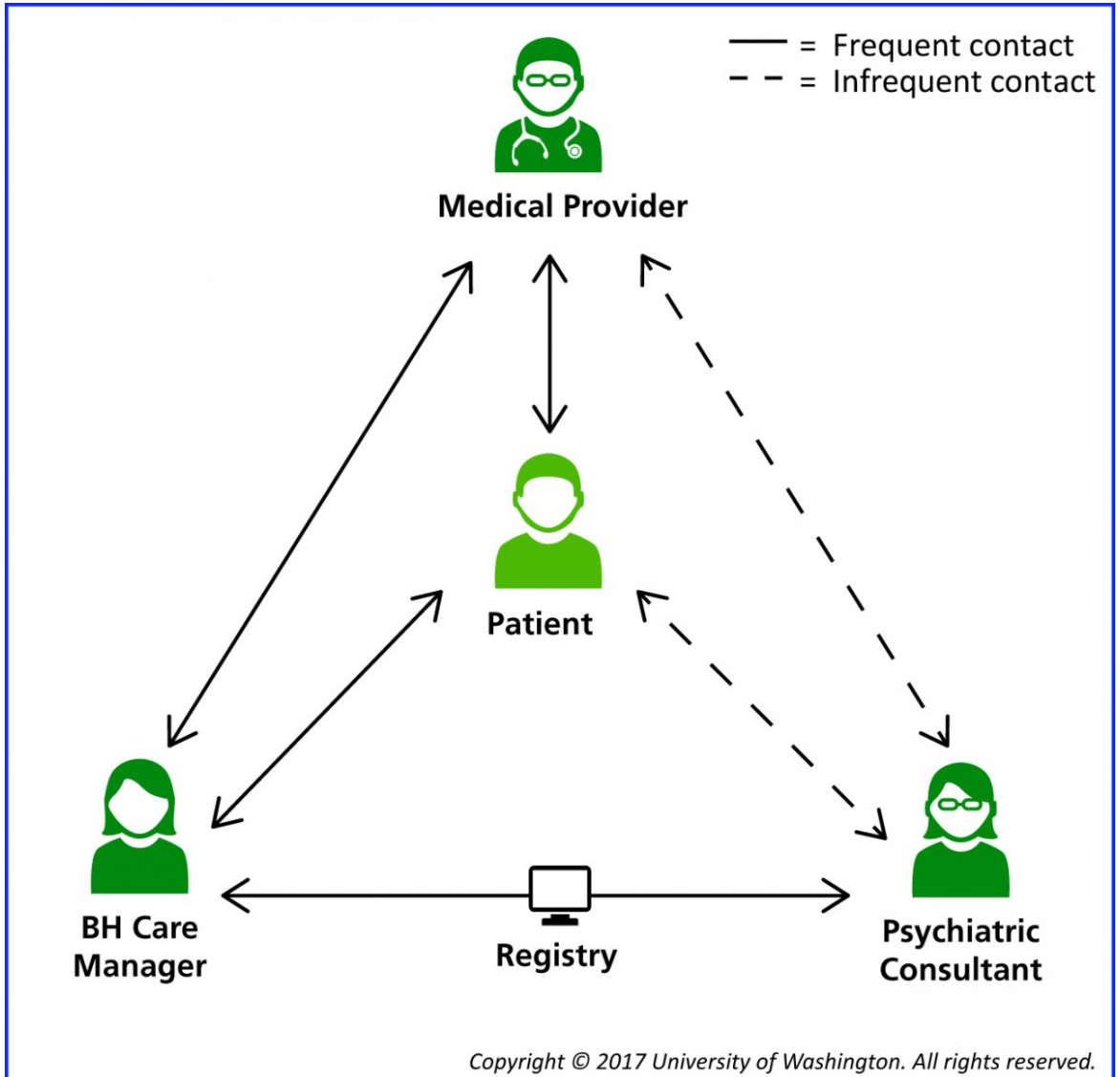
Summary

Rush University Medical Center

Collaborative Care

NIMH R44 MH114725

- ~250,000 primary care patients
- ~90% annual PHQ-9 screening rate in primary care
- ~5,000/year CoC uptake; ~2,000 to Rush CoC group
- 3 social workers



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Care Managers

Ringland, Reddy, Mohr (2019) *ACM CSCW (Computer-Supported Cooperative Work and Social Computing).*
Burgess, Reddy, Mohr (2019) *ACM CSCW (Computer-Supported Cooperative Work and Social Computing).*

- Overwhelmed by patient flow
- Poor compliance with ongoing depression symptom monitoring
- Poorly defined objectives, no consistent workflow
- Emphasize social work over depression treatment
  - Case management primarily focused on medications
  - Care managers use informal consultation
- Concerns that technology will surface non-compliance, restrict clinical judgement

Care Managers

Satisfaction

- Deeper engagement with patients
- Knowledge they have helped
- Interactions with colleagues

Opportunities

- Lots of time spent trying to contact patients
  - Phone is only contact method; many people do not answer.
- Difficulty obtaining critical information, such as depression screening, medication adherence, referral uptake.

Patients

Eschler, et al., (2020) Proceedings of the Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction (CHI)

Kornfield, et al., (2020) Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction (CHI)

- Many patients don't know who their care managers are
- Unclear of purpose of care management
- Variety of preferences for communications medium (text, email, phone, voice mail)
- Using technology to support mental health – just not what we think.

Organizational Issues

Leadership needs

- Clear protocols
- Quality assurance
- Treatment outcome data
- Revenue generation

Organizational Tensions

- Population focus, not just patient
- Workplace politics: "Surfacing non-compliance"
- Central vs. local control of policies

Patient Management Platform

- Integration into EHR (Epic) & CoC registry
  - Care Management tools within Epic
  - PHQ-9, GAD-7
  - Alerts
    - Suicide risk
    - Worsening of symptoms
    - Treatment target reached
    - Medication adherence/side effects
    - Referral uptake
    - Noncompliance (e.g. PHQ-9 completion; app use)
- Communication through app
- Extend IntelliCare monitoring for 12 months
  - Identify relapses after treatment target reached

Pragmatic Trial

Year	2020												2021												2022			
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CM 1	TAU								IntelliCare														Sustainment					
CM 2	TAU												IntelliCare										Sustainment					
CM 3	TAU														IntelliCare								Sustainment					

Outcomes

- **Implementation** (CM productivity; medication adjustments, referral uptake, cost, etc)
- **Effectiveness** (PHQ-9)
- **Economic** (cost; billing – PHQ-9 administration)

Policy: Banbury Forum

Mohr, et al, in press, *Psychiatric Services*

- Stakeholders from payers, care systems, policy, employers, DMHT companies, NIMH, researchers, patients, international representatives.
- Consensus statement:
  - Guided DMHTs should be available to all Americans
  - DMHT services and products should be reimbursable
  - Evidence standards framework required
- Next steps towards reimbursement…

Agenda

Problem Introduction

IntelliCare

Efficacy & Engagement Data

Design for HealthCare Systems

Implications for Digital Mental Health Research

Summary

Research Methods

Addressing the Research-to-Practice Gap

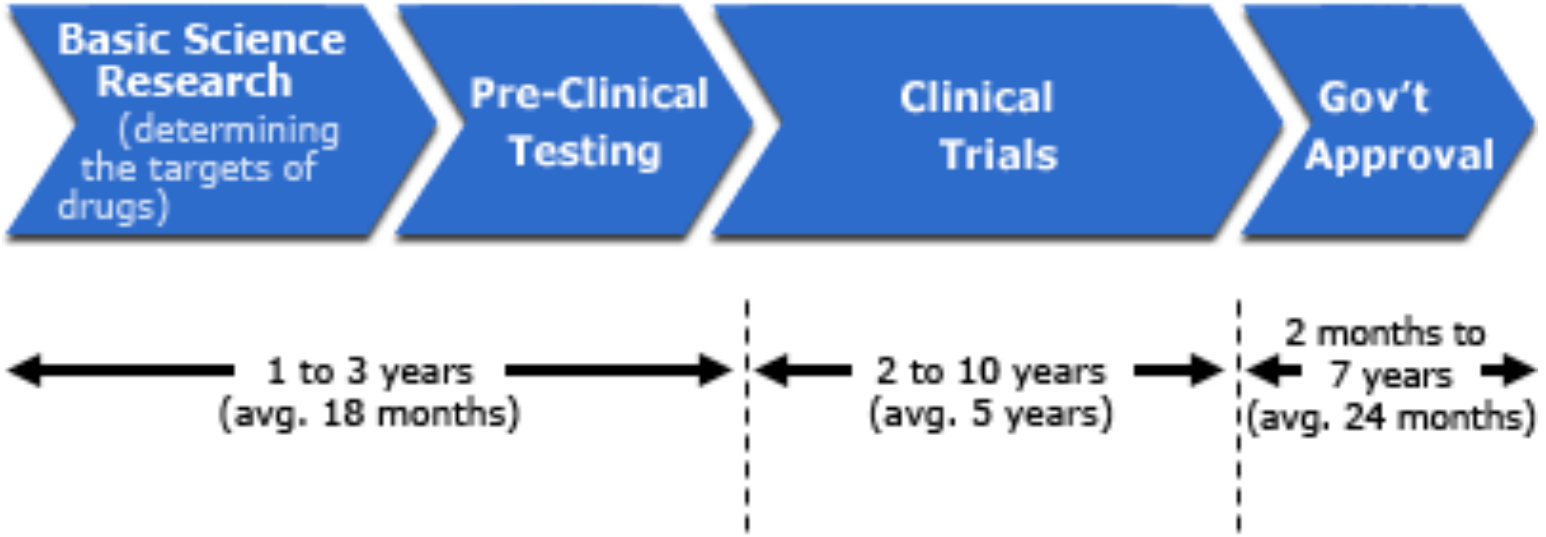
RCTs protect stakeholders (patients, providers, payers)

Methods derived from pharmaceutical trials

Contributors to Research-to-Practice Gap

Failure in Research Methods

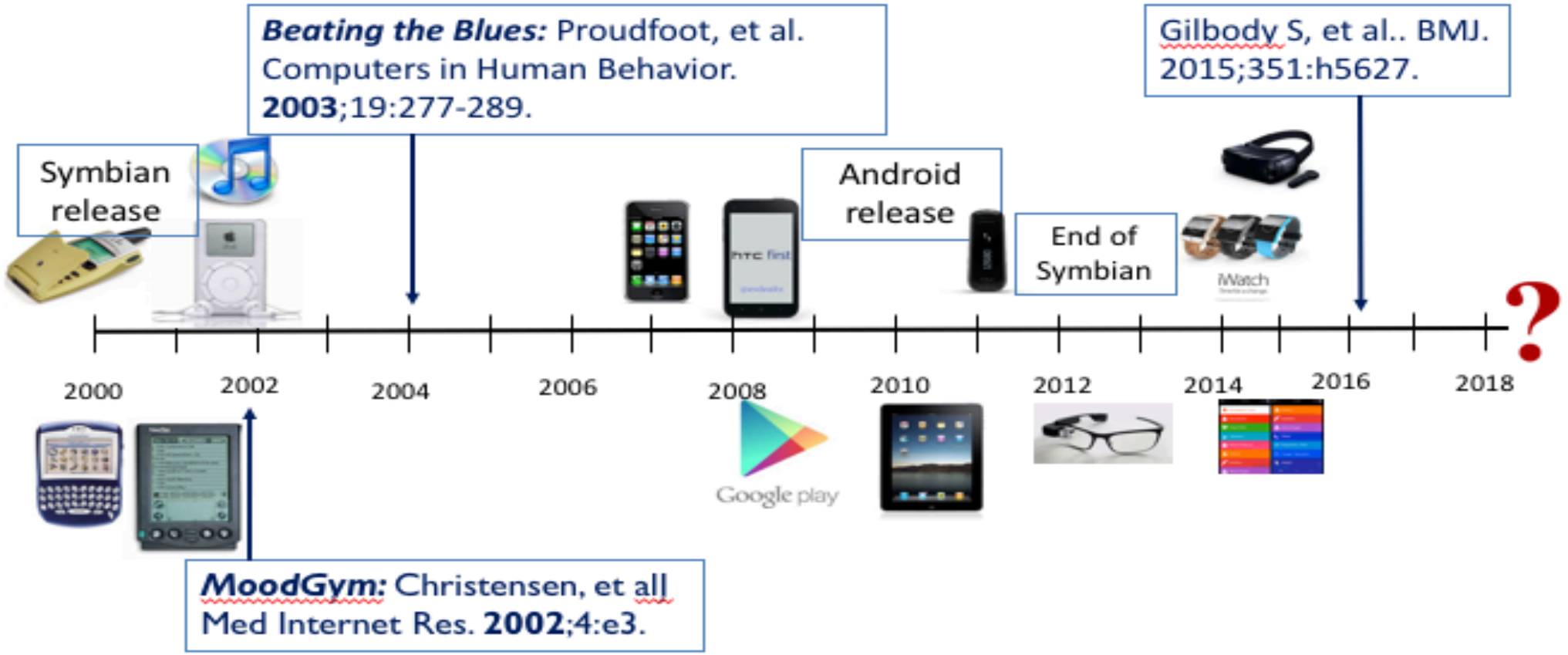
17 years to turn 14% of original research to the benefit of patient care



Balas, Boren.. in *Yearbook of medical informatics* 2000. Edited by van Bemmel, McCray., Schattauer; 2000. pp. 65-70.

Contributors to Research-to-Practice Gap

Failure in Research Methods



Obsolescence: Changing technologies and healthcare organization

Contributors to Research-to-Practice Gap

Denominator Problem

$$\frac{\#\ \text{Enrolled/completed}}{\#\ \text{In recruitment pool}}$$

CBITs (recent trials)

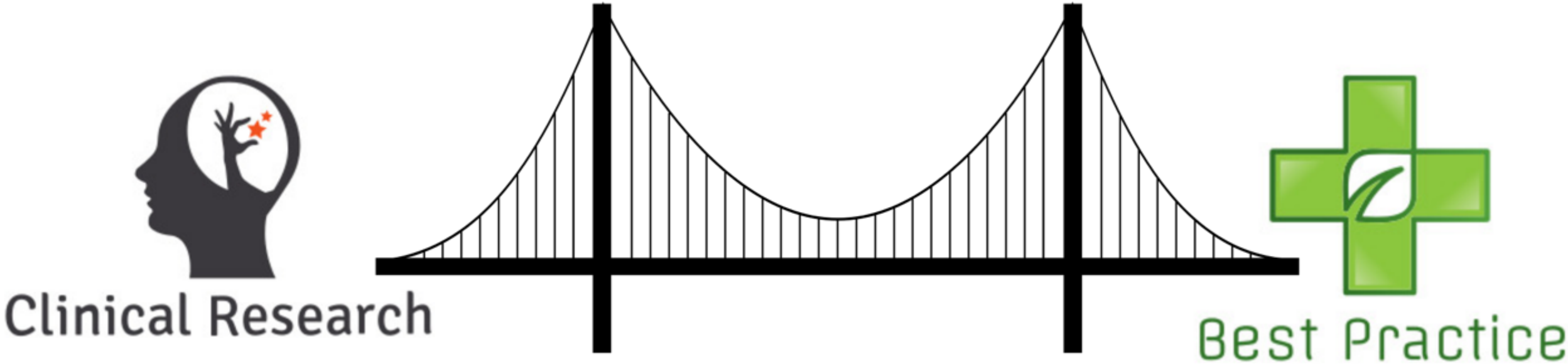
- >27,000 web screens
- ~ 700 recruited
- 2.6% of completed screenings recruited
- Very small ratio for views
- Direct recruitment of depressed clinic patients: **0.02%-1.3%**

Subthreshold depression & prevention

- 8.7 million Barmar Insurance members
- 1 year to recruit 406 participants
- Recruitment rate: **.00005%**

Buntrock, Ebert, et al. JAMA. 2016;315:1854-1863.

Implementation



Is it possible to build an implementation bridge?

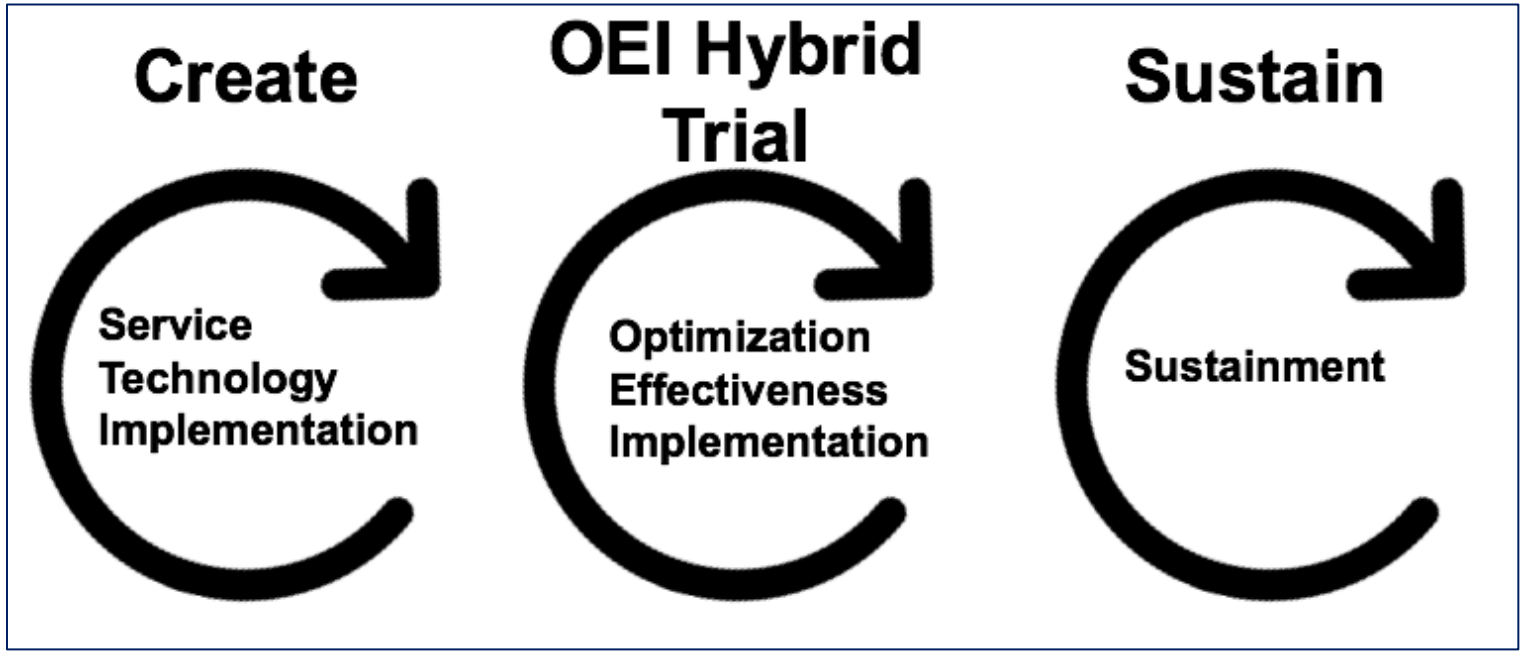
Solution Focused Research

Accelerated Creation-to-Sustainment (ACTS) Model

Mohr, et al. *J Med Internet Res*. 2017;19:e153
Mohr, et al. *JAMA Psychiatry*, 2018;*75*:113-114

Research needs

- Solution-focused
- Design in care setting
- Iterative & Adaptive
- Rapid
- Sustainment

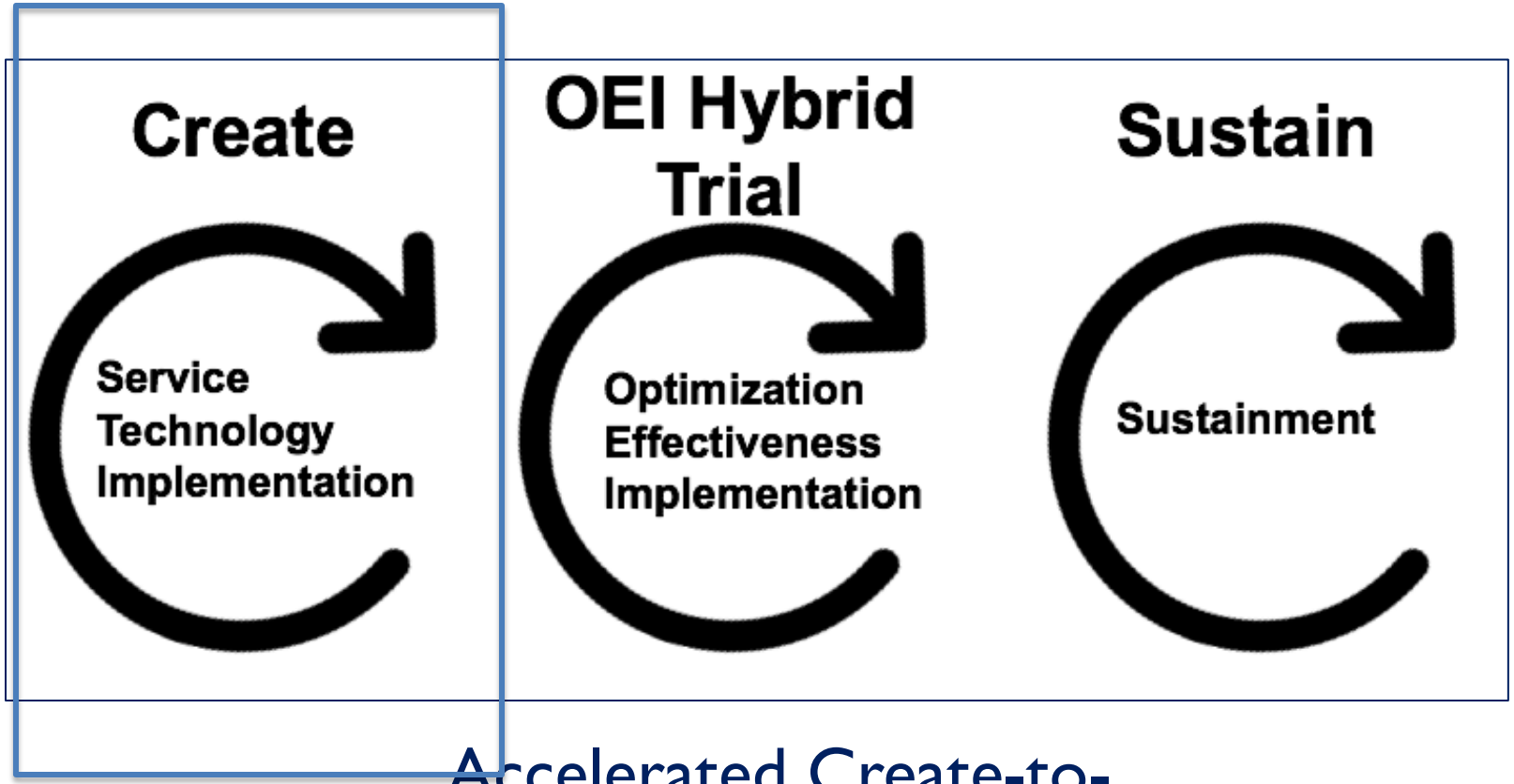


Create/Adapt

In the setting where it will be used!

Stakeholders

- Design in setting where it will be deployed
- Design with all stakeholders
  - Service Protocol
  - Technologies
  - Implementation Plan

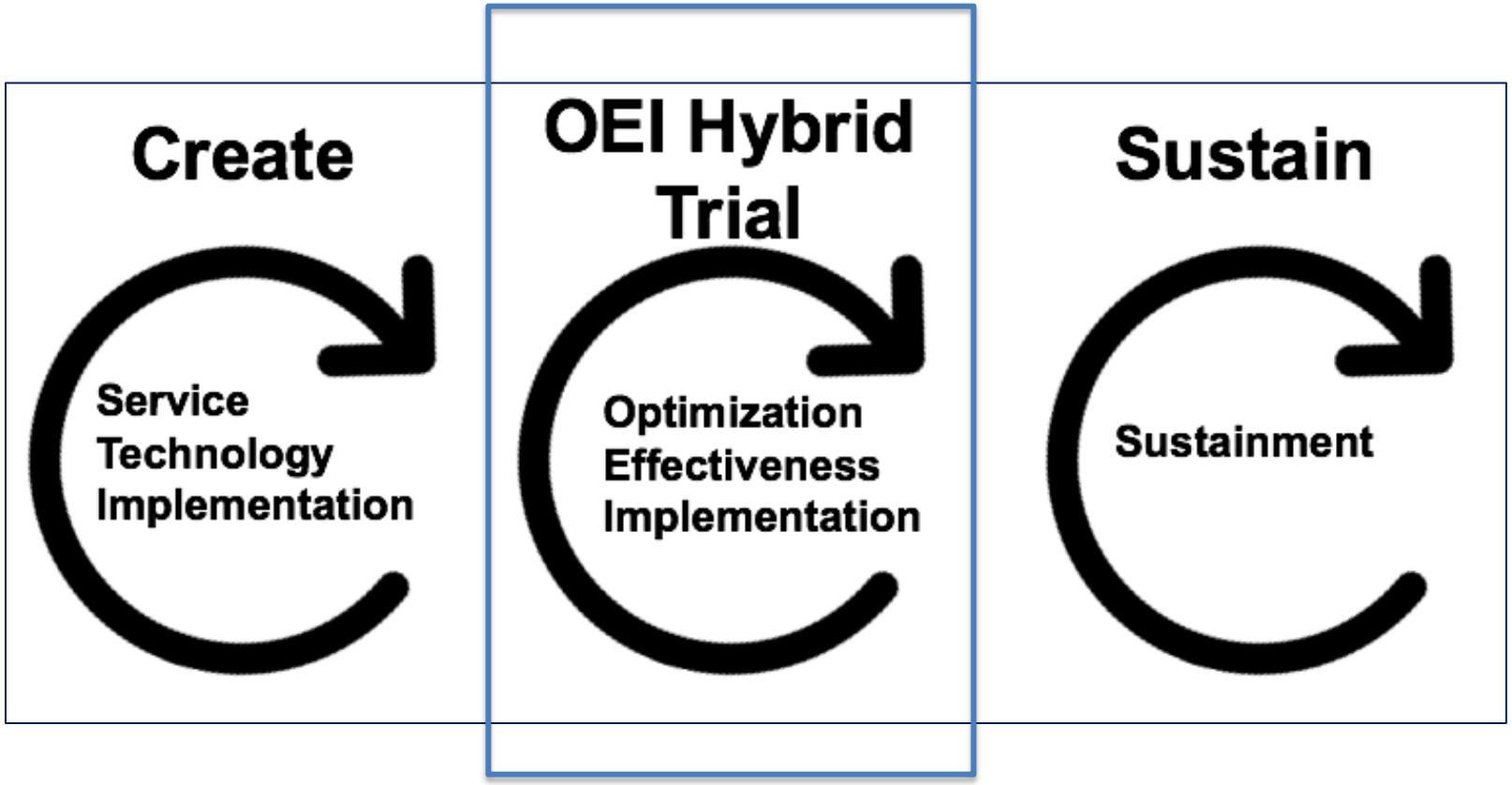


Accelerated Create-to-Sustainment (ACTS) Model

Optimization, Effectiveness, Implementation (OEI) Hybrid Trials

OEI Components

- *Evaluate effectiveness & implementation*
- *Optimization*
  - Technology
  - Service
  - Implementation



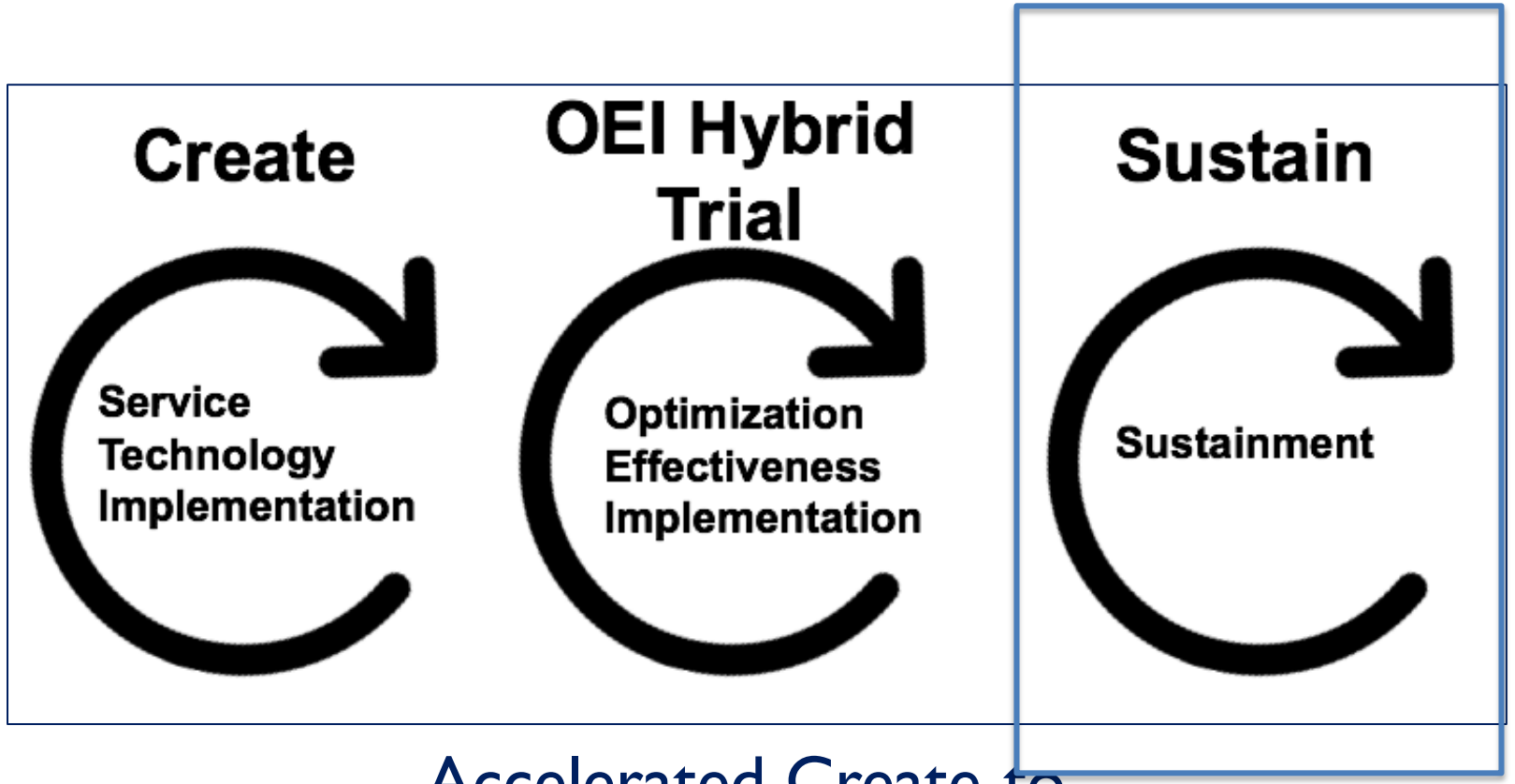
Accelerated Create-to-Sustainment (ACTS) Model

Sustainment

Chambers, et al. *Implementation science : IS*. 2013;8:117.

Aims and Methods

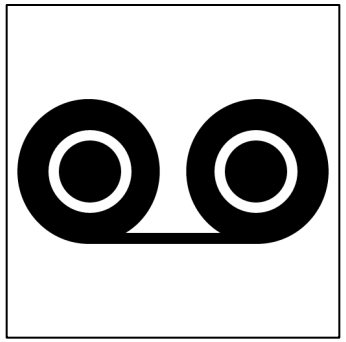
- Remove research support
- Low intensity data collection
- Quality Improvement



Accelerated Create-to-Sustainment (ACTS) Model

The Future of Digital Mental Health

Skeuomorph: A derivative object that retains design cues that were necessary in the original



Summary

- **Mindset:** Stop thinking about digital mental health as another form of delivery psychotherapy
- **Design:** Technology-enabled services that are *usable* and *useful* for end users (patients and clinicians) and healthcare systems.
  - Adapt to patients: Tools can be bundled by individuals
  - Adapt to setting needs
  - Adapt over time: Incorporate new components, technologies
- **Research Methods:** Rapid, Responsive, Relevant
- **Goals:** Sustainable implementation

Revolution in Mental Health Care

1890s
Psychoanalysis / Psychotherapy

1950s
Psychopharmacology

Today
Technology-Enabled Mental Health Care

Thanks to our team!

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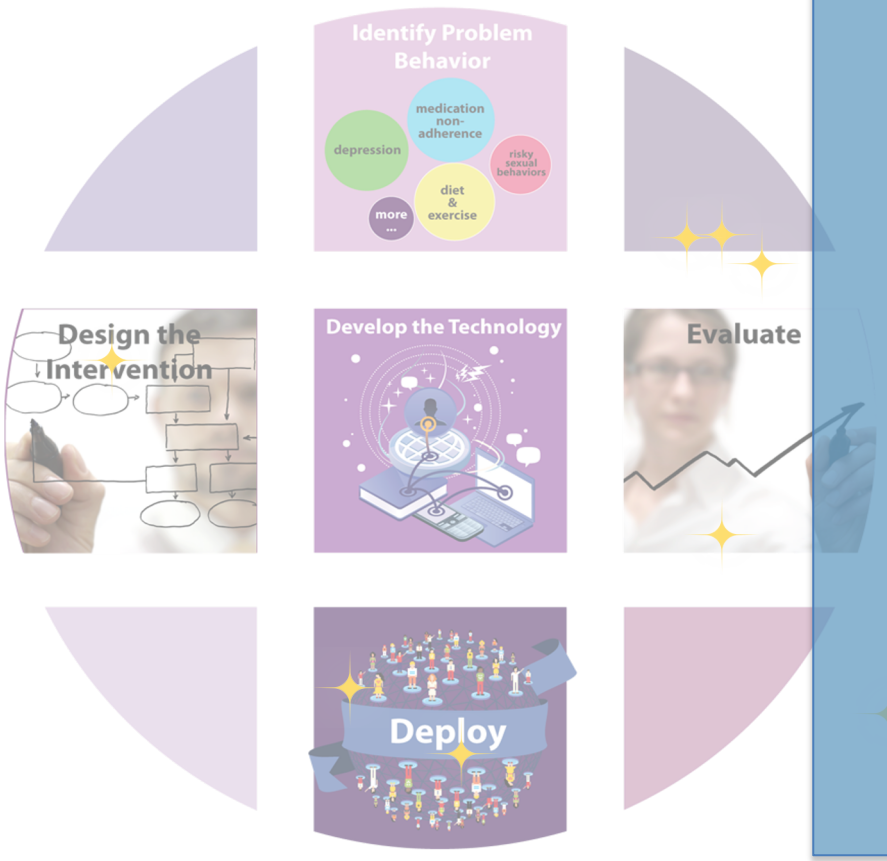

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NIMH T32 Postdoctoral Training Program in Digital Mental Health
http://cbits.northwestern.edu/training-081020/