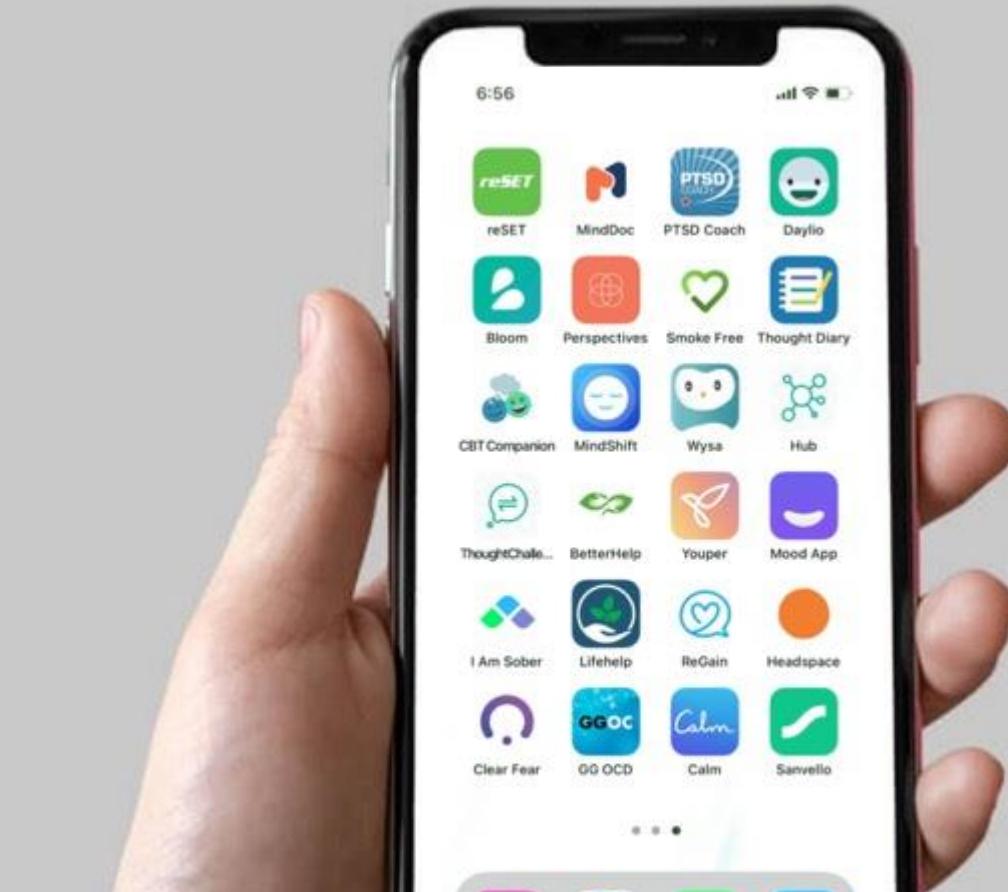




# Digital Therapeutics: Implications for Precision Treatment of Psychiatric Disorders

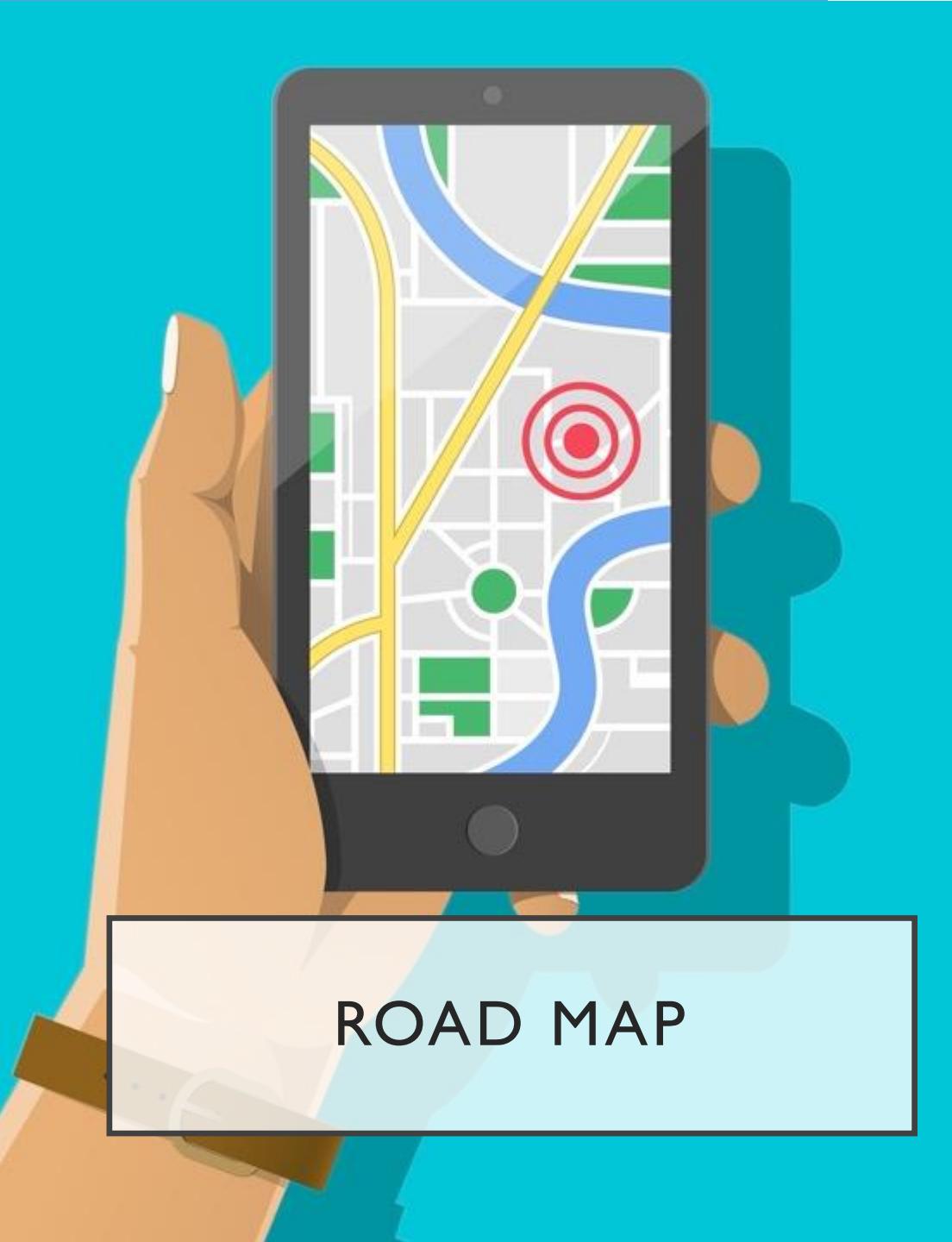


**Sabine Wilhelm, Ph.D.**  
Massachusetts General Hospital,  
Harvard Medical School



## DISCLOSURES

- Guilford Publications, New Harbinger Publications, Oxford University Press, Springer, Elsevier Publications
- Brattleboro Retreat, International Obsessive Compulsive Disorder Foundation, Tourette Association of America, Association for Behavioral and Cognitive Therapies
- National Institute of Mental Health
- Koa Health, Inc.
- Noom, Inc.
- One Mind (PsyberGuide)



ROAD MAP

Global Mental Health Crisis

Technology as a Solution

Internet & Smartphone Solutions

Bias and Diversity Considerations

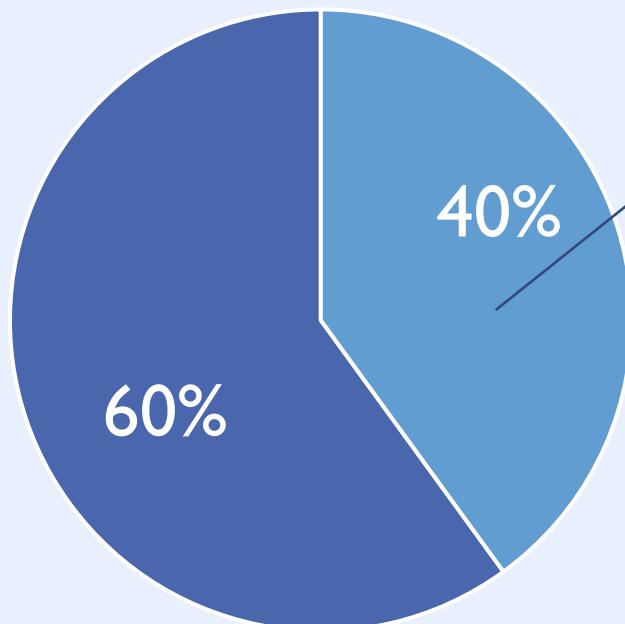
Chatbots, Social Media Platforms, Virtual Reality

Comprehensive Mental Health Platform





## OF THOSE WITH 12-MONTH PSYCHIATRIC DIAGNOSES



**38.9%** received at least “minimally adequate” care

Wang et al., 2005

■ No Care ■ Care



## BARRIERS TO MENTAL HEALTHCARE



# PATIENT-LEVEL BARRIERS



Shame & Stigma



Financial Barriers

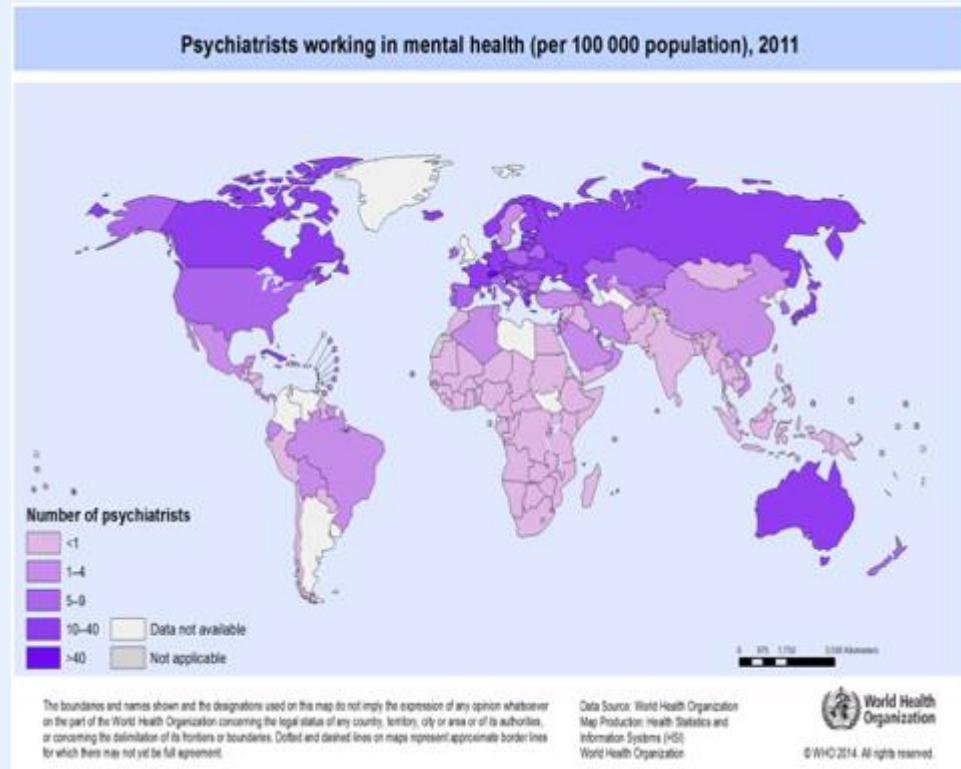
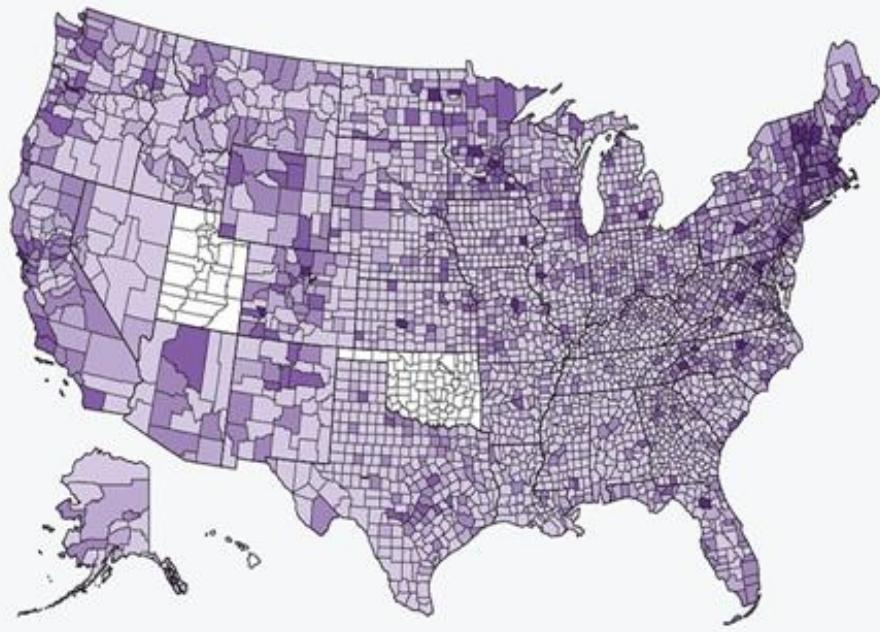


Logistical Issues

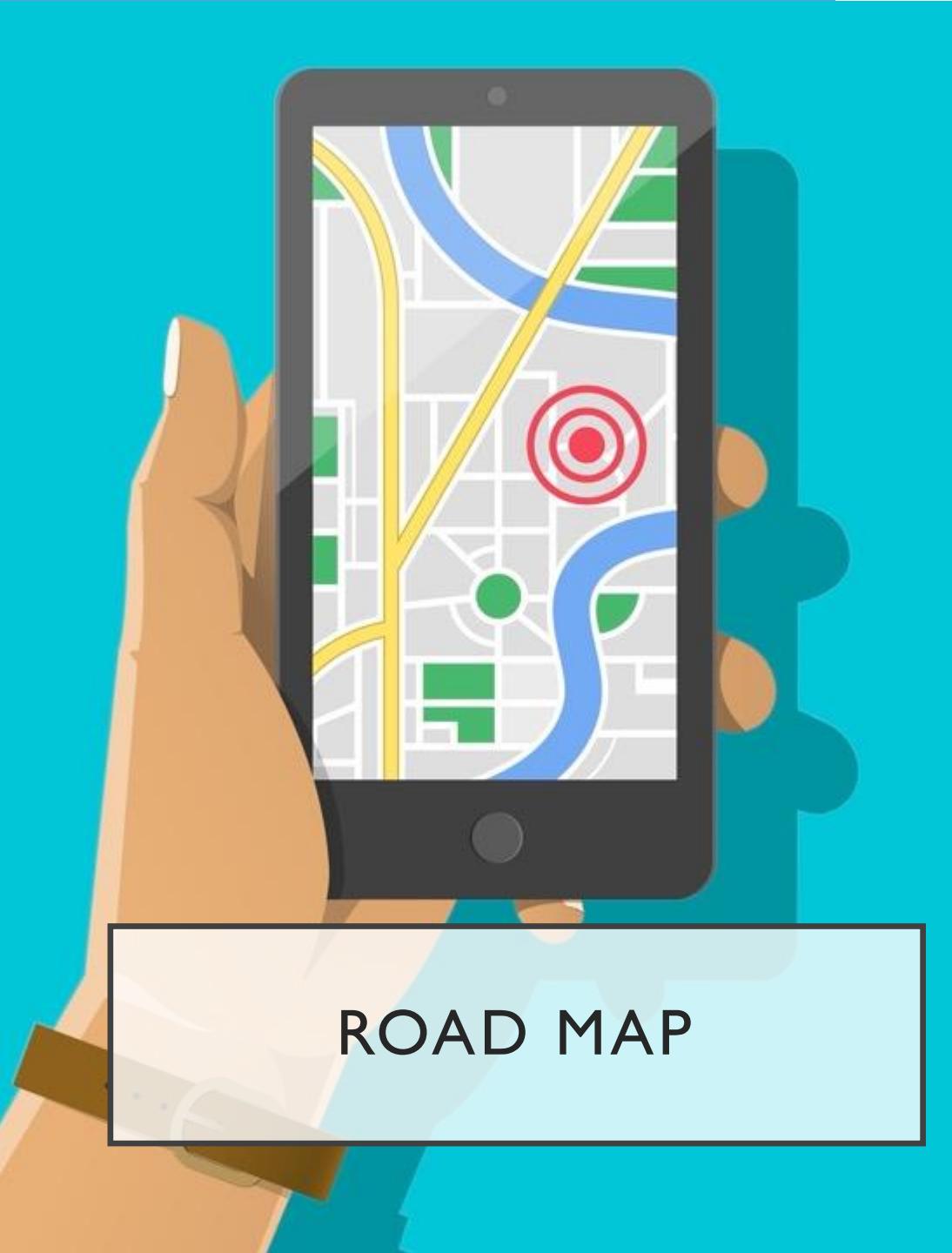
1. Kass et al., 2017; 2. Crow et al., 2013



# PROVIDER SHORTAGE



Lin, Stamm, Christdis, 2016



# Global Mental Health Crisis

Technology as a Solution

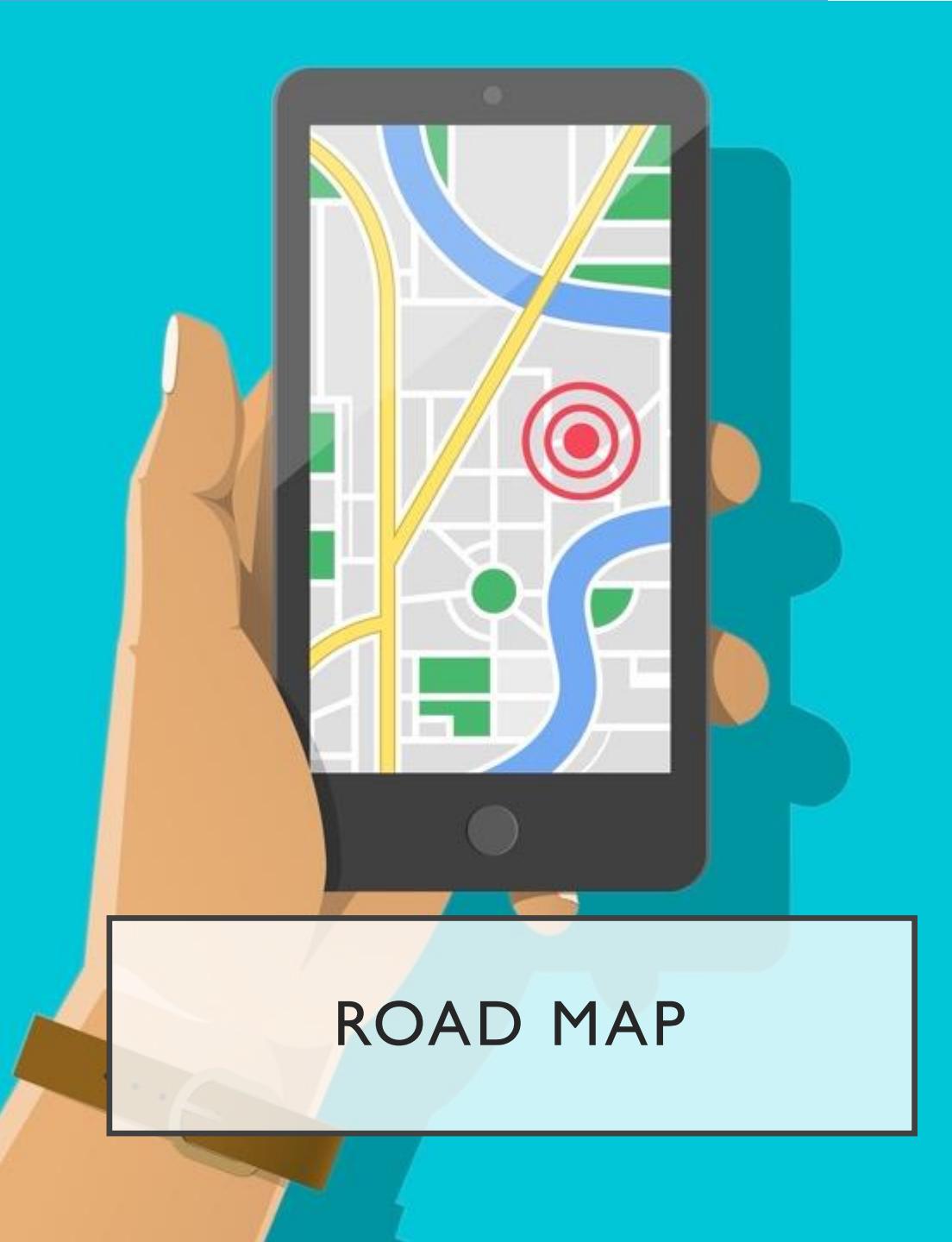
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ROAD MAP



ROAD MAP

Global Mental Health Crisis

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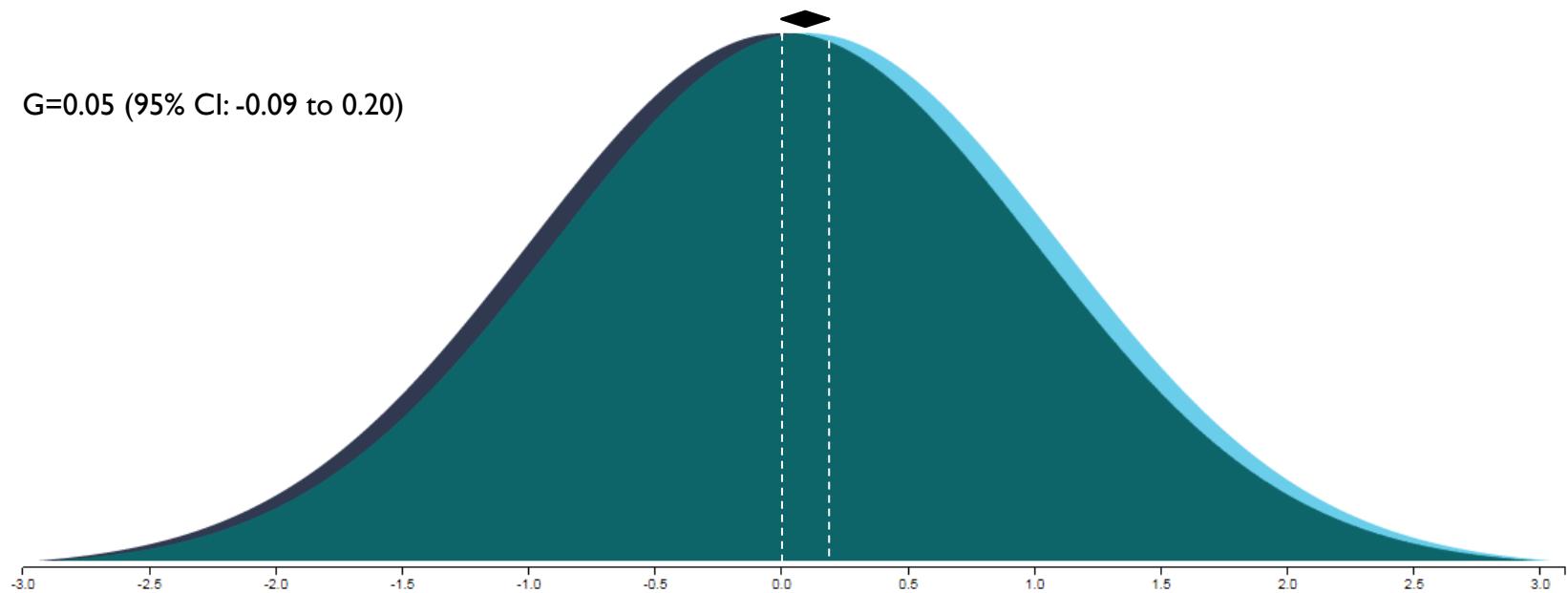
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# INTERNET CBT



GUIDED I-CBT IS EQUIVALENT TO  
IN-PERSON CBT



Carlbring et al., 2018





# I-CBT VS. CONTROL

- Major Depressive Disorder ( $g = 0.67$ )
- Panic Disorder ( $g = 1.31$ )
- Seasonal Affective Disorder ( $g = 0.92$ )
- Generalized Anxiety Disorder ( $g = 0.70$ )
- Post-Traumatic Stress Disorder ( $g = 0.71$ )



# SMARTPHONE PENETRATION

Your smartphone is always-on, always-with-you, and knows where you are

Mexico



Philippines



Brazil



S. Africa



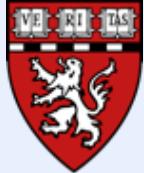
=76%



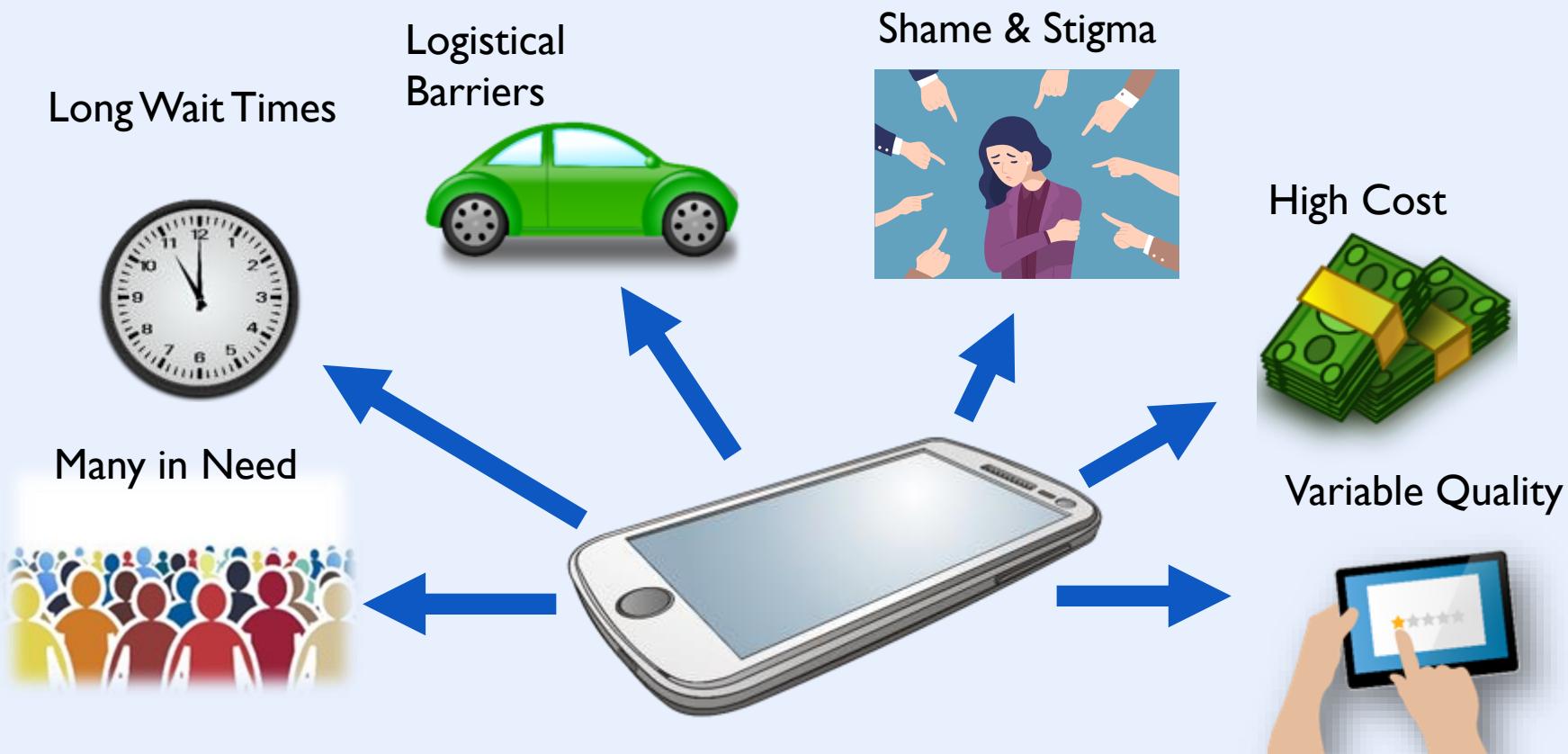
=78%



=81%



# PHONE-BASED TREATMENTS ADDRESS KEY BARRIERS





**There are over  
10,000 apps  
dedicated to  
mental health**

Marshall et al., 2019





Full-Fledged Treatment



Perspectives

With a Therapist



Recovery  
Record

Single Skill

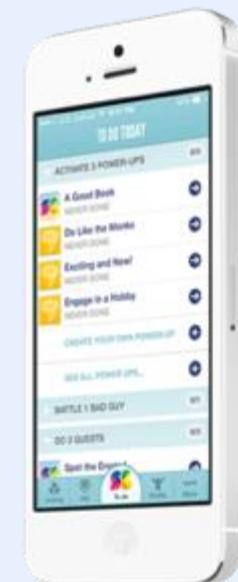


Daily Feats

Symptom Monitoring

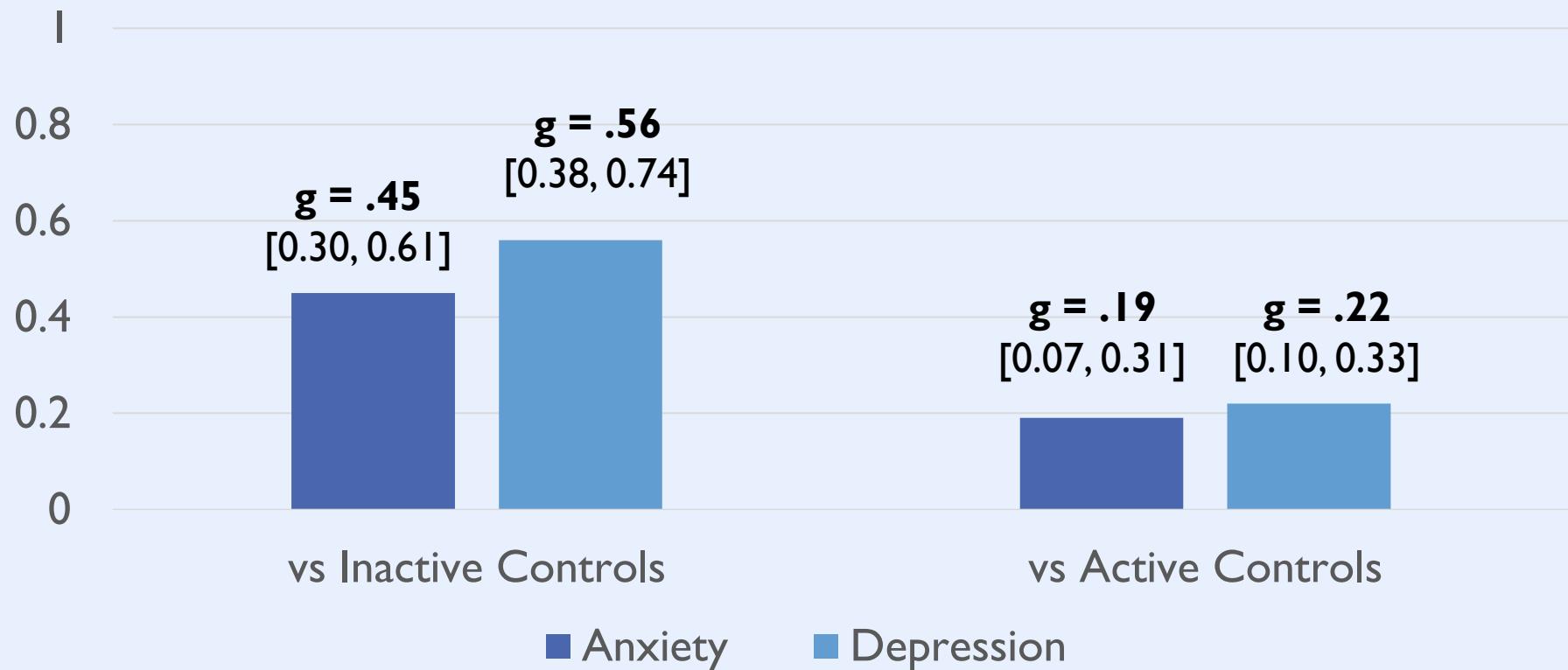


T2 Mood  
Tracker





## EFFICACY OF APPS



Firth et al., 2017a-b

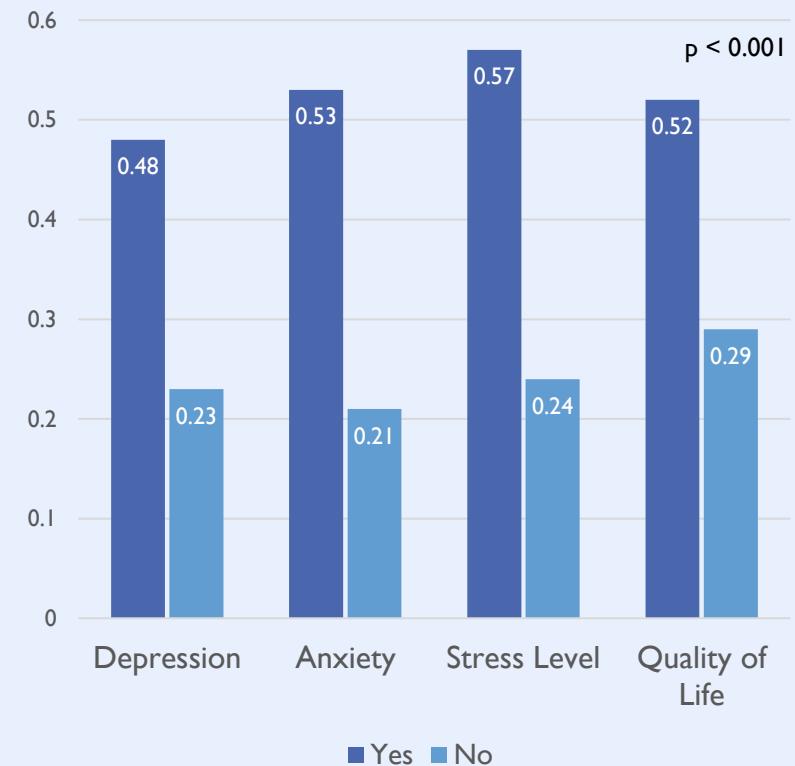


# WHAT DO THEY WORK FOR?

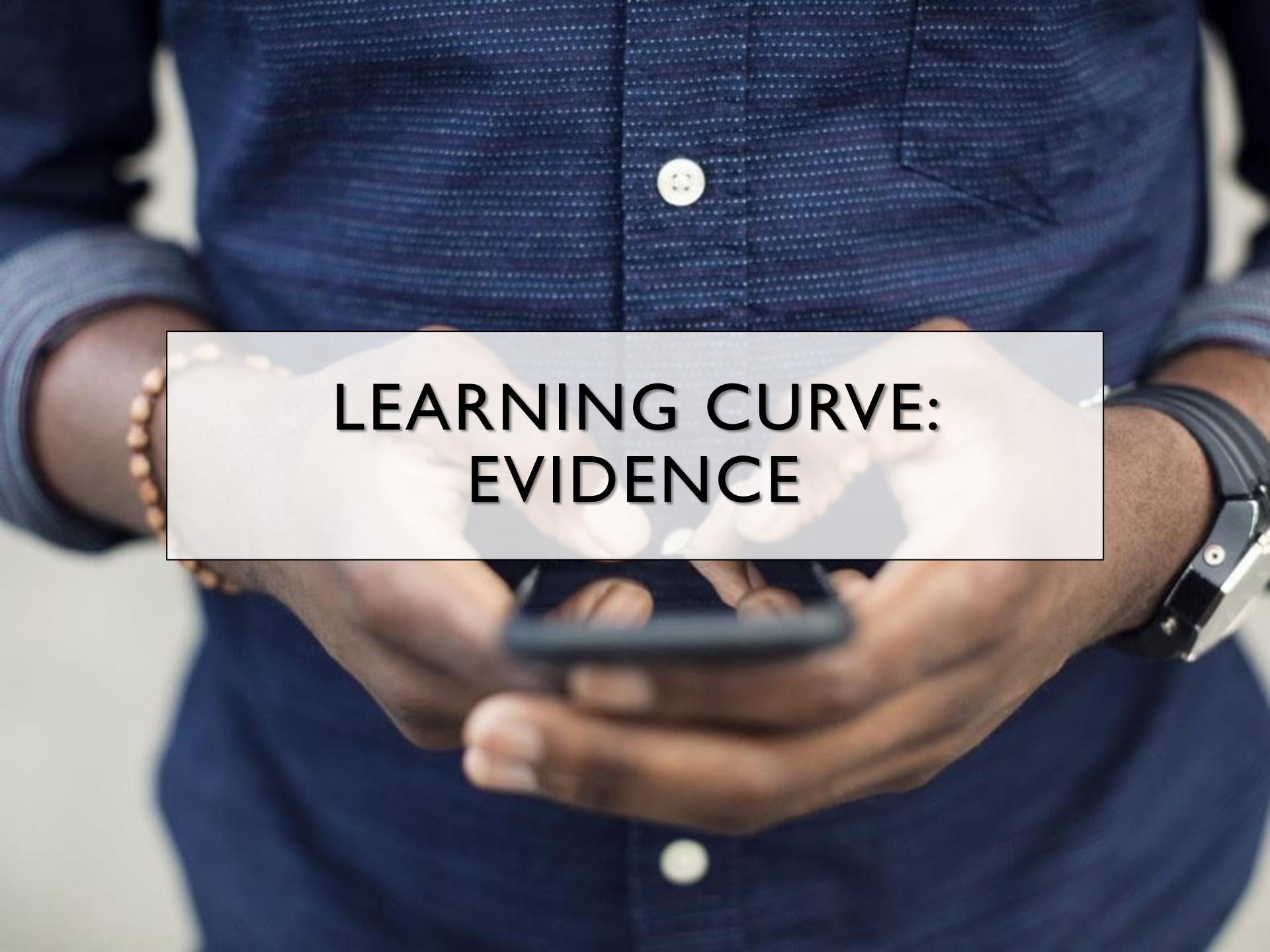


## APPS ARE USEFUL FOR IMPROVING:

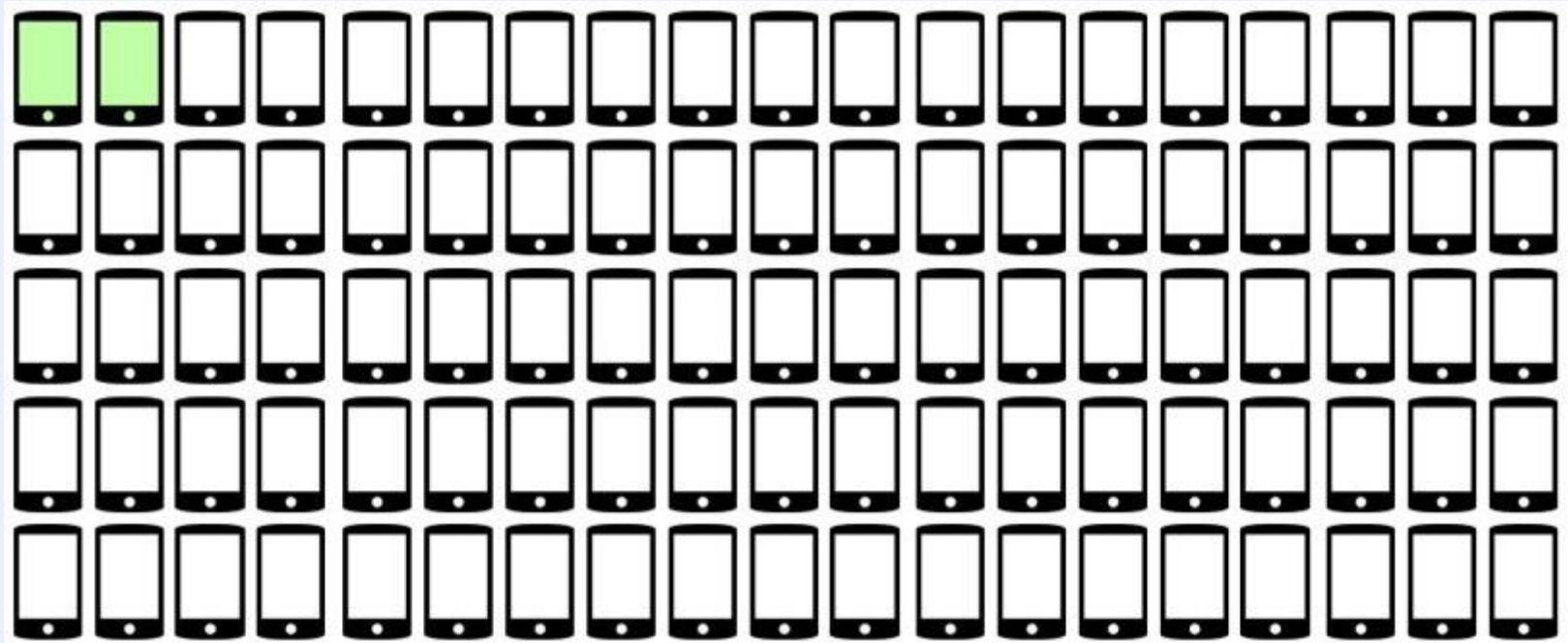
- Depression ( $g = .28$ )
- Generalized Anxiety ( $g = .30$ )
- Social Anxiety ( $g = .58$ )
- General Psychiatric Distress ( $g = .40$ )
- Stress Level ( $g = .35$ )
- Positive Affect ( $g = .44$ )
- Quality of Life ( $g = .35$ )



Professional guidance significantly increases effect sizes



# LEARNING CURVE: EVIDENCE



## RESEARCH TRIALS PER DEPRESSION APP



Martínez-Pérez, de la Torre-Díez, & López-Coronado, 2013

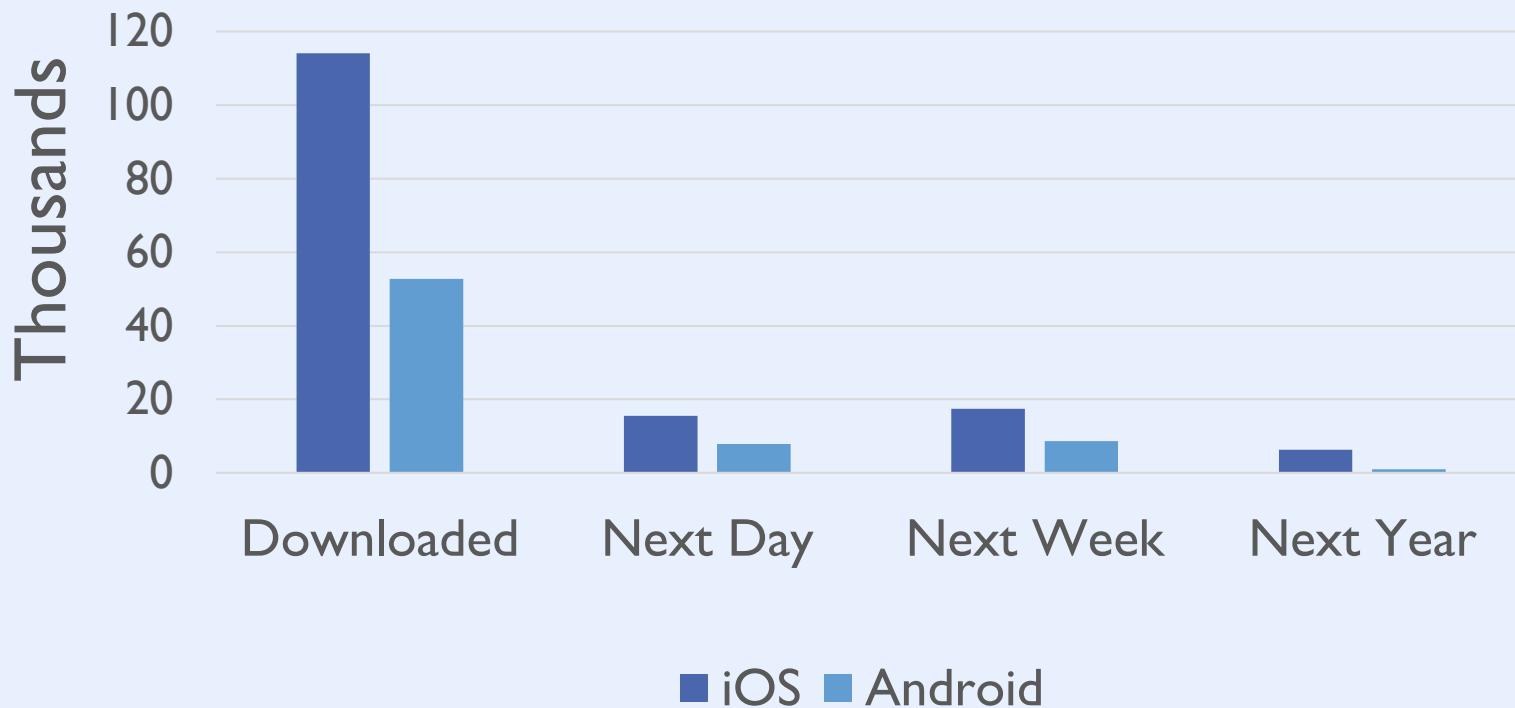


A classroom scene with students raising their hands. A white rectangular box with a black border is centered over the middle of the image, containing the text.

# LEARNING CURVE: ENGAGEMENT



## CURRENT TRENDS IN ENGAGEMENT





# COMMON REASONS FOR APP DISCONTINUATION



## POOR USABILITY

- **Unhelpful in emergency**
- Difficult/unenjoyable to use
- Takes too long to enter data
- Discovered hidden costs

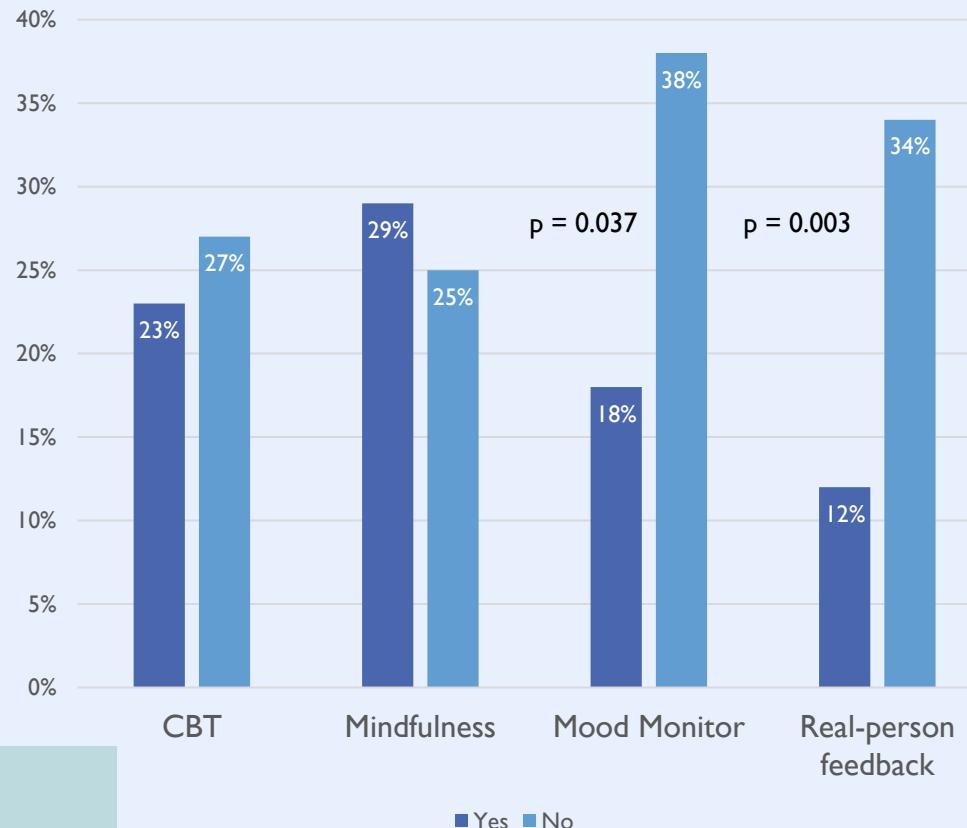
## LACK OF TRUST

- **Questions of effectiveness or usefulness (71%)**
- Bold claims create skepticism
- Too many apps/lack of regulation

## PRIVACY CONCERN

- **Concerns about data privacy (59%)**
- Only 8% will share data with a tech company
- Lack of transparent privacy policies

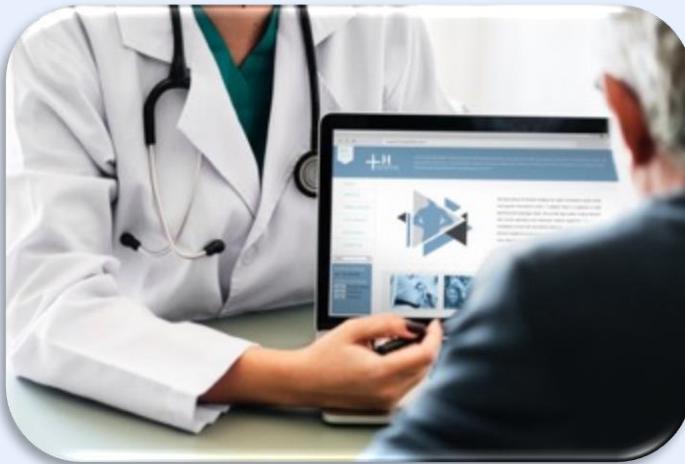
Treatment Element and Dropout Rate



1.Torous et al., 2018; 2. Lipschitz et al., 2019; 3.Torous et al., 2019



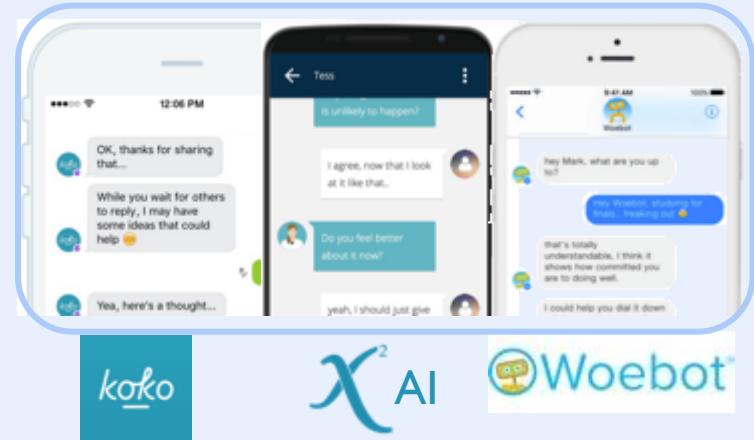
# Therapist Assisted



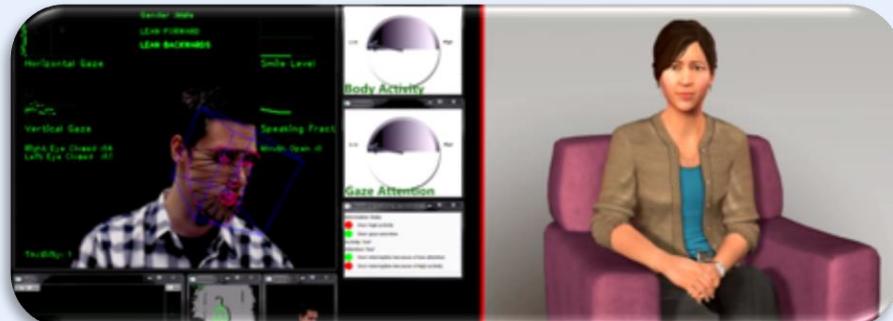
## AI Therapists



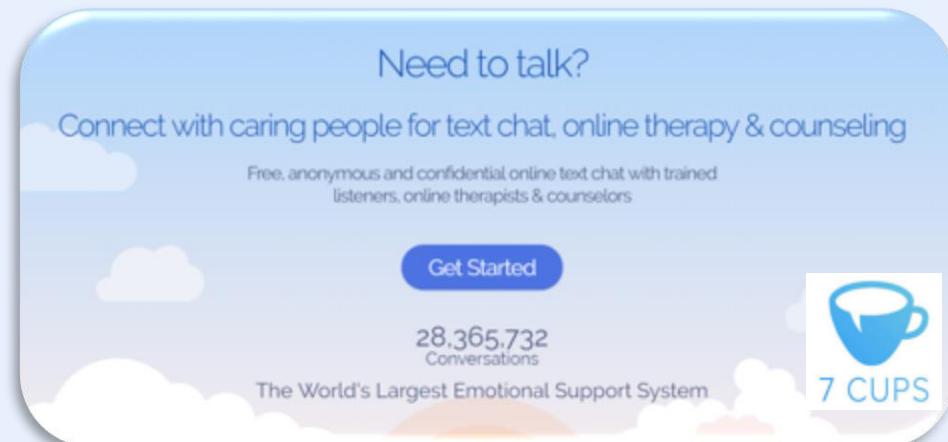
# Chatbots



## Peer-Support

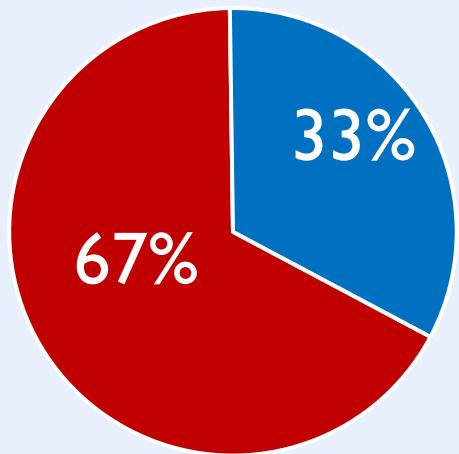


SimSensei

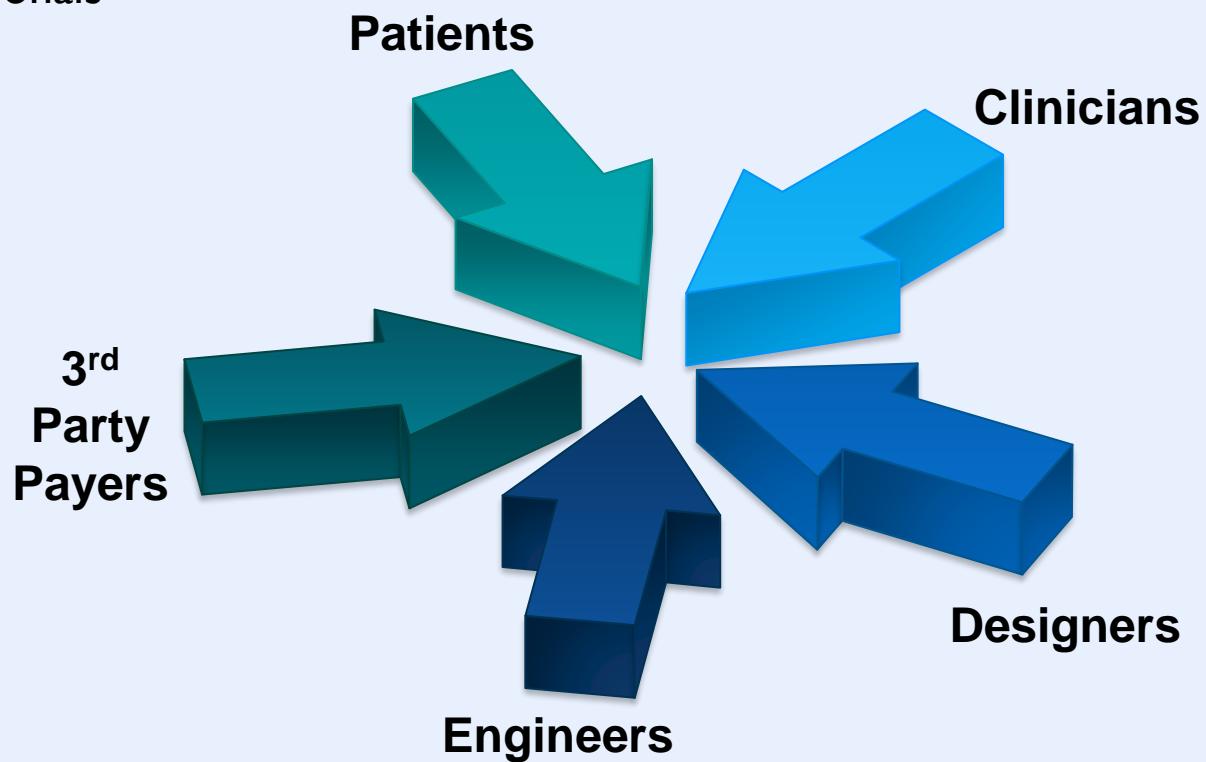


## STAKEHOLDER INVOLVEMENT FROM THE START

Input from Healthcare Professionals

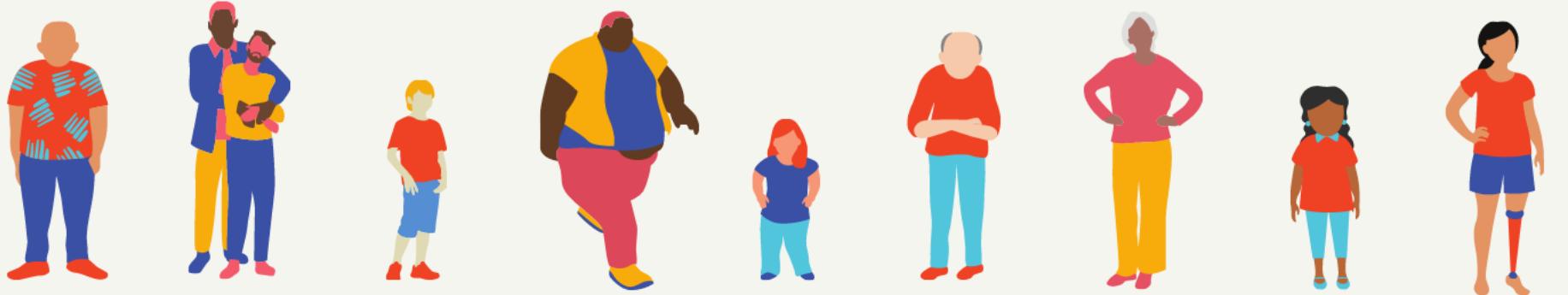


■ No Input





## PERSONALIZATION: JUST IN TIME INTERVENTIONS





# SMARTPHONE SENSOR-BASED TECHNOLOGY



Accelerometer:  
Movement



Heart Rate



Screen  
on/off:  
Sleep



Microphone:  
Vocal Tone



WiFi: Location



Outdoor  
Light

Camera:  
Facial Expression



GPS:  
Location



Bluetooth:  
Social Proximity



# JUST IN TIME INTERVENTIONS!

- Great potential
- Active (short questionnaires) and passive (sensor) data can be used to prompt personalized real time interventions
- Currently only 1% of marketplace apps support sensor use
- This will change soon

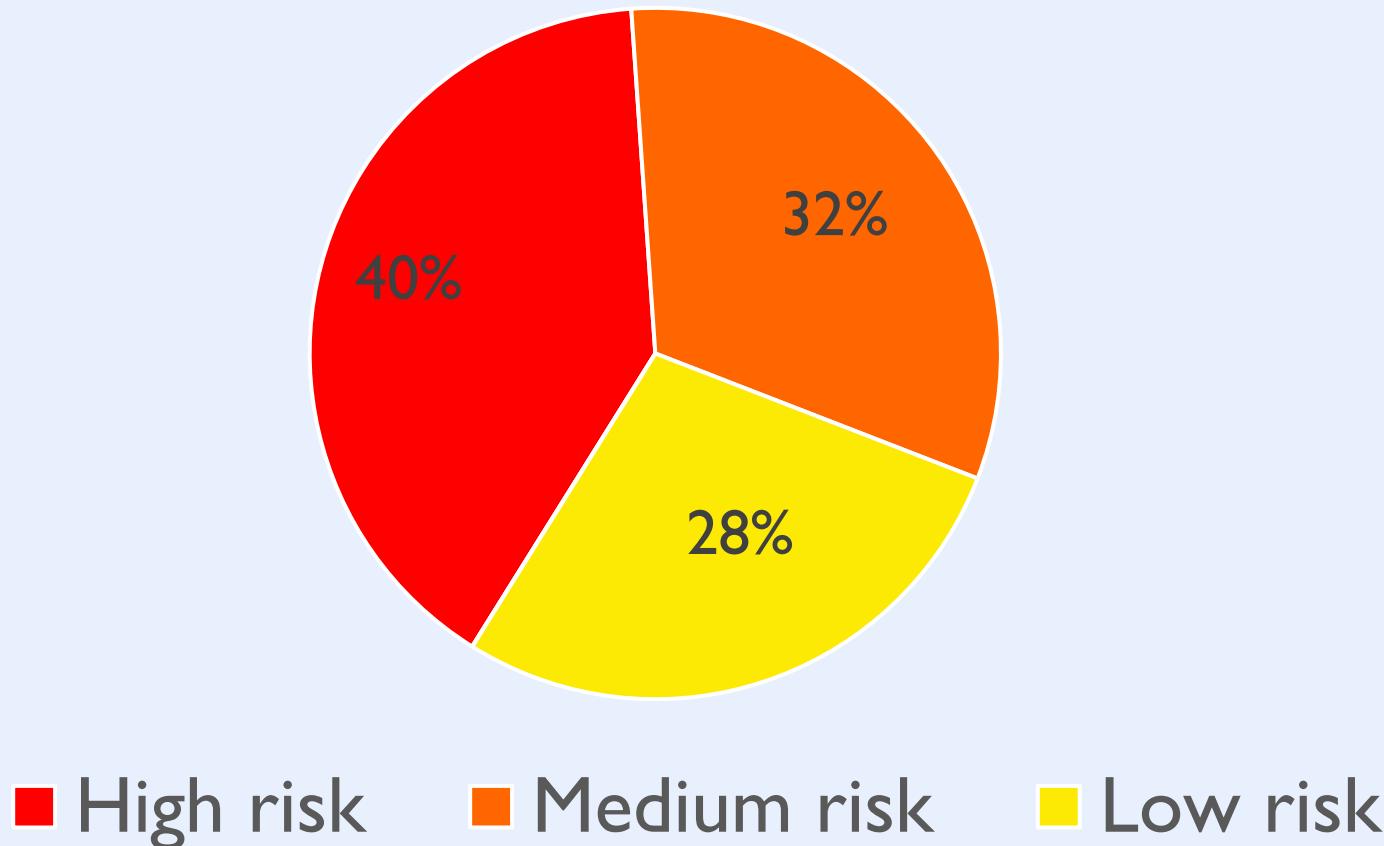


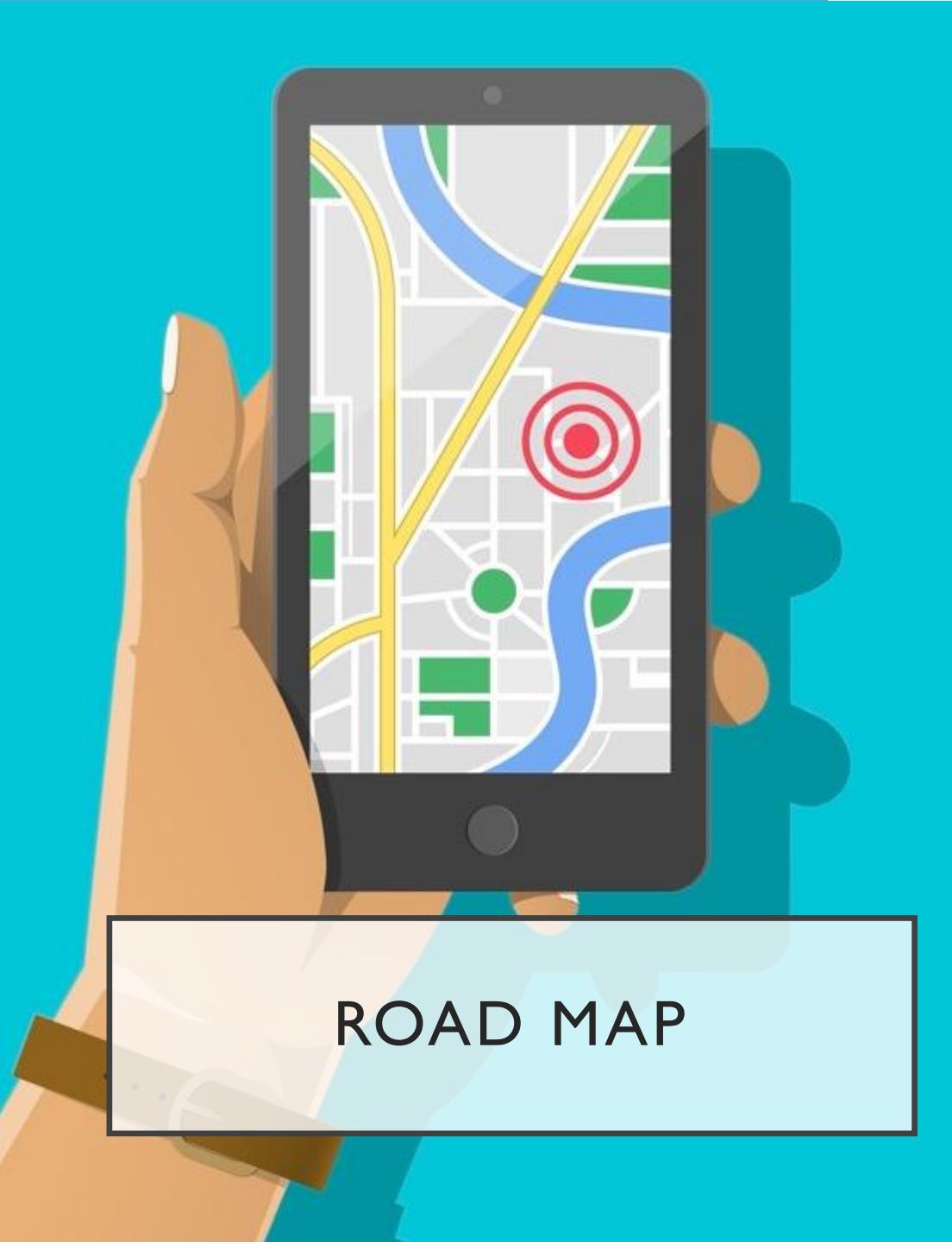


# LEARNING CURVE: SECURITY



## RISK TO USERS' PRIVACY ACROSS 43 HEALTH APPS





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# DIVERSITY CONSIDERATIONS

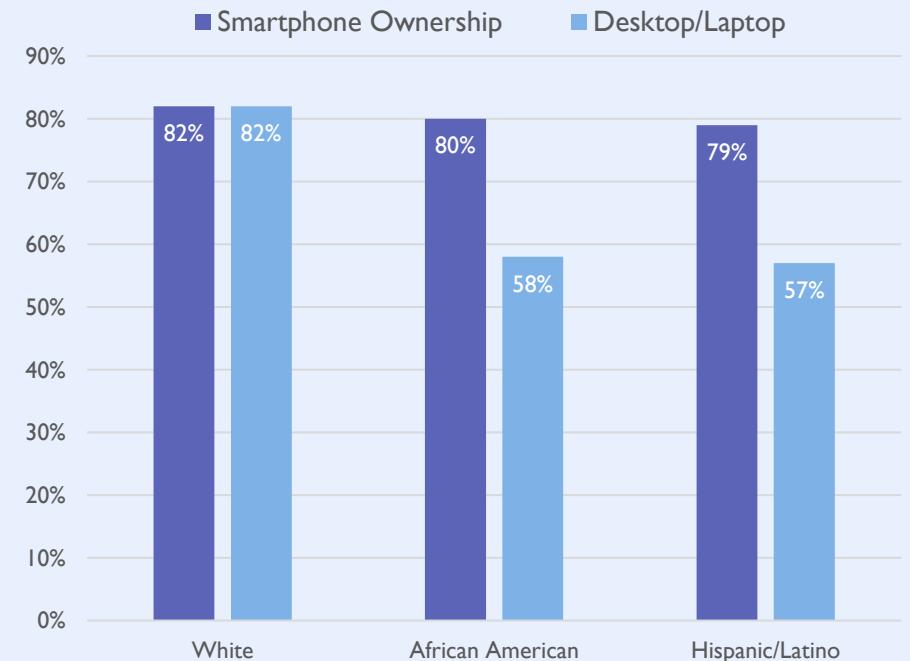
Underserved populations suffer the poorest health outcomes

African American and Latinx use smartphones to access health information more frequently than Whites

African -American: 75% own a smartphone, and 23% own a cellphone

Latinx, 77% own a smartphone, and 20% own a cellphone

Digital health interventions could alleviate mental health disparities



1. Anderson-Lewis et al., 2018; 2. Pew Research Center, 2019;  
3. Schueller, Hunter, & Figueroa, 2019 4. Fonagy & Luyten, 2021



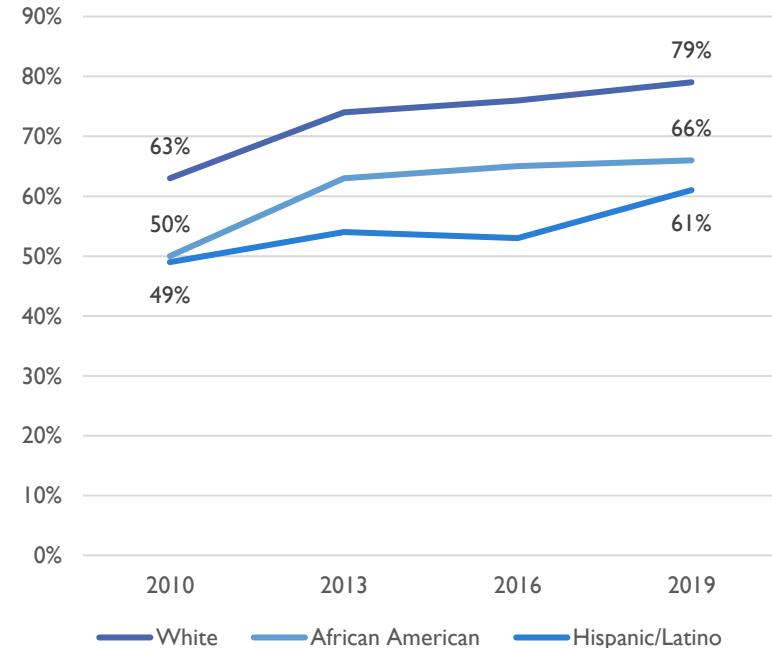
## TECHNOLOGY DEMOGRAPHICS

**LGBTQ:** Higher rates of seeking health information and resources online

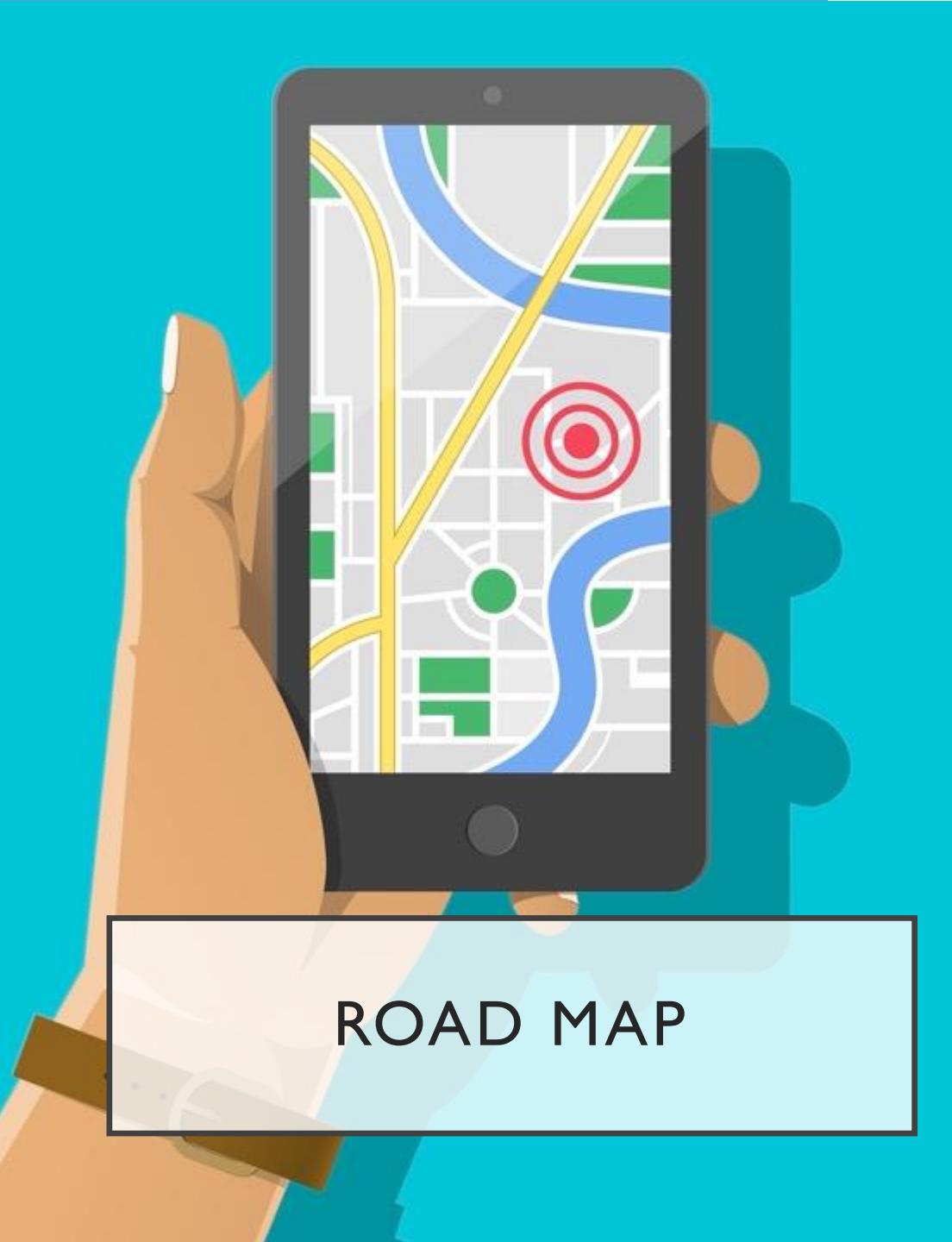
**Homeless Individuals:** 58% own a smartphone, 86% have an Android

**Rural Populations:** 65% own a smartphone, 61% have home internet access

## Home Internet Access



Messages must be designed to meet the **literacy, language, cultural and motivational** needs of the population



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# INNOVATIVE DIGITAL INTERVENTIONS<sup>1</sup>

- **Chatbots**

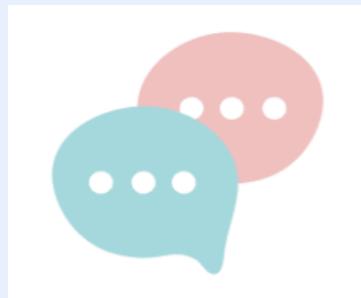
- Automated conversational interfaces, can detect and respond to immediate needs
- Some individuals feel more comfortable conversing with a chatbot
- Widely used in many commercially available apps

- **Social media Platforms**

- Patterns of social media use can be used to detect individual worsening of symptoms (i.e., Schizophrenia relapse)
- Platforms use personalized therapy combined with social connections (i.e., Moderated Online Social Therapy platform)

- **Virtual Reality**

- Can create and control personalized, real-world exposures in a safe, convenient environment
- Can be used for mindfulness and relaxation



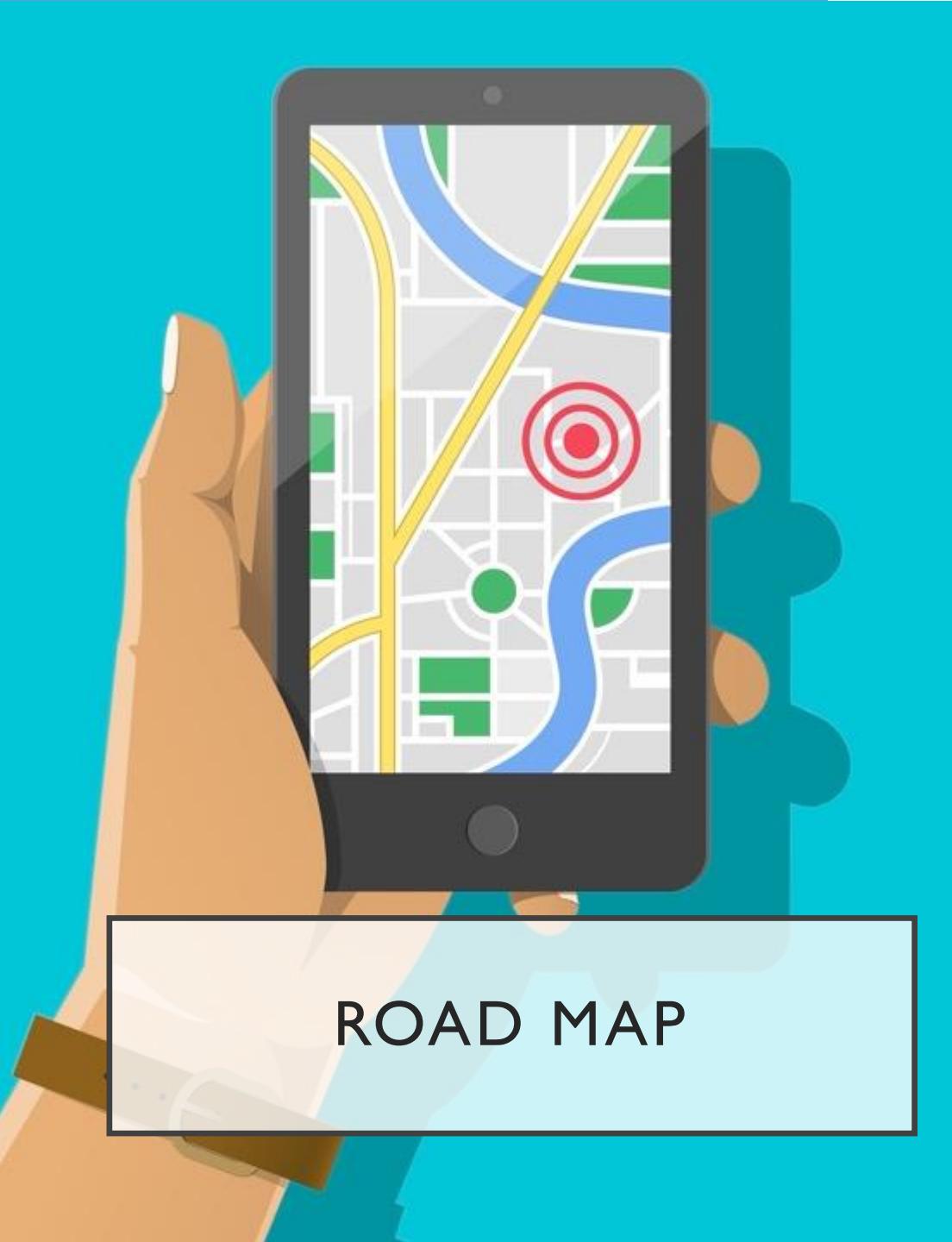


# AREAS OF IMPROVEMENT<sup>1</sup>



- **Chatbots**
  - Limited in recognizing serious mental health concerns and providing appropriate responses (i.e., suicidal ideation, domestic violence)
  - Privacy concerns
- **Social media Platforms**
  - Stigma and disinformation are widespread
  - Ethical concerns when using social media for treatment
- **Virtual Reality**
  - Mostly inaccessible and unfamiliar to the general public





ROAD MAP

Global Mental Health Crisis

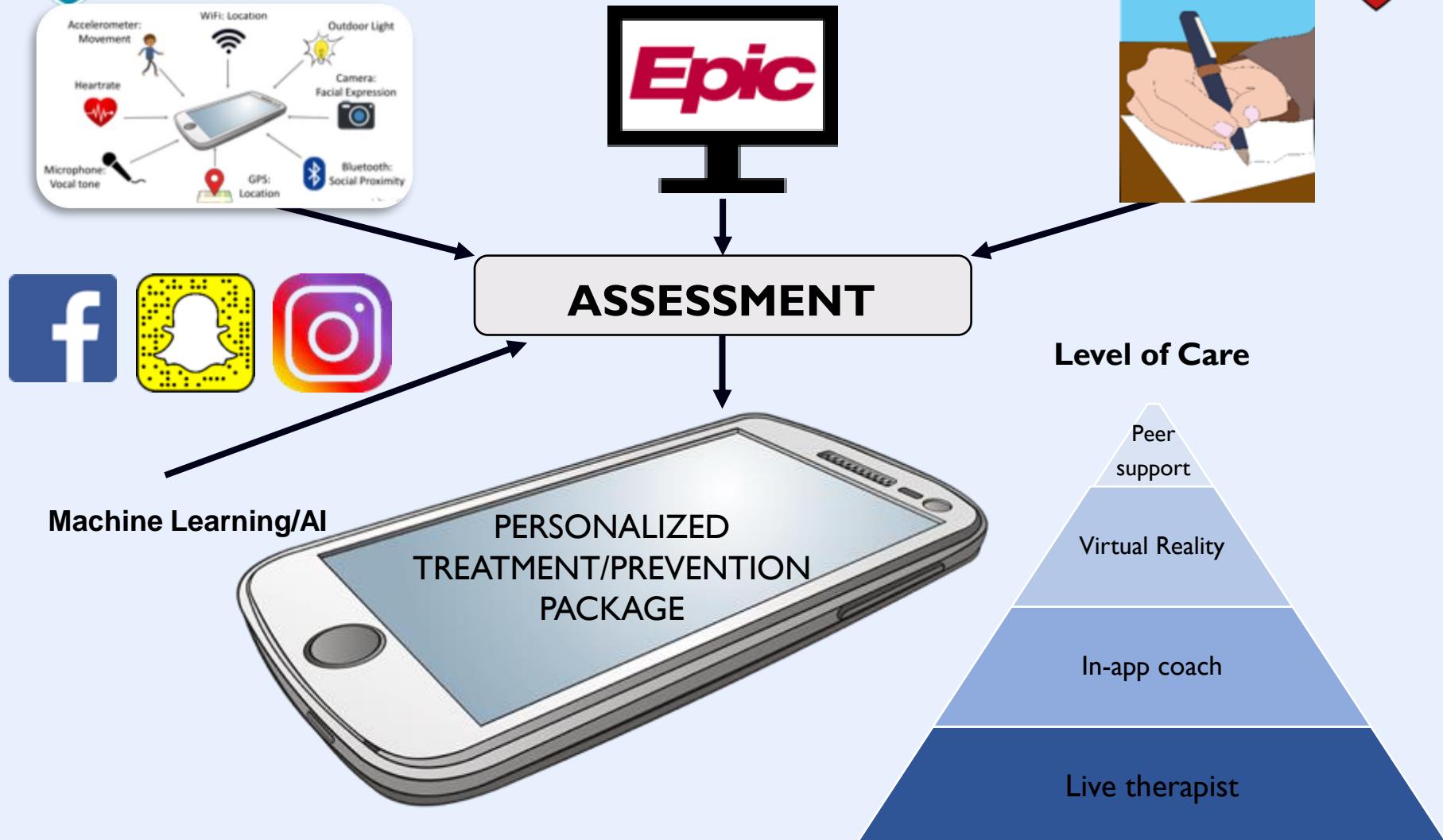
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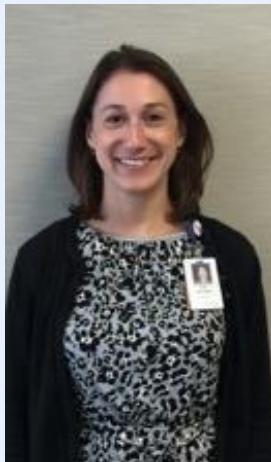


## SUMMARY AND CONCLUSIONS

- *Mental Health Crisis*
  - Most individuals with mental health issues are not getting care
- *Technology*
  - Offers scalable approaches to assessment and personalized treatment
  - Will continue to evolve rapidly
  - **Need to minimize risks and maximize benefits for our patients.**



# ACKNOWLEDGEMENTS



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Anna Schwartzberg



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