uTECH: Developing a Novel Machine-Learning HIV Prevention Intervention for Sexual and Gender Minority Young People Who Have Sex with Men

Ian Holloway, PhD, LCSW
Professor of Social Welfare
Director, Hub for Health Intervention, Policy and Practice
Editor-in-Chief, Sexuality Research and Social Policy
UCLA Luskin School of Public Affairs

Clinical Discovery Seminar Objectives

- Create a community of clinical, behavioral, and translational HIV researchers at UCLA and CDU and beyond

- Share innovative work by CFAR investigators utilizing NIH and other funded data and sample repositories

- Introduce investigators to opportunities to propose new work/projects using existing data and sample repositories

- Stimulate new ideas and collaboration

- Support investigators in proposing analyses to these cohorts

Upcoming Clinical Science Core Events

- • UCLA-CDU Center for AIDS Research (CFAR) Open House
  - Thursday, May 2, 2024, from 12:00-1:00 pm via Zoom
  - Register here:

- To access past seminars/workshops and learn about future events, please visit our website:
  https://cfar.ucla-cdu.org/cores/clinical-science-core/

  Core Contact Information:
  Core Director – Kara Chew, MD, MS
  Core Program Manager – Stephanie Buchbinder, MPH
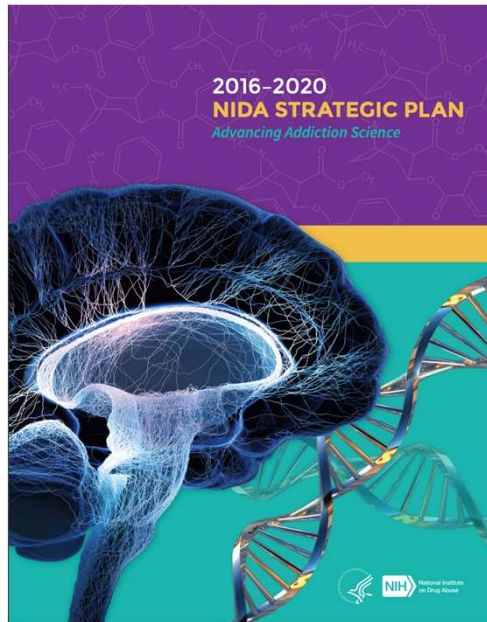 Core email: cfarclinicalcore@mednet.ucla.edu

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Ian Holloway, PhD, LCSW, MPH
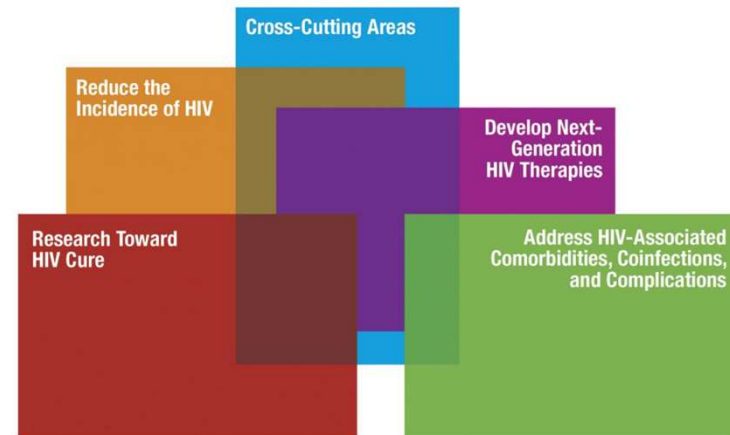Professor, Department of Social Welfare

Agenda

I.   **Strategic Plan and Priorities**
II. **Background: HIV & Substance Use**
III. **Background: Machine Learning for HIV Prevention**
IV. **uTECH Project Overview**
V.   **Phase 1 Methods & Data**
VI. **Phase 2 Methods & Data**
VII. **Implications, Challenges, & Opportunities**
VIII. **Collaborations & Acknowledgements**

NIDA Strategic Plan & OAR Priorities

2016–2020
NIDA STRATEGIC PLAN
Advancing Addiction Science

NIH National Institute on Drug Abuse

NIH Priorities for HIV and HIV-Related Research

Cross-Cutting Areas

Reduce the Incidence of HIV

Develop Next-Generation HIV Therapies

Research Toward HIV Cure

Address HIV-Associated Comorbidities, Coinfections, and Complications

"Explore the potential of technology-based methods for delivering prevention interventions, such as smartphones, video games, and social media"
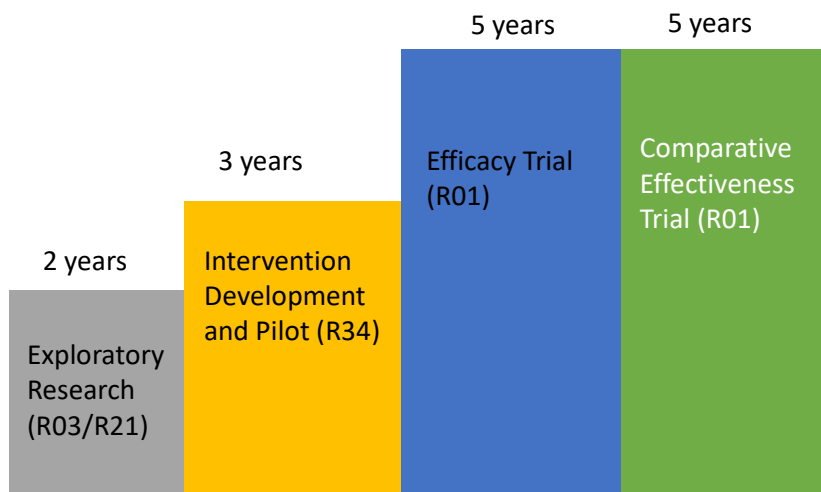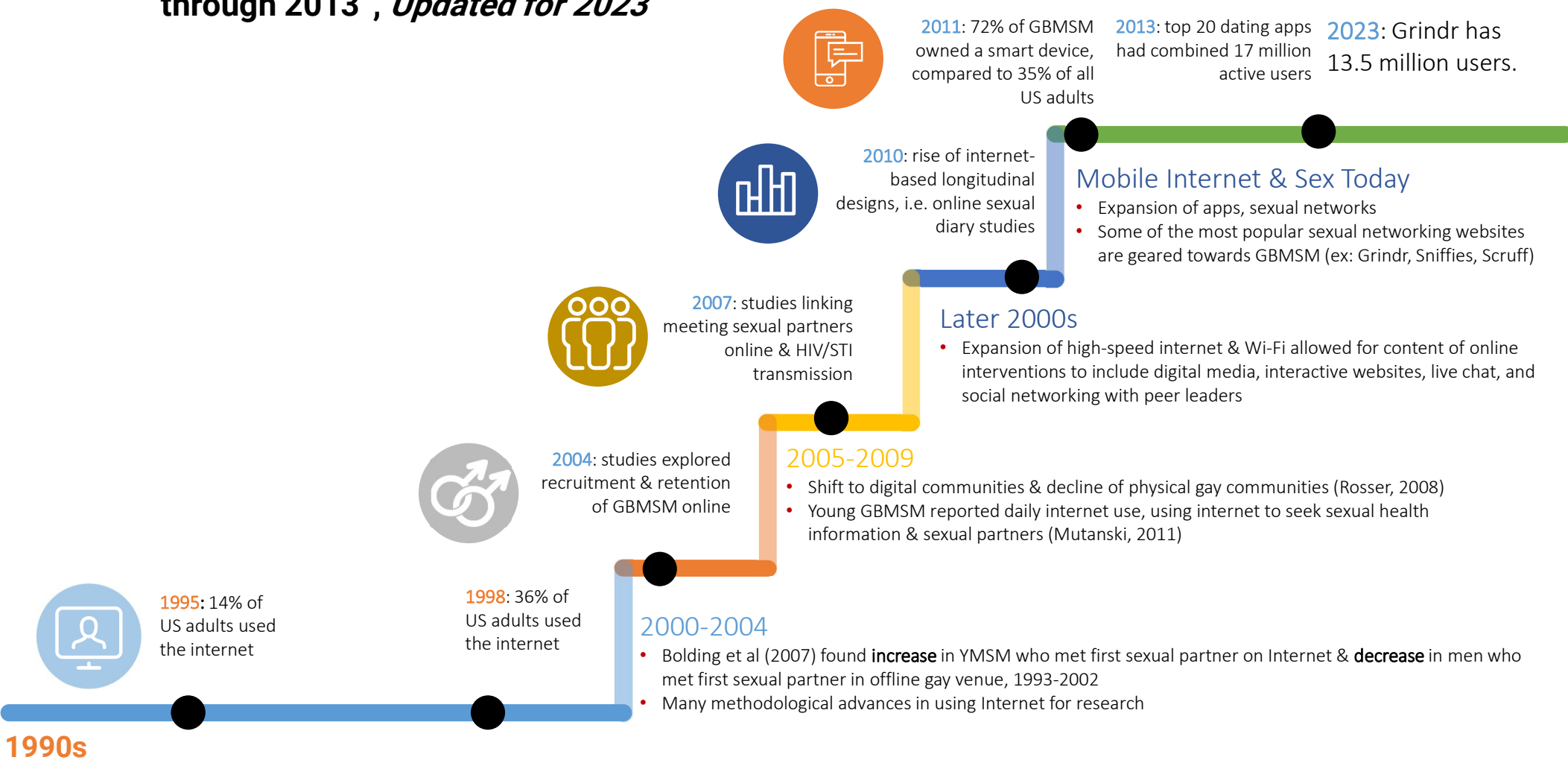
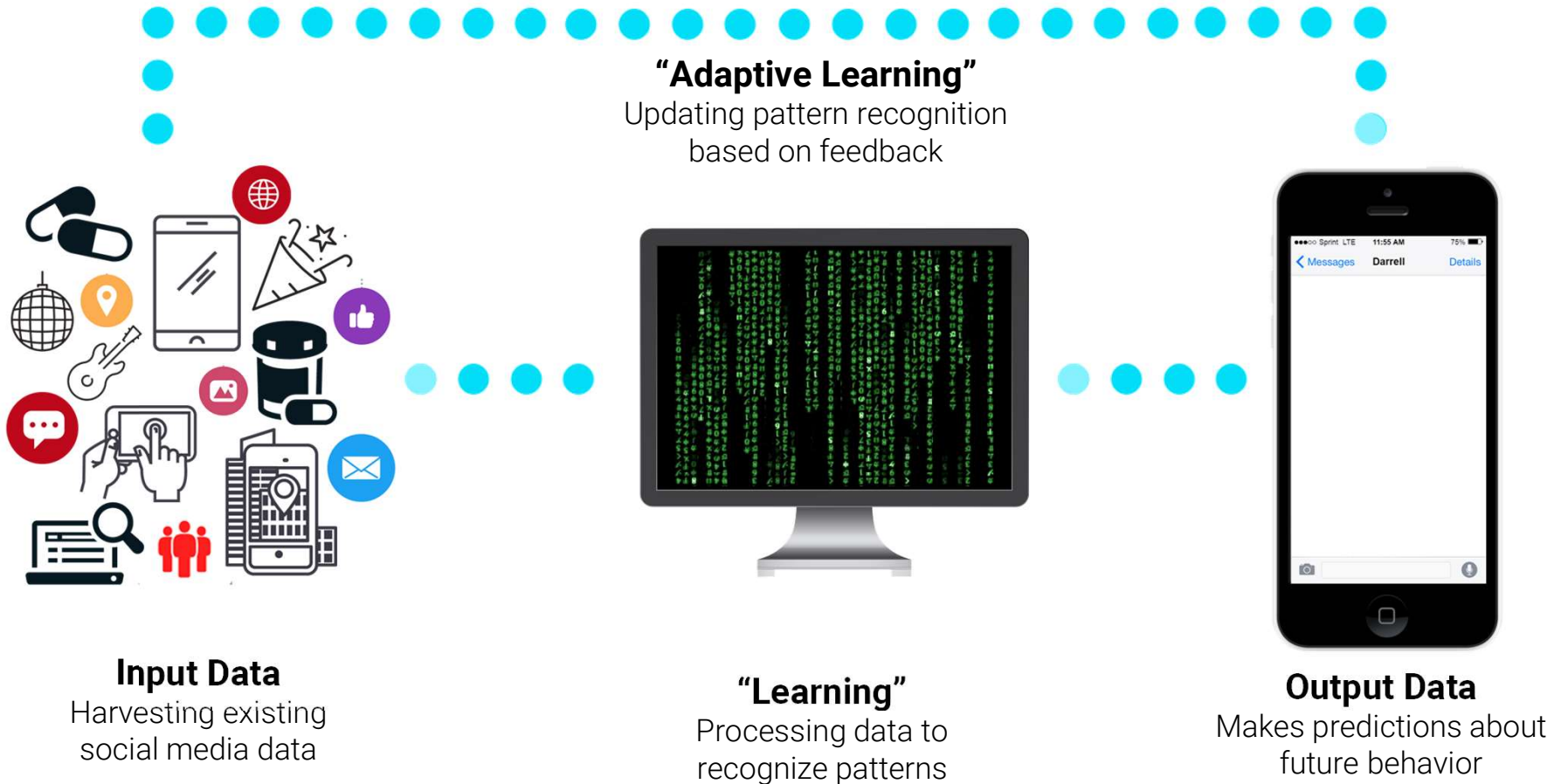**Grov et al 2014 "Gay & Bisexual Men's Use of the Internet: Research from 1990s through 2013",** *Updated for 2023*

2011: 72% of GBMSM owned a smart device, compared to 35% of all US adults

2013: top 20 dating apps had combined 17 million active users

2023: Grindr has 13.5 million users.

2010: rise of internet-based longitudinal designs, i.e. online sexual diary studies

Mobile Internet & Sex Today
- Expansion of apps, sexual networks
- Some of the most popular sexual networking websites are geared towards GBMSM (ex: Grindr, Sniffies, Scruff)

2007: studies linking meeting sexual partners online & HIV/STI transmission

Later 2000s
- Expansion of high-speed internet & Wi-Fi allowed for content of online interventions to include digital media, interactive websites, live chat, and social networking with peer leaders

2004: studies explored recruitment & retention of GBMSM online

2005-2009
- Shift to digital communities & decline of physical gay communities (Rosser, 2008)
- Young GBMSM reported daily internet use, using internet to seek sexual health information & sexual partners (Mutanski, 2011)

1995: 14% of US adults used the internet

1998: 36% of US adults used the internet

2000-2004
- Bolding et al (2007) found **increase** in YMSM who met first sexual partner on Internet & **decrease** in men who met first sexual partner in offline gay venue, 1993-2002
- Many methodological advances in using Internet for research

1990s

New Avenue for HIV Prevention: Machine Learning

"Adaptive Learning"
Updating pattern recognition
based on feedback

Input Data
Harvesting existing
social media data

"Learning"
Processing data to
recognize patterns

Output Data
Makes predictions about
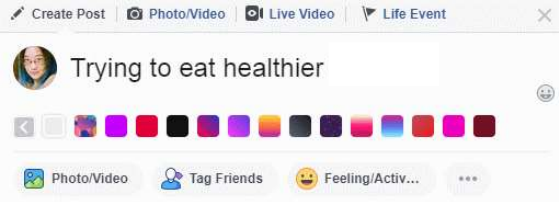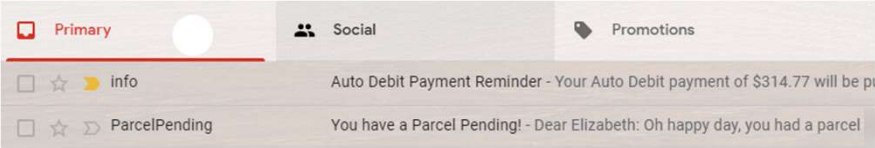future behavior

Machine Learning Example
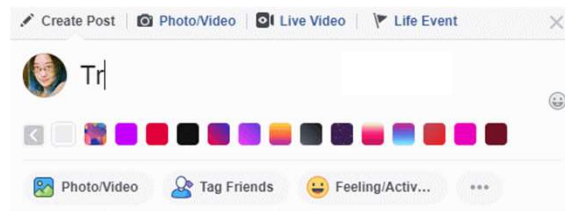
Facebook

Machine Learning Example

Facebook

Gmail

Machine Learning Example

Facebook Feed

Facebook

Gmail

Machine Learning Example
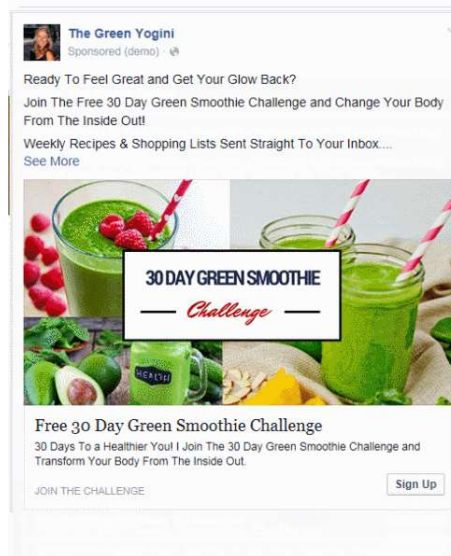
Facebook Feed   **Amazon Recommendations**

Facebook

Gmail

uTECH Project Overview

Qualitative interviews

60-90 min interviews

Qualitative methdologies to develop uTECH

Refining uTECH + best practice recomendations

Engineering

Use agile programming to build the uTECH platform using responsive web-design

Pilot Testing

Deploy uTECH using adaptive HTML 5 platform for GBMSM pilot testers

Data Analysis

Assess acceptability of uTECH dosing and content across GBMSM and observe flow

Randomization: 3 Arms

Participants are randomized into uTECH, YMHP, uTECH+YMHP

Intervention Trial

Collect data from uTECH, YMHP, uTECH+YMHP interventions

Data Analysis

Evaluate success of uTECH relative to YMHP

PHASE 1: ITERATIVE USER-CENTERED DESIGN

Pilot Testing and Analysis

PHASE 2: IMPLEMENTATION TRIAL

30 participants

400 participants

GSMSM 18+ years of age, engaging in condomless anal sex, and using illicit drugs

uTECH Project: Phase 1

Purpose: Conduct qualitative interviews with GBMSM using an iterative user-centered design process, which will result in a refined version of the uTECH intervention

uTECH Phase 1 Methods

Recruitment

- **Advertisements** placed in Los Angeles County venues (i.e., flyers in community-based organizations) frequented by GBMSM
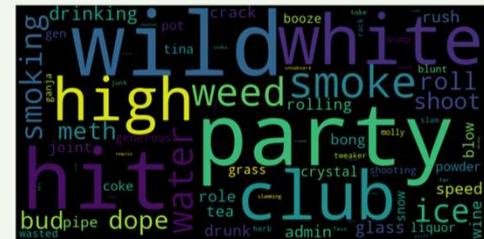- **Social media**

N=30

Baseline Interview

- **60-90 min survey** on sexual & HIV/STI behaviors, substance use, and preferred SNS platforms
- **Qualitative interview** on dating risks, safety, and app features
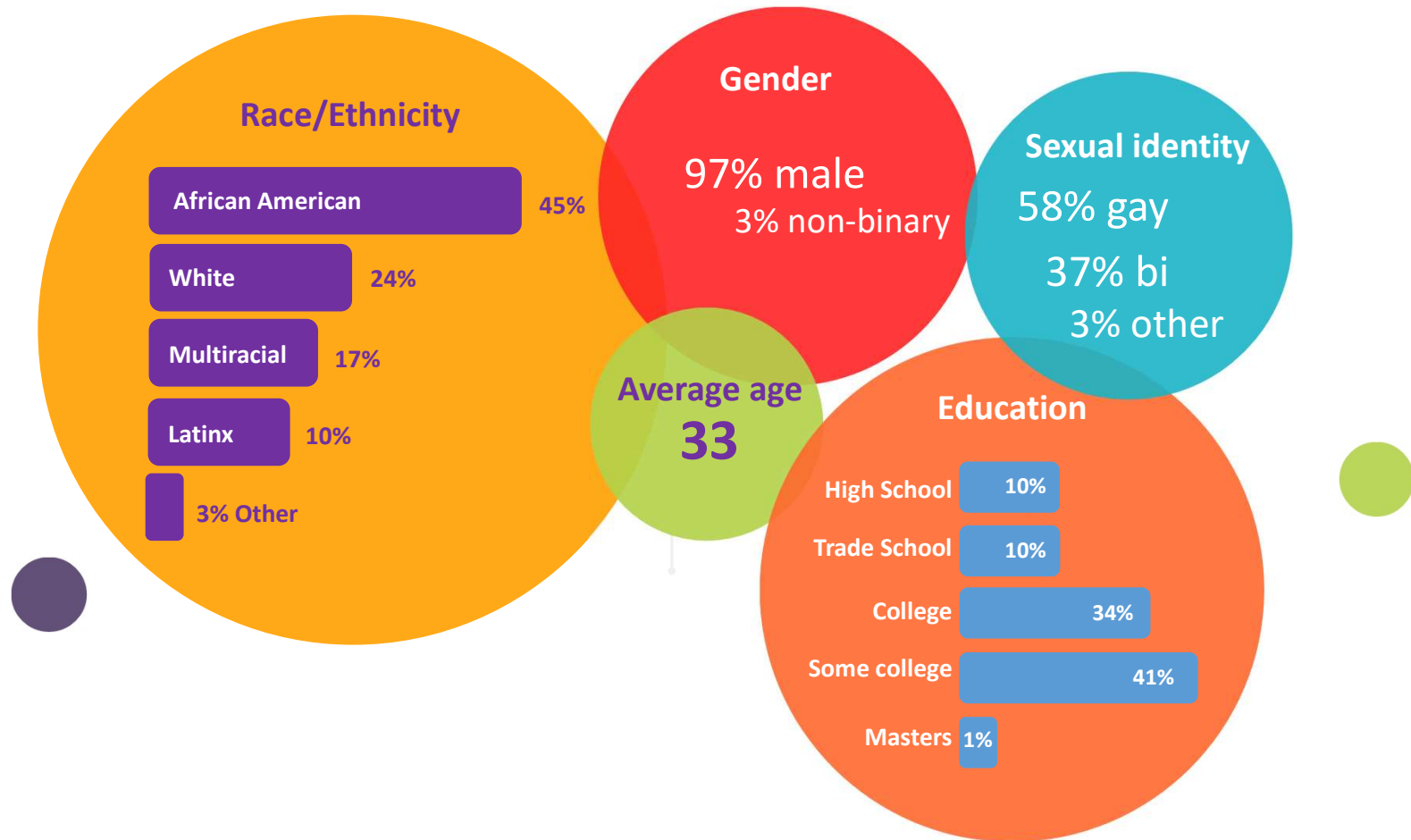- **App installation**

6-month interview

- **30 min interview** on app functionality and reflection on current data collected (word clouds)

Phase 1 Participant Demographics (n=29)

Race/Ethnicity

- African American — 45%
- White — 24%
- Multiracial — 17%
- Latinx — 10%
- 3% Other

Gender

97% male
3% non-binary

Sexual identity

58% gay
37% bi
3% other

Average age
33

Education

- High School — 10%
- Trade School — 10%
- College — 34%
- Some college — 41%
- Masters — 1%

Top online platforms to meet others for sex and partying:

Baseline Information: Technology Preferences to receive uTECH intervention

Mobile functions participants feel comfortable in providing access to uTECH reseachers

Legend: ■ Yes ■ No
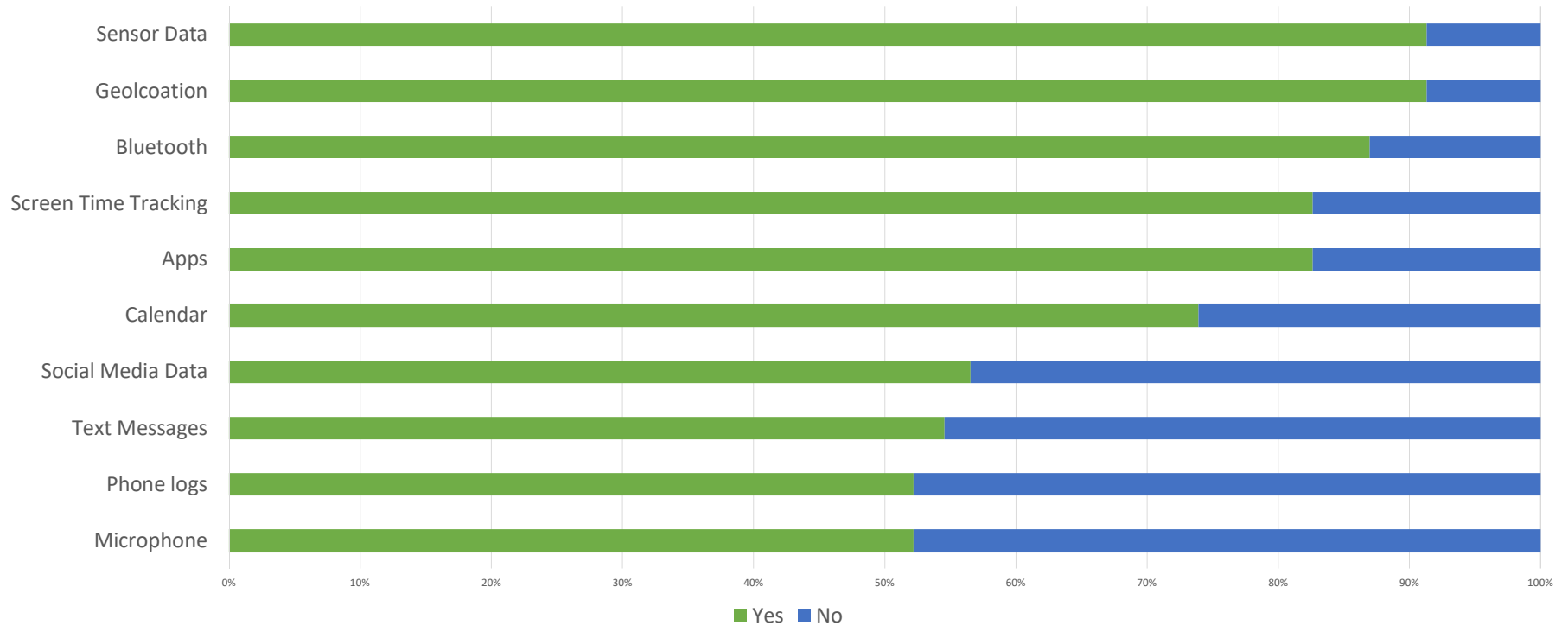
6-Month Interviews: Review of collected data

- Participants are asked to review the data collected from their mobile phones in the last 6 months:

Sex words

Suck
rimming
DTF Head
Top
Bottom
Host
Fuck

Drug words

high
white
smoke
party
dope
ecstasy
club
ice

Locations

uTECH Data Mining Library

302

text phrases and 21 special
characters (emojis)

6-Month Interviews: Revised Risky Words Dictionary

Category ranking	Risk level		
	3	2	1
Substance Use and Sex		"Party and play", "smoke and stroke", "pnp", "party", "partying"	"sharing"
Condomless sex	"BB", "bb", "Bareback", "bare", "cum dump", "pump and dump", "raw", "seed", "seeding", "creampie"	"loads", "loadz", "cum", "jizz", "Pussy", "bussy", "hole", "hole emoji", "raunchy", "pig", "piggy"	
Sex work			"$", "roses", "generous", "pro", "GEN", "G E N"
Group sex	"sex party", "gang bang", "orgy"	"3some", "3way", "bukkake"	
Anal intercourse		"pound", "power top", "power bottom"	"top", "bottom", "BTM", "fuck", "anal", "vers", "versatile", "sex", "butt sex", , "DTF", "topped"

Sex-related words: Word Cloud
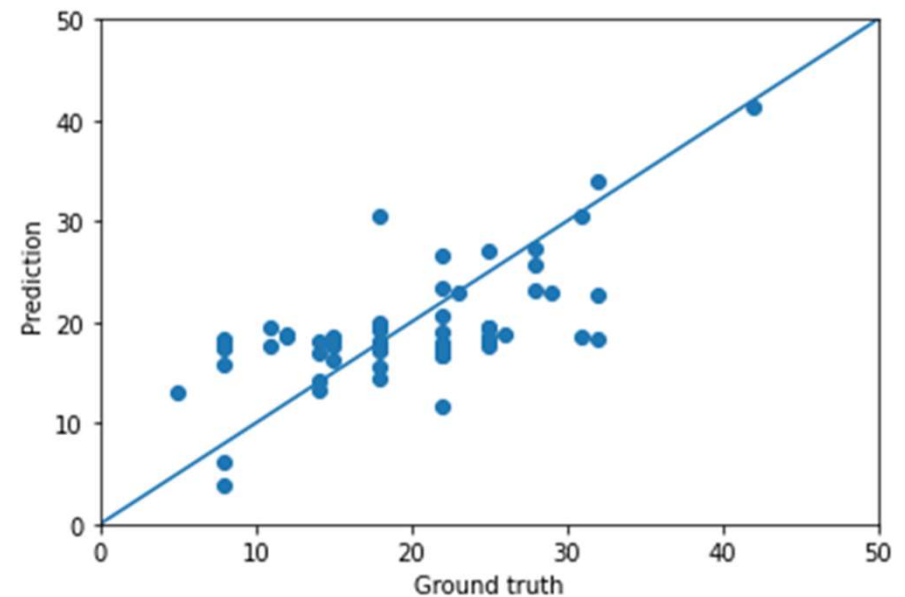
Drug-related words: Word Cloud

GPS Visualization – Phase 1
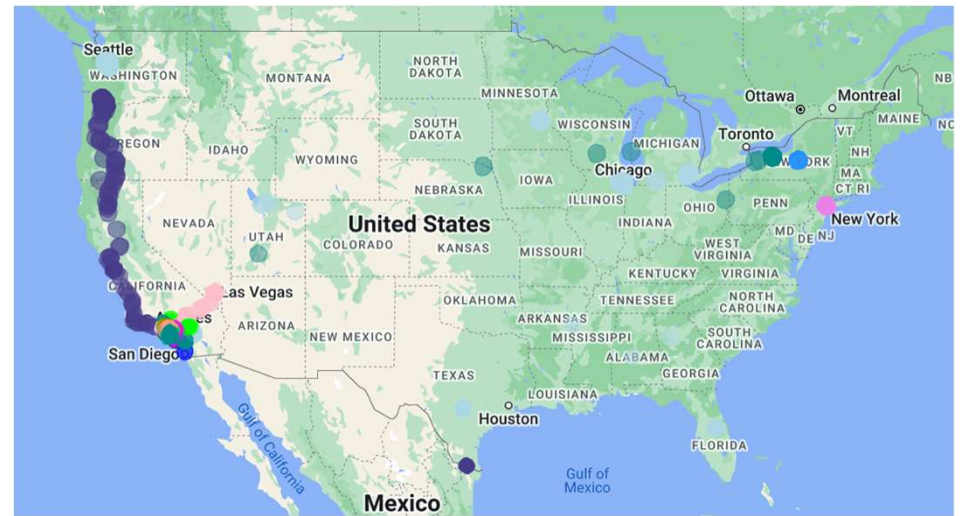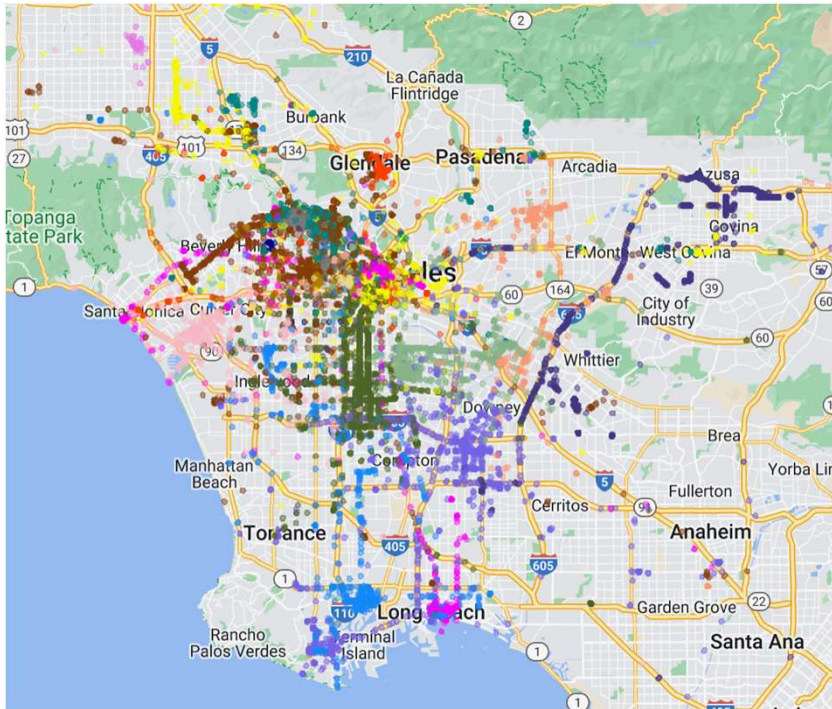
uTECH Phase 1: Predicting Risk Score

- Risk score predicted for iOS and Android users who have at least 30 days of social media data
- Model uses a list of risky words and how frequently our participants use them
  - i.e., What percentage of days include these words or phrases
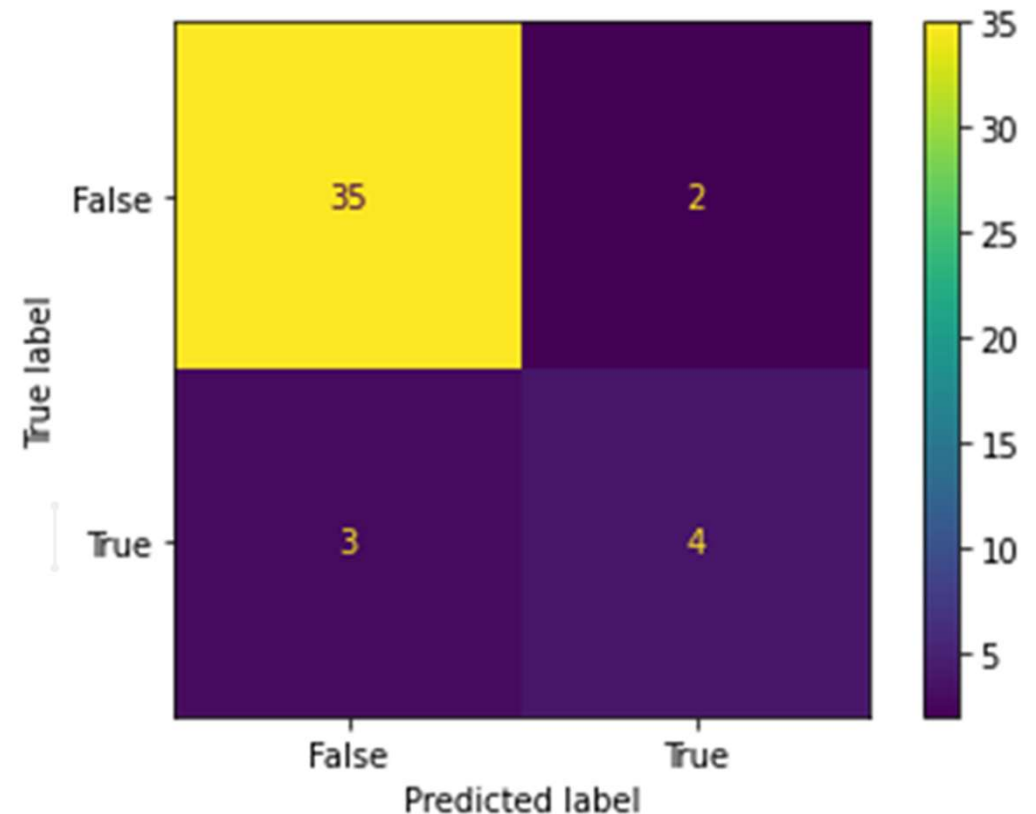- Model used linear regression

Methamphetamine Use

- Methamphetamine use can be determined from text data with 93% accuracy
  - Precision 0.95, Recall 0.90
  - Using a simple logistic regression model after TFIDF transformation
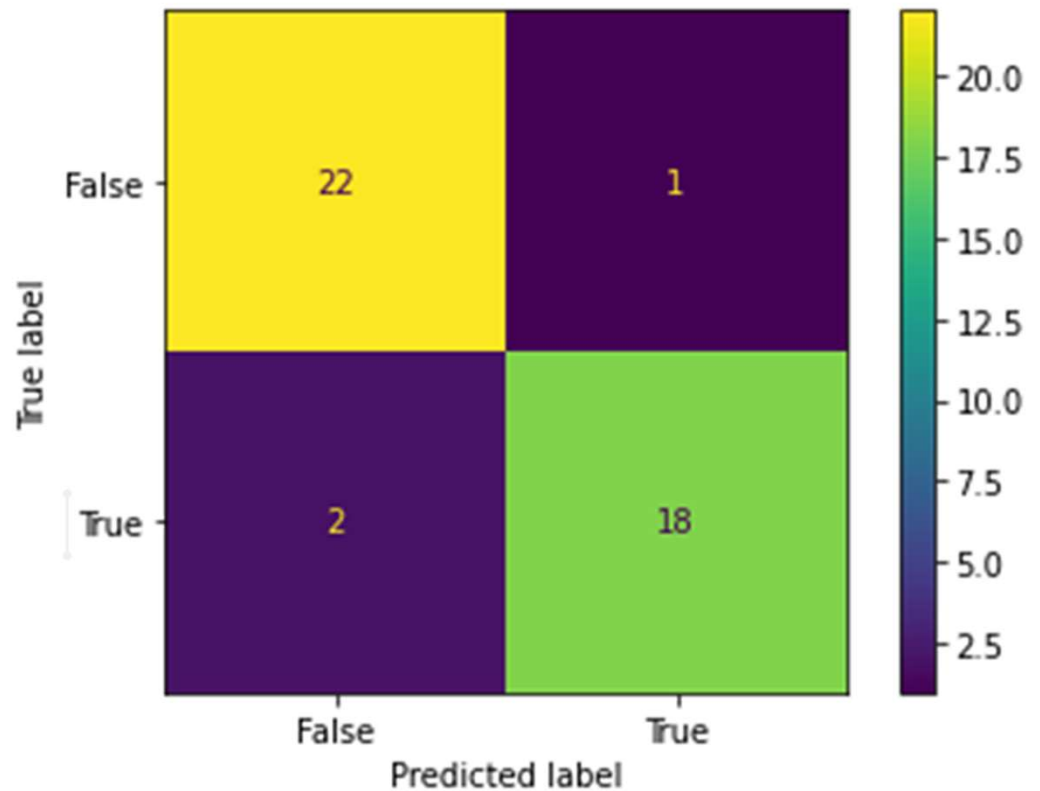
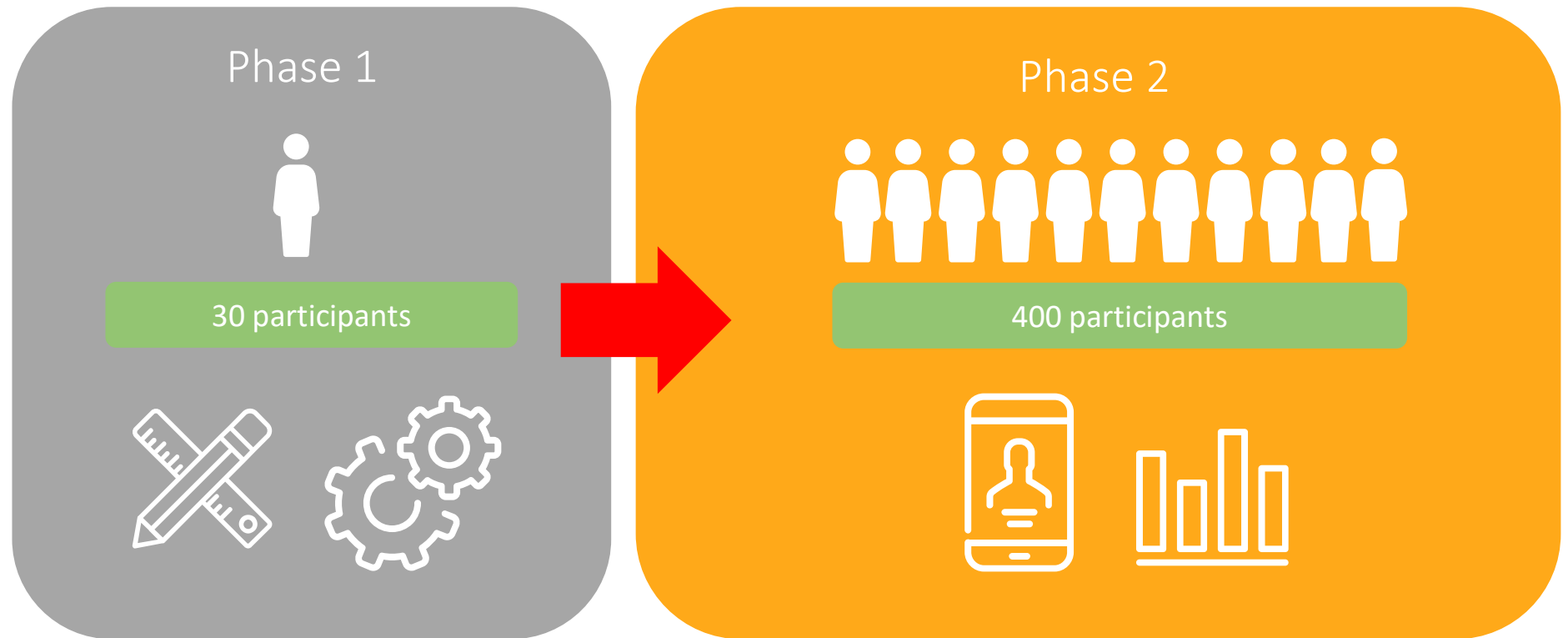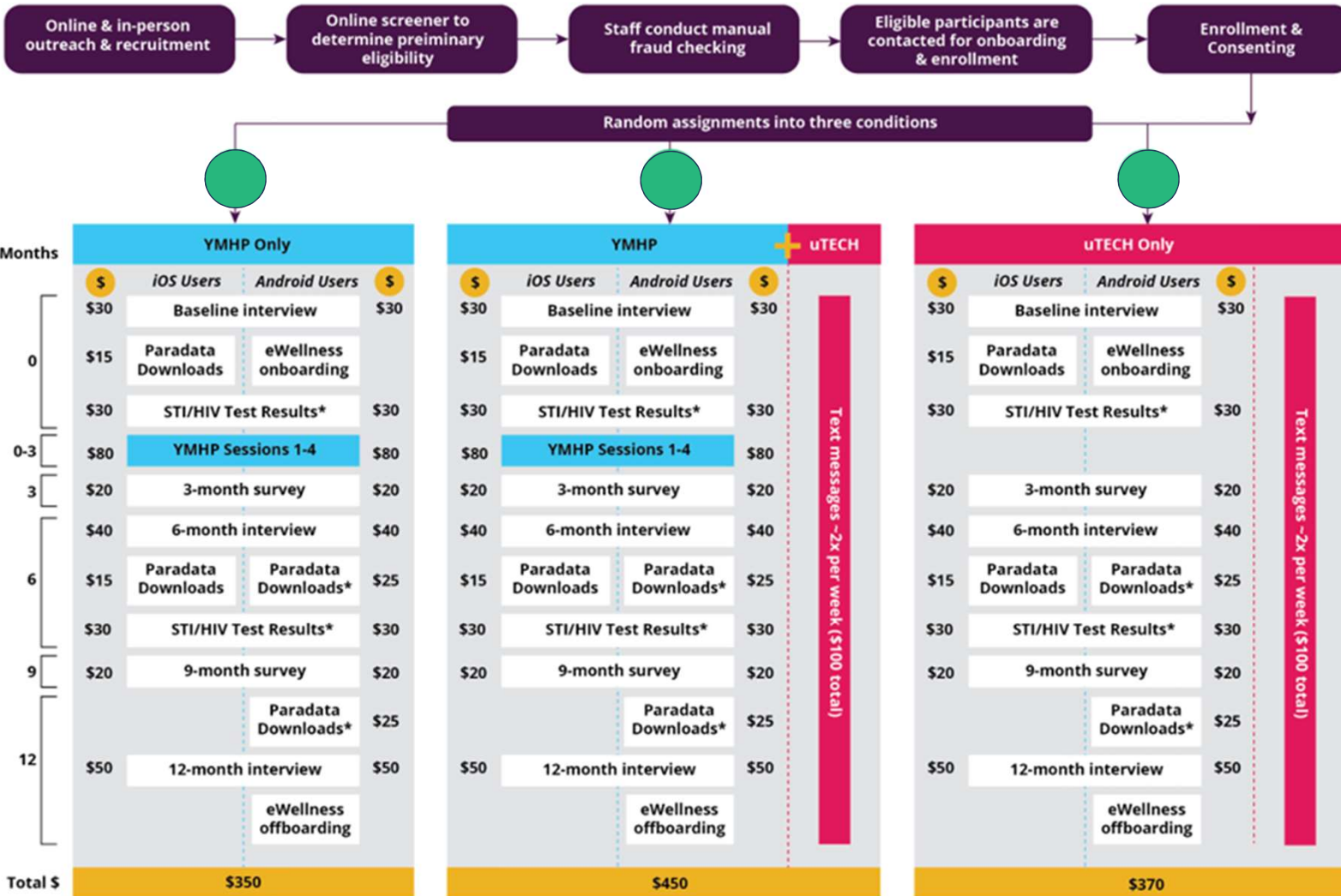# Injection Drug Use

- Injectable drugs are more difficult to detect
  - 89% accuracy
  - 0.67 precision, 0.57 recall
  - Using gradient boosting classifier
- Small number of positive participants makes task more challenging
  - Individuals might use different words/phrases

Assessing feasibility, accessibility and appropriateness

Phase 1

30 participants

Phase 2

400 participants

Phase 2 Methods

Online & in-person outreach & recruitment → Online screener to determine preiminary eligibility → Staff conduct manual fraud checking → Eligible participants are contacted for onboarding & enrollment → Enrollment & Consenting

Random assignments into three conditions

YMHP Only

Months	$	iOS Users	Android Users	$
0	$30	Baseline interview		$30
	$15	Paradata Downloads	eWellness onboarding	
	$30	STI/HIV Test Results*		$30
0-3	$80	YMHP Sessions 1-4		$80
3	$20	3-month survey		$20
6	$40	6-month interview		$40
	$15	Paradata Downloads	Paradata Downloads*	$25
	$30	STI/HIV Test Results*		$30
9	$20	9-month survey		$20
12			Paradata Downloads*	$25
	$50	12-month interview		$50
			eWellness offboarding	
Total $		$350		

YMHP + uTECH

$	iOS Users	Android Users	$
$30	Baseline interview		$30
$15	Paradata Downloads	eWellness onboarding	
$30	STI/HIV Test Results*		$30
$80	YMHP Sessions 1-4		$80
$20	3-month survey		$20
$40	6-month interview		$40
$15	Paradata Downloads	Paradata Downloads*	$25
$30	STI/HIV Test Results*		$30
$20	9-month survey		$20
		Paradata Downloads*	$25
$50	12-month interview		$50
		eWellness offboarding	
	$450		

Text messages ~2x per week ($100 total)

uTECH Only

$	iOS Users	Android Users	$
$30	Baseline interview		$30
$15	Paradata Downloads	eWellness onboarding	
$30	STI/HIV Test Results*		$30
$20	3-month survey		$20
$40	6-month interview		$40
$15	Paradata Downloads	Paradata Downloads*	$25
$30	STI/HIV Test Results*		$30
$20	9-month survey		$20
		Paradata Downloads*	$25
$50	12-month interview		$50
		eWellness offboarding	
	$370		

Text messages ~2x per week ($100 total)
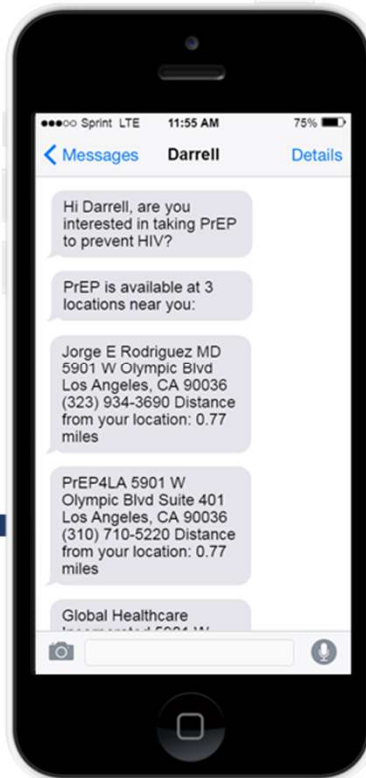
* Optional

uTECH "Push Notification"

Case #1

Darrell

- 20 year old, African American man
- Parties on the weekends
- Uses methamphetamine and GHB
- Often isn't able to successfully negotiate condom use

2. Machine pushes
a tailored prevention message
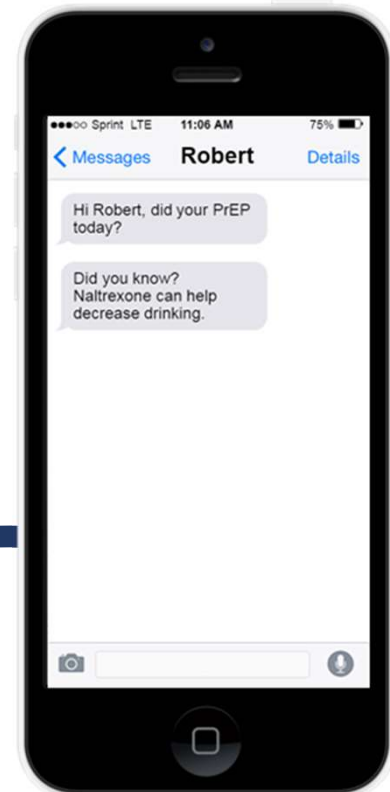
1. Machine detects
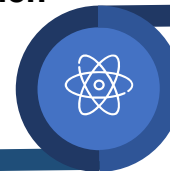he has or is approaching a risk event

Hi Darrell, are you interested in taking PrEP to prevent HIV?

PrEP is available at 3 locations near you:

Jorge E Rodriguez MD 5901 W Olympic Blvd Los Angeles, CA 90036 (323) 934-3690 Distance from your location: 0.77 miles

PrEP4LA 5901 W Olympic Blvd Suite 401 Los Angeles, CA 90036 (310) 710-5220 Distance from your location: 0.77 miles

Global Healthcare

Case #2

Robert

- 35 year old, white man
- PrEP user with inconsistent adherence
- Abuses alcohol

2. Machine pushes
tailored prevention messages
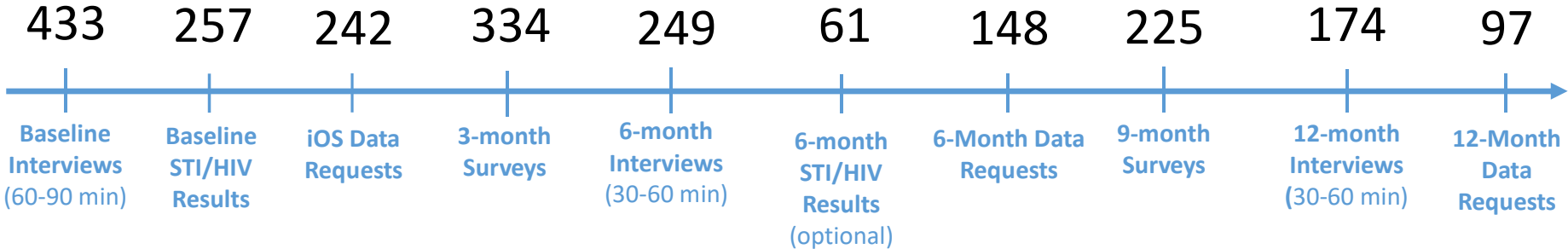
1. Machine leverages known information

Hi Robert, did your PrEP today?

Did you know? Naltrexone can help decrease drinking.

31

uTECH Examples: PrEP & Harm Reduction

	PrEP Initiation	Substance Use Harm Reduction
Informational	PrEP reduces the risk of getting HIV from sex by about 99% - if taken on an ongoing basis before sex and continued after sex. It's also called Truvada or Descovy. See where you can get it near you: https://preplocator.org/.	Here's a tip for staying hydrated while drinking: drink one glass of water for every alcoholic beverage you have. This is known as the 1-for-1 rule and may help moderate your drinking and lessen chance of hangover.
Motivational	Did you know that studies show taking PrEP lowers HIV-related anxiety? Are you less anxious about HIV when you're on PrEP?	If you ever inject with a friend, you could consider doing so at a safe injection site (SIS). SIS refers to places where people who use injectable, but illegal, opioids such as heroin, can do so without fear of overdose, prosecution or spreading disease. You can try looking up sites in your area to find them or contact a member of the research team for assistance.
Behavioral	Reply with the number of the statement that applies to you: 1. I have talked to a medical provider about getting PrEP but have not yet started taking it. 2. I already have talked to a medical provider about getting PrEP and have begun taking it. 3. I haven't talked to a medical provider about getting PrEP and haven't taken it yet.	Reply with the number of the statement that applies to you: Have you ever trusted someone to supervise you (or trip-sit) as you inject for safety purposes? 1. Yes, always. 2. Yes, but only once/a few times. 3. Yes, but I would not do it again. 4. No, but I would like to in the future. 5. No, I don't feel comfortable being supervised.

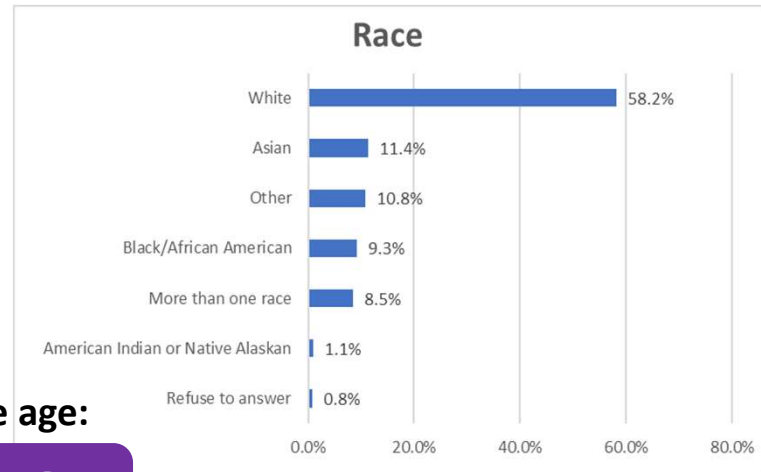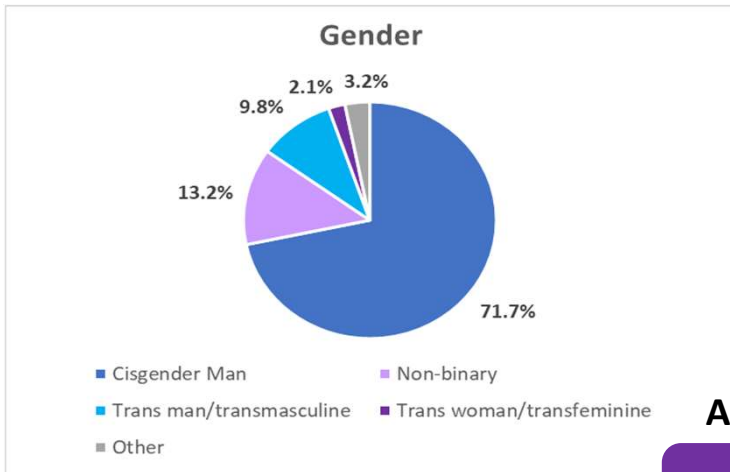# uTECH Phase 2: Recruitment, Enrollment, Data Collection

9,684 screened

433 interviewed

378 enrolled or offboarded

Data Collected

433	257	242	334	249	61	148	225	174	97
Baseline Interviews (60-90 min)	Baseline STI/HIV Results	iOS Data Requests	3-month Surveys	6-month Interviews (30-60 min)	6-month STI/HIV Results (optional)	6-Month Data Requests	9-month Surveys	12-month Interviews (30-60 min)	12-Month Data Requests

Dec. 2023
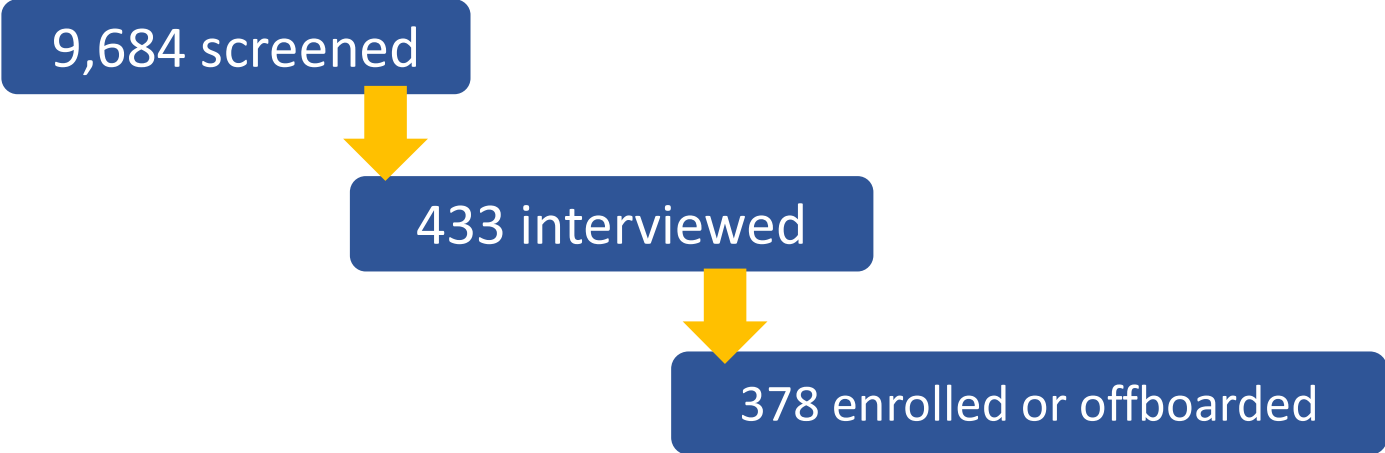
uTECH Phase 2: YMHP (n=342)

Session	Complete (n)	Complete (%)
YMHP1	288	84%
YMHP2	268	78%
YMHP3	254	74%
YMHP4	239	70%

Phase 2 Baseline: Participant Demographics (n=378)

Gender

- 71.7% Cisgender Man
- 13.2% Non-binary
- 9.8% Trans man/transmasculine
- 2.1% Trans woman/transfeminine
- 3.2% Other

Race

- White — 58.2%
- Asian — 11.4%
- Other — 10.8%
- Black/African American — 9.3%
- More than one race — 8.5%
- American Indian or Native Alaskan — 1.1%
- Refuse to answer — 0.8%

Average age:

24.6

Education

- 9 - 11 Grade — 1.3%
- High-school/GED — 9.8%
- Some college — 23.8%
- Technical/Associate's — 8.2%
- Bachelor's degree — 37.8%
- Master's degree — 15.1%
- Doctorate — 3.4%
- Refuse to answer — 0.5%

Sexual Orientation

- Gay — 65%
- Bisexual — 16%
- Queer — 6%
- Pansexual — 2%
- Straight/Heterosexual — 1%
- Other — 10%
- Blanks — 1%

Phase 2: Measures

Primary Measures:

Feasibility

Acceptability

Appropriateness

of uTECH text messages

Secondary Measures:

Methamphetamine Use

PrEP & PEP Use

Injection Drug Use

Intimate Partner Violence

Vaccination

Stigma

Hook-up App Use

Phase 2 Baseline: PrEP/PEP Use

**PrEP Use
(n=378):**

188 (50%)

**Used PEP in =< 6
months prior to
baseline (n=378):**

12 (3%)

PrEP Adherence (n=188)

In the last 7 days, rate your ability to take ALL of
your PrEP medications? (n=188)

Rating	Percentage
Excellent	22%
Very Good	14%
Good	6%
Fair	4%
Poor	2%
Very poor	1%
Refuse to answer	1%
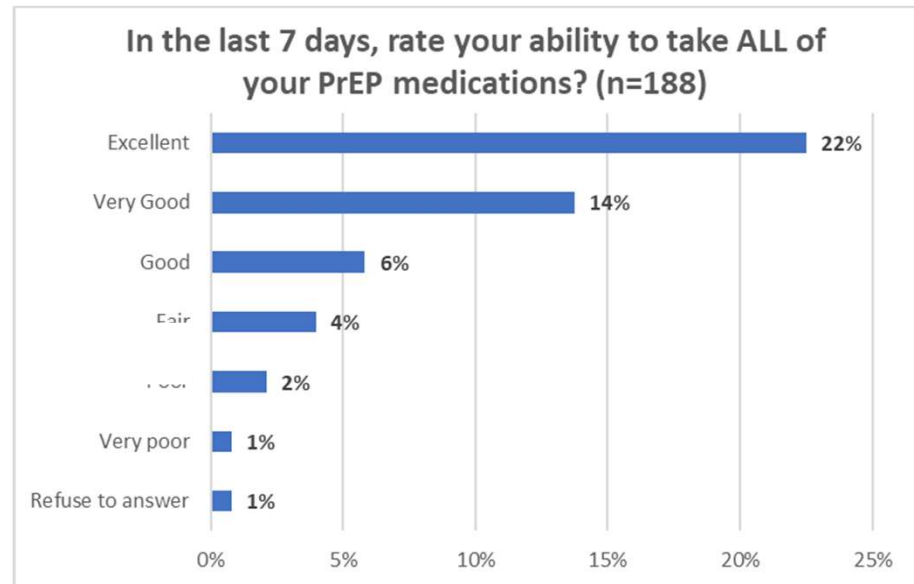
Phase 2 Baseline: PrEP Stigma

PrEP Stigma (n=295)   "People experience negative judgement because they take PrEP"

"My family would be supportive
of me taking PrEP"

25% disagree

"People taking PrEP would be
seen by others as slutty"

41% agree

"People experience negative
judgement because they take PrEP"

35% agree

Phase 2 Baseline: Secondary Measures

Meth use =< 6 months since baseline (n=378)

Any	38	10%
None	340	90%

Injection drug use =< 6 months since baseline (n=378)

Any	14	4%
None	364	96%

Phase 2 Baseline: Most popular dating/social media apps
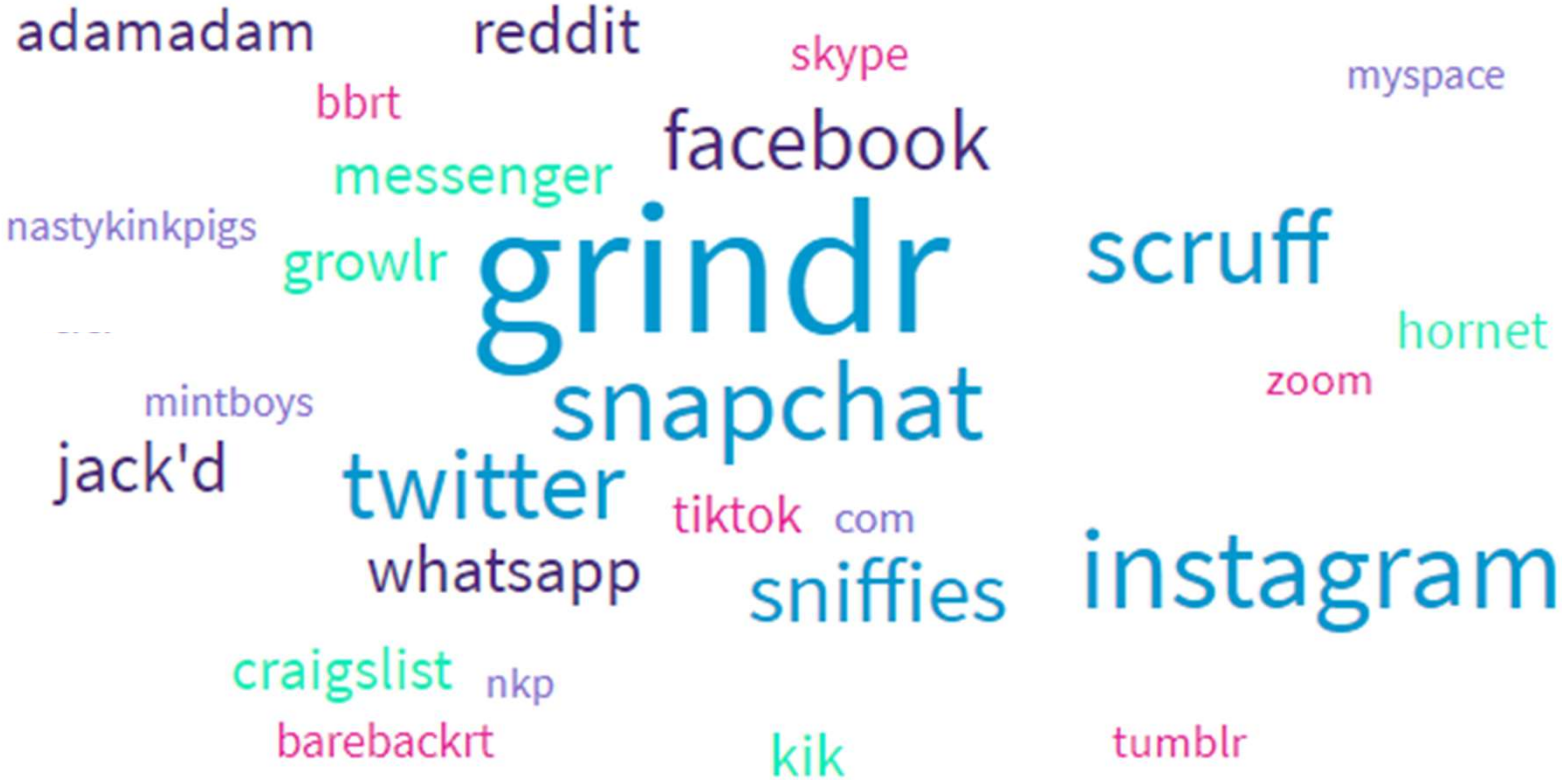
GPS Visualization – Phase 2

Implications & Future Directions

- Real time data monitoring is possible with participant consent
- Intimate partner violence is emerging as a risk factor for substance use and HIV risk
- Ideas for future directions:
  - 12-step program with integrated data monitoring by sponsor
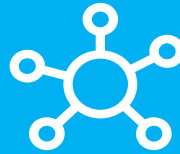
Opportunities for Collaboration

Data Topics	Data Type	Data collection points
YMHP – Confidence, Commitment, Readiness	Qualitative	One time
Feedback received on informational, motivational, behavioral text messages	Qualitative	Twice weekly for 12 months
Sexual risk behavior	Survey	Baseline, 3-month, 6-month, 9-month, 12-month
Intimate Partner Violence	Survey	Baseline, 3-month, 6-month, 9-month, 12-month
STIs	Survey	Baseline, 3-month, 6-month, 9-month, 12-month
Substance Use	Survey	Baseline, 3-month, 6-month, 9-month, 12-month
Substance & Sex Seeking via Social Networking	Survey	Baseline, 3-month, 6-month, 9-month, 12-month
Mpox attitudes, behaviors, and vaccination status	Survey	Baseline, 3-month, 6-month, 9-month, 12-month
COVID-19 attitudes, behaviors, and vaccination status	Survey	Baseline, 6-month, 12-month
Geolocation data (Android)	App	Continuous over 12 months
Keyboard tracking data (Android)	App	Continuous over 12 months

Acknowledgments

Thank you!

holloway@luskin.ucla.edu