

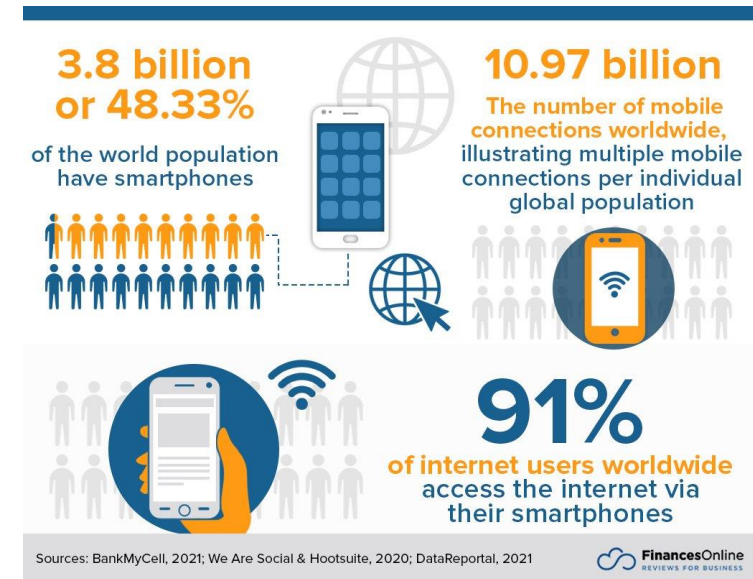
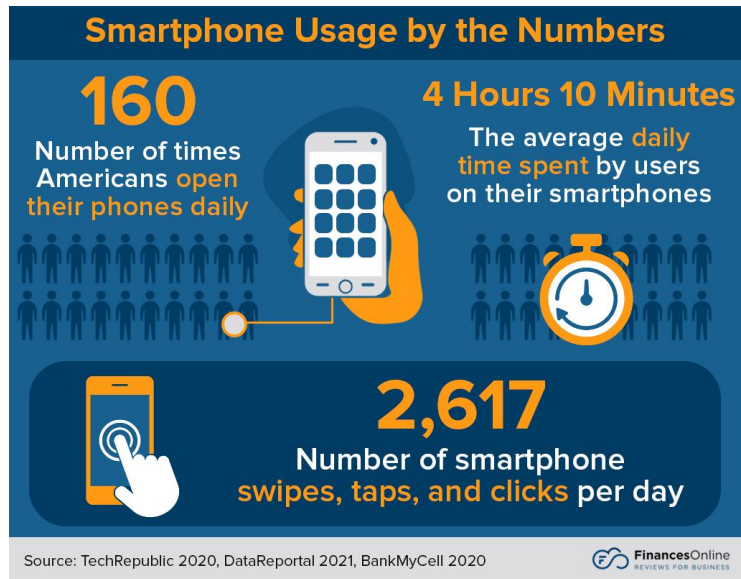


Innovations in digital health strategies for engaging youth in HIV treatment and prevention

LISA HIGHTOW-WEIDMAN, MD, MPH

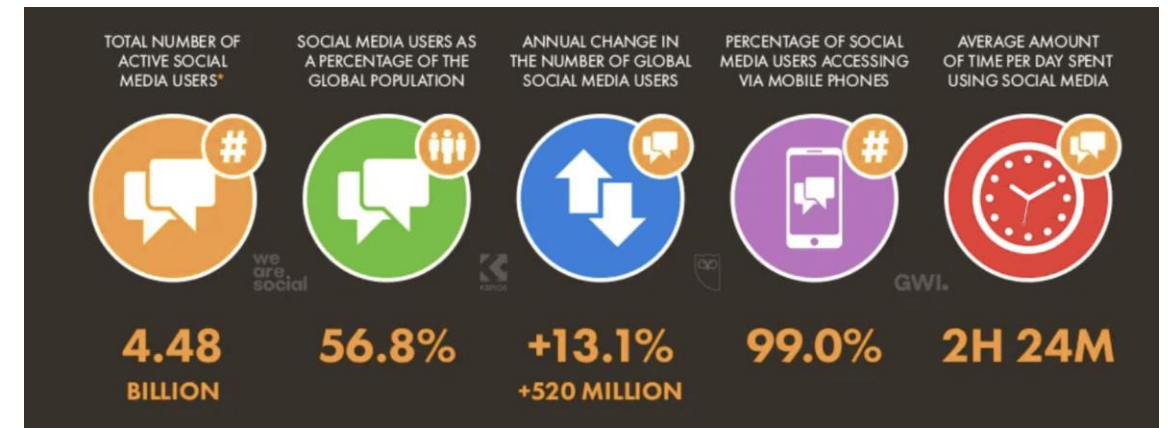
PROFESSOR MEDICINE AND HEALTH BEHAVIOR, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL (UNC)

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■ Mobile phones are pervasive among youth

- 95% report having a smartphone or access to one
- 90% go online at least multiple times per day



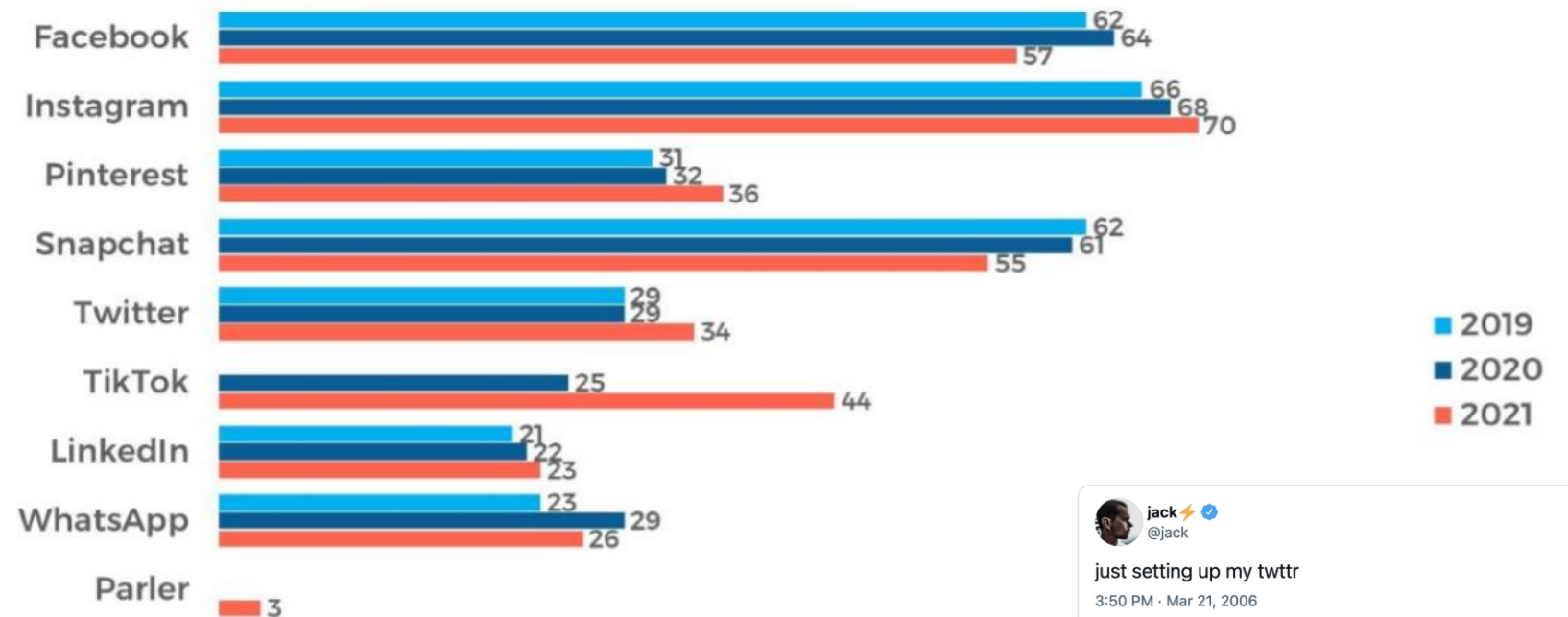
(200 YEARS OF) SOCIAL CONNECTIONS



Social Media Brand Usage (Age 12-34)

U.S. POPULATION

% USING SOCIAL MEDIA BRAND



WHY MHEALTH?



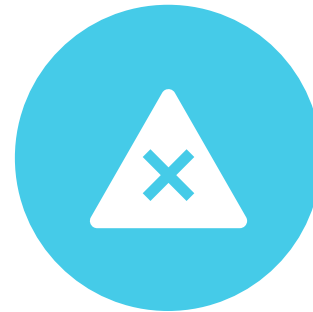
What is the health behavior wish to change?



Why is mHealth the “right” solution to address the problem?



Why is mHealth better than other solutions?



What has already been done?

TECHNOLOGY-BASED PLATFORMS

Basic Phone

Basic
Voice

SMS

Feature Phone

Basic Phone+

Internet-enabled
service

SMS+
Pictures

Smartphone

Camera

GPS

Feature Phone+

Accelerometer /
gyroscope

Onboard sensors

System logs

Microphone

Wi-Fi

Bluetooth



Short message
service (SMS)

Web-based +/-
mobile
optimization

Smartphone apps

Social
networking/media-
based

Telehealth, video
counseling

Virtual reality,
Artificial
Intelligence (AI)

Sensors/Wearable
devices

Electronic
Adherence
Monitors

TECHNOLOGY-BASED APPROACHES

WHAT MHEALTH FEATURES ARE CRITICAL TO INTERVENTION ENGAGEMENT?

- In many digital health intervention trials, a substantial proportion of users drop out before completion or stop using the app/website.
- Incorporating “youth focused” engagement strategies can support acceptability, usability, and adherence

- ✓ Tailoring interventions to users
- ✓ Fostering social (peer) support
- ✓ Inclusion of game-based elements
- ✓ Provision of self-monitoring/feedback
- ✓ Inclusion of “push factors” (reminders, notifications)

PREFERENCES FOR COMPREHENSIVE DIGITAL HEALTH INTERVENTIONS

- Formative studies have identified comparable preferences for intervention components across multiple settings (both US and globally).
- Features mentioned consistently include:

- ✓ Facilitating connections to peers and providers
- ✓ Inclusion of discrete reminders for HIV prevention/care related activities
- ✓ Provision comprehensive, holistic and accurate information
- ✓ Games/rewards/incentives for usage
- ✓ Careful attention to privacy/confidentiality

INNOVATIONS IN DIGITAL HEALTH STRATEGIES FOR PREVENTION

Domain	Intervention Components	Examples of evidence-informed interventions*
Sexual risk behavior	Information, motivation and skills-based activities, narrative story-telling, peer support	HealthMpowerment , Keep it Up, S4E, MyPEEPS, Tumaini
HIV testing	Tailored provision of testing plans, HIV self-testing w/ App-based ordering, geofencing, telehealth-support, social media strategies	MyChoices , LYNX , HealthMindr, Get Connected , We Prevent , HOPE, eSTAMP, CyBER/testing, Tu Amigo Pepe, eTest, Stick To It
PrEP uptake	Self-monitoring, risk estimators, telehealth platforms, PrEP navigation, machine learning algorithms	ePrEP , TechStep , PrEPTECH, PrEP@Home, EHR prediction tools
PrEP adherence and persistence	Information, motivation and skills-based activities, medication tracking and feedback, reminders, peer support, adherence coaches	P3 , PrEPmate, mSMART, ViralCombat

* Evidence-informed includes interventions that have shown feasibility, acceptability or preliminary efficacy

TECHNOLOGY TO SUPPORT VIRAL SUPPRESSION



Adaptation of **Thrive With Me** app which uses enhanced peer-to-peer interaction, medication reminders and self-monitoring, and ART and HIV informational content to improve adherence

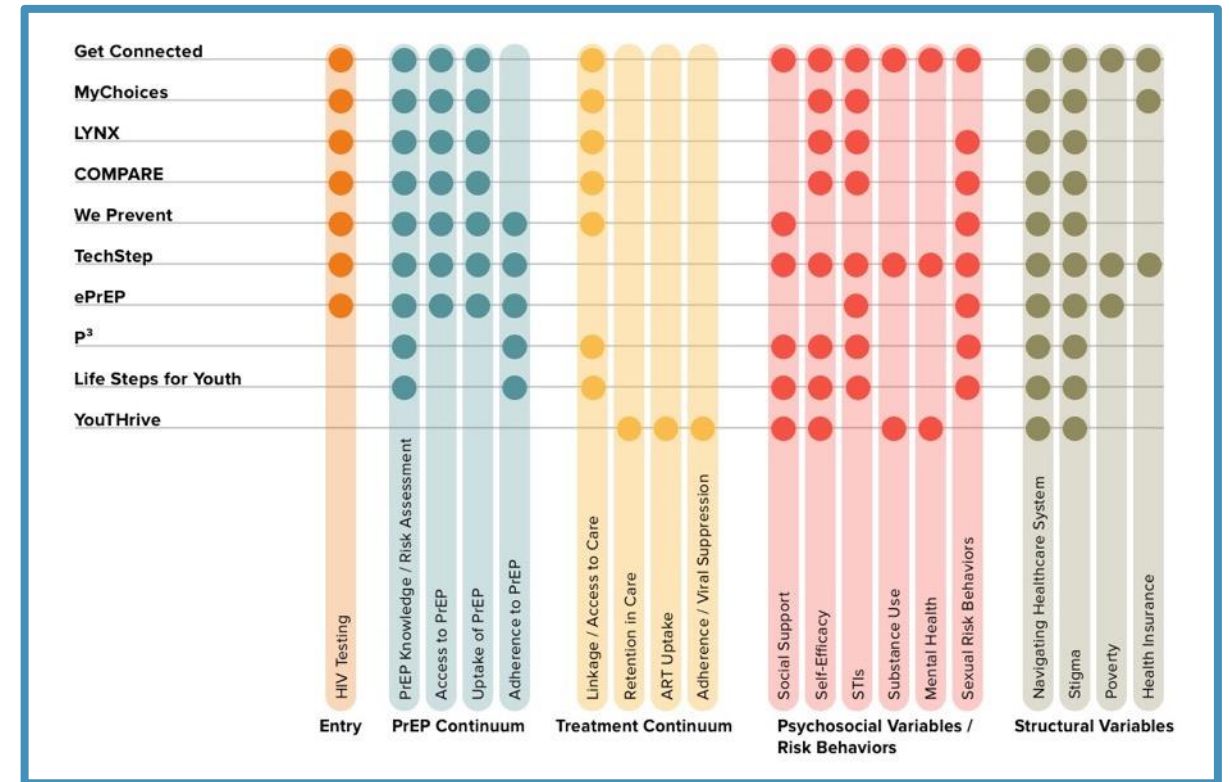


Tough Talks was developed for young men living with HIV to learn about HIV disclosure and to practice disclosing (or not disclosing) their HIV status to partners in a safe space.

iTECH: TECHNOLOGY WITHIN THE ATN



- One of three funded U19's comprising the Adolescent Trials Network (ATN)
- iTech supports 10+ technology-focused studies addressing the full prevention and care continuum for youth
- Majority of studies engaging HIV-SGM youth.
- One study for youth living with HIV
- >3100 participants enrolled in studies to date



iTech funded through U19HD089881

SIGNIFICANT CHALLENGES DIMINISH THE POTENTIAL FOR DHIs TO ACHIEVE BROAD DISSEMINATION AND SUSTAINED IMPACT

User engagement with DHIs is often low.

DHI content development and management processes are highly inefficient and time consuming.

Few DHI projects are equipped to efficiently incorporate new scientific knowledge into intervention content on an ongoing basis.

While there has been significant public investment in DHI programs for HIV, re-use and sharing of these investments is minimal, and few DHIs for HIV have demonstrated widespread dissemination.

ONE MAGIC APP DOES NOT (AND WILL NEVER) EXIST

- HIV prevention requires scalable interventions that are tailored toward multiple unique profiles of HIV-related risk and be adaptive to shifts in the same individual's risk profile (e.g., “seasons of risk”) over time
- Need to be thinking about app “suites” or better yet, **responsive suite** of evidence-supported digital interventions within a unified platform

Can we create a platform that allows for user customization of their HIV prevention and care needs through a menu of interventions delivered in real-time?



HMP PLATFORM DEVELOPMENT

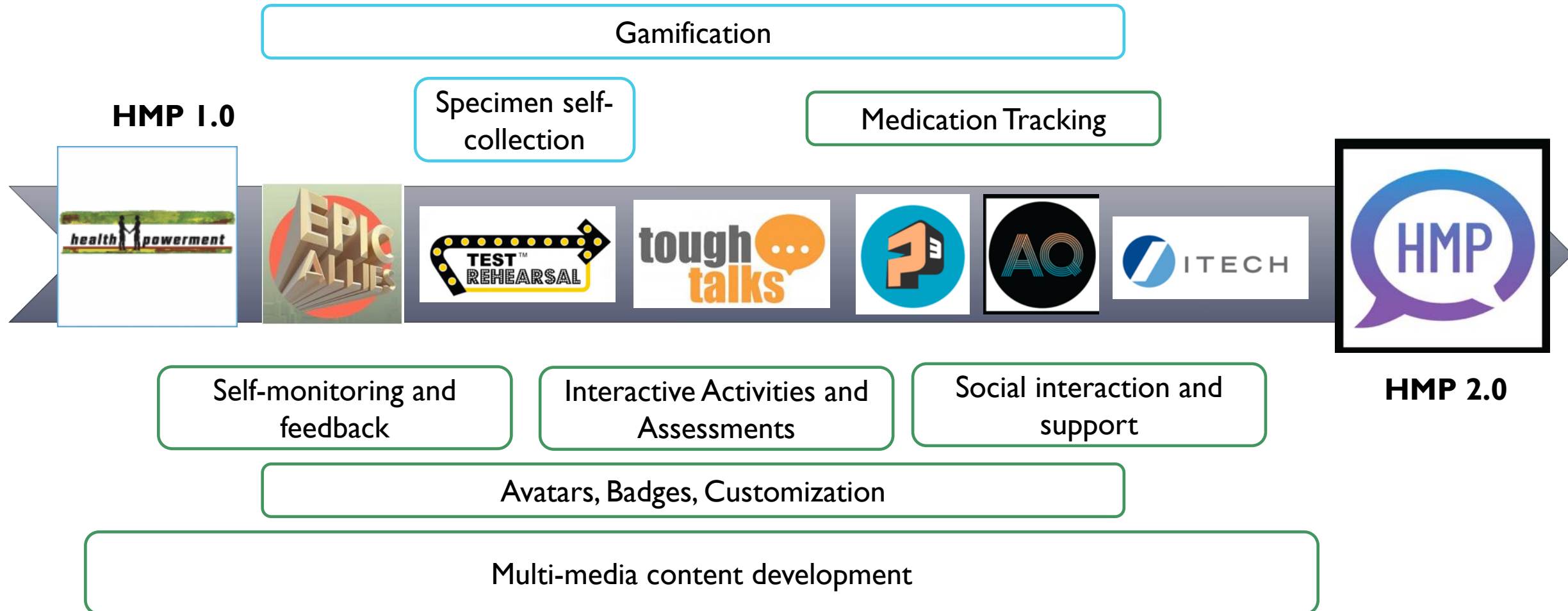
HMP 1.0



HMP 1.0

- HealthMpowerment (HMP) is a theory-based, status-neutral intervention designed to reduce sexual risk via a **mobile optimized platform**.
- HMP 1.0 was tested in a statewide randomized controlled trial (RCT) in North Carolina with 474 Black MSM (age 18-30) and found **statistically significant** reductions in condomless anal intercourse
- The study also found that greater engagement with the platform was associated with secondary effects such as:
 - HIV-related communication (e.g., provider communication, HIV status disclosure to sexual partners)
 - HIV care outcomes (e.g., perceived barriers to treatment access, engagement in care, self-reported adherence)

HMP PLATFORM DEVELOPMENT



VISION



- We want to build a feature-rich platform that incorporates the latest behavior change research and the latest advances in Human-Computer Interaction (HCI) and Artificial Intelligence (AI).
- Our vision for the future of HMP is to leverage this common platform to deliver a broader scope of capabilities to intervention studies within a reasonable budget and faster turn-around than *de novo* development.

HealthMpowerment (HMP) strives to be a state-of-the-art Digital Health Intervention platform

PHILOSOPHY



- A dedicated group of technologists and researchers work together daily to improve the platform and keep content up-to-date, fresh, and relevant.
- Our model is akin to a community Co-op. Everyone buys into the platform, and everyone shares in the enhancements, content and bug fixes made by the community at large
- Improving the capabilities of the apps that end up in the hands of at-risk individuals improves user engagement and patient outcomes.

a co-op is
A Social Enterprise Meeting Community Needs

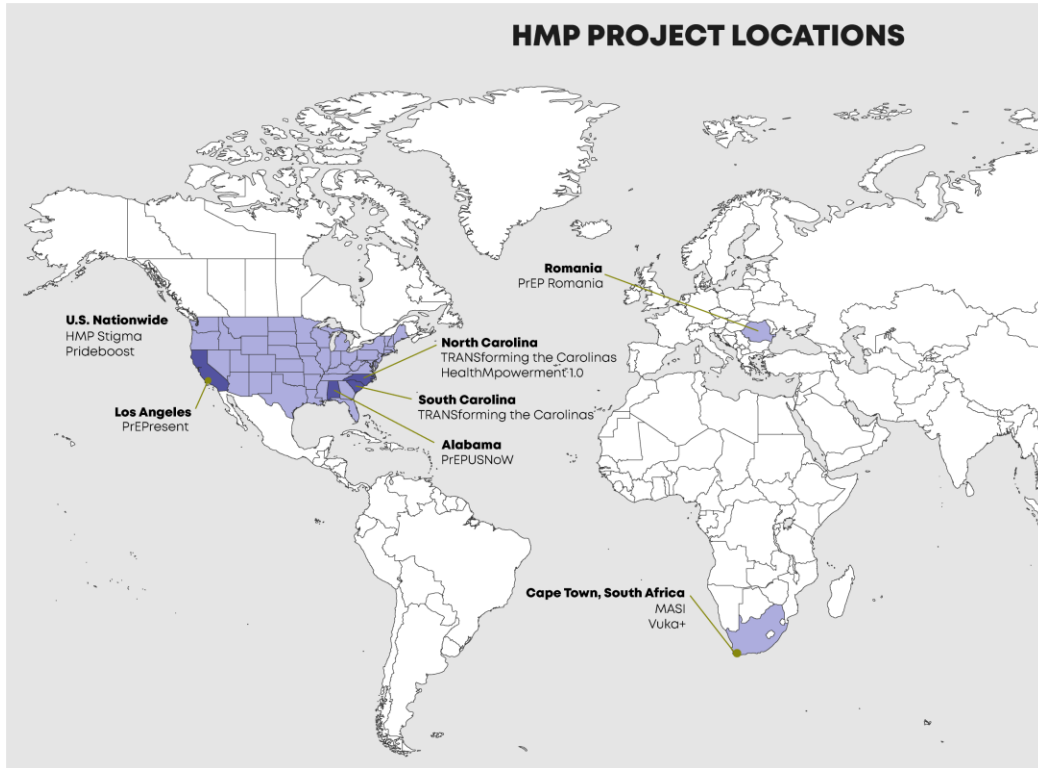
WHY BUILD ON –VS – BUILD ANEW?



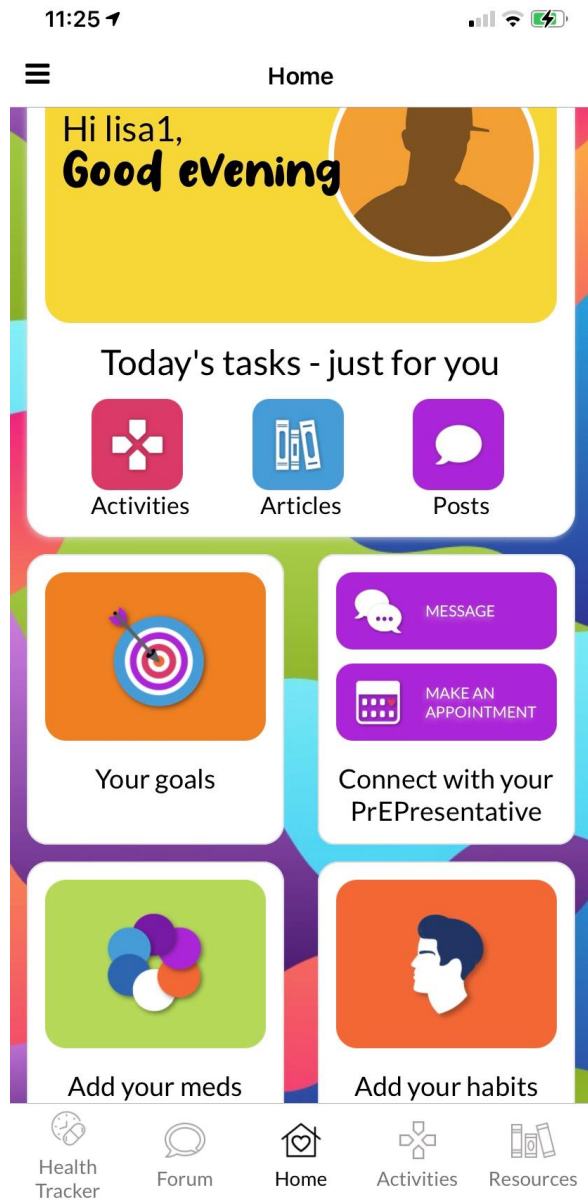
HMP 2.0



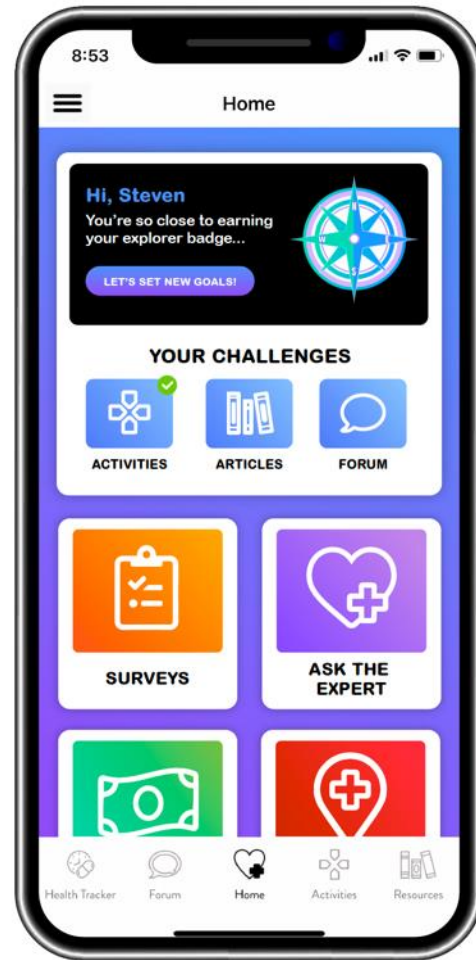
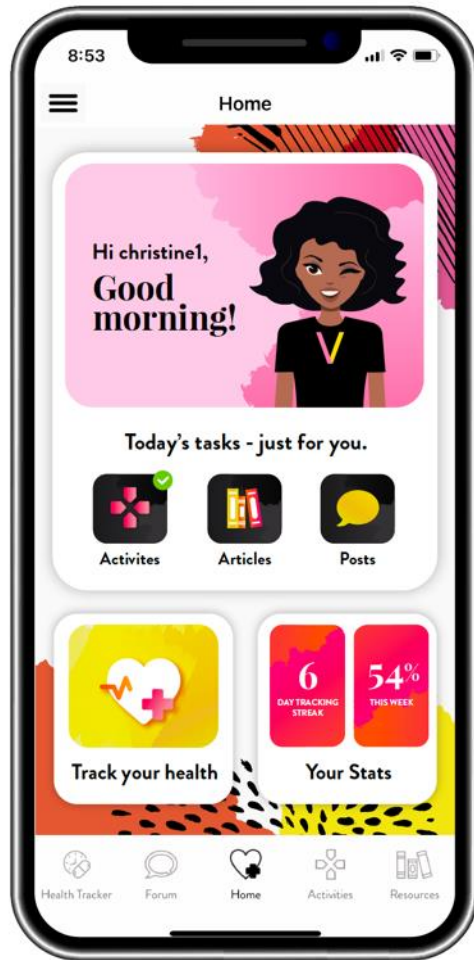
HMP PROJECT LOCATIONS



- Updated for delivery via iOS and Android smartphones
- Currently being used to support:
 - Stigma reduction and HIV outcomes
 - PrEP uptake and adherence
 - ART adherence
 - Engagement in care
 - Transgender community health workers
 - Peer support/Social capital



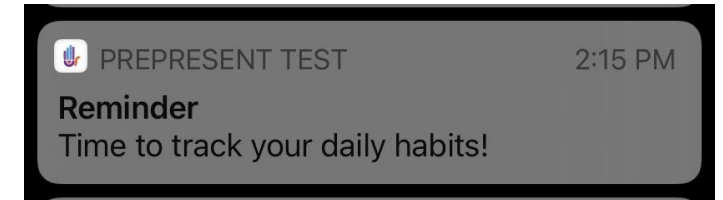
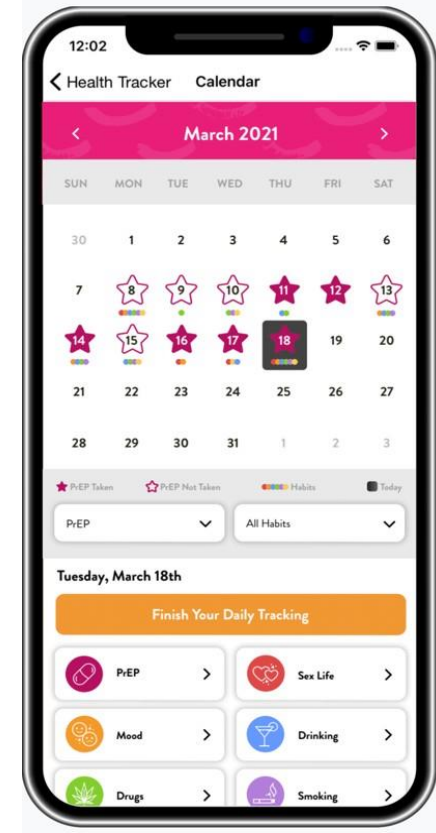
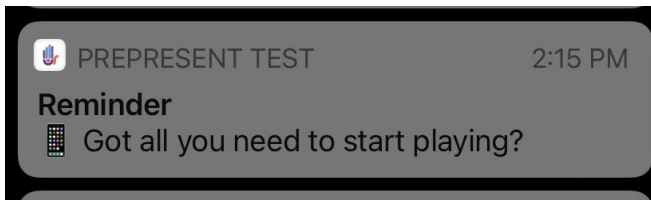
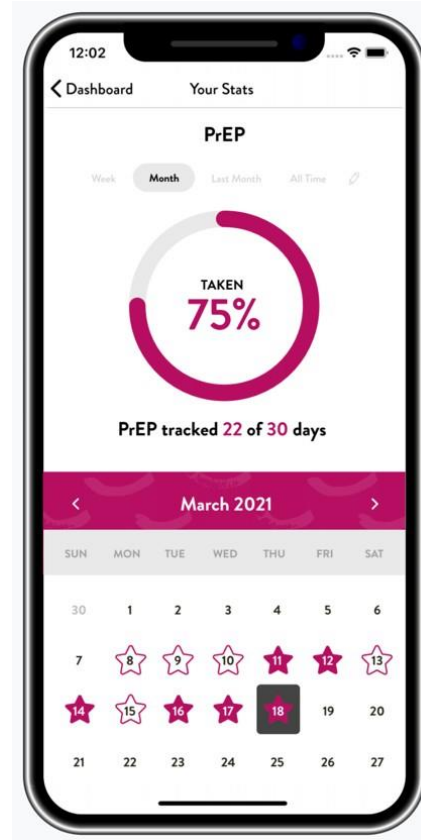
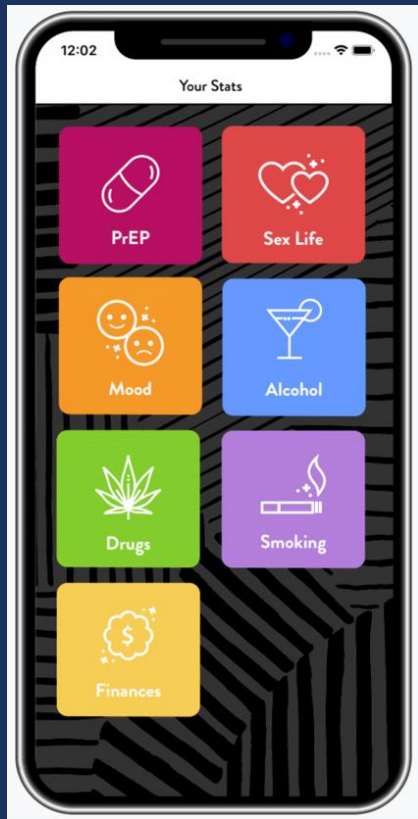
Study timeline	Access to upcoming study-related activities (surveys, incentives, specimen collection)
Resources	Multi-media content tailored for SGM populations of varying developmental stages
Activities	Information and skills building activities include quizzes, self-assessments, choose-your-own-adventure, etc.
Goals	Includes goal setting, milestones, tasks with goal progress and reminders
Forum	Social component for user-generated content to include peer-to-peer sharing, exchange of health information and discussions
Ask the Expert	Expert Q&As
Medication Tracker	Includes calendar and provision of user feedback.
Health Tracker	Self-monitoring of behaviors known to impact PrEP/ART adherence with reminders and provision of tailored feedback
Communication Portal	Two-way secure messaging between participants and staff; Calendar allows participants to request sessions (via in-app text, phone, video) and receive reminders to promote attendance

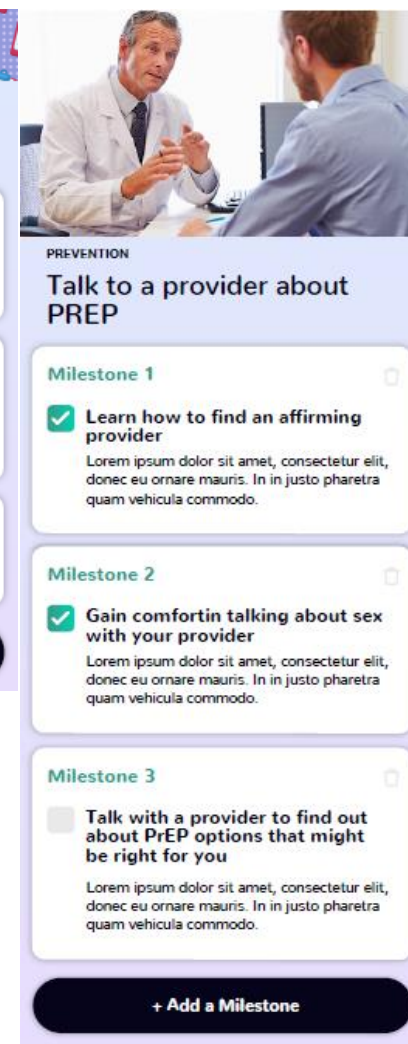
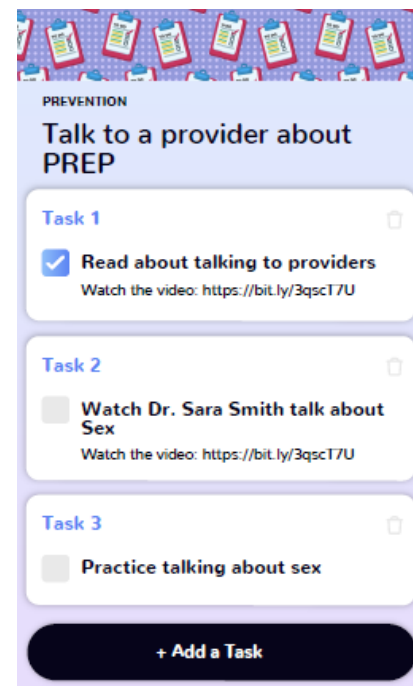
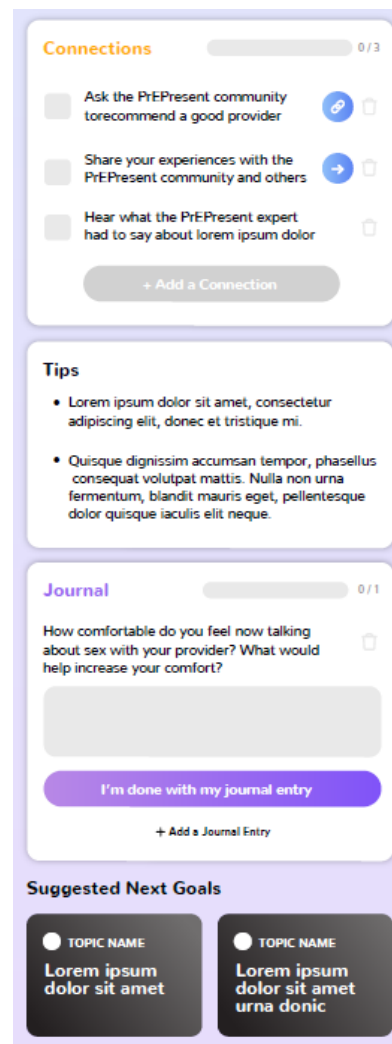
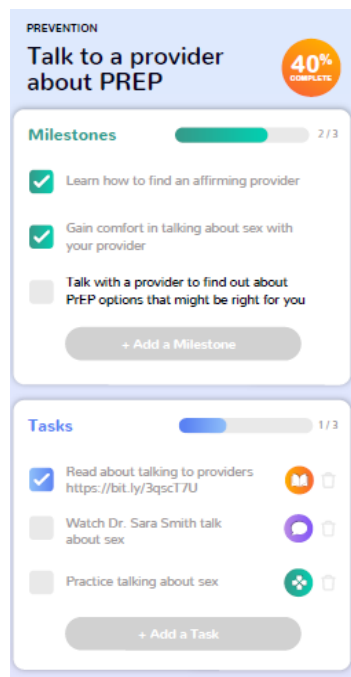
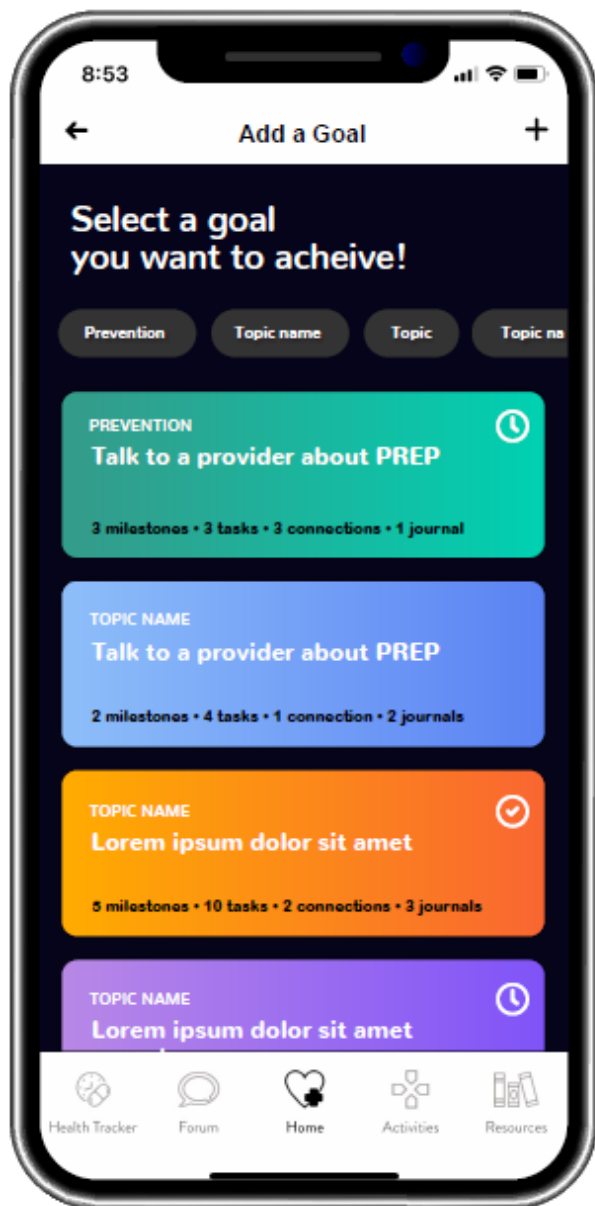


CUSTOMIZATION,
BRANDING &
TAILORING

Home screen examples

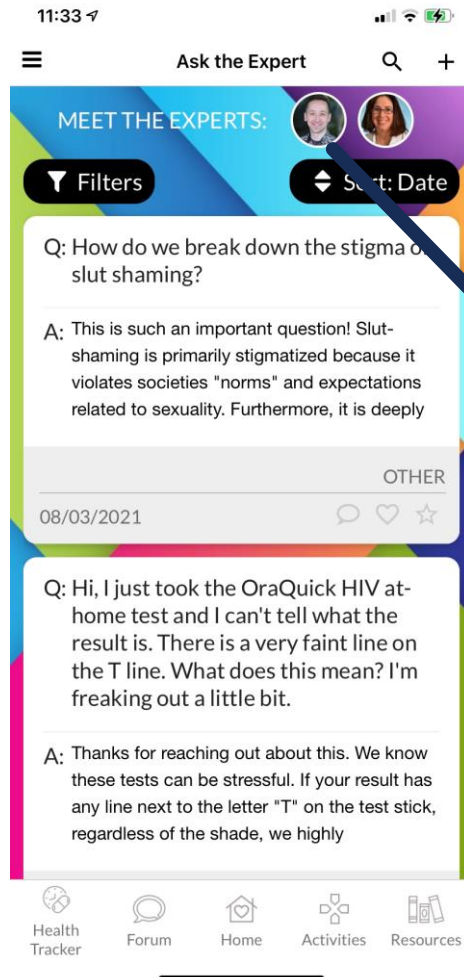
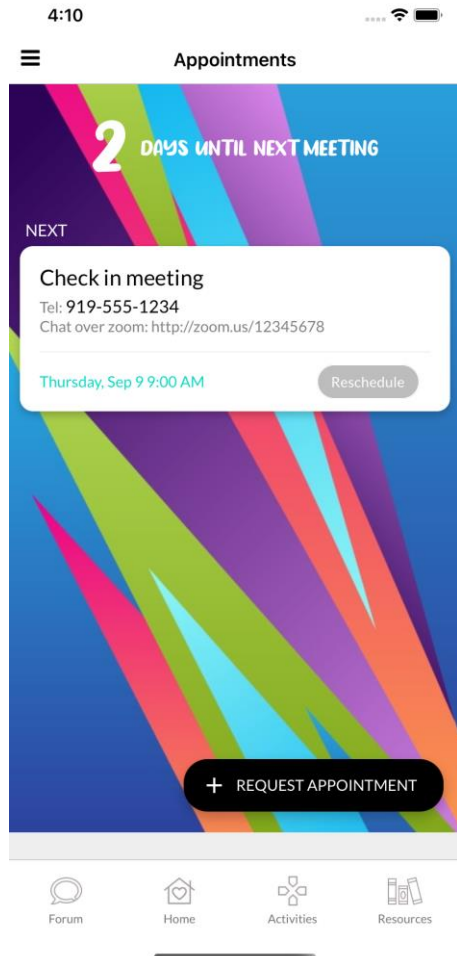
MEDICATION AND BEHAVIOR TRACKING





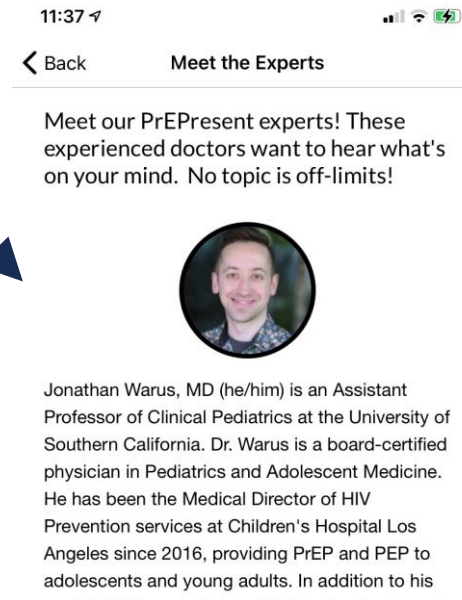
GOAL SETTING

Connection to Care



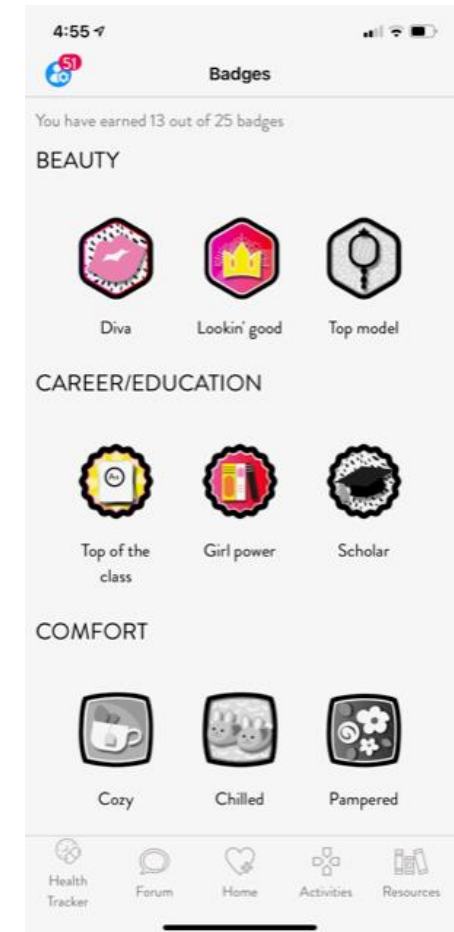
CARE NAVIGATION AND ASK AN EXPERT

ANSWER QUESTIONS, CONNECT TO RESOURCES, DELIVER INTERVENTIONS



GAME-BASED ELEMENTS

- Likely necessary but not sufficient for persistent engagement
- Virtual Rewards (Badges, levels, in-app content)
- Can be tied to tangible “Real-Life” Rewards (Financial incentives)



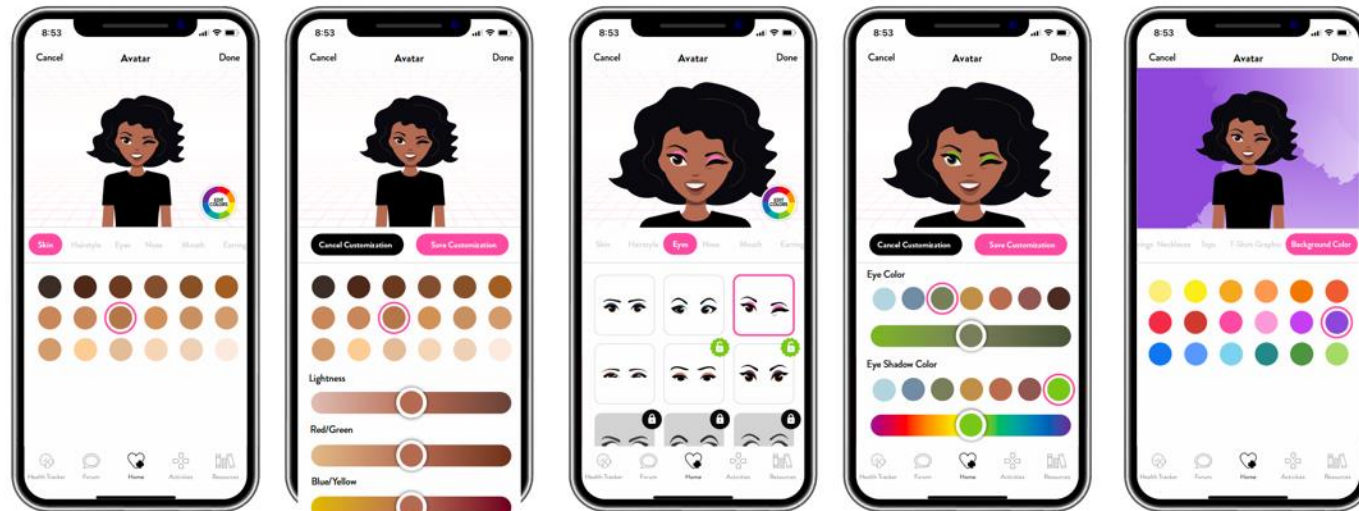
Tops



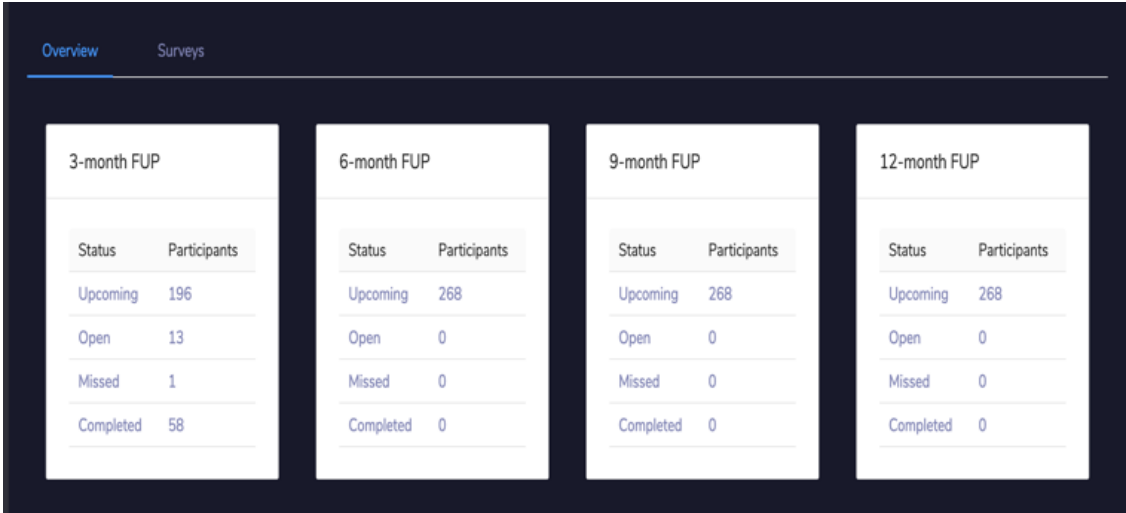
Hair



AVATARS AND GAMIFICATION SUPPORT ONGOING ENGAGEMENT

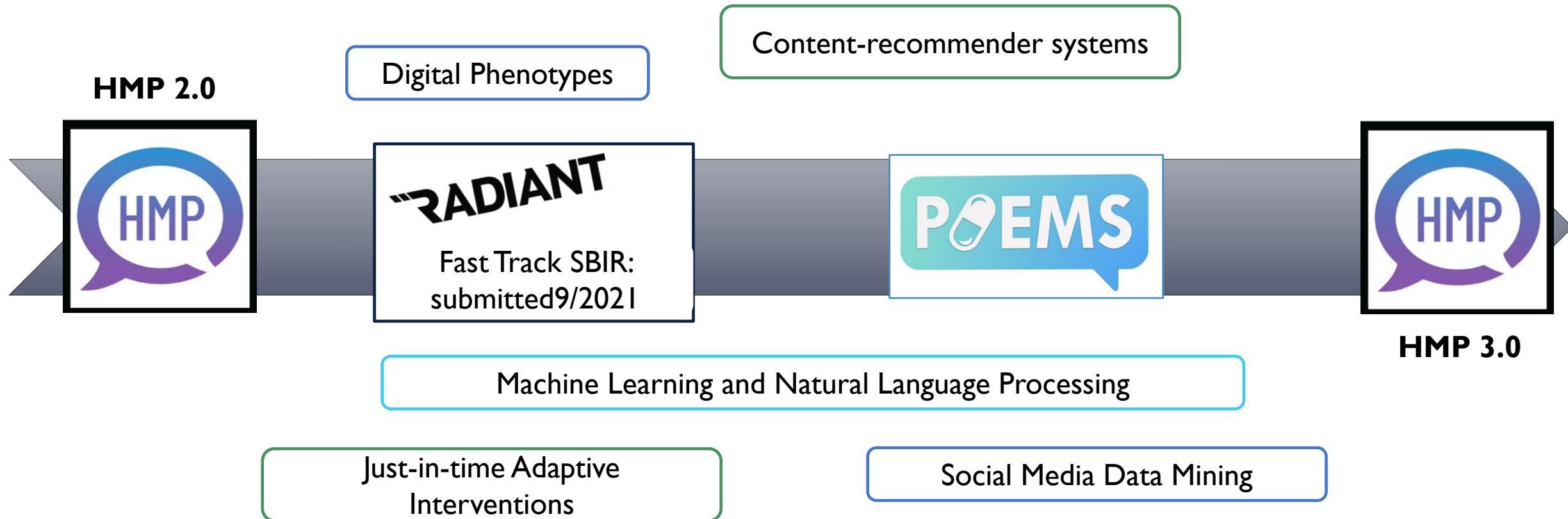


Study Management Administrative dashboard



Administration Dashboard	
Communication portal	Allows for participant management including two-way, secure, direct in-app messaging, and automated in-app and push notifications
Test Kit Portal	Allows for ordering and uploading testing results
Study Management	Survey integration and incentive tracking
Analytics	Every participant action is recorded as an “event”
	Dashboard includes set of event visualizations and provides export capabilities to monitor engagement and perform engagement analyses
Security	HIPPA compliant, encryption of data at rest and in transit

HMP PLATFORM DEVELOPMENT

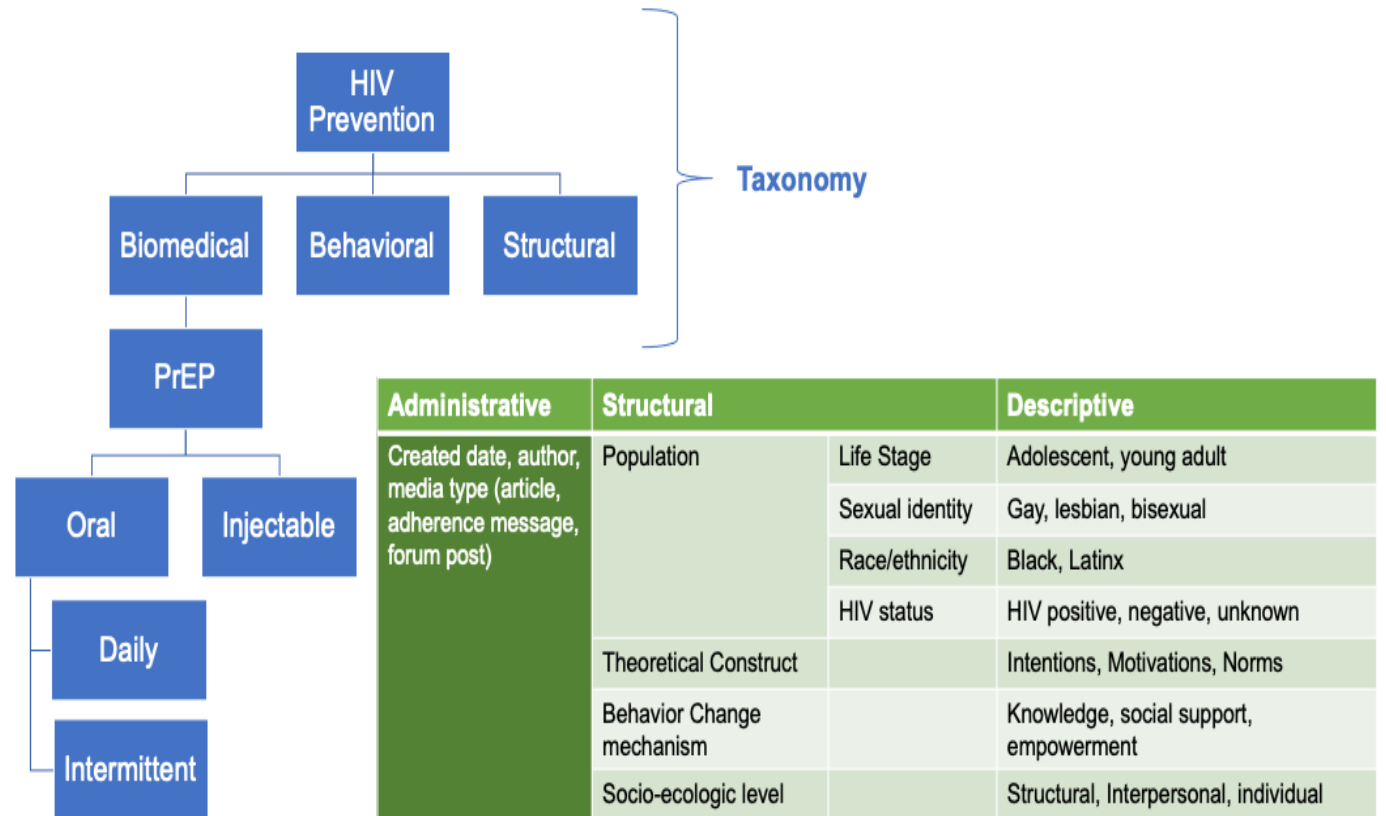


HMP 3.0 – DIGITAL TRANSFORMATION AT SCALE

- **HMP will streamline the process of developing, adapting, and disseminating evidence-informed interventions.** As an integrated platform, HMP will provide a standard technology platform for DHI research and a bi-directional channel for content contribution and consumption, amplifying the power of each intervention project that elects to join the ecosystem.
- **HMP will be capable of delivering interventions that are more relevant and engaging to end-users.** Through the novel application of machine learning (ML) and automated text analysis, HMP will deliver a highly relevant and tailored experience to an individual user, thereby increasing the likelihood of engagement.
- **HMP will facilitate broader adoption of DHIs.** For stakeholder groups with a vested interest in evidence-informed interventions for HIV risk reduction, HMP will provide “gold standard” content that may be integrated into existing programs.
- **HMP will facilitate tailored content management at a scale that is currently unachievable.** HMP will enable significant re-use, sharing and adaptation of evidence-informed content for intervention developers, reducing the required time to create, deploy and evaluate DHIs.

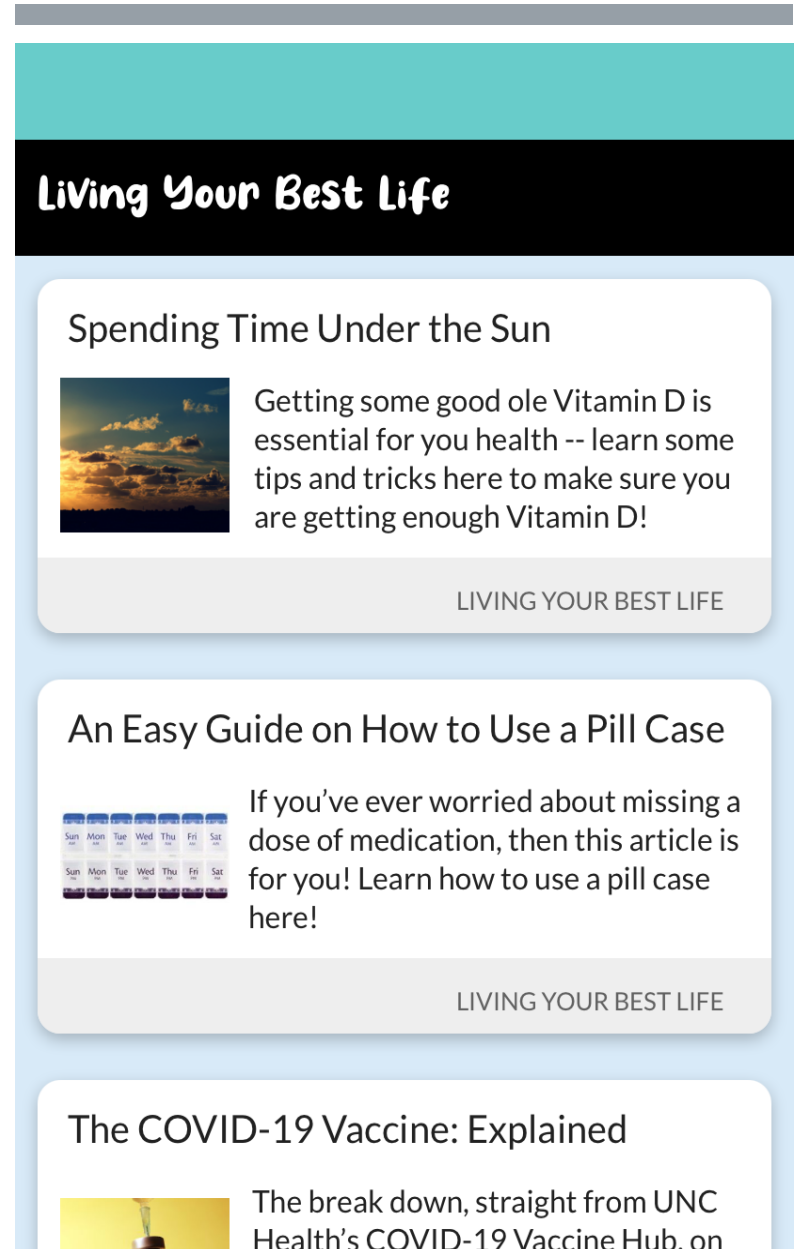
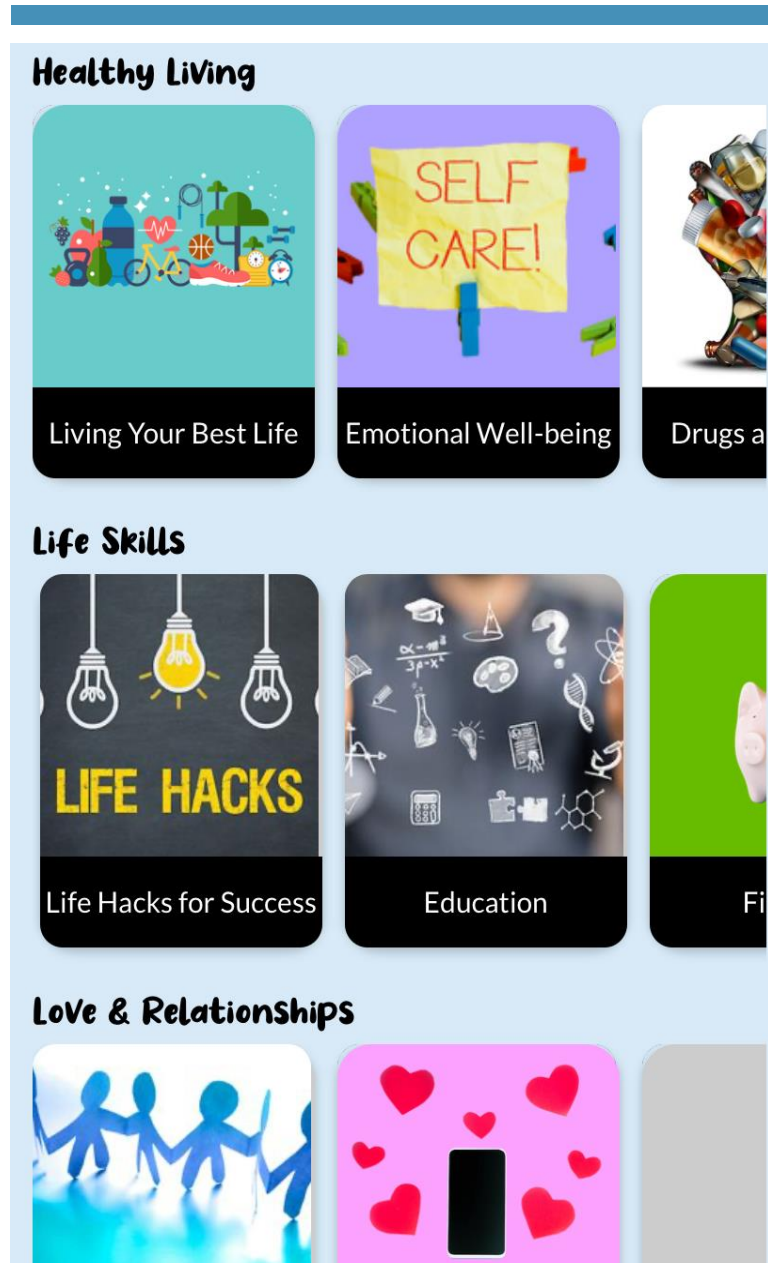
CONTENT MAPPING AND STRATEGY

- HMP houses >1500 content pieces (e.g., articles, videos, activities, Q&As) covering topics such HIV care and prevention, safer sex, stigma, mental health/substance use, general health and wellness tailored for youth/young adults at risk for or living with HIV



CONTENT MAPPING AND STRATEGY

- Allow access to **content repository** to support:
 - Expansion of topics and priority populations
 - Ability for researchers to use, adapt, update and thereby expand repository
 - Grant support and/or tiered licensing structure to support maintenance and hosting



CONTENT-RECOMMENDER SYSTEMS

Rules-Based Tailoring

Content tailored on fixed, manually curated decision rules that react to pre-defined variables (e.g., prevention knowledge, attitudes, behaviors) collected from users through surveys administered at varying time intervals

ML Tailoring

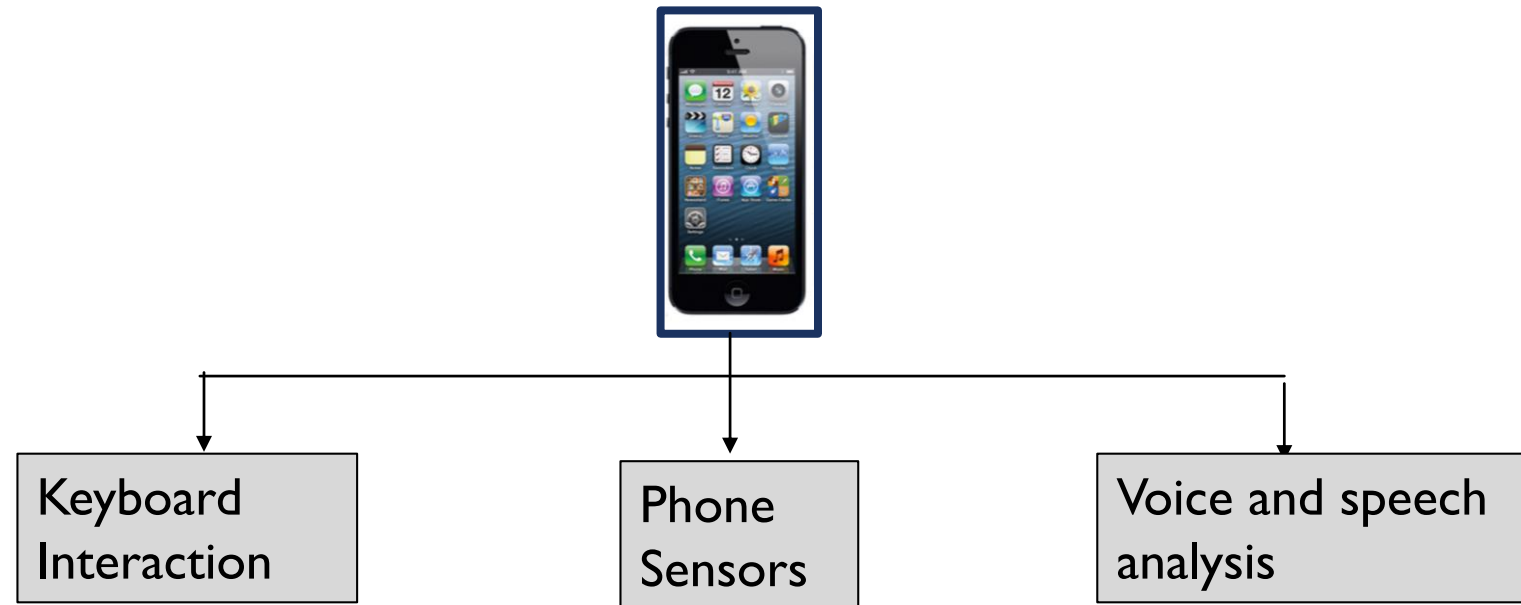
Features dynamically tailored content delivered (in near “real-time”) via a recommendation system that implements bidirectional (unsupervised learning and collaborative filtering algorithms to match user profiles (including in-app behaviors) to relevant content

SOCIAL MEDIA DATA MINING

- People's interactions on social media technologies (posts, searches, duration and timing of use) can be analyzed to provide information about their attitudes and behaviors.
 - A recent study which utilized ML and NLP techniques found social media data was correlated with offline sexual health and substance use behaviors.
- Social media can be used to identify at risk individuals or communities followed by focused messaging, education and intervention.
- Ethical considerations critical with need for careful and “near” constant attention to users’ privacy protections.

TECHNOLOGY TO CREATE A “DIGITAL PHENOTYPE”

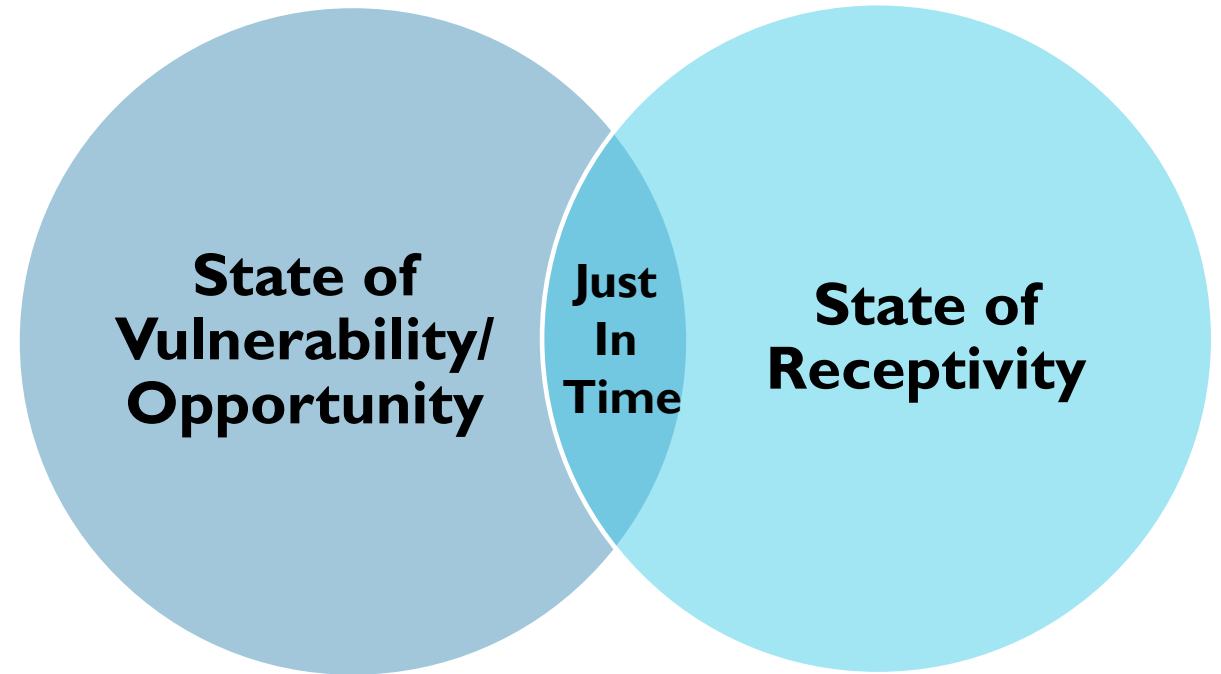
‘moment-by-moment quantification of the individual-level human phenotype in situ using data from personal digital devices’



*Physical mobility patterns *Social networks/social dynamics *Vocal markers of mood *Spatial trajectories

ADAPTIVE INTERVENTIONS

- Can we push **personalized** and **relevant** material?
- Can we respond at the **right time** with the **right intervention**?
- Will this **maximize engagement** at the individual level?
- Could this allow for more **efficient** and **expedient** scale-up?





PREP OPTIONS, EXPLORING MESSAGES TO PLAN FOR SEX



Assess the degree to which YMSM can accurately predict sexual encounters, necessary to successfully use on-demand PrEP strategy.



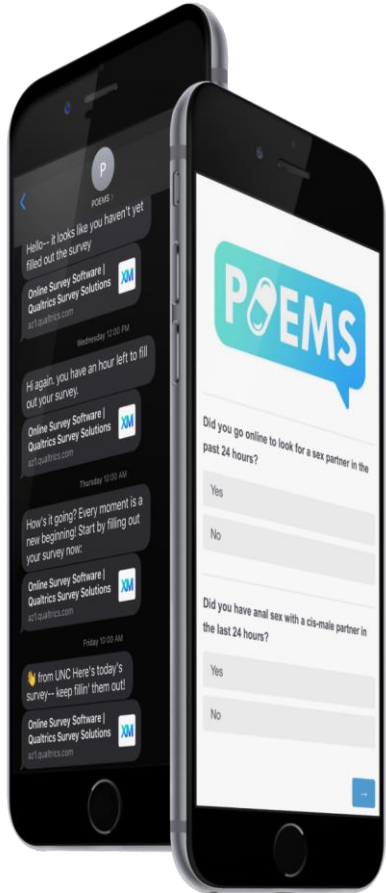
Identify factors associated with accurate predictions of and ability to plan for sexual encounters.



Develop a just-in-time intervention based on focus group feedback and study findings to increase YMSM's ability to plan for sexual activity and incorporate PrEP dosing based on accurate risk perception.

Neurocognitive/Neurodevelopmental Factors in Decision Making





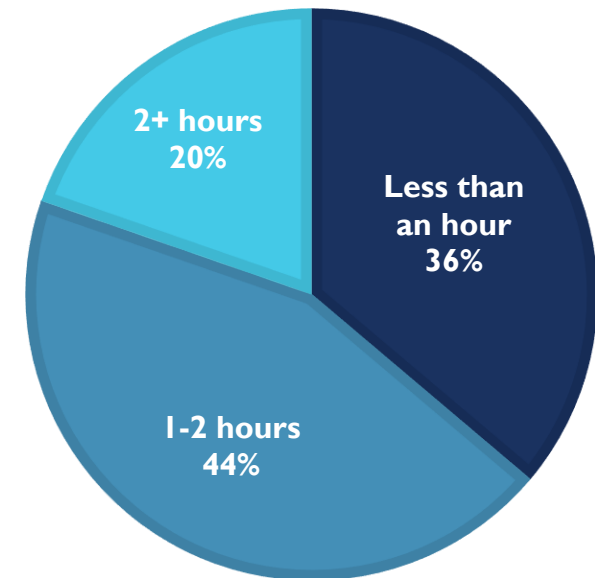
1. Did you go online to look for a sex partner in the past 24 hours?
2. Did you have anal sex with a cis-male partner in the past 24 hours?
3. The likelihood that I'll have anal sex in the next 24 hours is:
☐ Not at all likely ☐ Somewhat unlikely ☐ Somewhat likely ☐ Very likely
4. From 0-100%, the likelihood that I'll have anal sex in the next 24 hours is:

5. How many partners did you have sex with in the past 24 hours?
6. How would you describe your partner?
☐ Main partner (we are in a relationship)
☐ Casual partner (we are friends and/or occasionally have sex)
☐ Anonymous partner (we don't know each other that well or just met online)
7. Was sex spontaneous or planned?
8. How long before did you know you were going have sex?
☐ Less than an hour ☐ 1 to 2 hours ☐ 2 or more hours
9. Did you drink or use drugs prior to or during sex?
10. Select everything you did together:
☐ He topped with a condom ☐ He topped without a condom
☐ I topped with a condom ☐ I topped without a condom

PRELIMINARY RESULTS

- 120 YMSM (16-24 years) enrolled and followed for 2 months
 - Mean age: 21; 79% gay/15% bisexual; 53% non-white
 - On PrEP currently (28%) or taken in past (14%)
- Retention: **99.2%** (119/120)
- EMA completion: **97.8%** (6570/6720 daily responses)
 - 12% of EMAs report sex in prior 24 hours (>800 sex acts)

How long before did you know you were going to have sex?



ENGAGEMENT

the extent (e.g.,
amount, frequency,
duration, depth) of
usage

a subjective experience
characterized by
attention, interest and
affect

- **In an ideal world, how would you want users to engage with your DHI and over what time period?**
 - Will be different for directed vs. undirected interventions
 - How do you define high vs. low engagement?
 - How will you track it?
 - If engagement is low, what (if anything) will you do about it?

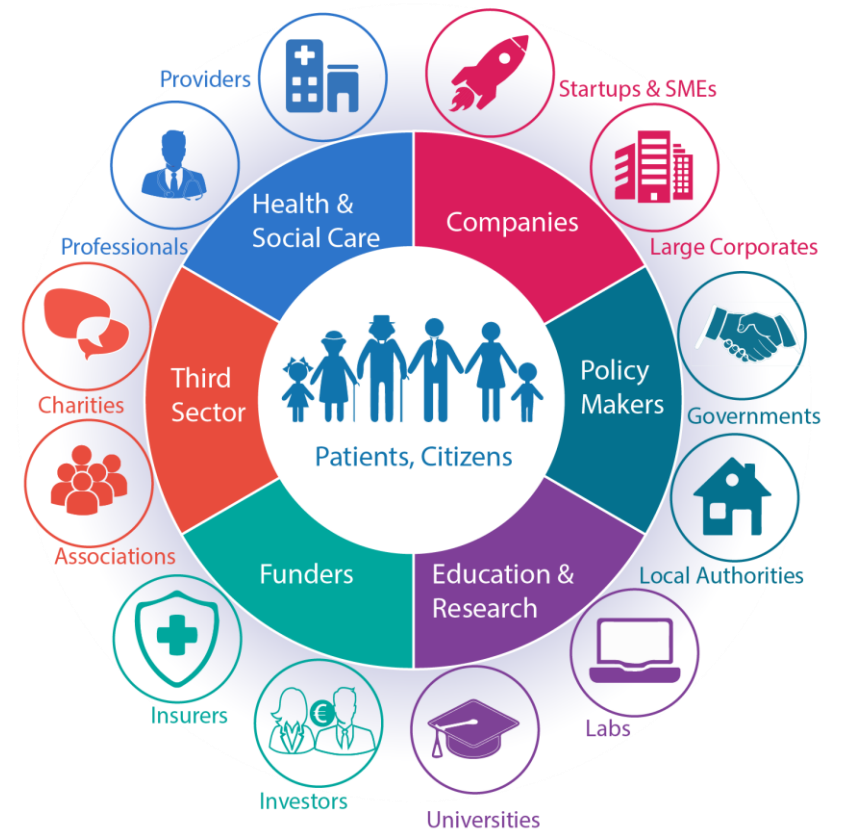
TOOLKIT FOR “RAPID” ADAPTATION

- Toolkit to identify what features can and should be adapted for different populations/settings
 - Provide guidance on the type of methods of formative data collection to hasten development
 - Provide information on time and cost-range for adaptations and enhancements
 - Provide information and what features accessible with no broadband, data usage



PROMOTING SCALE-UP AND DISSEMINATION

- Ensure that mHealth technologies are developed in collaboration at all stages with diverse groups of intended end-user populations.
- Future investments that incentivize both the **development and evaluation** of innovations and focus on sustainability with public and private partnerships, are needed.
- **Implementation science approaches** will need to be undertaken to demonstrate how the behaviors of end-users, health departments, CBOs/NGOs, and clinicians can be shaped to maximize the opportunities of these tools.



TECHNOLOGY CAN AND WILL HELP TO END THE EPIDEMIC

- Ending the epidemic will require an intentional, integrated and personalized approach that maximizes the likelihood of engaging key populations at each stage.

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- Technology-enabled HIV risk reduction, self-management, and prevention DHIs have the capability to improve lives; however, the potential of DHIs to achieve impact is significantly undermined by the current state-of-the-art in research-led intervention development.

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- Technology-enabled HIV risk reduction, self-management, and prevention DHIs have the capability to improve lives; however, the potential of DHIs to achieve impact is significantly undermined by the current state-of-the-art in research-led intervention development.
- To maximize potential for scale-up, need to apply strategies to adapt, integrate and transform “stand-alone” DHI tools.

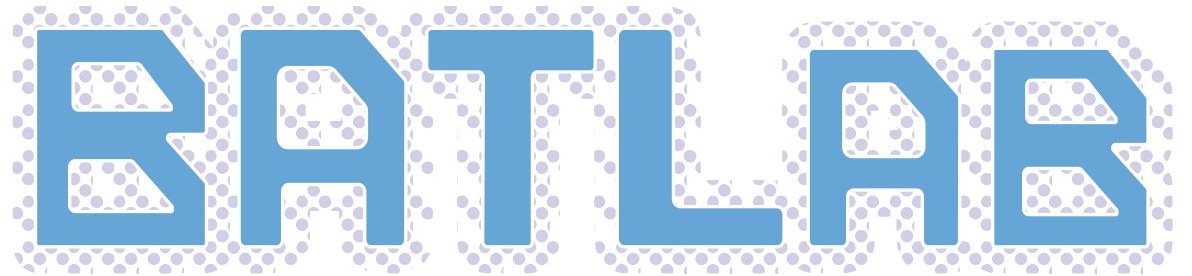
QUESTIONS?



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