



From concept to implementation: the story of PositiveLinks mhealth intervention for HIV

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The challenge in HIV care

- Inadequate retention in HIV Care is common and must be improved to meet revised EHE targets:
 - 95% of people know they have HIV
 - 95% of those remain in care
 - 95% achieve viral suppression
- Our clinic served over 50 counties, mostly rural, in Central and Northwest Virginia
 - Many patients said they knew nobody else with HIV



2010-12: addressing medication adherence: STEM

- Cellular phones had very basic functionality
- STEM was partially automated; required staff actions

Edit Text Messages

Schedule 1

Click to select or unselect the days messages are sent:

Mon	Tues	Wed	Thurs	Fri	Sat	Sun
✓	✓	✓	✓	✓	✓	✓

Enter time and text message (160 characters or fewer):

11	:	00	AM	Get your ass up and take your 5 meds.
09	:	00	PM	Did you take your 2?
	:		AM	

[Add another message](#)

[Clear Schedule](#)

- “Yeah, it did everything leading up to my decision to get back involved in my life. Take my meds on time, stop drinking, stop using drugs, be more accountable. It did everything because I’m like, ‘that #\$%^%\$# phone gonna blow up (ring)’ ‘cause I know it’s getting ready to, you know?”

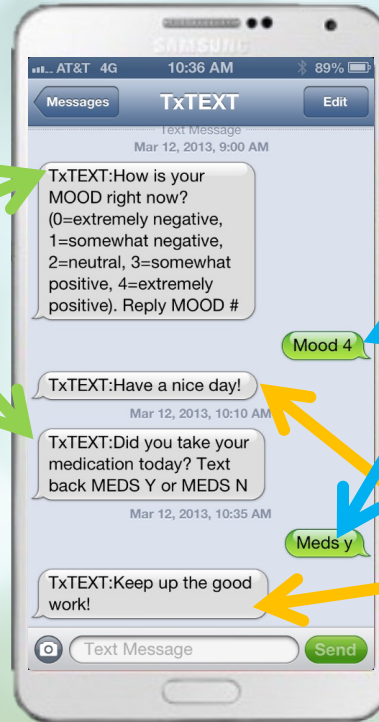




2012-14 Automated text messaging for HIV medication adherence and substance use: TxText

- Web interface allowed staff to set timing for med reminders/ queries and input patient-designed messages
- Fully automated system queried mood, substance use, med adherence daily using a code for SU: How were the skies? Clear, rainy, cloudy, snowy, other

Step 1: System sends automatic EMA queries for mood twice/day and medications at time of dosing



Step 2: Patient responds with keyword and answer

Step 3: Patient-designed responses automatically sent by system

System sent patient-designed personalized messages based on responses:

- Keep your head up
- God loves you
- Don't forget your grandchildren
- Great job!
- You need to clear it up
- Stay smiling
- Be more responsible
- Keep up the good work
- Yay!



TxText Pilot Outcomes/Participant reactions

STRONG USAGE:

Patients responded to 68% of Medication, 64% of Mood, and 66% of Substance Use queries over 12 weeks.

IMPACT ON ADHERENCE: Controlling for baseline, Pharmacy Refill Adherence improved by 12.2% from baseline to 3M in TxText vs. control ($p=.04$)

Minor improvements on RIC or DRUG USE; ns

“It feels good that I can actually talk to someone every day about it. Even if it’s a machine, its feels great to know that there's someone there to affirm to me that this is a good and right thing. “congratulations” sounds good, you know?”

“It gave me more positive feelings about myself that I’ve done something good that day for me. Having somebody at your back is a positive thing.”

2014-15 App vs. Text messaging

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Text messaging

- Better studied
- Phones are cheaper
- Phone screens more durable
- Cost per message on some plans
- Limited 1:1 communication

App

- Consumer demand
- Rich media
- Community features possible
- Security & privacy features
- Can send more messages without added cost



Theoretical bases of *PositiveLinks*

ARTAS model:

1. Linkage relationship
2. Focus on strengths
3. Facilitation of goals
4. Patient-driven

IMB model:

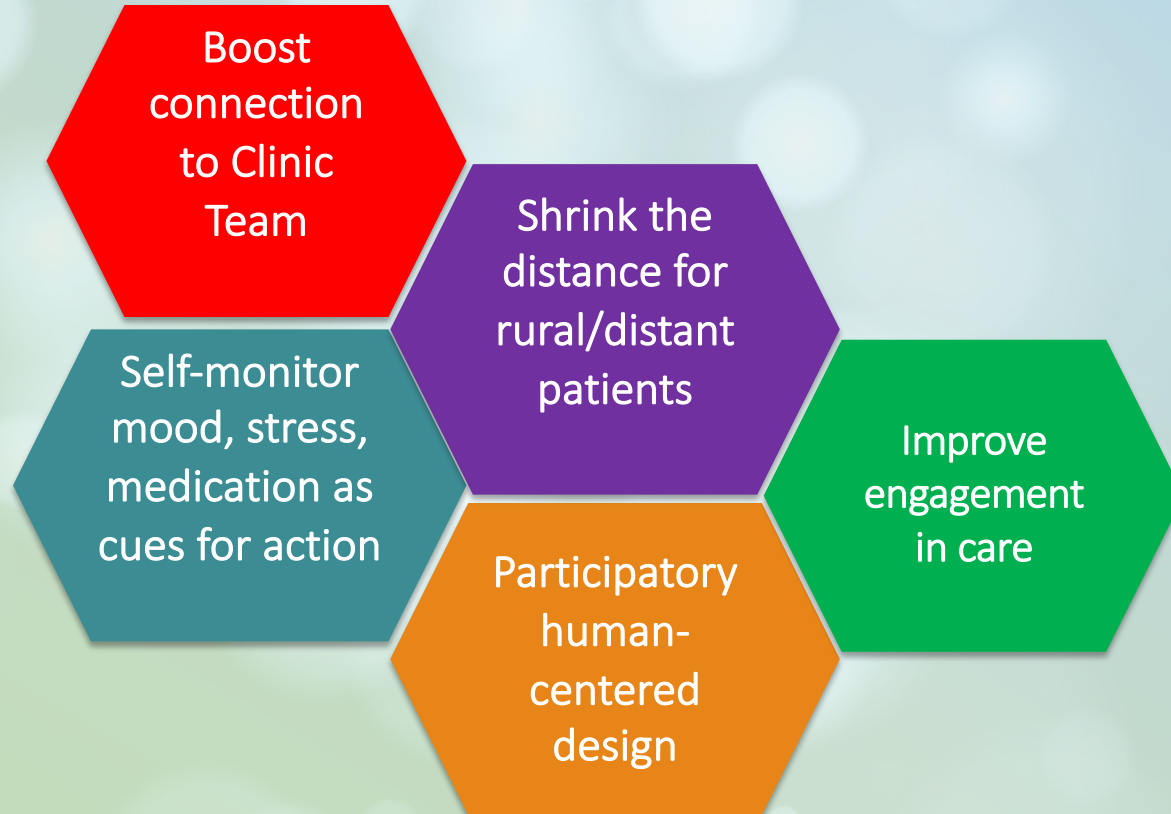
1. Care Information
2. Quizzes/prizes and HIV Education
3. Self monitoring over time

Social Action Theory:

1. Self-change processes
2. Contextual influences
3. Action States: Self control, problem solving



Platform Development Strategy



PL App Components

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- Self monitoring for self management
- Care coordination/easy connection
- Social support with peers with HIV
- Educational resources
- Platform Security:
 - Access via app stores is “invitation code only”
 - Password protection with Biometric sign-in option
 - Automatic Log-out with disuse
 - Requires anonymity on secure community board
 - No personally identifying information stored



Self-monitoring Check-Ins

The image displays three sequential screens of the PositiveLinks app on a smartphone. The app's header is a blue bar with a white hamburger menu icon on the left and the text 'PositiveLinks' in white. The status bar at the top shows the time as 4:10 on the first screen and 4:11 on the others, along with signal and battery icons.

Screen 1: The date 'Monday June 18' is centered. Below it is the question 'Have you taken your meds yet?'. There are two buttons: a green 'YES' button and a blue 'NO' button. Below the buttons is a text input field containing 'with breakfast'. At the bottom is a white 'SUBMIT' button.

Screen 2: The date 'Monday June 18' is centered. Below it is the question 'How are you feeling?'. There is a green smiley face icon with a green dot above it. Below the icon is a horizontal slider with a green dot at the right end, labeled '(+4) Very Happy'. Below the slider is a text input field containing 'feeling good'. At the bottom is a white 'SUBMIT' button.

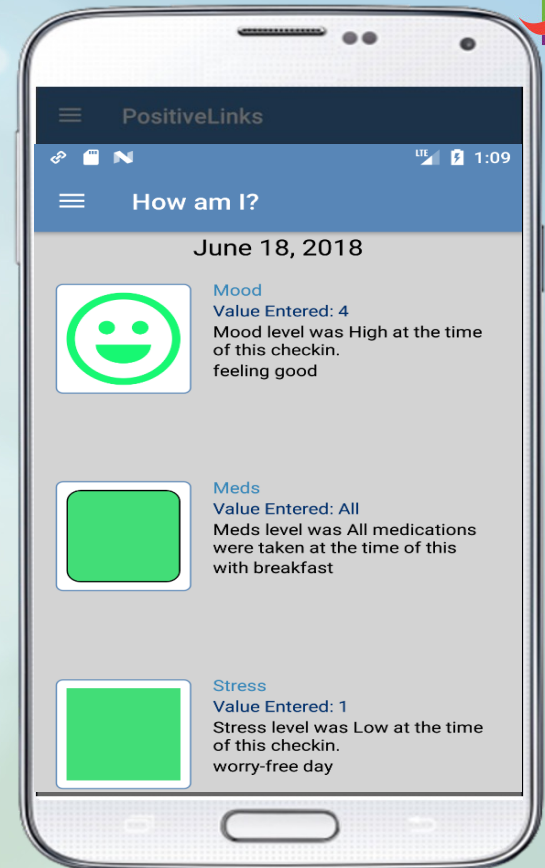
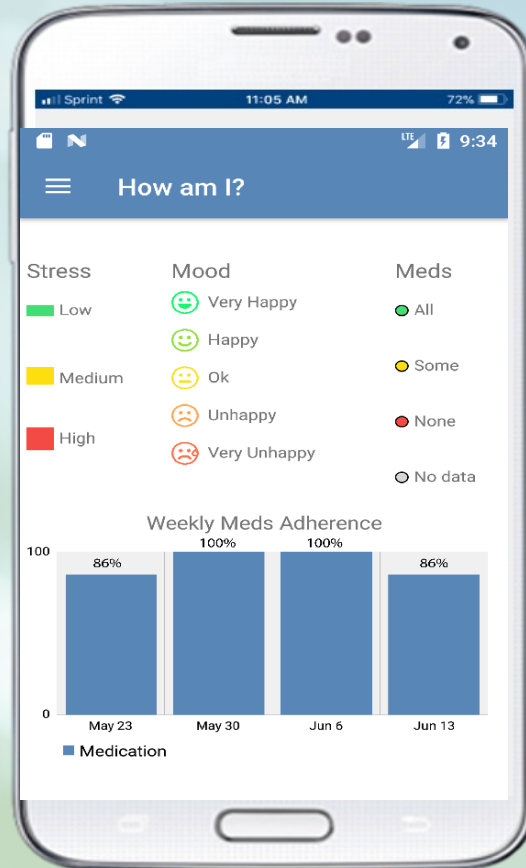
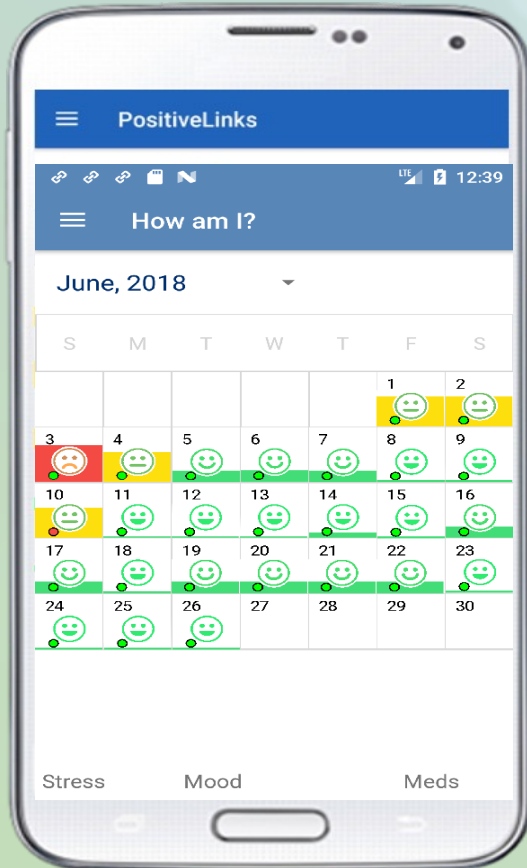
Screen 3: The date 'Monday June 18' is centered. Below it is the question 'What is your Stress Level right now?'. There is a green frowny face icon with a green dot above it. Below the icon is a horizontal slider with a green dot at the left end, labeled '(1) Low'. Below the slider is a text input field containing 'worry-free day'. At the bottom is a white 'SUBMIT' button.

“The questions make me focus on my mood and my stress and makes me more in touch with myself you can say. When it pops up, it makes me stop and think. I usually don’t think about that kind of thing.”

- PL Participant

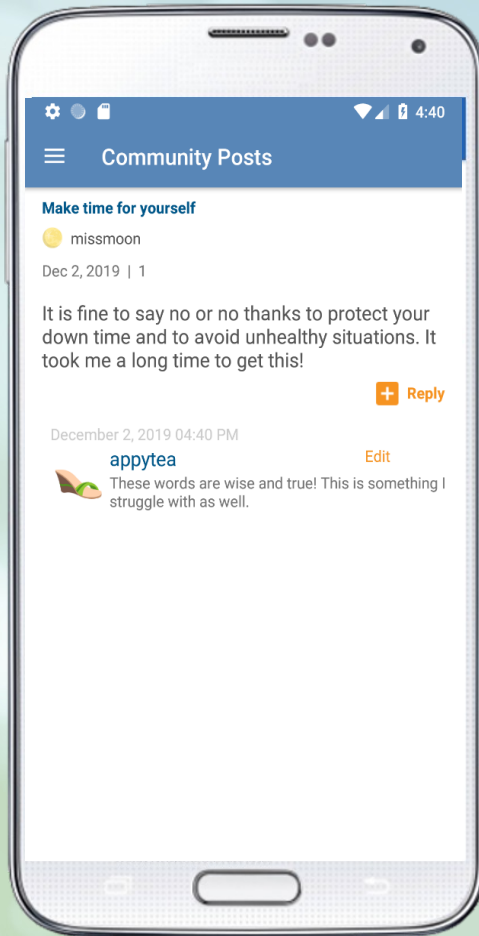
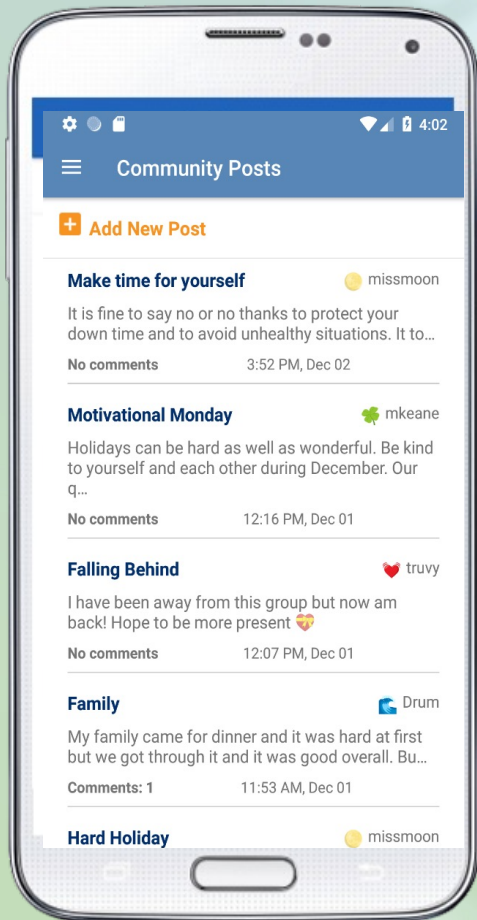
How am I?

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Community Board

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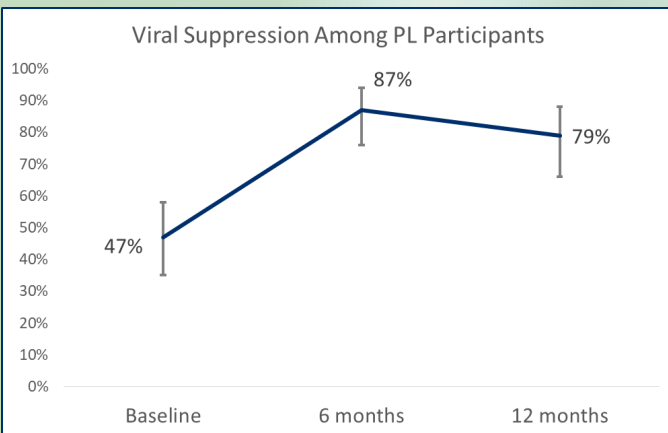
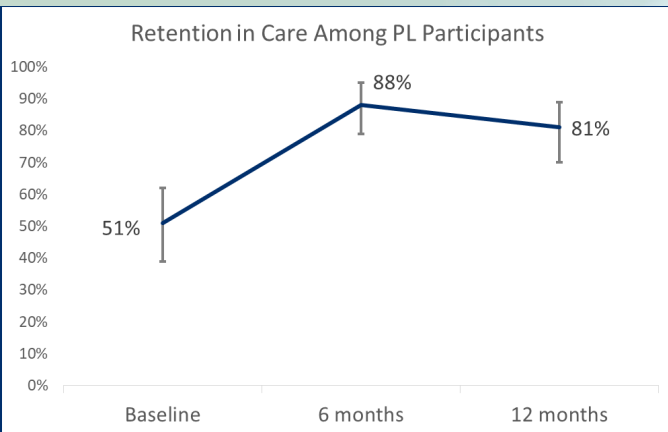


“You get to talk to people who are going through exactly what you are going through. When you are down somebody uplifts you, when somebody else is down you can uplift them, it’s basically like one big family”

- PL Member

PL V1.0 Outcomes

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A 12-month prospective trial of the *PositiveLinks* v1.0 app with **nonurban PWH** found significant improvements in RIC (top) and viral suppression (bottom) over **one year of follow-up** (n=77).

AIDS PATIENT CARE and STDs
Volume 32, Number 6, 2018
Mary Ann Liebert, Inc.
DOI: 10.1089/apc.2017.0303

BEHAVIORAL AND PSYCHOSOCIAL RESEARCH

PositiveLinks: A Mobile Health Intervention for Retention in HIV Care and Clinical Outcomes with 12-Month Follow-Up

Rebecca Dillingham, MD, MPH,¹ Karen Ingersoll, PhD,² Tabor E. Flickinger, MD, MPH,¹
Ava Lena Waldman, MHS, CHES, CCRP,¹ Marika Grabowski, MPH,¹ Colleen Laurence, MPH,¹
Erin Wispelwey, MSC,¹ George Reynolds, BA,³ Mark Conaway, PhD,⁴ and Wendy F. Cohn, PhD⁴

PL Provider Portal/ PL 2.0 added Provider App

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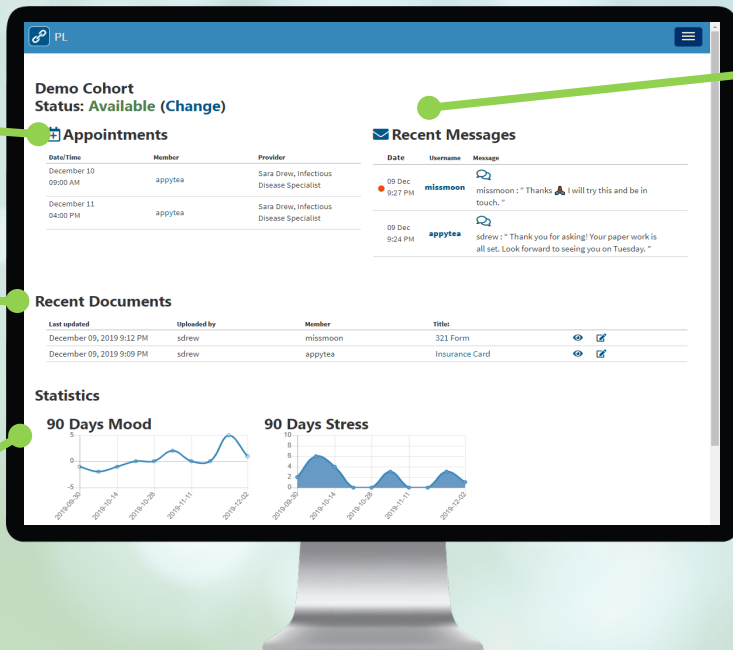


PL Provider App

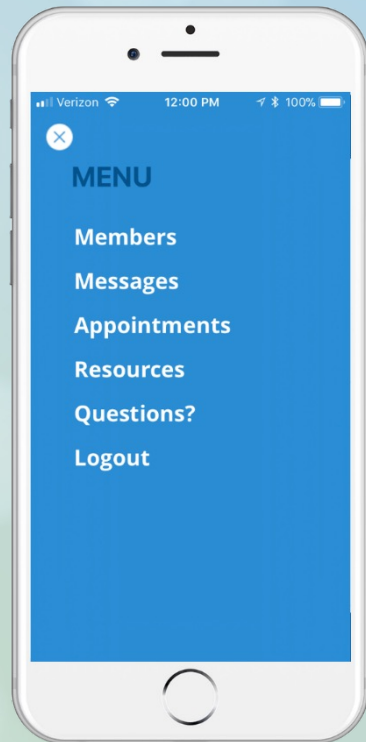
Upcoming
Appointments
with PL
Members

Documents
recently shared
with or by
Members

Cohort Mood
and Stress
graphs for past
90 days



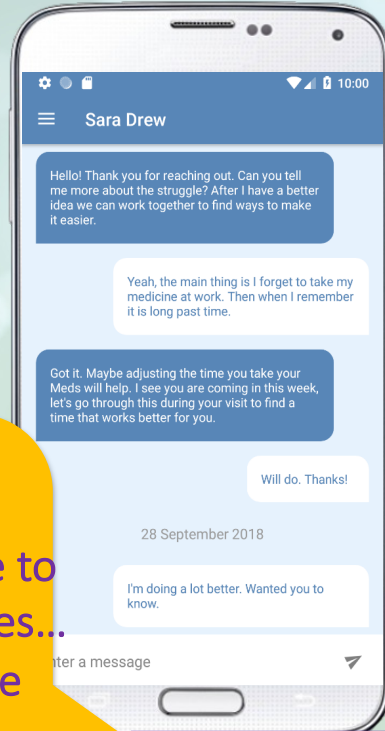
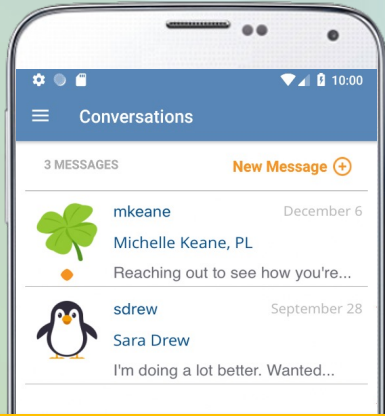
Recent Messages
from or to
Members



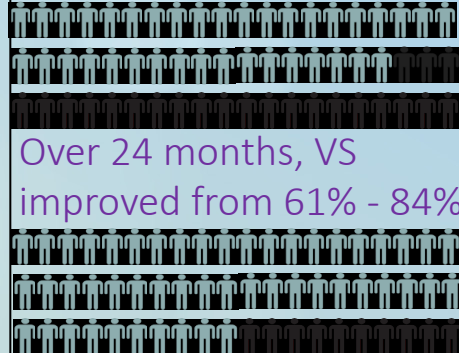
Scaling to other clinics with a turn key system
We distributed the app to Virginia HIV clinics statewide

PL 2.0: Longer term Outcomes, Secure messaging, Internal Design/Dev team

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Usage Impact:
Patients with high PL use
were 2.09 (95% CI 0.64–
6.88) times more likely to
achieve viral suppression
and 1.52 (95% CI 0.89–2.57)
times more likely to become
engaged in care compared
to patients with low PL use.



Over 24 months, VS
improved from 61% - 84%

RESEARCH ARTICLE
Long term impact of *PositiveLinks*: Clinic-
deployed mobile technology to improve
engagement with HIV care *PLOS One*,
2020

Chelsea E. Canan¹, Marika E. Waselewski¹, Ava Lena D. Waldman¹,
George Reynolds², Tabor E. Flickinger¹, Wendy F. Cohn³, Karen Ingersoll⁴,
Rebecca Dillingham^{1*}

TBM 2019 ORIGINAL RESEARCH

Toward understanding the impact of mHealth
features for people with HIV: a latent class analysis of
PositiveLinks usage

Chelsea E. Canan^{1,4}, Tabor E. Flickinger¹, Marika Waselewski¹, Alexa Tabackman², Logan Baker¹,
Samuel Egge², Ava Lena D. Waldman¹, Karen Ingersoll⁴, Rebecca Dillingham¹

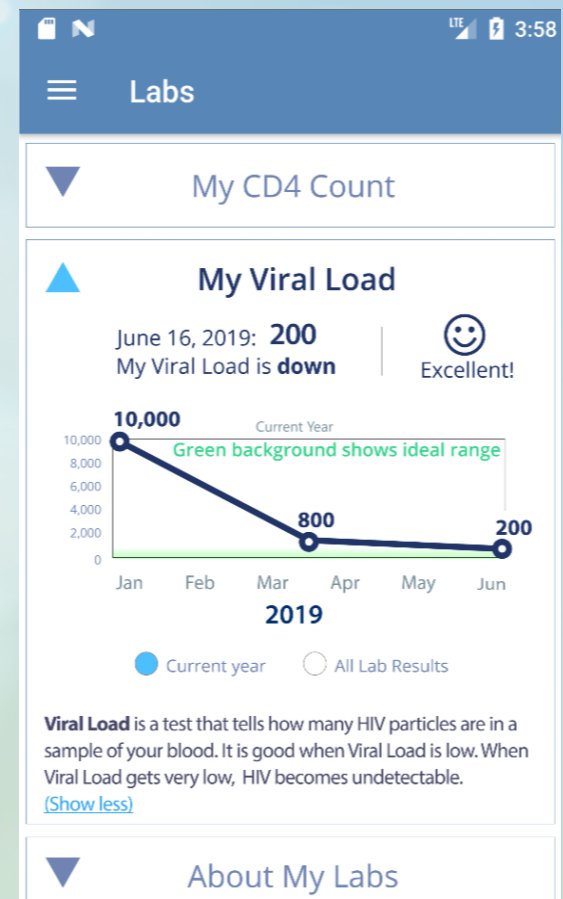
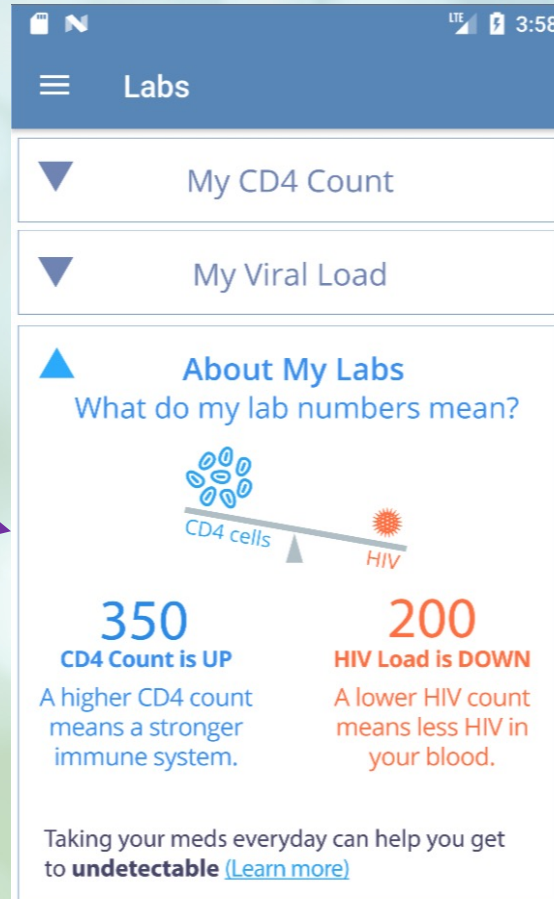
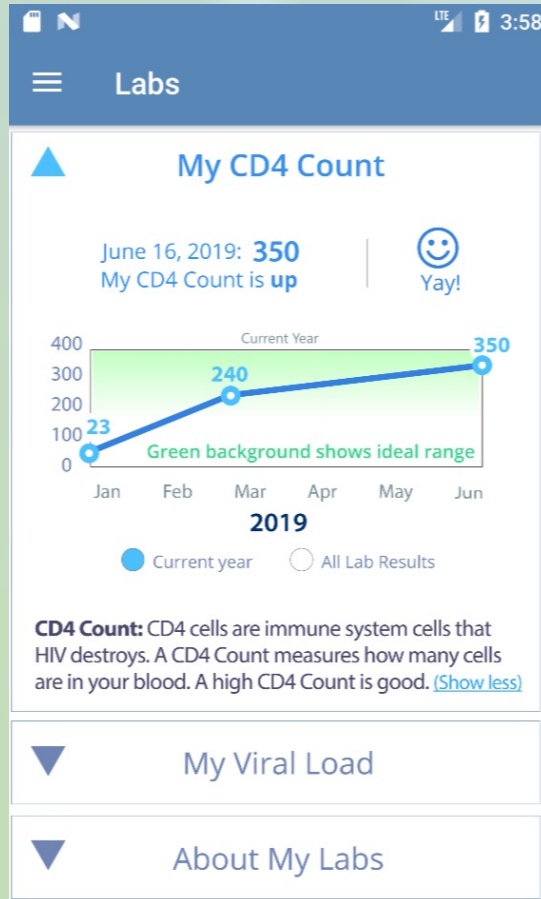
Flickinger, et al, 2020. Secure Messaging Through PositiveLinks: Examination of Electronic
Communication in a Clinic-Affiliated Smartphone App for Patients Living with HIV.

• VOL. 26 NO. 3 • MARCH 2020 **TELEMEDICINE and e-HEALTH**

“It’s convenient to be able to
talk with doctors and nurses...
it’s kind of made me care
more about wanting to
continue in care.”

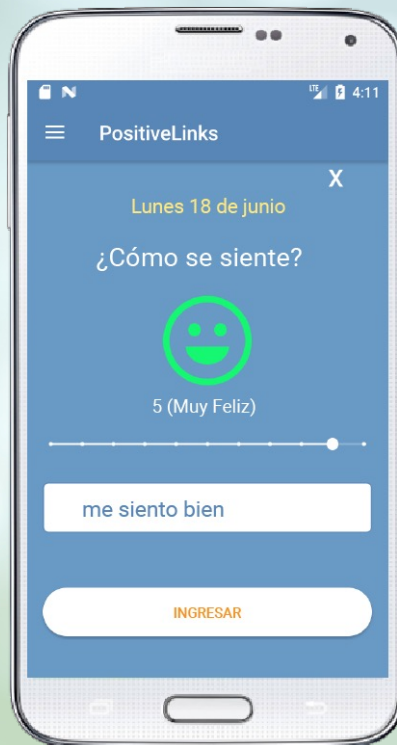
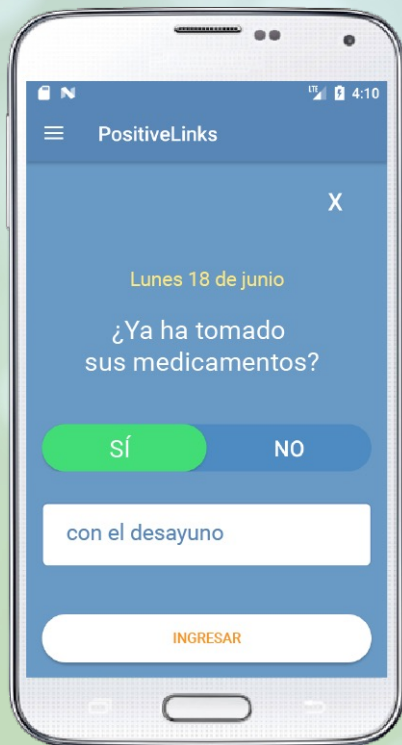
Labs display revised

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PositiveLinks Spanish: *Prospera Libre*



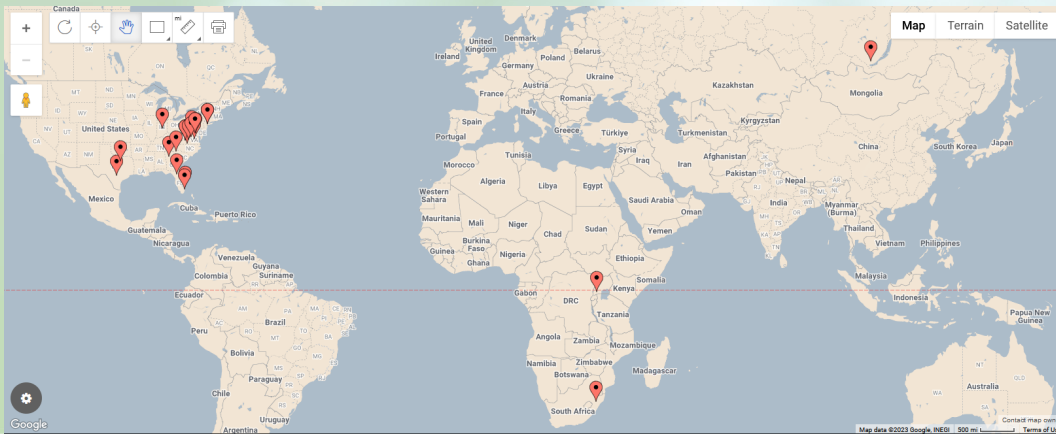
KEYWORDS Mhealth; mobile applications; text messaging; HIV; smartphone; internet; digital divide; telemedicine

Dissemination

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- *PL v3.0* became usual care In 2017 in the originating clinic and in other Virginia HIV clinics (with Health Dept support)
- Clinics outside Virginia wanted PL; University of Virginia established a company, *Warm Health Technology, LLC*, to disseminate a commercial version (*PLCares*). <https://www.wht.care/>
- PL/PL Cares: 22 implementations in 7 U.S. states and 4 countries



What drove success?

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- *PositiveLinks* is a clinic-based **HIV care** app that **promotes connection** between patients and clinic teams
- Community Board promotes **Social support**
- **Clinic-based innovation** (in COVID, had early telehealth)
- **In-house design/dev team**: responsive, nimble
- Research to **establish evidence** of *PositiveLinks*' impact, mechanisms
- Visionary support for PL as **part of standard HIV care** from State Health Department
- National awards/recognition as **Evidence-based practice in HIV care**
- **University-commercial partnership** to distribute the app outside Virginia



Thank you!

Karen Ingersoll: kes7a@uvahealth.org

<https://www.positivelinks4ric.com/>

<https://www.wht.care/>