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

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

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!

- 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.
**TxDText 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 TxDText 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, it 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.”

Ingersoll et al., JSAT. 2014; Ingersoll et al., *Health Psychology*, 2015.
| Text messaging 📨 | App |  
|------------------|-----|---|
| • Better studied  | • Consumer demand |    |
| • Phones are cheaper | • Rich media |    |
| • Phone screens more durable | • Community features possible |    |
| • Cost per message on some plans | • Security & privacy features |    |
| • Limited 1:1 communication | • 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

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

IMB model:
1. Care Information
2. Quizzes/prizes and HIV Education
3. Self monitoring over time
Platform Development Strategy

- Boost connection to Clinic Team
- Shrink the distance for rural/distant patients
- Improve engagement in care
- Self-monitor mood, stress, medication as cues for action
- Participatory human-centered design

Self-monitor mood, stress, medication as cues for action to improve engagement in care, shrink the distance for rural/distant patients, and boost connection to Clinic Team. Participatory human-centered design is also a key component.
PL App Components

- 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
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?

**June 18, 2018**

**Mood:** Value Entered: 4
Mood level was High at the time of this checkin. Feeling good.

**Meds:** Value Entered: All
Meds level was All medications were taken at the time of this checkin with breakfast.

**Stress:** Value Entered: 1
Stress level was Low at the time of this checkin. Worry-free day.
“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
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).
PL Provider Portal/
PL 2.0 added 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

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.

2019
"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

My CD4 Count

June 16, 2019: **350**
My CD4 Count is **up**
(Yay!)

CD4 Count: CD4 cells are immune system cells that HIV destroys. A CD4 Count measures how many cells are in your blood. A high CD4 Count is good.

My Viral Load

June 16, 2019: **200**
My Viral Load is **down**
(Excellent!)

Viral Load is a test that tells how many HIV particles are in a sample of your blood. It is good when Viral Load is low. When Viral Load gets very low, HIV becomes undetectable.

About My Labs

What do my lab numbers mean?

- **350** CD4 Count is UP
  - A higher CD4 count means a stronger immune system.

- **200** HIV Load is DOWN
  - A lower HIV count means less HIV in your blood.

Taking your meds everyday can help you get to undetectable (Learn more)
PositiveLinks Spanish: *Prospera Libre*
Continuous Research
• **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/](https://www.wht.care/)

• **PL/PL Cares:** 22 implementations in 7 U.S. states and 4 countries
What drove success?

- 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!

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https://www.positivelinks4ric.com/

https://www.wht.care/