Actioning the Vision – How Do We Attain an End to HIV Transmission by 2030: Network Intervention Implementation

Adherence 2017

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Disclosures

• NIH, CDC, Chicago Department of Public Health
Outline

• HIV Transmission Elimination Efforts
  – Projections
  – Examples

• Care Continuum Network Intervention Implementation
HIV Elimination*†‡

*Elimination of new transmission events (not cure)
†Domestic by 2041
‡Assuming investment at current levels
Epidemic Transmission Dynamics

• Reproductive rate $R_0 < 1$; epidemic is not sustainable

• $R_0 = \left(\frac{T(x)}{100}\right) \times D$
  
  – $T(x)$ is the annualized transmission rate (number of HIV transmissions to HIV seronegative partners of 100 HIV infected persons)
    • Incidence/prevalence $\times 100$
  
  – $D$, duration of infectiousness

May, Nature 1987
• In 2006, $T(x)$ less than 5.0 in the US; in 2015 was 2.6

• National AIDS Strategy goal is $T(x)$ decrease by 30%
  – This could then get $R_0 < 1$ and on the path to elimination

Focus on Transmitter - Duration of infectiousness (D)

• Some use 28.9 years of life expectancy following a diagnosis as infectious period. But.....
  – Viral suppression decreases infectiousness
  – Previously - advanced illness; 9-12 months following diagnosis. Are these really infectious periods?

• Age of the candidate transmitter is important
  – Sex frequency, concurrency and number of partners declines with age
  – Only 28% of molecular ties among YBMSM 20-24 years of age are with older partners (at least 5 years)

HIV elimination programs

- Vancouver
- New York
- Washington
- Arizona
- San Francisco
- Cambodia
- And others
New HIV Diagnoses and HAART Use

HIV Testing Rate in BC

New Diagnoses

Active on HAART

HAART

TasP


# new diagnoses

# active on HAART

Modified from Montaner et al, PLOS One, Feb 12 2014
## Shortened time to care, ART, virologic suppression

<table>
<thead>
<tr>
<th>Metric</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016 Q2</th>
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<tbody>
<tr>
<td><strong>Median Days</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Diagnosis -&gt; Care</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>5</td>
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<tr>
<td>Care -&gt; ART</td>
<td>27</td>
<td>16</td>
<td>6</td>
<td>0</td>
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<tr>
<td>Diagnosis -&gt; VL&lt;200</td>
<td>133</td>
<td>91</td>
<td>75</td>
<td>51</td>
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<tr>
<td><strong>Cases</strong></td>
<td>331</td>
<td>286</td>
<td>249</td>
<td>116</td>
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<td><strong>Missing</strong></td>
<td>69</td>
<td>43</td>
<td>47</td>
<td>18</td>
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<tr>
<td><strong>Total N</strong></td>
<td>400</td>
<td>329</td>
<td>296</td>
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<table>
<thead>
<tr>
<th>Care-&gt;ART</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016 Q2</th>
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<tr>
<td>% Not in care</td>
<td>6.75</td>
<td>3.95</td>
<td>5.07</td>
<td>4.48</td>
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<tr>
<td>% 0-2 days</td>
<td>11.80</td>
<td>21.00</td>
<td>31.80</td>
<td>45.50</td>
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<tr>
<td>% 3-5 days</td>
<td>2.50</td>
<td>4.56</td>
<td>6.42</td>
<td>5.22</td>
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<tr>
<td>% 6-7 days</td>
<td>2.25</td>
<td>3.65</td>
<td>7.09</td>
<td>4.48</td>
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<tr>
<td>% &gt;7 days</td>
<td>60.50</td>
<td>53.50</td>
<td>35.80</td>
<td>24.60</td>
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<tr>
<td>% None</td>
<td>16.30</td>
<td>13.40</td>
<td>13.90</td>
<td>15.70</td>
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</table>
The New HIV (and HCV and 1 Care+) Prevention and Treatment Continuum, NYC

HIV CARE AND PREVENTION ARE THE SAME = GETTING TO HIV NEUTRAL

A Human Rights Approach:
Access to Primary Care and Prevention

HIV Elimination is Possible: New York City
PrEP Implementation Planning

• University of Chicago and Department of Public Health collaboration starting in 2011
  – Estimated 5,578 YBMSM (NHBS/SRN HIV seropositive rate 23.4%/27.8%)
Unique PrEP starts (n=4151)
1/12- 5/17 at HBH

<table>
<thead>
<tr>
<th>age</th>
<th>Frequency</th>
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<tr>
<td>&lt;18</td>
<td>14</td>
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<tr>
<td>18-24</td>
<td>937</td>
<td>22.57</td>
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<tr>
<td>25-29</td>
<td>1,193</td>
<td>28.74</td>
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<tr>
<td>30-34</td>
<td>782</td>
<td>18.84</td>
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<tr>
<td>35-39</td>
<td>467</td>
<td>11.25</td>
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<tr>
<td>40-49</td>
<td>521</td>
<td>12.55</td>
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<td>&gt;=50</td>
<td>237</td>
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<table>
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<th>Percent</th>
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<tr>
<td>cis-male</td>
<td>3,797</td>
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<td>cis-female</td>
<td>85</td>
<td>2.05</td>
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<td>transfemale</td>
<td>191</td>
<td>4.60</td>
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<tr>
<td>transmale</td>
<td>44</td>
<td>1.06</td>
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<td>GNC</td>
<td>31</td>
<td>0.75</td>
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<tr>
<td>Unknown</td>
<td>3</td>
<td>0.07</td>
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<table>
<thead>
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<th>msm</th>
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<th>Percent</th>
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<tr>
<td>MSM</td>
<td>3,677</td>
<td>88.58</td>
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<tr>
<td>non-MSM</td>
<td>474</td>
<td>11.42</td>
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<table>
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<th>insurance</th>
<th>Frequency</th>
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<tr>
<td>Private</td>
<td>2,235</td>
<td>53.84</td>
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<tr>
<td>Medicaid</td>
<td>697</td>
<td>16.79</td>
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<tr>
<td>Uninsured</td>
<td>1,219</td>
<td>29.37</td>
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<tr>
<td>Missing</td>
<td>0</td>
<td>0.00</td>
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<table>
<thead>
<tr>
<th>Year of PrEP</th>
<th>Starts/Month</th>
<th>Percent</th>
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<tbody>
<tr>
<td>2012</td>
<td>2/month</td>
<td>0.58</td>
</tr>
<tr>
<td>2013</td>
<td>5/month</td>
<td>1.54</td>
</tr>
<tr>
<td>2014</td>
<td>47/month</td>
<td>13.61</td>
</tr>
<tr>
<td>2015</td>
<td>93/month</td>
<td>26.79</td>
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<tr>
<td>2016</td>
<td>135/month</td>
<td>39.00</td>
</tr>
<tr>
<td>2017</td>
<td>153/month</td>
<td>18.48</td>
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</table>

<table>
<thead>
<tr>
<th>R/E</th>
<th>Frequency</th>
<th>Percent</th>
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<tr>
<td>NH White</td>
<td>2,355</td>
<td>56.73</td>
</tr>
<tr>
<td>NH Black</td>
<td>663</td>
<td>15.97</td>
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<tr>
<td>Hispanic</td>
<td>805</td>
<td>19.39</td>
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<tr>
<td>NH Asian</td>
<td>221</td>
<td>5.32</td>
</tr>
<tr>
<td>Unknown</td>
<td>107</td>
<td>2.58</td>
</tr>
</tbody>
</table>

First Patient seen
55th street (4/16)
63rd street (6/16)
PrEP4love
Transmitting Desire Across Chicago

CROI 2016 Innovations in PrEP 2.23.16

Jim Pickett
AIDS Foundation of Chicago [AFC]
Director of Prevention Advocacy and Gay Men’s Health

Pickett J. CROI 2016.
One pill. Once a day. Protect against HIV.

#CatchDesire  #ContractHeat  #SpreadTingle  #TransmitLove
Twenty-twenty (T2) intervention

New HIV Infections, Chicago, 2006-2025

- Fitted smooth line through incidence data (slope -39)
- In 2025, we will expect 531 new infections at current rate of incidence reduction.
- Current Howard Brown estimates indicate that about 20% of negative MSM on PrEP
- uConnect data suggests 10% of BMSM on PrEP
- <100 new cases by 2030

Khanna et al., BARS modeling team
Other Infectious Disease elimination programs

- Smallpox/Polio
  - Smallpox/Polio both with effective vaccine
  - HIV/smallpox/polio all have human reservoirs only
  - Stigma with smallpox/polio

- Smallpox/polio surveillance and containment strategy – “cocooning”
  - Identify cases → Vaccinate contacts → Vaccinate contacts’ contacts
  - Contact tracing - “network analysis and intervention”

- What if we can’t identify contacts?
  - Social network tracing, network analysis

- What if we don’t have an effective vaccine?
  - Network alerts; Testing for acute HIV; PreP/PEP; Treatment as prevention
Malaria transmission elimination strategy in Southern Africa and MeKong Delta

Households or individuals within a specified area, typically a pre-determined radius around a locally acquired case, are screened or radically treated with the goal of preventing further malaria transmission by identifying additional infections.
Young Black Men Who have Sex with Men Venue Affiliations in Chicago
uConnect Study, 2013-2016 (n=618): A Two-Mode Network Analysis and Visualization

Legend

1. Clubs and bars - gay enclave area
2. Clubs and bars - ethnically mixed area
3. Clubs and bars - black community area
4. Public spaces - gay enclave area
5. Public spaces - ethnically mixed area
6. Public spaces - black community area
7. Bathhouses and bookstores - gay enclave area
8. Bathhouses and bookstores - ethnically mixed area
9. Bathhouses and bookstores - black community area
10. Gyms - gay enclave area
11. Gyms - ethnically mixed area
12. Gyms - black community area
13. Ball events – gay enclave area
14. Ball events – ethnically mixed area
15. Ball events – black community area

Blue – Gay enclave cluster
Green – Bridge cluster
Yellow – Black community cluster

Behler, ABE, 2017
Network Interventions

Any change program that uses network data to: Define groups
  – Select change agents
  – Affect network structure
  – Assist behavior change program implementation

4 General Types

1. Identify Individuals “Change Agents” – opinion leaders, key players, bridges (positional)
2. Segmentation – Identify Groups, Identify leaders within groups or match leaders to groups
3. Induction – Recruitment of sub-networks or word of mouth - Respondent Driven Sampling / Snowballing / Contact tracing
4. Alteration – Adding deleting nodes/ties, rewire Networks

Valente, *Science* 2012
Common Antiretroviral Pathway

Persons at increased risk for HIV

Persons Living with HIV

Marketing/Recruitment
Testing
Linkage to Healthcare
Engagement/Retention in Healthcare
ARV RX for PrEP/HIV Treatment
Successful PrEP Use/Viral Suppression
Decreased HIV Transmission

Common ARV Pathway

Similar needs → clinical care, behavioral health, supportive services, etc.

Common barriers and obstacles → access, cost, quality, etc.

PrEP Chicago - #1
TRIP - #3
PrEP-R; Project nGage - #1

Network Intervention match
Persons Living with HIV

Persons at increased risk for HIV

**Common Antiretroviral Pathway**

- **Marketing/Recruitment**
- **Testing**
- **Linkage to Healthcare**
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- **ARV RX for PrEP/HIV Treatment**
- **Successful PrEP Use/Viral Suppression**

**Decreased HIV Transmission**

**#1 Change Agent type Network Intervention**

PrEP Chicago

Network Intervention match
Network Extraction Tool

Figure 1. SIM card reader
Indian Men who have sex with men communication network (n= 4,583) generated from linked study respondents (n=245)\(^1\).

\(^1\)Circled actor represents individual with highest centrality (in-degree=39), most characteristic of an opinion leader (Valente and Pumpuang 2007); Squared actor represents individual with both the greatest bridging (constraint=0.08) and lower centrality (in-degree=6). (In-degree is one centrality measure and here measures how many participants had a given individual in their cell-phone contact list). IAS 2010
PrEP Chicago: Applying a diffusion framework...

Diffusion is the process through which an innovation is communicated through certain channels over-time among members of a social system.

(face to face) (communication channels) (social system)
...to an intervention context

The Intervention:

• Identify and recruit peer change agents who are affiliated with the YBMSM/transwomen community in Chicago

• Train and support them in their efforts to inform and motivate their social networks around PrEP
Project PrEP.

Welcome to PrEP Chicago, a project of the Chicago Center for HIV Elimination (CCHE) at Universit... See More

Tags:
- HIV
- AIDS
- HIV/Aids
Network

- Proximity to individuals in key structural positions matters

### Persistently PrEP Unaware vs. Became PrEP Aware

<table>
<thead>
<tr>
<th></th>
<th>Mean (median)</th>
<th>Mean (Median)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Betweenness</td>
<td>27% (33%)</td>
<td>32% (37%)</td>
</tr>
<tr>
<td>High Eigenvector</td>
<td>27% (28%)</td>
<td>37% (45%)</td>
</tr>
<tr>
<td>High Bridging</td>
<td>8% (9%)</td>
<td>11% (11%)</td>
</tr>
</tbody>
</table>

Common Antiretroviral Pathway

Chicago Department of Public Health

Persons Living with HIV

Marketing/Recruitment

Testing

Linkage to Healthcare

Engagement/Retention in Healthcare

ARV RX for PrEP/HIV Treatment

Successful PrEP Use/Viral Suppression

Persons at increased risk for HIV

Decreased HIV Transmission

Common ARV Pathway

#3 Induction Type Network Intervention

TRIP (Transmission Reduction Intervention Project)

Network Intervention match
TRIP - Process of the Intervention

Community education about acute and recent infection and reasons not to stigmatize those with early infection

Network Intervention
1. Early warning system “Emergency alert”
2. HIV phase testing

Recruit Network Contacts

Identify High-Risk Venues

Venue Intervention
1. Early warning system “Emergency alert”
2. HIV phase testing

Locate People with Acute or Recent Infection

Reduce transmissions even by those we never meet

We will very ACTIVELY link people with acute or recent infection into care

Reduce viral loads and thus transmissions

NIDA Avant Garde - Friedman
Table 2. Yield ratios for strategic identification of recent infections for the Transmission Reduction Intervention Project (TRIP) in Chicago, IL, 2014-2016 (n=185)

<table>
<thead>
<tr>
<th>Network Contact Tracing Yield</th>
<th>Network of Recent Seeds (NRS)</th>
<th>Recent Seeds (RS)</th>
<th>NRS/RS</th>
<th>Network of Control Seeds (NCS)</th>
<th>Control Seeds (CS)</th>
<th>NCS/CS</th>
<th>(NRS/RS) / (NCS/CS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV-diagnosed</td>
<td>36</td>
<td>24</td>
<td>1.50</td>
<td>6</td>
<td>21</td>
<td>0.29</td>
<td>5.17</td>
</tr>
<tr>
<td>HIV-diagnosed unaware</td>
<td>6</td>
<td>24</td>
<td>0.25</td>
<td>0</td>
<td>21</td>
<td>0.00</td>
<td>-2</td>
</tr>
<tr>
<td>Recent HIV infection</td>
<td>1</td>
<td>24</td>
<td>0.04</td>
<td>0</td>
<td>21</td>
<td>0.00</td>
<td>-2</td>
</tr>
<tr>
<td>Active syphilis infection¹</td>
<td>11</td>
<td>24</td>
<td>0.46</td>
<td>1</td>
<td>21</td>
<td>0.05</td>
<td>9.20</td>
</tr>
</tbody>
</table>

¹Defined as titer ≥ 1:8

²Undefined

Index is comparable to 5.28 among injectors in Athens. Nikolopoulos et al. Scientific Reports, 2017
Preliminary Results

• Largely a YBMSM/Transwoman epidemic
  – 24 recents/acutes
  – Positives among network members: 26 (26/52 or 50%)
  – 8 (31%) highly infectious (VL >60K)
  – Surprisingly few recents/acutely infected in the networks of recent/acutely infected

• Differs from epidemics in Indiana, Greece and Ukraine among PWID

• Yield of new infections is no different when we ask for social contacts compared to risk contacts
  – Recruitment of social contacts less challenging than sex contacts

• Shift to network services instead of partner services
• Shift to re-engagement in care
Sociomolecular approach

Molecular ties overlap with sex or Facebook ties less than half of the time
Persons Living with HIV

Persons at increased risk for HIV

Similar needs → clinical care, behavioral health, supportive services, etc.

Common barriers and obstacles → access, cost, quality, etc.

Marketing/Recruitment

Testing

Linkage to Healthcare

Engagement/Retention in Healthcare

ARV RX for PrEP/HIV Treatment

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Decreased HIV Transmission

Common ARV Pathway

Change Agent Type Network Intervention

PrEP-R; Project nGage

Network Intervention match
Project nGage: Network Supported Engagement in Care for YBMSM/TW Living with HIV
Project nGage: Results

• Intervention condition participants were 2.70 times more likely to be retained in care with at least 3 provider visits

• Intervention condition participants were 2.9 times more likely to be 90% adherent to antiretrovirals than the control condition

• No differences in viral load suppression across groups

• Currently testing similar approach for PrEP retention in care
Global HIV Imperative

Human Rights

Food security
Education
Housing, safety
Women, children, families
Environment
Job, income security
Non-discrimination

“HIV illustrates...that individual & population vulnerability to disease, disability, & premature death is linked to the status of respect for human rights.”
- J Mann, HHR, p 17

Prevention
(epidemiology)

Care
(support)
Final Thoughts

- Network analysis and intervention for HIV Elimination Efforts is intuitive and makes sense

- Infectious diseases (and non-infectious; e.g., social contagion) work through networks – social, digital, sexual, molecular

- Epidemiologic data where unit of analysis is the individual benefits when network analysis is conducted on each of these units - or in parallel

- Implementation that utilizes network interventions is key to HIV elimination

- Ethical considerations are not trival; but are managed with greater precaution than other research including 3rd party data
Thank-you!

Collaborators

CCHE Students and Staff

Funders

http://hivelimination.uchicago.edu
https://www.facebook.com/hivelimination
@HIVEDiscovery