
Xiao Zang

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Background

- Simulation modeling plays a critical role in priority setting for HIV treatment and prevention interventions.

- Dynamic HIV transmission models can provide a unified framework to quantify the health and economic value of different strategies to address the HIV epidemic while accounting for microepidemic context and the synergistic effects of different combinations of interventions.

- Accounting for costs of implementing, delivering and sustaining interventions is necessary to assessing the value they may provide.

- A number of efficacious HIV interventions are available; however, there is a paucity of evidence on real-world implementation costs of many of these interventions.
Objective

- To inform a U.S. six-city microepidemic HIV transmission model, we executed a targeted literature review to estimate costs of implementing evidence-based interventions delivered at previously-documented scale among adults.

This research informed work presented during this conference:

1. **What will it take to ‘End the HIV epidemic’ in the US? An economic modeling study in 6 cities**
   - Looking Beyond 90-90-90 to Support, Measure, and Model City-Level Impact session: September 10 16:00–17:15 by Bohdan Nosyk.

2. **Estimating ranges on the scale of implementation for evidence-based HIV/AIDS interventions in the United States**
   - Data/Modeling session: September 10 17:15–18:15 by Emanuel Krebs

   - Policy/Finance session: September 11 14:30–15:30 by Emanuel Krebs.
Methods

We identified 16 evidence-based HIV interventions selected from the US CDC’s Compendium of Evidence-Based Interventions and Best Practices for HIV Prevention and the literature:

**Protect**
- Syringe services program (SSP)
- Medication for opioid use disorder (MOUD) with buprenorphine
- MOUD with methadone
- Targeted pre-exposure prophylaxis (PrEP) for high-risk MSM & MWID

**Diagnose**
- Opt-out testing in ER
- Opt-out testing in primary care (PC)
- EMR testing offer reminder
- Nurse-initiated rapid testing
- MOUD integrated rapid testing

**Treat**
- Case management for initiation
- Care coordination for retention
- Care coordination for retention, targeted
- EMR alert of suboptimal ART
- Same-day ART initiation
- Enhanced personal contact
- Re-linkage program
Methods

For each intervention, when applicable, we estimated costs of implementation, delivery and sustainment (2018$US):

- **Implementation** (over an 18-month implementation period)
  - Infrastructure
  - Training
  - Program Development

- **Delivery**
  - Human resources
  - Physical resources: medication/material, health service

- **Sustainment**
  - Refresher training, other provider engagement efforts
Methods

For each intervention, when applicable, we estimated costs of *implementation, delivery* and *sustainment* (2018$US):

- Costs were specific to intervention setting and city, where applicable and/or possible given available evidence.

- A majority of the accrued costs in our model required estimated costs per individual:
  - We made assumptions on patient volumes for healthcare settings and patient caseloads for HIV clinics based on peer-reviewed studies.

- Cost for implementing / sustaining intervention applicable to Public Health department planning were adjusted for city population size.
Results

We synthesized evidence from: 25 peer-reviewed publications; 11 public health and surveillance reports; 6 publicly-available data sets.
A Worked Example – Opt-out Primary Care Testing

A worked example for costs of implementing Opt-out Primary Care HIV Testing:

- **Implementation:**
  - $41,602 ($35,915 - $49,887) to $90,587 ($81,263 - $115,091) lump-sum across cities
  - $0.25 ($0.20 – $0.34) per individual

- **Delivery:**
  - Non-reactive HIV test: $12.44 ($12.21 - $19.13);
  - Reactive HIV test: $92.98 ($81.25 - $100.50)

- **Sustainment:** monthly costs adapted from Public Health department consultation on a prior study\(^1\):
  - $9,404 ($8,820 – $12,407) to $58,388 ($54,168 - $77,611) lump-sum across cities
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A Worked Example – Opt-out Primary Care Testing

A worked example for costs of implementing Opt-out Primary Care HIV Testing:

Calculations of Public Health departments personnel costs for the implementation and sustainment of expanded HIV testing interventions (2018 USD).

<table>
<thead>
<tr>
<th>Personnel</th>
<th>Salary*</th>
<th>FTE</th>
<th>Yearly $</th>
<th>Monthly $</th>
<th>FTE</th>
<th>Yearly $</th>
<th>Monthly $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opt-out HIV testing (ER &amp; PC) and Nurse-initiated testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registered Nurse (Educational leader)</td>
<td>75,072</td>
<td>1.0</td>
<td>75,072</td>
<td>6,256</td>
<td>1.0</td>
<td>75,072</td>
<td>6,256</td>
</tr>
<tr>
<td>Project manager</td>
<td>75,072</td>
<td>0.5</td>
<td>37,536</td>
<td>3,128</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physician (Clinical leader)</td>
<td>219,144</td>
<td>1.0</td>
<td>219,144</td>
<td>18,262</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Administrative support</td>
<td>39,399</td>
<td>1.0</td>
<td>39,399</td>
<td>3,283</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical and Health Services Manager</td>
<td>113,992</td>
<td>0.1</td>
<td>11,399</td>
<td>950</td>
<td>0.1</td>
<td>11,399</td>
<td>950</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td></td>
<td>31,879</td>
<td>7,206</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total**</td>
<td></td>
<td></td>
<td>41,602</td>
<td>9,404</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18-month implementation period total $ 748,842

* Full-time equivalent (FTE) salaries are from the Bureau of Labor Statistics (BLS) (4).
** Total includes fringe benefits of 30.5% based on national BLS estimates (5).

A Worked Example – Opt-out Primary Care Testing

A worked example for costs of implementing Opt-out Primary Care HIV Testing:

- **Implementation:**
  - $0.25 ($0.20 – $0.34) per individual

**Per individual implementation cost estimated by:**

\[
\text{Total implementation cost per healthcare facility} = \frac{\text{Average number of patient visits}}{} \]

## Results

Costs attributable to implementation, delivery, and sustainment of HIV testing and care interventions.

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Implementation Cost</th>
<th>Delivery Cost</th>
<th>Sustainment Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Testing Interventions</td>
<td>$ (95% CI)</td>
<td>$ (95% CI)</td>
<td>$ (95% CI)</td>
</tr>
<tr>
<td>Rapid HIV Test (HIV+)</td>
<td>N/A</td>
<td>12.43 (12.21-10.13)</td>
<td>N/A</td>
</tr>
<tr>
<td>Confirmatory HIV Test (HIV+)</td>
<td>N/A</td>
<td>92.95 (61.26-100.50)</td>
<td>N/A</td>
</tr>
<tr>
<td>Opt out testing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emergency department</td>
<td>748,842 (646,472-897.970)</td>
<td>--</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>Primary care</td>
<td>748,842 (646,472-897.970)</td>
<td>--</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>EMR testing order reminder</td>
<td>824,947 (709,445-961,715)</td>
<td>--</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>Nurse-initiated rapid testing</td>
<td>748,842 (646,472-897.970)</td>
<td>--</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>MOUD integrated rapid testing</td>
<td>1,258.29 (526.19-2,402.19)</td>
<td>--</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>ART engagement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual case management for ART initiation</td>
<td>104.875+</td>
<td>92.71 (24.72-165.42)</td>
<td>34.22 (11.72-142.59)</td>
</tr>
<tr>
<td>Individual care coordination for ART retention</td>
<td>104.875+</td>
<td>30.90 (8.64-161.86)</td>
<td>N/A</td>
</tr>
<tr>
<td>EMR alert of suboptimal ART engagement</td>
<td>1,892.67+</td>
<td>1.15 (0.67-1.72)</td>
<td>N/A</td>
</tr>
<tr>
<td>RAPID ART initiation</td>
<td>56.785+</td>
<td>607.89 (503.66-745.73)</td>
<td>N/A</td>
</tr>
<tr>
<td>ART re-engagement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhanced personal contact</td>
<td>966.89+</td>
<td>3.97 (2.71-5.94)</td>
<td>N/A</td>
</tr>
<tr>
<td>Re-linkage program</td>
<td>134,091 (71,046-201,137)</td>
<td>3,564.80+</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Costs in the model are applied monthly per individual and the respective sections of the supplement present all assumptions and calculations.

* Public Health department implementation and sustainment costs are applied in the model as monthly lump sum costs and Supplemental Appendix Tables 6 & 7 presents all calculations for each city (costs shown are for Seattle).

† 95% confidence interval for monthly costs applied in the model were derived based on the ranges of testing-specific patient volumes, as described in the supplement.

CI: Confidence interval, MOUD: Medication for opioid use disorder, ART: Antiretroviral therapy, EMR: Electronic medical records, RAPID: Rapid ART Program for Individuals with an HIV Diagnosis, PH: Public Health department.
# Results

## Costs attributable to implementation, delivery, and sustainment of HIV testing and care interventions.

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<td>2.29 (1.15-3.44)</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>Nurse-initiated rapid testing</td>
<td>748,842 (646,472-897,970)</td>
<td>2.36 (0.79-3.92)</td>
<td>9,404 (8,820-12,407)</td>
</tr>
<tr>
<td>MOUD integrated rapid testing</td>
<td>1,256,29 (536,18-2,402,19)</td>
<td>22.66 (14.57-30.16)</td>
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Conclusion

- The analysis suggests that resources used for HIV intervention programs varied across health settings and cities.

- Given the paucity of evidence on real-world implementation costs of many interventions, there is substantial decision value in devoting efforts to collecting data in this domain.

- Estimating costs of real-world implementation for evidence-based interventions to be incorporated in simulation modeling is necessary to assessing their potential population-level health and economic effectiveness.
Our Scientific Advisory Committee

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