
Emanuel Krebs

Emanuel Krebs, Xiao Zang, Benjamin Enns, Czarina N Behrends, Carlos Del Rio, Julia C Dombrowski, Daniel J Feaster, Kelly A Gebo, Matthew Golden, Brandon DL Marshall, Lisa Metsch, Bruce R Schackman, Steven Shoptaw, Steffanie A Strathdee, Bohdan Nosyk on behalf of the localized economic modeling study group supported by the US National Institute on Drug Abuse (R01-DA041747)
Background

The HIV epidemic in the US is best characterized as a set of diverse microepidemics.

### Total adult 15-64 Population (% projected change to 2040)

<table>
<thead>
<tr>
<th></th>
<th>Total population (2016)</th>
<th>Black / African American</th>
<th>Hispanic / Latinx</th>
<th>Non-Hispanic White and others</th>
<th>People Living with HIV (rate/100,000)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total adult 15-64</td>
<td>3,812,143 (37%)</td>
<td>1,336,469 (-1%)</td>
<td>391,265 (10%)</td>
<td>2,084,409 (-9%)</td>
<td>Prevalence 31,961 (670)</td>
</tr>
<tr>
<td>Population</td>
<td>1,874,601 (-1%)</td>
<td>553,665 (5%)</td>
<td>102,495 (3%)</td>
<td>1,218,441 (-8%)</td>
<td>New diagnoses 1,618 (33)</td>
</tr>
<tr>
<td>(2016)</td>
<td></td>
<td>568,815 (-1%)</td>
<td>3,385,948 (4%)</td>
<td>3,010,220 (-3%)</td>
<td>National Rank 2</td>
</tr>
<tr>
<td>Projection</td>
<td>1,821,311 (16%)</td>
<td>296,354 (-2%)</td>
<td>1,246,583 (7%)</td>
<td>278,374 (-5%)</td>
<td></td>
</tr>
<tr>
<td>Change to 2040</td>
<td>5,865,683 (3%)</td>
<td>1,304,687 (-1%)</td>
<td>1,703,286 (4%)</td>
<td>2,857,710 (-3%)</td>
<td></td>
</tr>
<tr>
<td>(%)</td>
<td>1,503,497 (15%)</td>
<td>95,550 (1%)</td>
<td>137,818 (7%)</td>
<td>1,270,129 (-8%)</td>
<td></td>
</tr>
</tbody>
</table>

### Adult 15-64 Population by race/ethnicity (% projected change in proportion by 2040)

<table>
<thead>
<tr>
<th></th>
<th>Black / African American</th>
<th>Hispanic / Latinx</th>
<th>Non-Hispanic White and others</th>
<th>People Living with HIV (rate/100,000)†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>31,961 (670)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New diagnoses</td>
<td>1,618 (33)</td>
<td>441 (19)</td>
<td>1,720 (20)</td>
<td></td>
</tr>
<tr>
<td>National Rank</td>
<td>2</td>
<td>25</td>
<td>27*</td>
<td>1</td>
</tr>
</tbody>
</table>

† Includes those living with HIV and those who are deceased due to HIV.

* Calculations based on estimated population growth and HIV prevalence rates.
Background

- 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.

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

- Our objective was to determine the cost-effectiveness of HIV treatment and prevention interventions among adults, offered at previously-documented levels of scale in six US cities with diverse HIV microepidemics.

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.
1. **Scientific Case** (Panagiotoglou et al, AIDS Behav. 2018;22(9):3071-3082)
3. **Medical Care Costs** (Enns et al, AIDS. 2019;33(9):1491-1500)
4. **Disease progression, ART persistence** (Wang et al, Lancet HIV. 2019;6(8):e531-e539)
5. **Model Calibration** (Zang et al, 2nd review)
7. **Defining the evidence-based interventions** (Krebs et al, under review)
Methods

Our model, at a glance:

- For each city, the population aged 15-64 was stratified as:
  - disease progression accounted for acute infection and CD4 strata

- Disease progression accounted for acute infection and CD4 strata

42 strata

19 states
Methods

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

**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

We used the Reach Effectiveness Adoption Implementation Maintenance (RE-AIM) framework to define for each intervention:

- **Effectiveness**: Drawn from RCTs, meta-analyses, and recently published literature.

- **Reach and Adoption determining the Scale of Delivery**: Drawn from evidence of real-world implementation.

- **Costs of implementation, delivery and sustainment**: Adapted from published sources.
Methods

We estimated averted HIV infections and incremental costs and quality-adjusted life-years (QALYs), and incremental cost-effectiveness ratios (ICERs):

- Payer perspective;
- 3% annual discount rate;
- 2018 USD;

for each intervention and city compared to the status quo.


- Interventions were implemented at previously-documented scale for a 10-year period.
- All outcomes were measured over a 20-year time horizon (2020-2040).
- We performed probabilistic sensitivity analysis (2,000 best-fitting parameter sets).
Results

Similarities across cities:

- Value of MOUD;
- HIV testing cost-saving;
- ART initiation valuable.

Differences across cities:

- SSP scale-up;
- Expanded targeted PrEP.
Results

Percentage of total averted infections:

- No single intervention averted more than 10.1% of new infections (PrEP in Miami)
Conclusion

- The value of individual HIV interventions depends on microepidemic context.

- Combination implementation strategies for HIV should be tailored to microepidemic context in order to provide the most value and have maximum impact on reducing the public health burden of HIV.

- A rapid scale-up of multiple evidence-based interventions will be needed to meet the newly-established targets for HIV elimination in the United States.
Our Scientific Advisory Committee

- Czarina N Behrends, PhD, Department of Healthcare Policy and Research, Weill Cornell Medical College
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- Steffanie A Strathdee, PhD, School of Medicine, University of California San Diego
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