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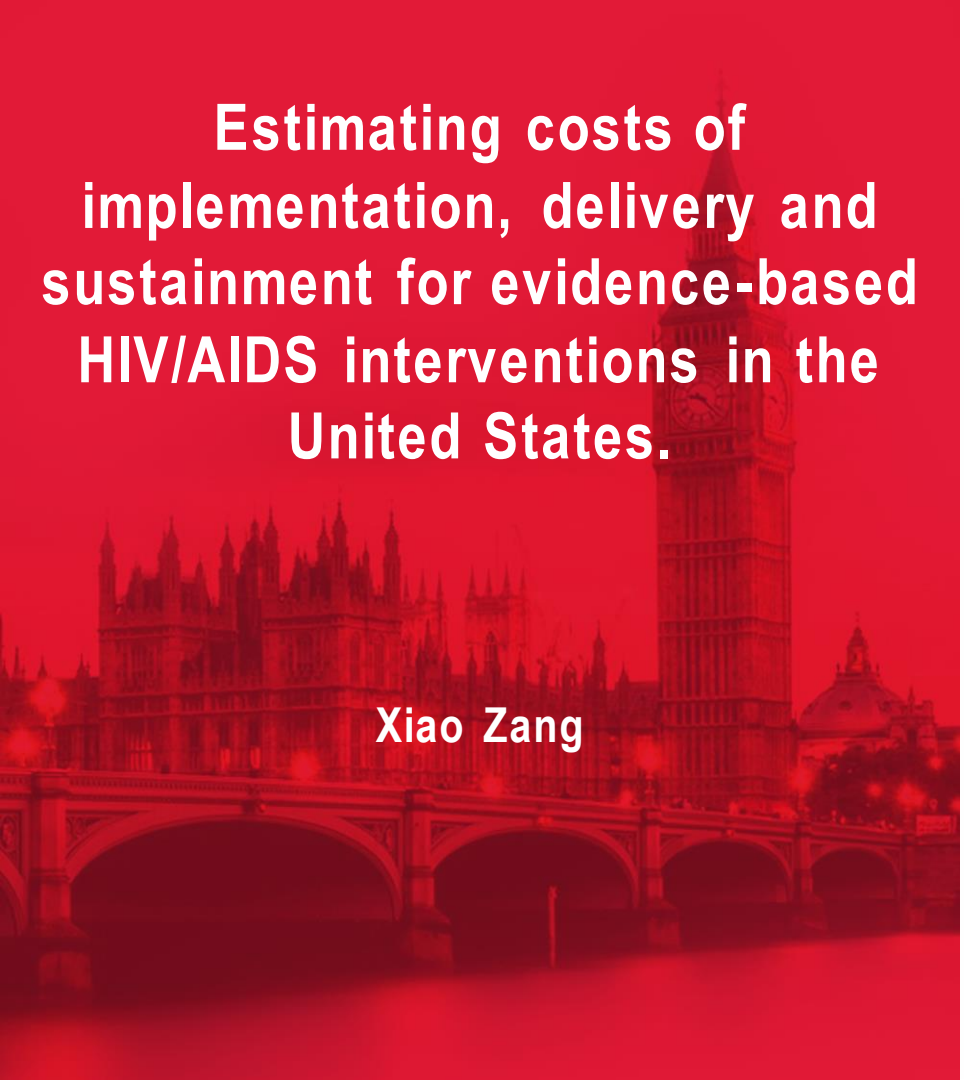

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IN PARTNERSHIP WITH: UNAIDS GNP+ GLOBAL NETWORK OF PEOPLE LIVING WITH HIV

Estimating costs of implementation, delivery and sustainment for evidence-based HIV/AIDS interventions in the United States.

Emanuel Krebs[1], **Xiao Zang**[1,2], Benjamin Enns[1], Czarina N Behrends[3], Carlos Del Rio[4], Julia C Dombrowski[5], Daniel J Feaster[6], Kelly A Gebo[7], Matthew Golden[5], Brandon DL Marshall[8], Lisa Metsch[9], Bruce R Schackman[3], Steven Shoptaw[10], Steffanie A Strathdee[11], Bohdan Nosyk[1,2] **on behalf of the localized economic modeling study group**

supported by the US National Institute on Drug Abuse (R01-DA041747)

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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
3. ***The impact of localized implementation: determining the cost-effectiveness of HIV prevention and care interventions across six U.S. cities***
   - *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

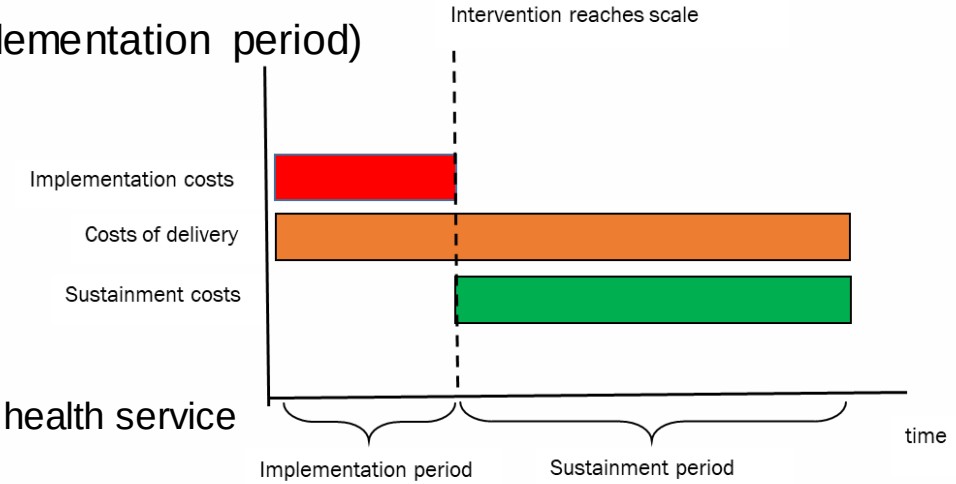
- Case management for initiation
- Care coordination for retention
- Care coordination for retention, targeted
- EMR alert of suboptimal ART
- Same-day ART initiation

- 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.

	Implementation			Delivery		Sustainment	
Costs included:	Public Health Dept	Facility or Clinic	Time Costs	Unit Costs	Time Costs	Public Health Dept	Time Costs
Syringe service program							
MOUD with buprenorphine							
MOUD with methadone							
Targeted PrEP for high-risk MSM							
Opt-out testing in ER							
Opt-out testing in primary care							
EMR testing offer reminder							
Nurse-initiated rapid testing							
MOUD integrated rapid testing							
Case management (ARTAS)							
Care coordination							
Targeted care coordination							
EMR ART engagement reminder							
RAPID ART initiation							
Enhanced person contact							
Re-linkage program							

Applicable

Not Applicable

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 ($8820 – $12,407) to $58,388 ($54,168 - $77,611) lump-sum across cities

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Derived from a micro-costing study[1]

- *The fourth-generation HIV assay and equipment*
- *Costs attributable to personnel time and material costs*

1. Schackman, et al, Public Health Rep. 2016; 1:71-81.

A Worked Example – Opt-out Primary Care Testing

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1. Nosyk, et al, Clin Infect Dis. 2017;66(5):765-77.

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).

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

1. Nosyk, et al, Clin Infect Dis. 2017;66(5):765-77.

A Worked Example – Opt-out Primary Care Testing

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

Per individual implementation cost estimated by:

$$\frac{Total\ implementation\ cost\ per\ healthcare\ facility^{1}}{Average\ number\ of\ patient\ visits}$$

1. White, et al, Ann Emerg Med 2011; 58:032.

Results

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

Intervention	Implementation Cost		Delivery Cost		Sustainment Cost	
	$ (95% CI)	Description	$ (95% CI)	Description	$ (95% CI)	Description
HIV Testing						
All Testing Interventions						
Rapid HIV Test (HIV+/-)	--	N/A	12.43 (12.21-19.13)	Cost per test	--	N/A
Confirmatory HIV Test (HIV+)	--	N/A	92.98 (81.25-100.50)	Cost per test	--	N/A
Opt-out testing						
Emergency department	748,842 (646,472-897,970)	Total costs per PH department^	--	N/A	9,404 (8,820-12,407)	Monthly costs per PH dpt.^
	2,527.64†	Costs per facility*	--	N/A	--	N/A
Primary care	748,842 (646,472-897,970)	Total costs per PH department^	--	N/A	9,404 (8,820-12,407)	Monthly costs per PH dpt.^
	2,527.64†	Costs per facility*	--	N/A	--	N/A
EMR testing offer reminder	824,947 (709,445-991,715)	Total costs per PH department^	--	N/A	9,404 (8,820-12,407)	Monthly costs per PH dpt.^
	1,692.67†	Costs per facility*	2.29 (1.15-3.44)	Time cost per offer reminder	26.94†	Monthly costs per facility*
Nurse-initiated rapid testing	748,842 (646,472-897,970)	Total costs per PH department^	--	N/A	9,404 (8,820-12,407)	Monthly costs per PH dpt.^
	71.52†	Costs per facility*	2.36 (0.79-3.92)	Additional time cost per test	--	N/A
MOUD integrated rapid testing	1,258.29 (526.19-2,402.19)	Costs per OTP*	22.66 (14.97-30.15)	Overhead and time cost per test	--	N/A
ART engagement						
Individual case management for ART initiation	104,875†	Costs per clinic*	92.71 (24.72-185.42)	Monthly costs per individual	34.22 (11.72-142.59)	Monthly costs per individual
Individual care coordinataion for ART retention	104,875†	Costs per clinic*	30.90 (8.24-61.81)	Monthly costs per individual	--	N/A
EMR alert of suboptimal ART engagement	1,692.67†	Costs per clinic*	1.15 (0.57-1.72)	Time cost per EMR alert	--	N/A
RAPID ART initiation	55,785†	Costs per clinic*	607.89 (503.66-745.73)	Monthly costs per individual	--	N/A
ART re-engagement						
Enhanced personal contact	988.89†	Costs per clinic*	3.97 (2.71-5.94)	Monthly costs per individual	--	N/A
Re-linkage program	134,091 (67,046-201,137)	Monthly costs per PH Department	3,564.80†	Monthly costs per PH Department	--	N/A

* 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 setting-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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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.

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Acknowledgements

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