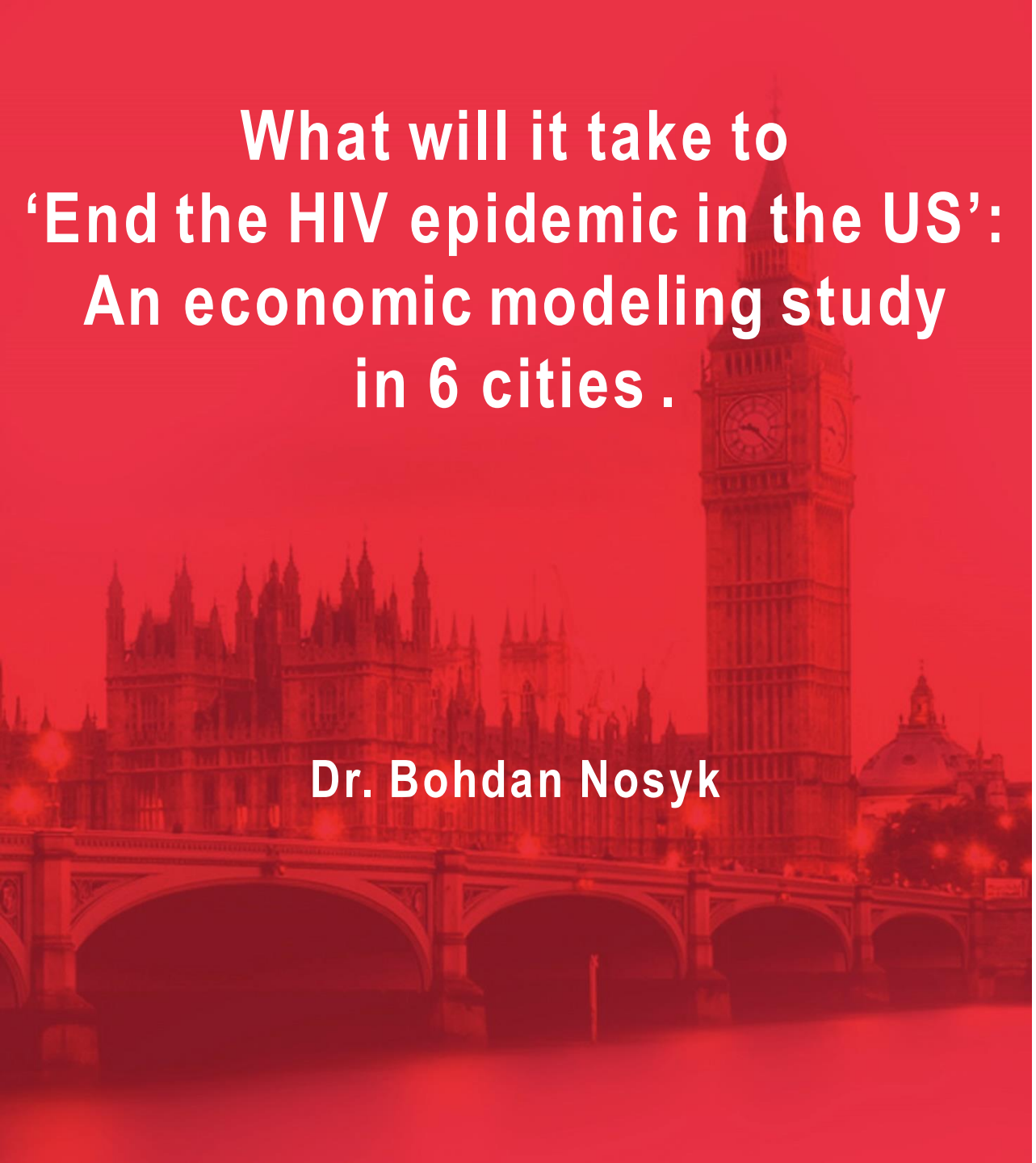
What will it take to ‘End the HIV epidemic in the US’: An economic modeling study in 6 cities .



Dr. Bohdan Nosyk

LONDON

FAST-TRACK CITIES 2019

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What will it take to ‘End the HIV epidemic in the US’: An economic modeling study in 6 cities

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

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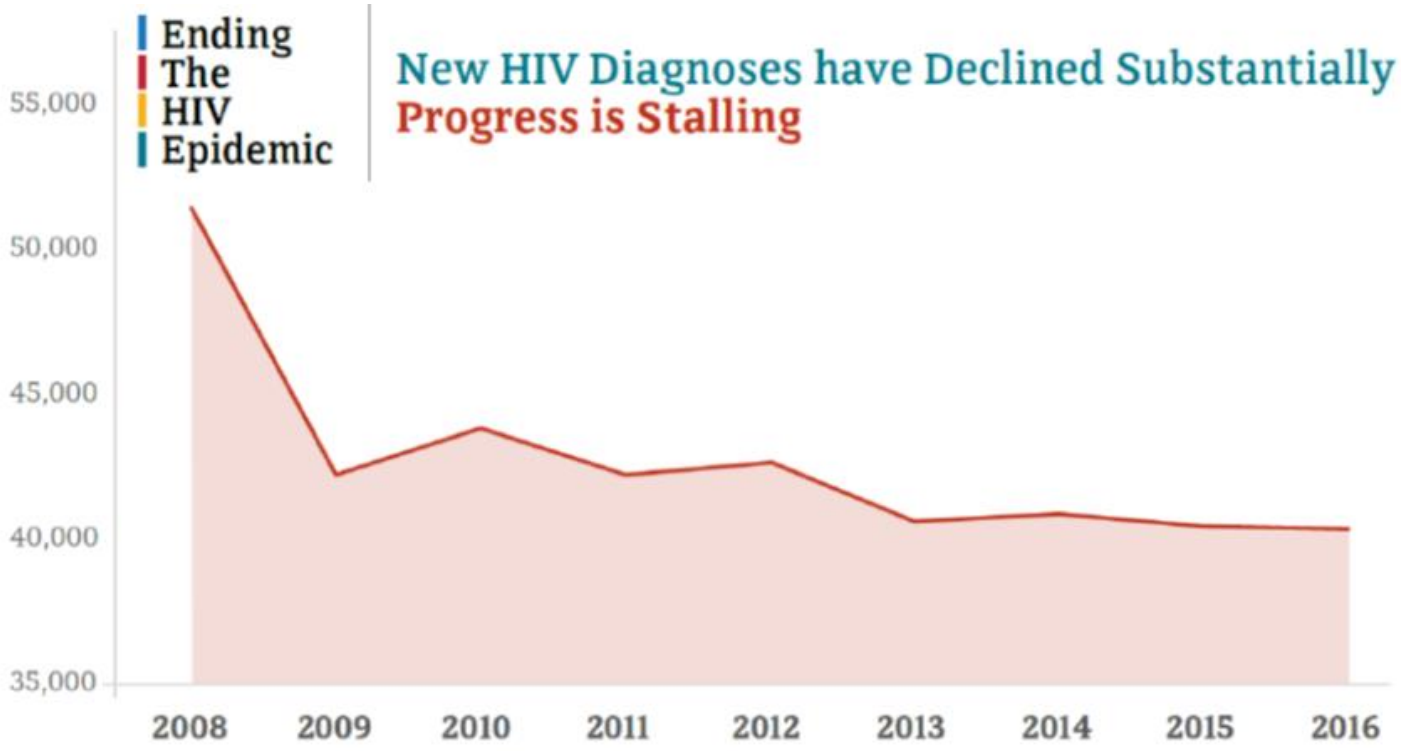
Background

- Despite numerous successes in the fight against HIV/AIDS and a $20B annual investment in the US, progress is stalling

- Evidence-based interventions available to ***Protect***, ***Diagnose*** and ***Treat*** HIV/AIDS

- Implementation has been suboptimal, with wide disparities in access across regions, ethnic groups.



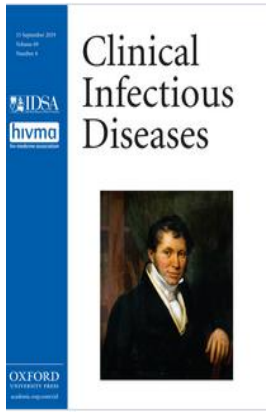
Our Objective

- Considering 16 evidence-based interventions to diagnose, treat and prevent HIV infection, we aimed to identify the highest-valued combination implementation strategies to reduce the public health burden of HIV/AIDS in six US cities.

- Value was estimated for interventions at previously- documented scale, and ideal implementation
  - How close can we get to the EtE incidence reduction targets?

- Value judged on the basis of quality-adjusted life years
  - International consensus as best practice
  - Captures, weighs benefits of reduced morbidity, mortality and transmission
  - Focus on equity, maximizing population health

Background Research



1. **Scientific Case** (Panagiotoglou et al, AIDS Behav. 2018;22(9):3071-3082)
2. **Evidence Synthesis** (Krebs et al, PLoS One. 2019;14(5):e0217559)
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)
6. **Defining the 'status quo' comparator** (Nosyk et al, *in press*, Clin Infect Dis. 2019)
7. **Defining the evidence-based interventions** (Krebs et al, under review)

Methods

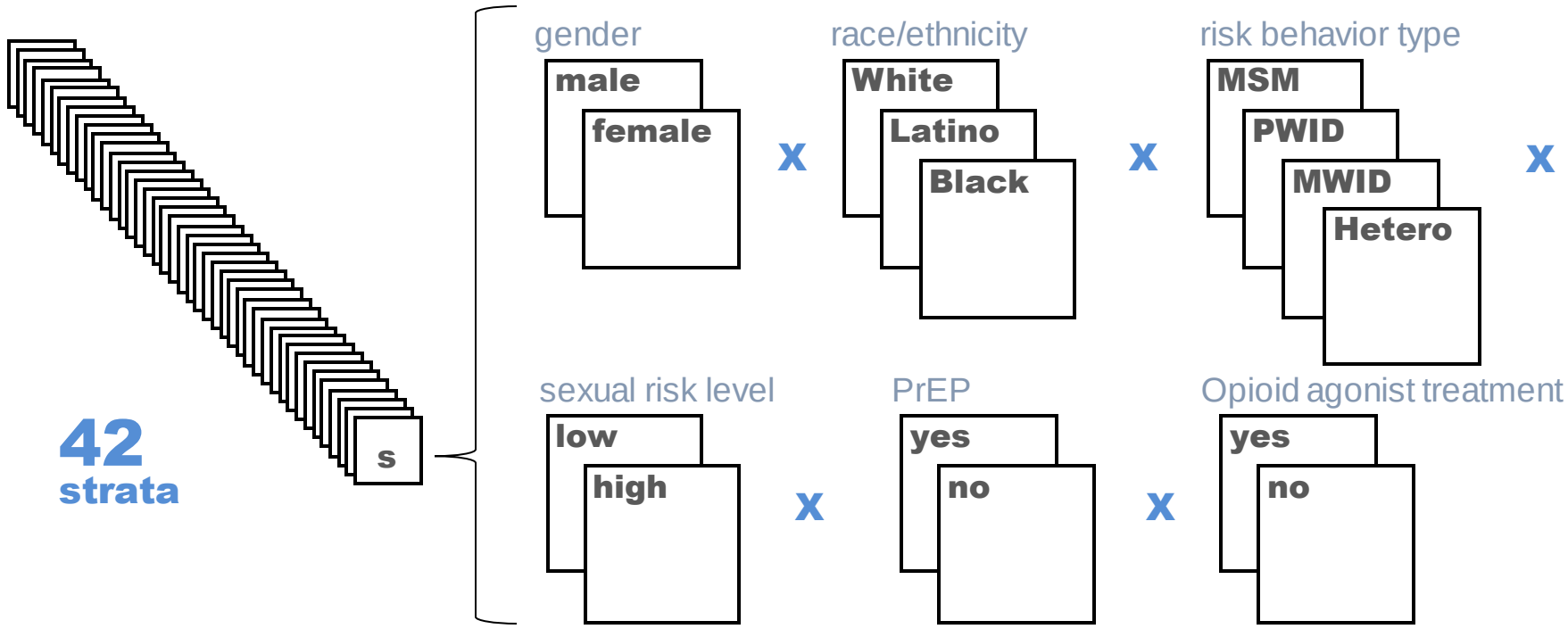
- We estimated 23,039 unique combinations of interventions per city to identify the optimal combination implementations strategies for a range of investment levels.

- The strategy providing the greatest health benefits while still remaining cost-effective by WHO standards was chosen for each city

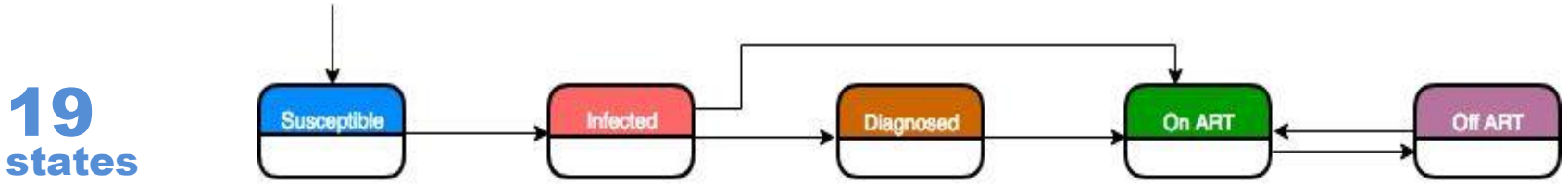
- We considered an ‘Ideal implementation’ scenario to see how close we could get to the EtE goals
  - Prevention strategies: **90%** target population ocverage
  - ART engagement strategies: **90%** target population coverage
  - HIV testing: **90%** target population coverage

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



Selected Evidence-Based Interventions

Selected from the CDC's Compendium of Evidence-Based Interventions and Best Practices for HIV Prevention

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

Further information provided in the coming sessions

1. *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.

2. *A preamble to ending the HVI epidemic in the United States: Modeled status quo projections for new HIV diagnoses in six US cities*
   - Poster session: September 10 17:15–18:15 by Xiao Zang.

3. *Estimating costs of implementation, delivery and sustainment for evidence-based HIV/AIDS interventions in the United States*
   - Policy/Finance session: September 11 14:30–15:30 by Xiao Zang.

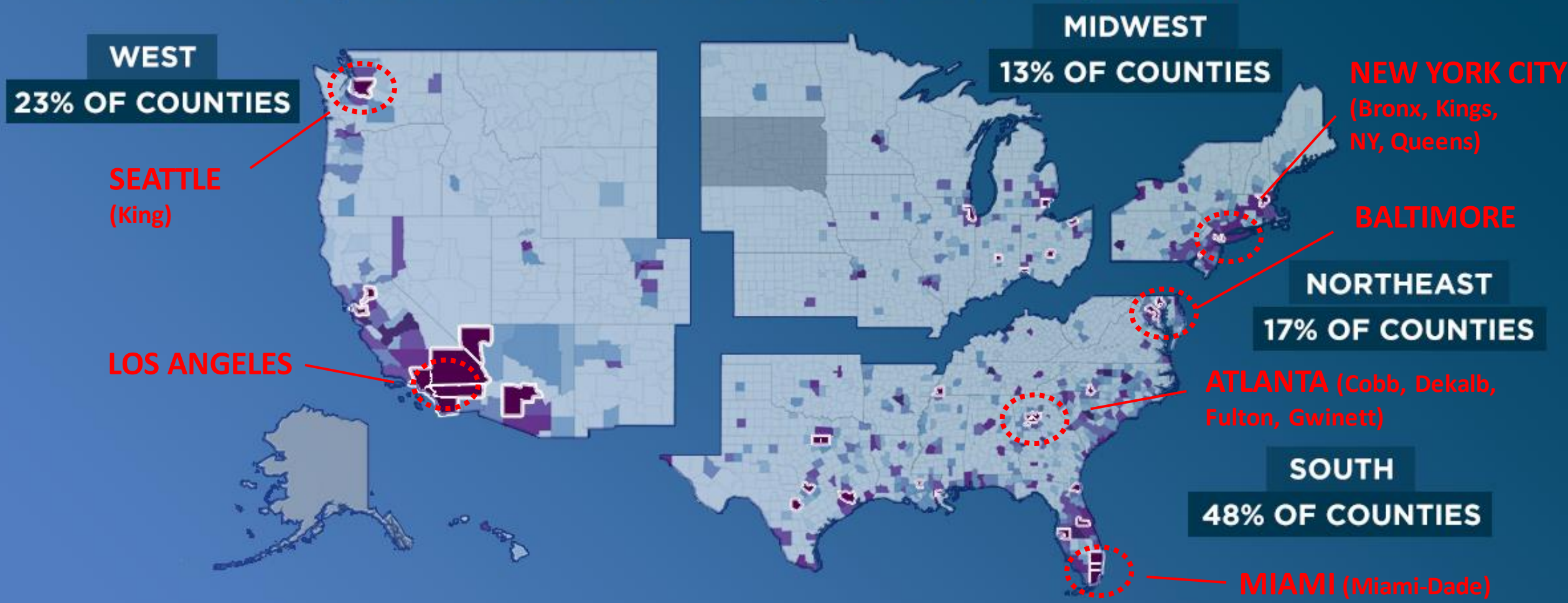
4. *The impact of localized implementation: determining the cost-effectiveness of HIV prevention and care interventions across six U.S. cities*
   - Policy/Finance session: September 11 14:30–15:30 by Emanuel Krebs.

Our focal cities: Home to 24.1% of the US population of people living with HIV/AIDS

Total adult 15-64 Population (% projected change to 2040)						
Total population (2016)	3,812,143 (37%)	1,874,601 (-1%)	6,964,983 (-2%)	1,821,311 (16%)	5,865,683 (3%)	1,503,497 (15%)
Adult 15-64 Population by race/ethnicity (% projected change in proportion by 2040)						
Black / African American	1,336,469 (-1%)	553,665 (5%)	568,815 (-1%)	296,354 (-2%)	1,304,687 (-1%)	95,550 (1%)
Hispanic / Latinx	391,265 (10%)	102,495 (3%)	3,385,948 (4%)	1,246,583 (7%)	1,703,286 (4%)	137,818 (7%)
Non-Hispanic White and others	2,084,409 (-9%)	1,218,441 (-8%)	3,010,220 (-3%)	278,374 (-5%)	2,857,710 (-3%)	1,270,129 (-8%)
People Living with HIV (rate/100,000) †						
Prevalence	31,961 (670)	16,931 (718)	48,100 (564)	26,128 (1,120)	117,260 (959)	7,768 (312)
New diagnoses	1,618 (33)	441 (19)	1,720 (20)	1,150 (49)	2,608 (21)	248 (10)
National Rank Δ	2	25	27*	1	21*	75*

Ending the HIV Epidemic: A Plan for America

Regional Breakdown of the 48 Highest Burden Target Counties



NUMBER OF PERSONS NEWLY DIAGNOSED WITH HIV, 2016

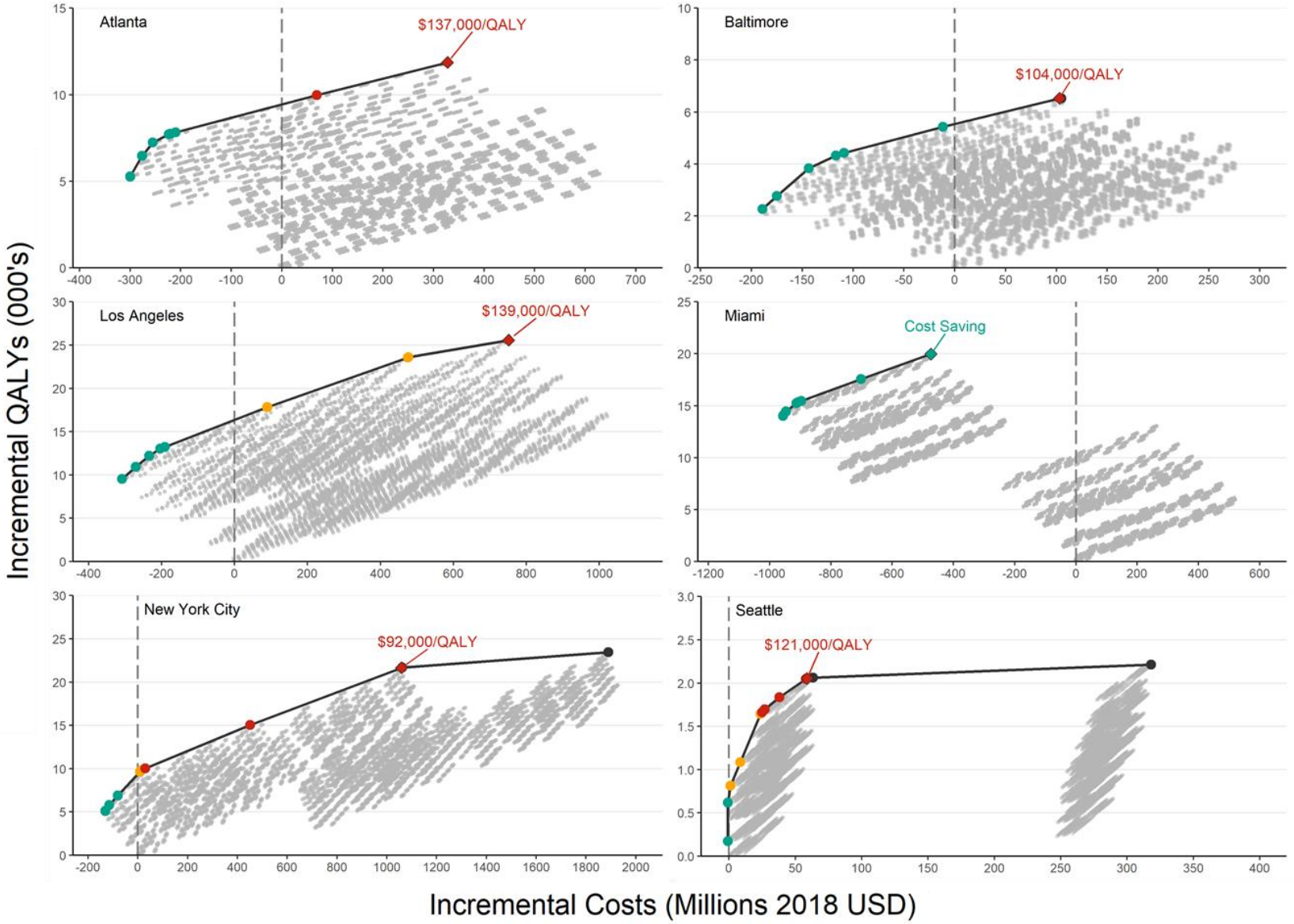
5 - 5	6 - 6	7 - 8	9 - 10	11 - 13	14 - 19	20 - 28	29 - 49	50 - 111	112+

AIDSVu.ORG

SOURCE: U.S. CENTERS FOR DISEASE CONTROL AND PREVENTION

AIDSVu

Localized combination implementation strategies delivered at previously-documented scale

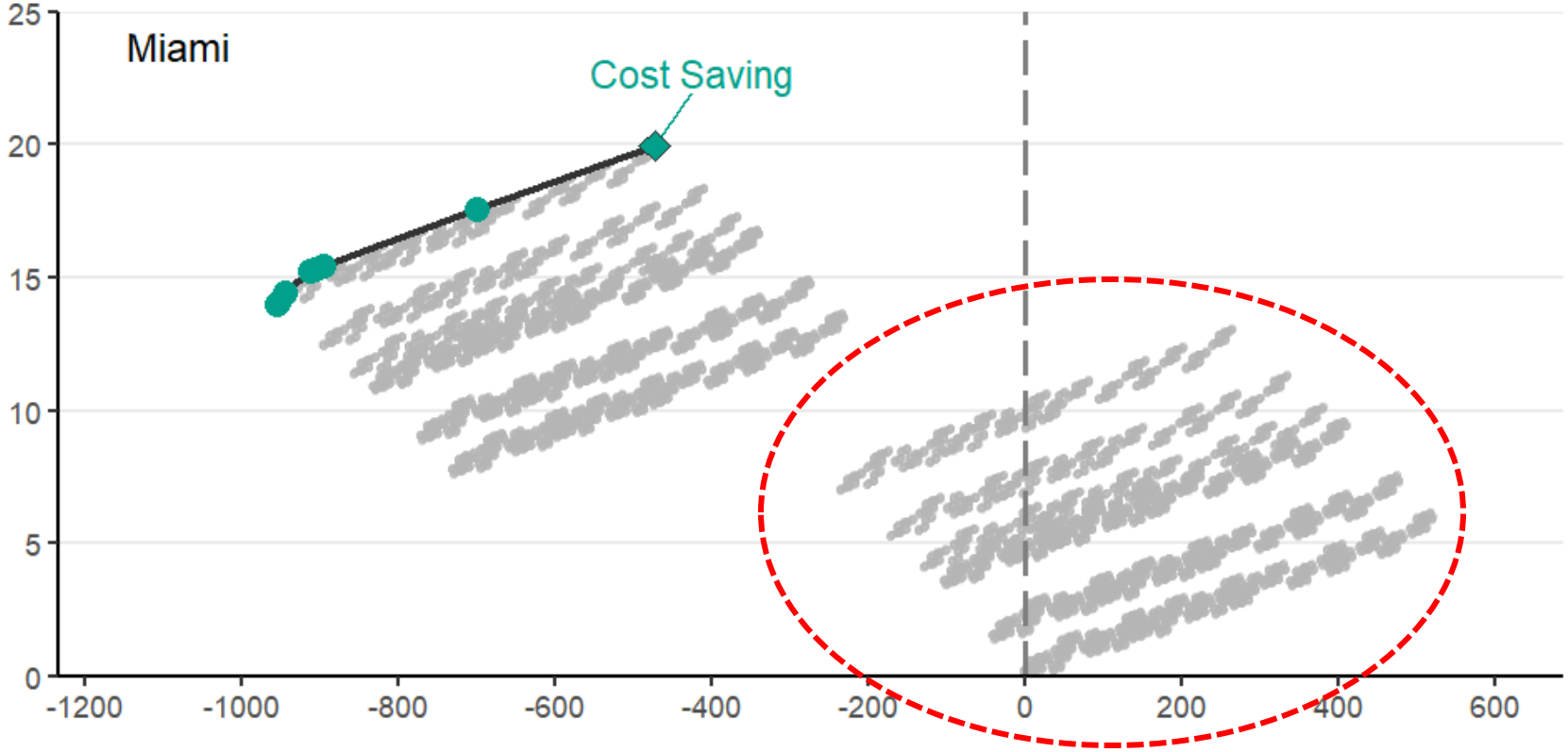


- 11-13 interventions were included in health-maximizing strategies per city

Health-maximizing cost-effective strategy
Cost Saving
Very Cost-Effective
Cost-Effective
Not Cost-Effective
Other combination

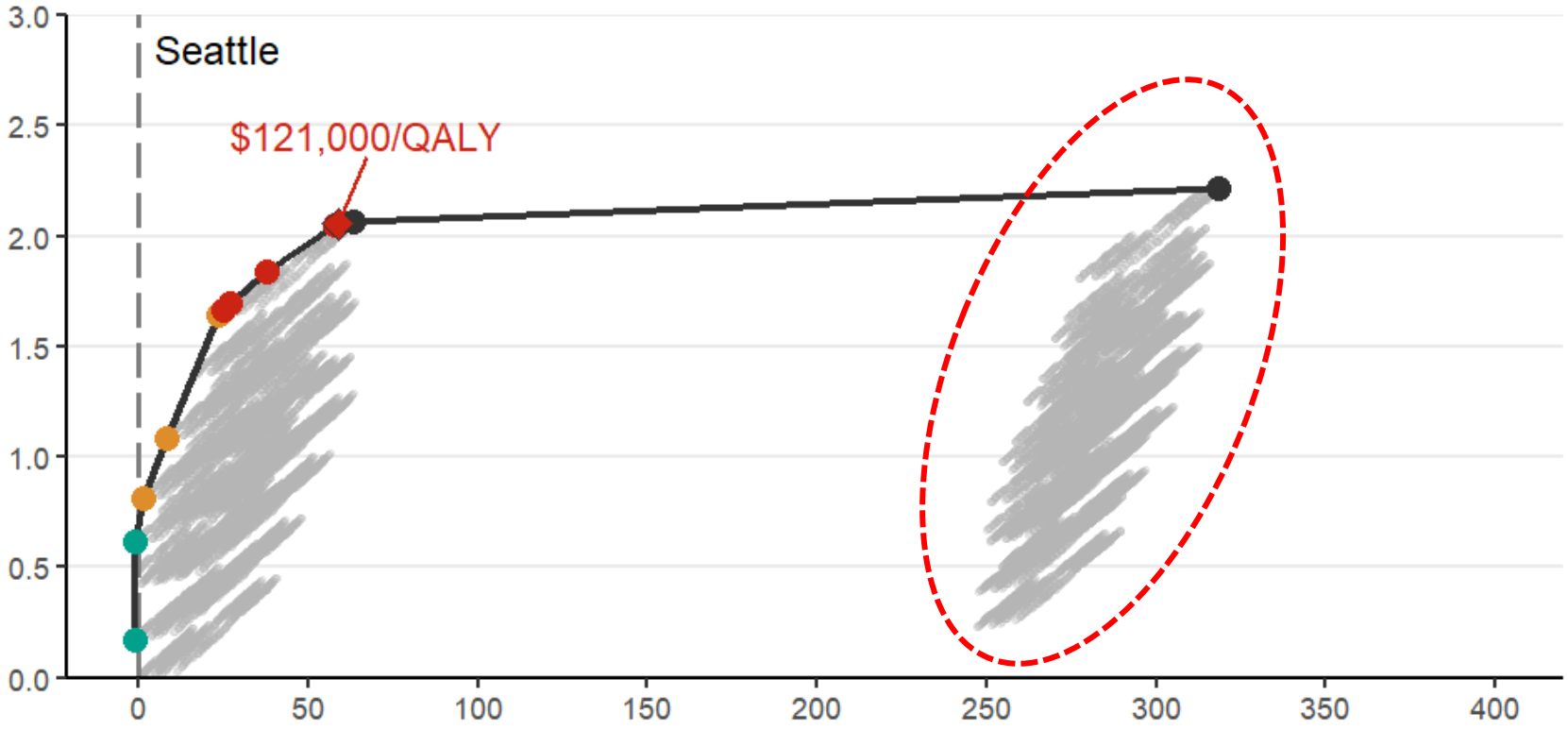
Nosyk et al. Submitted 2019.

A case study: Miami's Health Production Function



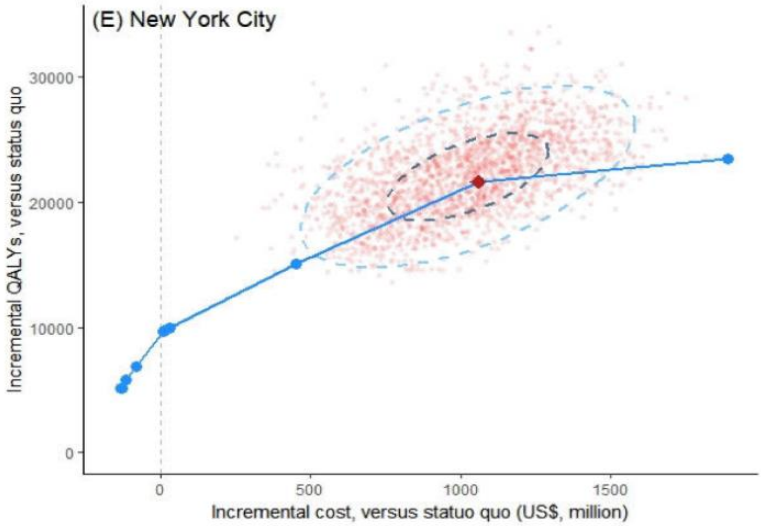
- Selected strategy: will deliver a gain of 19,973 QALYs at a savings of $473.7M in present value over a 20-year time horizon.
- The costliest strategy (ltd testing, no SSP or PrEP) is estimated to cost an additional $994.2M over 20 years while delivering only 30.1% of the QALY gain of the selected strategy (31.4% fewer infections averted in 2030).

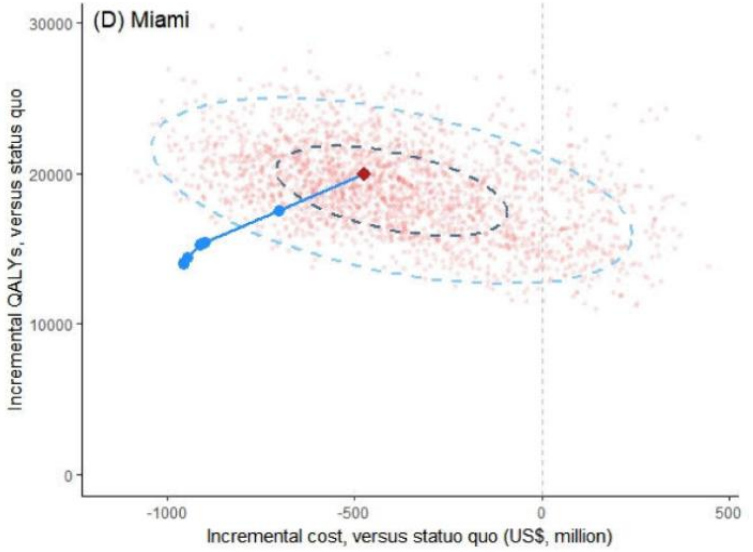
A case study: Seattle's Health Production Function

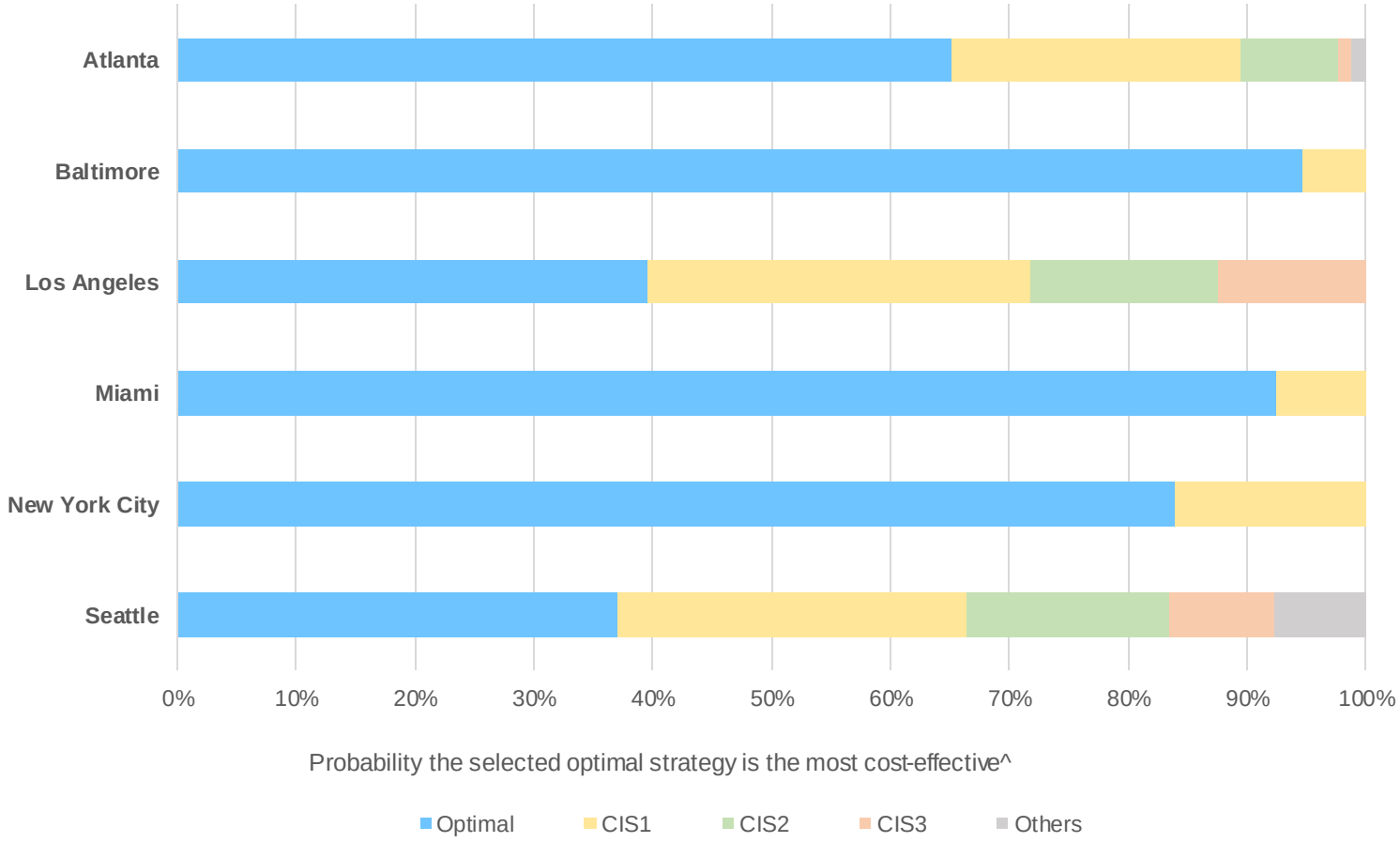


- Selected strategy: will deliver a gain of 2,046 QALYs at an additional investment of $57.9M in present value over a 20-year time horizon, resulting in an ICER of $95,416 per QALY .
- The strategy including PrEP generated an additional 168 QALYs (5.7% more infections averted in 2030), but at an incremental cost of $260.2M; ICER: $1.54M/QALY gained

Analysis of uncertainty

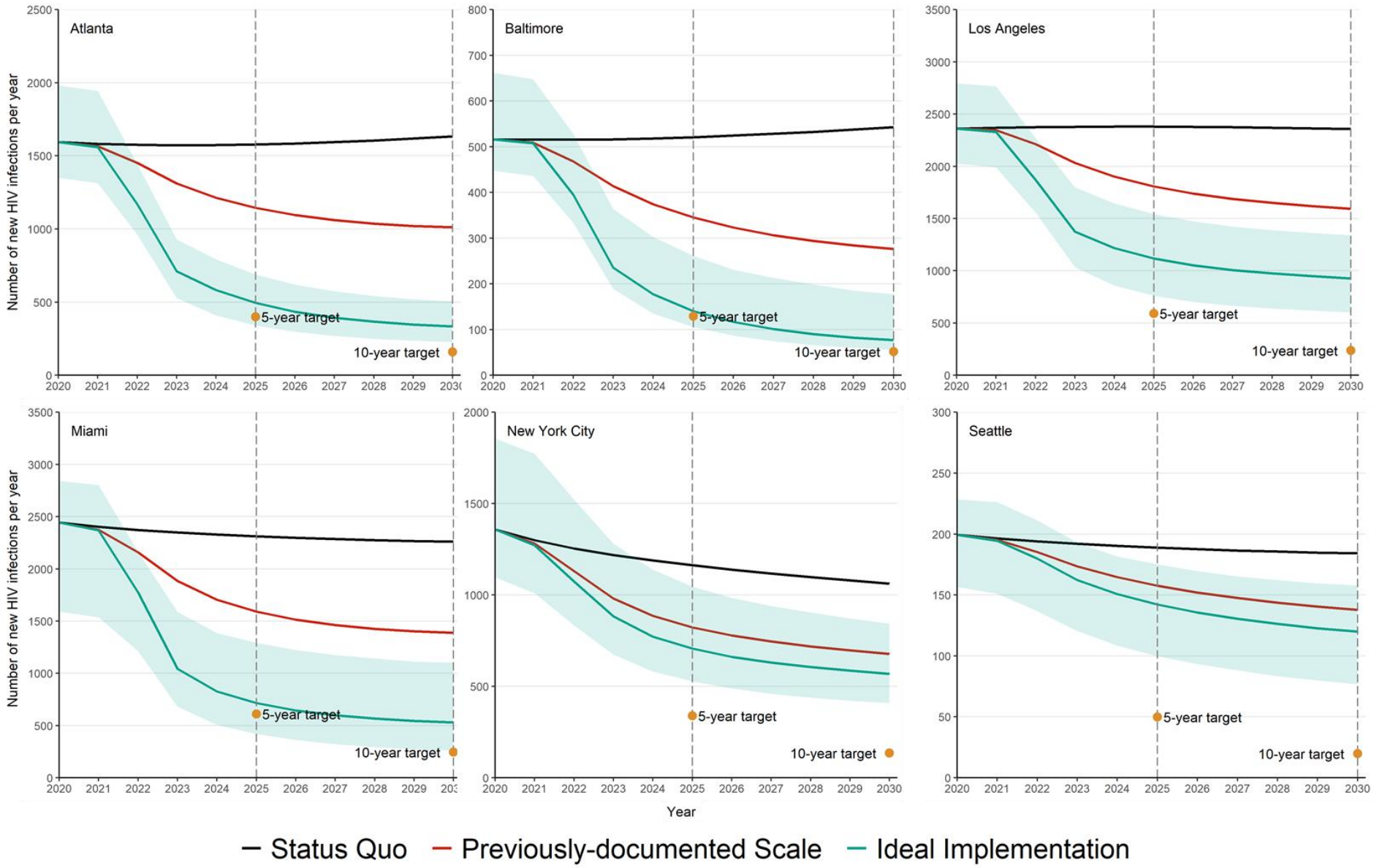






The selected strategies had a high probability of providing the greatest health gains compared to the most proximal competing strategies, with probabilities ranging from 37% (Seattle) to 95% (Baltimore).

Estimated impact on HIV incidence: 2020-2030

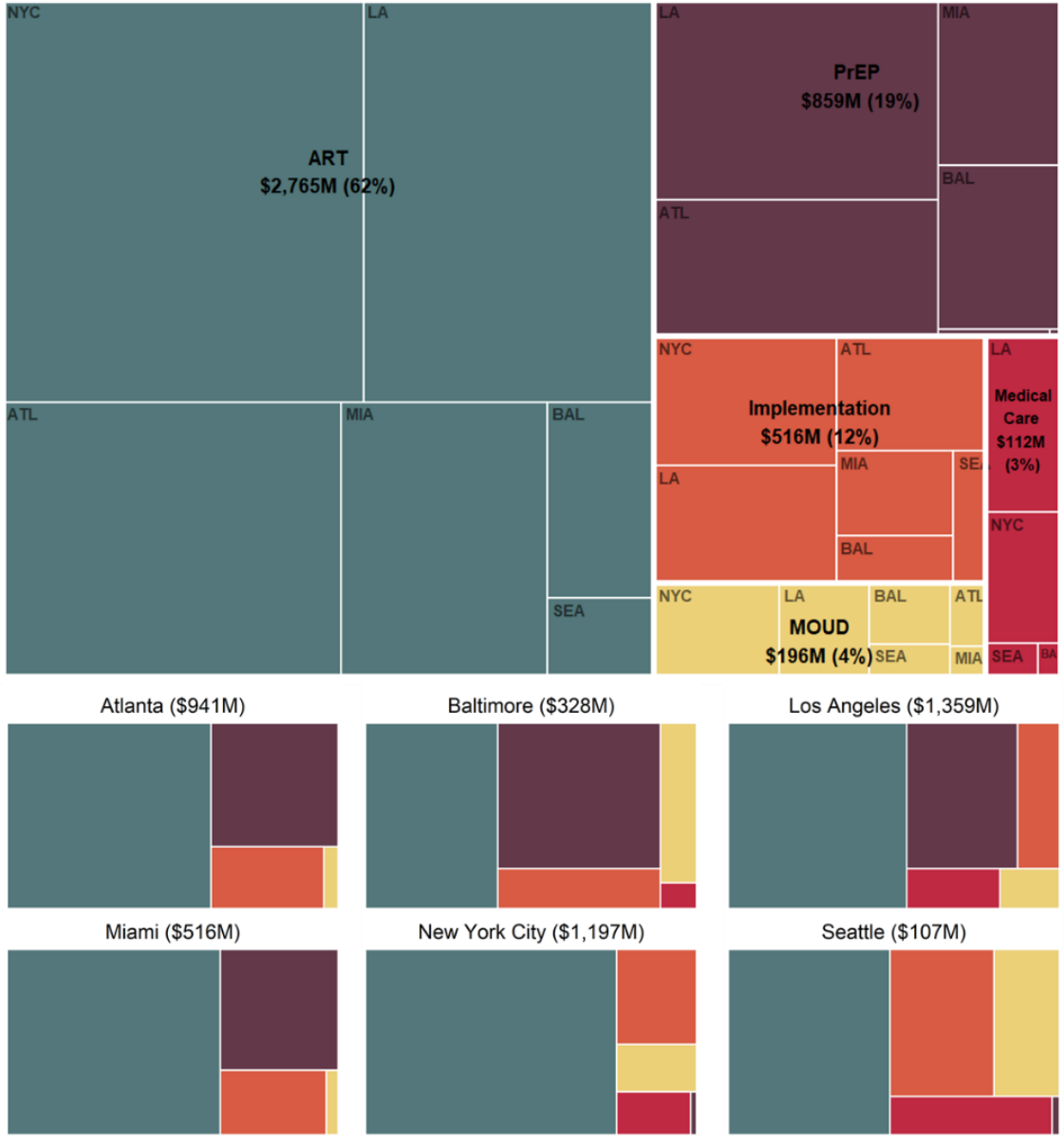


- **Previously-documented scale**: incidence reductions of 30.8% (Seattle) to 50.1% (NYC) by 2030

- **Ideal Implementation**: approaching EtE targets in Atlanta, Baltimore and Miami; LA, NYC and Seattle reaching 60.7%, 58.1% and 39.8% reductions.

Nosyk et al. Submitted 2019.

Estimated expenditures to implement optimal strategies at previously-documented scale: 2020-2030



- Strategies implemented at previously-documented scale-up: estimated cost of $4.45B in present-value by 2030.
- Investment would be front-loaded, peaking at an annual expenditure of $671M in 2024.
- Implementing these strategies for our focal cities would require 2.3 times the proposed US national budget allotment for 2020 to the ‘Ending the HIV Epidemic’ initiative.

Nosyk et al. Submitted 2019.

Limitations

- Simplifying assumptions in the structure of the model; transmission
- Limits in the evidence base on which it was built
- Interventions we assessed are not exhaustive
- Uncertainty on the potential scale of delivery, and the attributable costs of implementation, delivery and sustainment

Conclusions

- The EtE goals are not attainable without large reductions in new infections among black and Hispanic MSM in particular.
  - At ideal implementation, incidence in 2030 among black and Hispanic MSM in Miami would be reduced by 78.8% and 84.7%, nearly eliminating disparities relative to white MSM

- We only considered costs of delivering interventions directly impacting HIV-related outcomes. People who are most likely to be living with or acquire HIV are frequently living in poverty, without stable housing or reliable health insurance, hindering access to care. The limited scale-up of delivery for interventions incorporated in this study reflects these realities.

- Interventions will need to be augmented with efforts to:
  - reduce stigma
  - improve health literacy
  - address capacity constraints in healthcare delivery
  - reduce other social and structural barriers to healthcare access

Our Scientific Advisory Committee

- Czarina N Behrends, PhD, Department of Healthcare Policy and Research, Weill Cornell Medical College
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- Fahmida Homayra, MSc
- Lindsay Pearce, MPH
- Charlie Zhou, MSc
- Trevor Thomson, PhD(c)
- Megan Kurz, MSc student
- Ken Peng, BSc student

Acknowledgements

Questions?

THE TIME IS NOW: RIGHT DATA, RIGHT TOOLS, RIGHT LEADERSHIP ?

- **Epidemiology**
  - Most new HIV infections are clustered in a limited number of counties and specific demographics
- **Antiretroviral Therapy**
  - Highly effective, saves lives, prevents sexual transmission; increasingly simple and safe
- **Pre-exposure Prophylaxis (PrEP)**
  - FDA-approved and highly effective drug to prevent HIV infections
- **Proven Models of Effective Care and Prevention**
  - 25 years' experience engaging and retaining patients in effective care
- **Detect and Respond Strategy**
  - Extensive surveillance infrastructure in place, rapid detection and response capacity increasing

There is a real risk of HIV exploding again in the U.S.

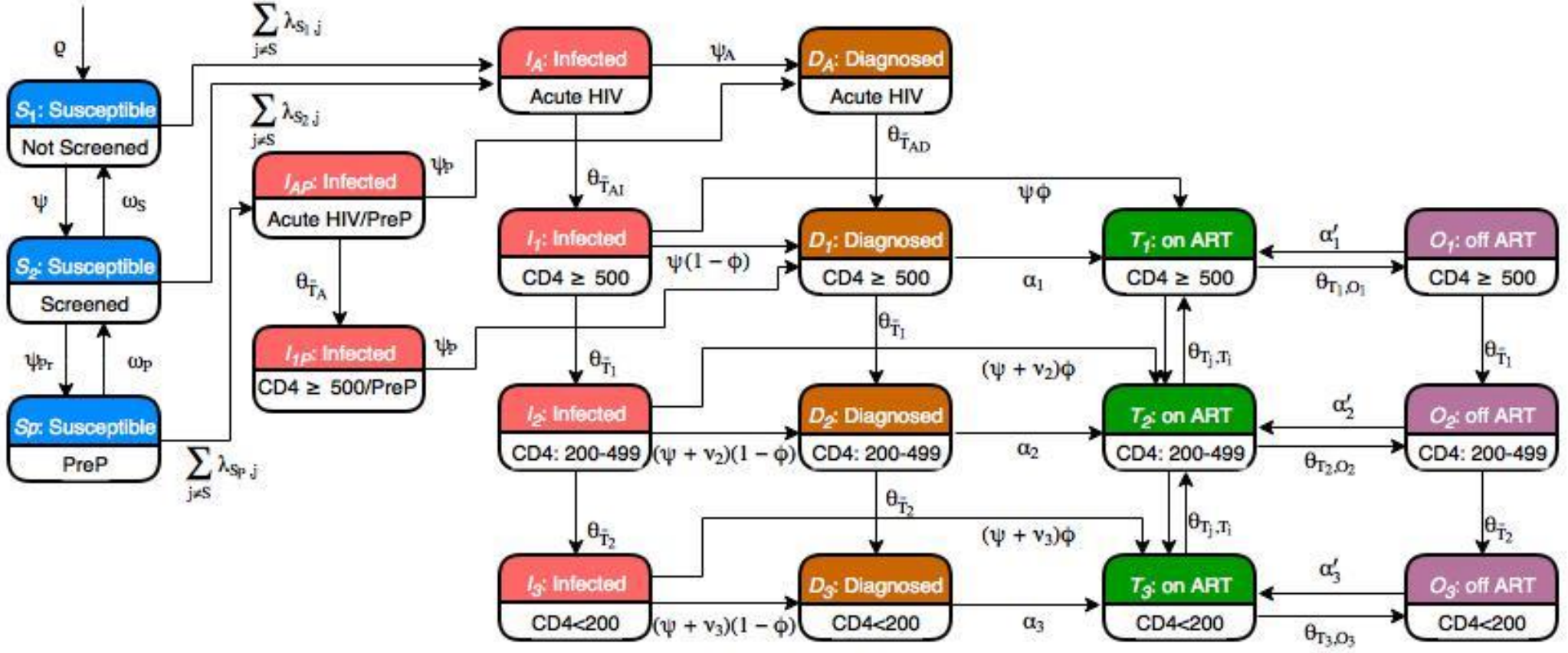
due to several factors *including injection drug use and diagnostic complacency among healthcare providers*

Ending the HIV Epidemic | www.hiv.gov

https://www.hhs.gov/sites/default/files/ending-the-hiv-epidemic-fact-sheet.pdf

Our model, at a glance

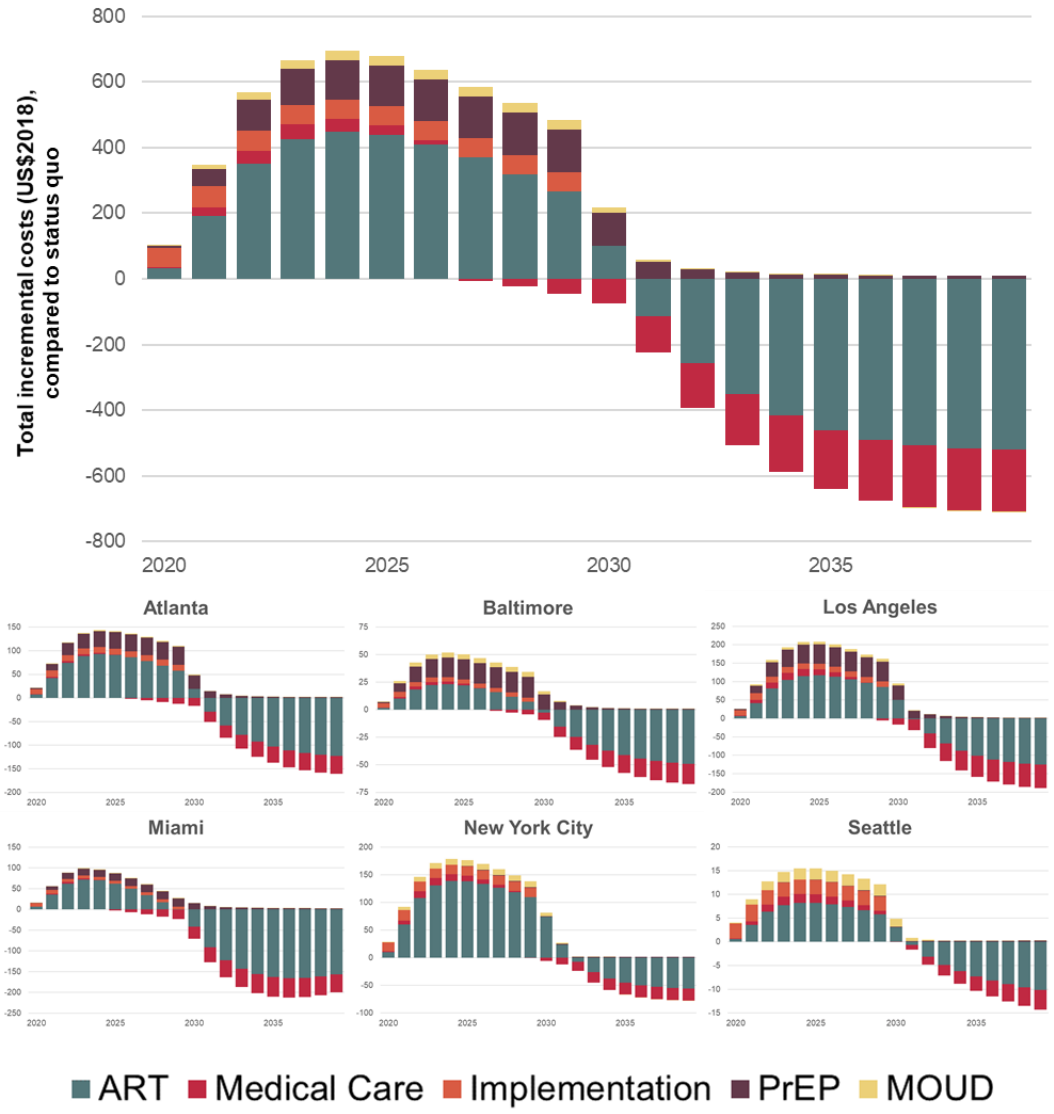
- Individuals within each of the 42 strata progress through the model according to the health states outlined in the schematic diagram:



Zang et al. Under review.

5. Localized combination implementation strategies to reach national *'Ending the HIV Epidemic'* goals

Results: Estimated annual incremental costs of implementing optimal combination implementation strategies, delivered at previously-documented scale-up, by source: 2020-2040



Nosyk et al. Submitted 2019.

Composition of optimal combination implementation strategies

		ATL	BAL	LA	MIA	NYC	SEA
Protect	Syringe service program						
	MOUD with buprenorphine						
	MOUD with methadone						
	Targeted PrEP for high-risk MSM						
Diagnose	Opt-out testing in ER						
	Opt-out testing in primary care						
	EMR testing offer reminder						
	Nurse-initiated rapid testing						
	MOUD integrated rapid testing						
Treat	Case management (ARTAS)						
	Care coordination						
	Targeted care coordination						
	EMR ART engagement reminder						
	RAPID ART initiation						
	Enhanced person contact						
	Re-linkage program						

Expand Maintain

Nosyk et al. Submitted 2019.