OPTIMIZING HIV PREVENTION EFFORTS WITHOUT NEW INVESTMENT CAN REDUCE INCIDENCE

[1]Jacobson EU, [2]Hicks KA, [2]Carrico J, [1]Sansom SL.

[1]Division of HIV/AIDS Prevention, Centers for Disease Control and Prevention, Atlanta, GA.; [2]RTI Health Solutions, Raleigh, NC.

Background

- **Research objective:** To better provide guidance on how HIV prevention resources in the United States could be focused to prevent the most new cases of HIV
- **Approach:** Input current estimated societal spending on HIV prevention into a complex model, and use an optimization method to assess how to achieve the largest reductions in HIV incidence

Methods

- **THE GOAL:** Estimate the potential maximum 10-year reduction in new infections
- **THE MODEL:**
  - A comprehensive dynamic compartmental model of HIV progression and transmission in the United States (HIV Optimization and Prevention Economics Model)
  - 27 Compartments: 2 HIV-susceptible (on PrEP and not on PrEP), 23 HIV disease stage and care, and 2 death (AIDS and non-AIDS)
    - Groups of patients flow from one compartment to another
    - 273 subpopulations stratified by age, risk level, transmission category, sex, circumcision status, and race/ethnicity
  - 5 key categories of model input parameters:
    - Population trends
    - Continuum of care characteristics
    - Infectivity rates
    - Transmission-related behavior
    - HIV disease progression rates and costs
  - Input data extracted from three main sources: (1) Surveillance reports; (2) Other published literature; (3) Model calibration
  - Calibration time frame: 2010 to 2017
  - Analytic time frame: 2018 to 2027, divided into two consecutive 5-year periods
  - Current estimated public and private HIV prevention spending: $2.6 billion for 2018
  - Applied the same total prevention spending each year for 10 years
  - Interventions for which funds could be allocated
    - HIV screening (high- and low-risk MSM, high-and low-risk heterosexuals, all PWID)
    - Interventions influencing HIV care continuum (linkage to care at and after diagnosis, prescription of ART, and adherence to care and treatment to achieve and maintain viral suppression)
    - PrEP
    - SSPs

Methods (Continued)

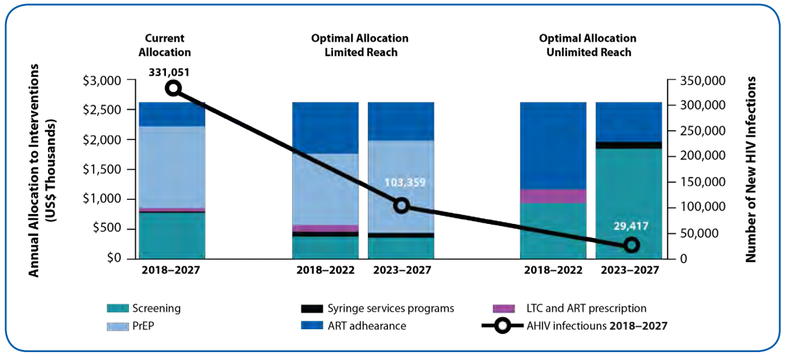
- **OPTIMAL ALLOCATION METHODOLOGY AND SCENARIOS:**
  - Used MATLAB's Optimization Toolbox to estimate the optimal allocation as the average annual allocation that produced the smallest number of HIV infections over two consecutive 5-year periods
  - Assumed all persons prescribed ART received it and incurred annual treatment costs while in care
  - Compared the current allocation scenario to two optimized allocations of spending on HIV prevention interventions
    - Current allocation: continuation of current allocation of spending
    - Limited-reach optimized allocation: allocation of total base-case spending on prevention interventions, optimized to minimize HIV incidence, considering limitations on expected intervention uptake throughout the 2018–2027 time frame
    - Unlimited-reach optimized allocation: same as limited-reach except assuming 100% intervention uptake of all eligible persons throughout the 2018–2027 time frame

Results

- **Current allocation:**
  - 30.0% and 16.7% of societal allocations applied to HIV screening and care-continuum interventions, respectively
  - 331,000 new cases from 2018 to 2027
- **Limited-reach optimized allocation versus current allocation:**
  - 10-year reduction in incidence: 69%
  - Allocation to HIV screening decreased to 13.4% in the first 5-year allocation, primarily due to less funding for screening low-risk heterosexuals
  - Allocation to care-continuum interventions increased to 35.1% in the first 5-year allocation
  - Continued allocation to PrEP
- **Unlimited-reach optimized allocation versus current allocation:**
  - 10-year reduction in incidence: 94%
  - Allocation to screening and care-continuum interventions increased to 35.4% and 64.6%, respectively, in the first 5-year allocation
  - Screening increased to cover all eligible persons
  - Allocation to PrEP minimized due to extensive diagnosis and effective viral suppression through the increased funding of ART adherence interventions

Results (Continued)

Figure: Outcomes under Current and Optimized HIV Prevention-related Allocation Scenarios, 2018-20277



Conclusions

- Optimized allocation of current societal spending in HIV prevention can achieve substantial reductions in new infections
- Achieving reductions in annual HIV incidence in 10 years by over 90% is theoretically possible, but implausible with current resources

Limitations

- The large amount of data required to inform model inputs, and uncertainty in those data, can lead to uncertainty in projected cumulative HIV incidence, which we addressed through sensitivity and uncertainty analyses
- Model does not consider infrastructure capacity

Contact Info

Evin Jacobson
wqm4@cdc.gov
404-639-0007

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