U.S. Population Benefits of HIV Preexposure Prophylaxis for Injection Drug Users

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Poster #1121

Background

- Injection drug users (IDUs) account for an oversized share of HIV infections in the US: 0.4% of the adult population, 11% of new HIV infections
- Bangkok Tenofovir Study (BTS), a 2013 Centers for Disease Control and Prevention (CDC)-sponsored randomized trial of daily oral preexposure chemoprophylaxis (PrEP) with Truvada, demonstrated a 48.9% reduction in HIV infection among high-risk IDUs in Thailand
- CDC revised its clinical practice guidelines in 2014 to recommend PrEP for IDUs

Objective

Estimate total population health benefits, costs, and cost-effectiveness of expanding access to PrEP for IDUs in the US over the next 20 years

Overview

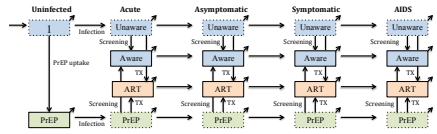
- Dynamic compartmental model captures both sexual and injection transmission routes and respects preferential mixing between IDU, men who have sex with men (MSM), and low-risk groups
- Inputs related to risky sexual and injection behavior, access to opioid replacement therapy and antiretroviral treatment (ART), and HIV screening and awareness from the published literature
- Calibrated to match current CDC estimates for HIV prevalence and incidence in each risk group
- For a variety of possible PrEP scenarios, we project HIV prevalence and incidence, quality-adjusted life-years (QALYs), and health care costs (discounted at 3% annually) from a societal perspective
- Scenarios evaluated in terms of infections averted and incremental cost-effectiveness ratios (ICERs) over a 20-year analytic time horizon

Population

- US adult population (18-64) stratified by
  - Risk group (IDU, MSM, low risk)
  - HIV infection status
  - CD4 count if infected
  - HIV awareness status
  - HIV treatment status (ART)
  - Enrollment in Opioid Replacement Therapy (IDU only)
  - PrEP status

Methods: Dynamic Compartmental Model

Figure 1: Simplified Model Schematic



Methods: Technical Details

- Background mortality rate is adjusted for risk and AIDS status
- Phases of HIV: acute, asymptomatic (CD4 count ≥ 500 cells/mm3), symptomatic (200-500 cells/mm3), and AIDS (≤ 200 cells/mm3)
- Depending on risk group, health, and treatment status, a differing number of QALYs and costs accrue to each compartment
- The model is a system of dynamic equations, which we numerically project over time, updating monthly over a 20-year time horizon
- Programmed in Matlab R2014b

Methods: Analysis of PrEP

- As outlined in the CDC's 2014 guidelines, PrEP includes both a daily oral Truvada pill as well as HIV testing every 3 months and monitoring for adverse effects
- We assume 90% of those infected while on PrEP will enroll in ART
- Base case analyses assume that PrEP coverage could reach 50% of IDUs in a relatively short period of time
- Per the BTS study, we assume a 49% reduction for both sexual and injection-based transmission in the risk of acquiring HIV

Results: Base Case Analysis Over 20 Years

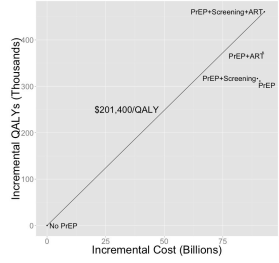
Table 1: Base Case Results

Strategy	Total HIV Infections Averted	HIV Prevalence in IDUs at 20 Years	Incremental Costs over 20 years (Billions)	Incremental QALYs over 20 years	ICER ($ per QALY gained)
No PrEP	-	6.2%	-	-	-
50% PrEP	71,382	4.2%	92.8*	461,000	$201,400

*Costs of $110 billion for PrEP and $10 billion for additional screening partially offset by costs saved from averted infections

Package of Care

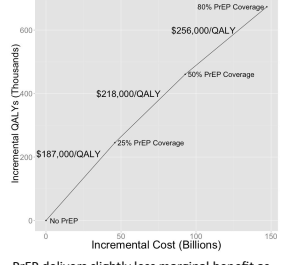
Figure 2: Components of PrEP Care



PrEP's value in IDUs is greatly enhanced when frequent screening and timely treatment are available for those who become infected

Levels of Coverage

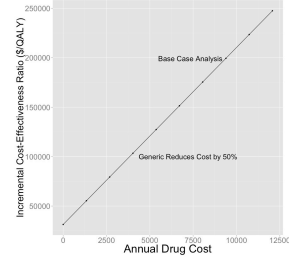
Figure 5: PrEP Coverage



PrEP delivers slightly less marginal benefit as coverage increases

Cost of PrEP

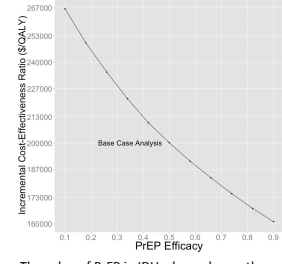
Figure 3: Sensitivity to PrEP Cost



A generic priced at 50% of Truvada costs less than $100,000 per QALY gained

PrEP Efficacy

Figure 4: Sensitivity to PrEP Efficacy



The value of PrEP in IDUs depends greatly upon efficacy; average population adherence is important for maintaining efficacy

Conclusions

- PrEP can deliver significant health benefits, especially when administered as a package of care with increased screening and prompt enrollment in treatment
- At current prices, PrEP is an expensive intervention at $201,400 per QALY gained, but reductions in price could improve cost-effectiveness
- Total program expenditures are very large (nearly $5 billion per year at 50% coverage)
- The cost-effectiveness of PrEP depends greatly on its efficacy, which itself depends upon adherence in the IDU population
- As the magnitude of PrEP's health benefits is largely driven by an individual's risk of HIV infection without it, the intervention costs as little as $46,000 per QALY gained when delivered in subgroups characterized by a variety of increased transmission risks

The cost-effectiveness of PrEP depends on its efficacy and drug price as well as rates of transmission in the covered population. Thus, PrEP as a package of care has the potential to be a valuable intervention for IDUs with high levels of adherence or for IDUs most at risk for acquiring HIV.

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