RTI INTERNATIONAL | Memorandum

To: Carl Schmid, Kevin Herwig, HIV+Hepatitis Policy Institute

From: Sophia D'Angelo, Laurel Bates, Amanda Honeycutt

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Subject: Memorandum on the Updated HIV Incidence Assumptions for the PrEP Cost Calculator

Background

Our pre-exposure prophylaxis (PrEP) Cost Calculator estimates the number of human immunodeficiency virus (HIV) infections averted through oral and long-acting PrEP use. We also estimate the cost ($2021) per HIV infection averted for our proposed national PrEP program Honeycutt et al. (2022). The "Results" tab of the PrEP Cost Calculator shows the estimated person-years of HIV infections averted by transmission group and in total over the selected time horizon (1-10 years, 5-year default).

As part of the latest PrEP Cost Calculator updates, RTI conducted further research to refine our assumptions for HIV incidence for individuals on PrEP and not on PrEP by formulation and transmission group. In this memo, we summarize our findings from the literature and explain our methods for updating the HIV incidence components of the PrEP Cost Calculator.

HIV Incidence Assumptions for Men Who Have Sex with Men (MSM)

We based our assumptions for MSM HIV incidence on data from a Professional Society for Health Economics and Outcomes Research (ISPOR) presentation by Davis et al. (2022) on the cost effectiveness of long-acting injectable cabotegravir (CAB-LA, or Apretude®) for PrEP in the United States. This presentation was informed by published data from Landovitz et al. (2021) and unpublished HPTN 083 data. We further discussed these data with one of the researchers, Dr. Anita Brogan, Vice President of Decision Analytic Modeling, RTI Health Solutions, to ensure we applied these data appropriately to our PrEP Cost Calculator.

We assumed that MSM not on PrEP have an HIV incidence of **3.25** events per 100 person-years (Table 1). For MSM on oral PrEP, we assumed an HIV incidence of **1.22** events per 100 person-years. For MSM on long-acting PrEP, we assumed an HIV incidence of **0.37** events per 100 person-years.

HIV Incidence Assumptions for Heterosexuals (HETs)

Our assumptions for HET incidence for those on PrEP versus not on PrEP were also based on data from Davis et al. (2022). However, this study only examined HIV incidence rates for HET females. We searched the literature but did not find any other data source for HIV incidence rates for HET males. Due to the lack of available data, we used the cisgender women (i.e., HET female) values from Davis et al. (2022) to represent all HETs. We believe this is a reasonable

approach given that HIV prevalence rates are similar for HET males and females at an increased risk for HIV (2019 NHBS HET cycle: CDC, 2021).

In our PrEP Cost Calculator, we assumed that HETs not on PrEP have an HIV incidence of **2.73** events per 100 person-years (Table 1). For HETs on oral PrEP, we assumed an HIV incidence of **1.85** events per 100 person-years. For HETs on long-acting PrEP, we assumed an HIV incidence of **0.15** events per 100 person-years.

HIV Incidence Assumptions for People Who Inject Drugs (PWID)

To estimate HIV incidence among PWID not on PrEP, we used methods from Sullivan et al. (2023). These methods include a formula for calculating HIV incidence for PWID not on PrEP using the following inputs: overall incidence, number eligible for PrEP, number on PrEP, percent of all diagnoses that are among people eligible for PrEP versus not, and the percentage the year individuals on PrEP are covered by PrEP (i.e., persistence).

Overall incidence, number eligible for PrEP, and number on PrEP for PWID were identified through sources described in Honeycutt et al. (2022). All PWID were considered eligible for PrEP. To identify PrEP persistence among PWID we searched the literature but did not identify data specific to PWID. Therefore, we back calculated the implicit PrEP persistence values required to achieve the HIV incidence rates for HETs and MSM in Davis et al. (2022) using the Sullivan et al. (2023) approach. We found that Davis et al. (2022) implied 100% PrEP coverage throughout the year. Using this value for persistence, we calculated that PWID not on PrEP have an HIV incidence rate of **5.87** events per 100 person-years (Table 1).

For HIV incidence rates among PWID on PrEP, we searched the literature but were unable to find a data source for these values. Therefore, we decided to take the weighted average of the HIV incidence values for MSM and cisgender women from Davis et al. (2022). Our weights were from Handanagic et al. (2021) which provides data on the proportions of PWID who are male, female, and transgender (Table 1). Making a simplifying assumption that all transgender individuals in this sample are transgender women (TGW), this provides PWID proportions of 68% male/TGW and 32% cisgender women.

For PWID on oral PrEP, we estimated an HIV incidence of **1.42** events per 100 person-years (Table 1). For PWID on long-acting PrEP, we estimated an HIV incidence of **0.30** events per 100 person-years.

Table 1. Assumptions for Estimated HIV Incidence Per 100 Person-Years by Transmission Group and PrEP Formulation

Transmission Group	No PrEP	Oral PrEP*	Long-Acting PrEP†	% of the Year on PrEP	Source(s)
MSM	3.25	1.22	0.37	N/A	Davis et al. (2022); Landovitz et al. (2021)
HETs‡	2.73	1.85	0.15	N/A	CDC (2021); Davis et al. (2022)
PWID§	5.87	1.42	0.30	100%	Davis et al. (2022); Handanagic et al. (2021); Honeycutt et al. (2022); Sullivan et al. (2023)

*Oral PrEP includes tenofovir alafenamide (TAF/FTC, or Descovy®) and tenofovir disoproxil fumarate/emtricitabine (TDF/FTC, or Truvada®). Note that TAF/FTC is not indicated for individuals assigned female at birth.

†Long-acting injectable cabotegravir (CAB-LA, or Apretude®)

‡We assumed the values for cisgender women apply to all HETs.

§We used the methods from Sullivan et al. (2023) to calculate the HIV incidence rate without PrEP for PWID. For on-PrEP incidence among PWID, we took the weighted average from Handanagic et al. (2021) (weights: 68% MSM/TGW, 32% cisgender women) of the MSM and HET values from Davis et al. (2022).

Results

After updating the PrEP Cost Calculator with the above assumptions for HIV incidence by PrEP formulation and transmission group, we generated refined estimates of HIV infections averted. We estimate that expanding PrEP could result in **139,296** person-years of HIV infections averted over 10 years (Table 2 and Figure 1).

The largest share of these person-years would be for MSM, at approximately 70%. Assuming annual HIV treatment costs of $28,950 per person per year in 2019 dollars, or $30,510 in 2021 dollars[1] (Bingham et al., 2021), results suggests medical cost savings from avoided HIV treatment of more than **$4.25** billion over 10 years.

By transmission group, we estimate 97,445 person-years of HIV infections averted for MSM, 17,753 person years of HIV infections averted for HETs, and 24,098 person-years of HIV infections averted for PWID over 10 years. In terms of costs for our proposed national PrEP program, we estimate that it would cost $44,371 per HIV infection averted over 10 years.

[1] Per person per year costs are estimated as undiscounted lifetime costs divided by overall additional life expectancy from Bingham and colleagues (2021; Table 3).

Table 2. Estimated Person-Years of HIV Infections Averted Through Oral and Long-Acting PrEP Use Over 10 Years

Estimated Person-Years of HIV Infections Averted	Men Who Have Sex with Men	Heterosexuals	People Who Inject Drugs	All Risk Transmission Groups
Total	97,445	17,753	24,098	139,296

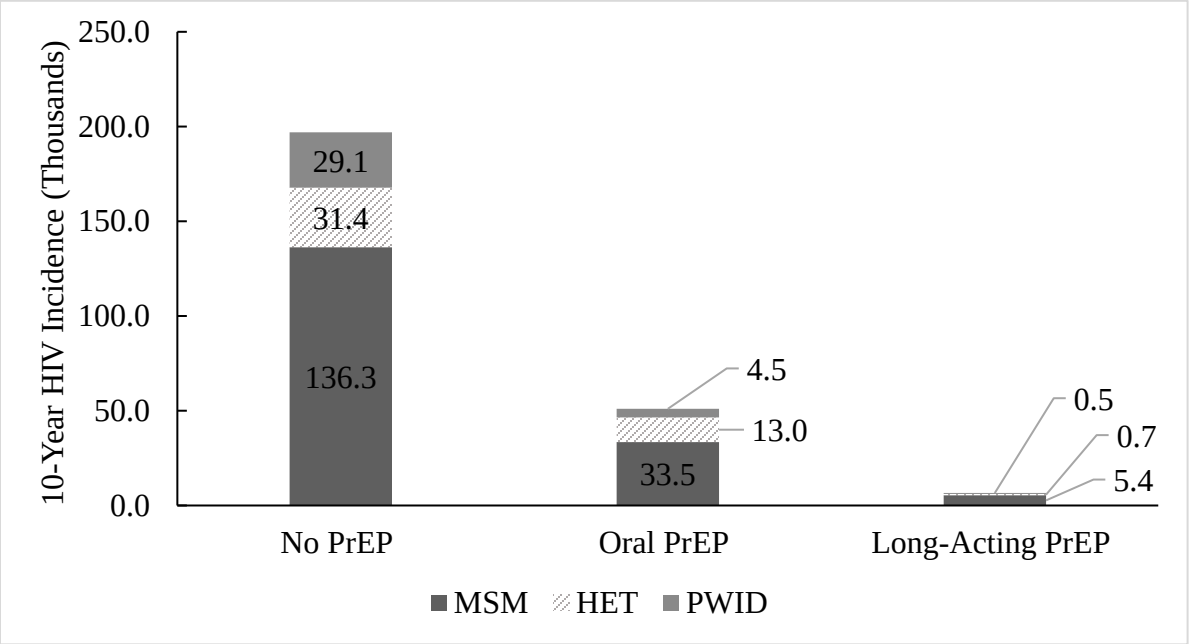

Figure 1. HIV infections expected (thousands) over 10 years without PrEP, among oral PrEP users, and among long-acting PrEP users by transmission group (N = 12,664,911 person-years of people eligible for PrEP over 10 years).

References

Bingham, A, Shrestha, RK., Khurana, N, Jacobson, EU, & Farnham, PG. (2021). Estimated Lifetime HIV-Related Medical Costs in the United States. *Sexually transmitted diseases.* 48(4):299–304. https://doi.org/10.1097/OLQ.0000000000001366

Centers for Disease Control and Prevention (CDC). (January 2021). HIV Infection, Risk, Prevention, and Testing Behaviors Among Heterosexually Active Adults at Increased Risk for HIV Infection—National HIV Behavioral Surveillance, 23 U.S. Cities, 2019. HIV Surveillance Special Report 26, Table 2. Accessed 24 October 2023 https://www.cdc.gov/hiv/pdf/library/reports/surveillance/cdc-hiv-surveillance-special-report-number-26.pdf

Davis AE, Brogan AJ, Mellott CE, Fraysse J, Oglesby A. (May 2022). Cost Effectiveness Analysis of CAB-LA for PrEP in the United States. ISPOR 2022. Washington. D.C. & virtual. Accessed 24 October 2023 https://www.ispor.org/docs/default-source/intl2022/0305971-20cem-20ispor-20podium-20presentation-202022-04-20.pdf?sfvrsn=8350998e_0

Handanagic, S, Finlayson, T, Burnett, JC, Broz, D, Wejnert, C, & National HIV Behavioral Surveillance Study Group. (2021). HIV Infection and HIV-Associated Behaviors Among Persons Who Inject Drugs - 23 Metropolitan Statistical Areas, United States, 2018. MMWR. Morbidity and mortality weekly report. 70(42):1459–1465. https://doi.org/10.15585/mmwr.mm7042a1

Honeycutt A, D'Angelo S, Vincent A, Bates L. U.S. PrEP Cost Analysis. (21 November 2022). Prepared by RTI International under RTI Project No. 0218439.000. Accessed 24 October 2023 https://hivhep.org/wp-content/uploads/2022/11/PrEP_Cost_Final_Report_21November2022.pdf

Landovitz RJ, Donnell D, Clement ME, et al. (2021). Cabotegravir for HIV Prevention in Cisgender Men and Transgender Women. *The New England Journal of Medicine*. 385(7):595-608. https://doi.org/10.1056/nejmoa2101016

Sullivan, PS, Hall, E, Bradley, H, Sanchez, T, Woodyatt, CR, & Russell, ES. (2023). Estimating HIV Incident Diagnoses Among Men Who Have Sex With Men Eligible for Pre-exposure Prophylaxis but Not Taking It: Protocol and Feasibility Assessment of Data Sources and Methods. *JMIR research protocols*. 12, e42267. https://doi.org/10.2196/42267

U.S. Department of Health and Human Services. (18 August 2019). America's HIV Epidemic Analysis Dashboard (AHEAD): Data methods. Accessed 24 October 2023 https://ahead.hiv.gov/methods/overview