Supplementary Appendix. Surveillance Systems for Estimating HIV Infection and Diagnosis and Measuring HIV Testing, Prevention, and Treatment

National HIV Surveillance System

The National HIV Surveillance System (NHSS) collects data on newly diagnosed HIV infection reported by the 50 U.S. states, the District of Columbia, and six U.S. dependent areas (*1*). Data include cases diagnosed during 2010–2019 with vital status information reported to CDC through December 2020. The analysis was restricted to persons aged ≥13 years with diagnosed HIV infection attributed to male-to-male sexual contact. Persons with diagnosed infection attributed to both male-to-male sexual contact and injection drug use were not included. Multiple imputation was used to assign a transmission category to cases reported to CDC without an identified risk factor. Relative standard errors (RSEs) were used to determine the reliability of estimates. Estimates with RSE >50% were not reported.

NHSS data were used to estimate ten-year trends in the estimated number of annual HIV infections during 2010–2019, the percentage of persons living with HIV infection at year-end 2019 who had received a diagnosis, and the percentage of persons with diagnosed infection who were virally suppressed at year-end 2019.

Annual number of new infections were estimated using the first CD4 test result after diagnosis and a CD4-depletion model indicating disease progression or duration after infection (*2*). To reflect model uncertainty, numbers were rounded to the nearest 100 for estimates of >1,000 and to the nearest 10 for estimates of ≤1,000 (*3*). To assess changes, the z test was used to compare the estimated number of new infections in 2019 to 2010; p<0.05 indicated significant change.

The percentage of persons living with HIV infection who had received a diagnosis was calculated as the number of persons living with HIV who received an HIV diagnosis divided by the estimated number of persons living with HIV (diagnosed and undiagnosed).

The percentage of persons with diagnosed infection who were virally suppressed was defined as the number of persons with a viral load test result of <200 copies of HIV RNA per mL at last test divided by the number of persons with diagnosed HIV infection (*4*). Viral suppression was measured among persons whose infection was diagnosed by year-end 2018, who resided in any of the 45 jurisdictions with complete laboratory reporting as of their most recent known address during 2019, and who were alive at year-end 2019.

National HIV Behavioral Surveillance

National HIV Behavioral Surveillance (NHBS) is a cross-sectional biobehavioral surveillance system conducted annually in U.S. urban areas with high HIV prevalence (*5*). Different populations are sampled each year on a rotating basis; 2017 is the most recent year in which men who have sex with men (MSM) were recruited. Recruitment used venue-based, time-space sampling from venues at which the majority of attending men were MSM.in 23 U.S. urban areas (Atlanta, Georgia; Baltimore, Maryland; Boston, Massachusetts; Chicago, Illinois; Dallas, Texas; Denver, Colorado; Detroit, Michigan; Houston, Texas; Los Angeles, California; Memphis, Tennessee; Miami, Florida; Nassau and Suffolk counties, New York; New Orleans, Louisiana; New York, New York; Newark, New Jersey; Philadelphia, Pennsylvania; Portland, Oregon; San Diego, California; San Francisco,

California; San Juan, Puerto Rico; Seattle, Washington; Virginia Beach, Virginia; and Washington, DC). Men were eligible to participate in the NHBS survey if they were aged 18 years or older, a resident in a participating urban area, able to complete the survey in English or Spanish, male at birth, identified as being male, and reported having oral or anal sex with a male partner in the past 12 months. Details about NHBS methodology have been described elsewhere (6,7).

In this analysis, NHBS data were used to estimate the percentage of MSM tested in the past 12 months, the percentage of MSM who saw a health care provider but were not tested in the past 12 months, the percentage of MSM who discussed preexposure prophylaxis (PrEP) with a health care provider in the past 12 months, and the percentage of MSM who used PrEP in the past 12 months.

All NHBS analyses were limited to participants who consented and completed an interview and NHBS HIV testing and either did not report a previous HIV-positive test result or received their first HIV-positive test result less than 12 months before the interview (N=7,577). For NHBS analyses about being offered an HIV test by a health care provider, the analytic sample was further restricted to participants who visited a health care provider and did not test for HIV within the past 12 months (N=1,181).

Only participants who likely met clinical indications for PrEP were included in NHBS analyses about PrEP discussions with a health care provider and PrEP use within the past 12 months (N=4,466). Men likely indicated for PrEP included those who had (1) a negative NHBS HIV test result following the NHBS interview; (2) either 2 or more male sex partners or any male sex partner with HIV infection within the past 12 months; and (3) either condomless anal sex or a bacterial sexually transmitted infection within the past 12 months. Estimates were weighted to represent the population of MSM attending sampled venues in the 23 U.S. urban areas. Unweighted frequency and weighted percentages and 95% confidence intervals (CI) were generated. Estimates with a denominator sample size <30 were not reported.

Medical Monitoring Project

The Medical Monitoring Project (MMP) is a cross-sectional, nationally representative, complex sample survey that assesses the behavioral and clinical characteristics of adults with diagnosed HIV infection in the United States (8). Adults with diagnosed HIV were sampled for MMP using data from NHSS. To be eligible for the 2018 cycle of MMP conducted during June 2018–May 2019, the person had to be, as of December 31, 2017: living with diagnosed HIV infection, aged ≥18 years, and residing in an MMP project area. The 2018 MMP cycle included 23 project areas: California (excluding Los Angeles County and San Francisco); Chicago, Illinois; Delaware; Florida; Georgia; Houston, Texas; Illinois (excluding Chicago); Indiana; Los Angeles County, California; Michigan; Mississippi; New Jersey; New York (excluding New York City); New York City, New York; North Carolina; Oregon; Pennsylvania (excluding Philadelphia); Philadelphia, Pennsylvania; Puerto Rico; San Francisco, California; Texas (excluding Houston); Virginia; and Washington. Sampled persons were recruited to participate in person, by telephone, or by mail. A trained interviewer conducted either a computer-assisted telephone interview or an in-person interview in English or Spanish. After the interview, MMP staff abstracted clinical data from the medical records of participants at the health care facility identified by the participant as his or her most frequent source of HIV care. Details about MMP methodology have been described elsewhere (9).

In this analysis, MMP data were used to estimate the percentage of MSM fully adherent to antiretroviral therapy (ART) and the median HIV-related stigma score.

ART adherence was measured as reporting taking 100% of one's ART doses during the past 30 days among persons taking ART.

HIV-related stigma was measured using a ten-item scale that measures 4 dimensions of HIV stigma: personalized stigma during the past 12 months, current disclosure concerns, current negative self-image, and current perceived public attitudes about people living with HIV. A median score was calculated based on responses on a 5-point Likert scale to each of the following statements: 1) During the past 12 months, I have been hurt by how people reacted to learning I have HIV, 2) During the past 12 months, I have stopped socializing with some people because of their reactions to my HIV status, 3) During the past 12 months, I have lost friends by telling them I have HIV, 4) I am very careful who I tell that I have HIV, 5) I worry that people who know I have HIV will tell others, 6) I feel that I am not as good a person as others because I have HIV, 7) Having HIV makes me feel unclean, 8) Having HIV makes me feel that I'm a bad person, 9) Most people think that a person with HIV is disgusting, 10) Most people with HIV are rejected when others find out. The stigma score ranges from 0 to 100, with 0 indicating no stigma and 100 indicating highest stigma.

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