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CDC-Funded HIV Testing and Undiagnosed HIV Infection in *Ending the HIV Epidemic in the U.S.* Jurisdictions

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INTRODUCTION

In 2021, an estimated 1.2 million persons aged 13 years and older were living with HIV infection in the United States; however, approximately 13% of persons with HIV (PWH) were unaware of their HIV status [1]. It has been estimated that persons living with undiagnosed HIV infection account for approximately 38% of HIV transmissions in the United States [2]. HIV testing is key to diagnosing PWH and linking them to HIV medical care in order to achieve viral suppression and ultimately reduce HIV transmission [2, 3].

In 2019, the U.S. Department of Health and Human Services announced the *Ending the HIV Epidemic in the U.S.* (EHE) initiative, with the goal of reducing new HIV infections in the United States by 75% by 2025 and by at least 90% by 2030 [4, 5]. During Phase 1, EHE aims to achieve these goals by applying four key strategies—one of which is to "diagnose all people with HIV as early as possible"—to the 57 jurisdictions with disproportionate burden of HIV diagnoses (i.e., 48 counties, Washington, DC, and San Juan, Puerto Rico, where >50% of HIV diagnoses occurred in 2016 and 2017, and an additional seven states with a substantial burden of HIV diagnoses in rural areas) [4, 5].

The Centers for Disease Control and Prevention (CDC) has a longstanding history of funding state and local health departments and community-based organizations (CBOs) to provide HIV prevention services, which include programs for HIV testing, linkage to HIV medical care, partner services, and other prevention services. Beginning in fiscal year 2020, CDC awarded funding to the state and local health departments that represent the 57 EHE jurisdictions to support programmatic efforts for achieving the EHE goals [6]. As noted by Fauci et al. [4], CDC is key to bringing "HIV testing to all who need it, [and] to diagnose infections as early as possible."

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The objective of our analysis was to assess the association between rates of CDC-funded HIV tests per 1,000 population and estimated undiagnosed HIV infection per 100,000 population in Phase 1 EHE jurisdictions. This analysis will help us understand if CDC-funded HIV tests were being conducted in accordance with the estimated undiagnosed HIV infection rates in these jurisdictions.

METHODS

Data Sources

National HIV Prevention Program Monitoring and Evaluation System—In 2021, 32 state and local health departments—representing the 57 Phase 1 EHE jurisdictions—were funded by CDC to conduct HIV testing and prevention services in support of EHE [6]. These recipients submitted their HIV testing and prevention services data semiannually to CDC through the National HIV Prevention Program Monitoring and Evaluation (NHM&E) data reporting system, EvaluationWeb®; we conducted our analysis with 2021 data submitted through March 15, 2023.

National HIV Surveillance System and AtlasPlus—In order to monitor HIV trends, CDC funds and assists state and local health departments to collect data for the National HIV Surveillance System (NHSS) [7]. The 50 states, the District of Columbia, and 6 U.S. dependent areas collect data on persons with confirmed diagnoses of HIV infection. After the removal of personally identifiable information, data are submitted to CDC [8]; detailed methods of estimating HIV incidence, prevalence, and other measures can be found elsewhere [1]. For our analysis, we obtained 2021 NHSS data, reported to CDC through December 2022, on knowledge of HIV status and estimated HIV prevalence (undiagnosed and diagnosed cases) from the National Center for HIV, Viral Hepatitis, STD, and TB Prevention (NCHHSTP) AtlasPlus—a publicly available interactive tool that provides nearly 20 years of CDC's surveillance data on HIV, viral hepatitis, sexually transmitted diseases, and tuberculosis [9]. We also used Vintage Census 2021 numbers from AtlasPlus for the population denominators to calculate rate measures [9].

Both NHM&E and NHSS are determined to be public health activities and thus do not require institutional review board approval.

Analysis

By each EHE jurisdiction, we report the estimated numbers of persons living with undiagnosed HIV infection, estimated rates of persons living with undiagnosed HIV infection per 100,000 population, numbers of CDC-funded HIV tests, and rates of CDC-funded HIV tests per 1,000 population. We also report the numbers of persons living with diagnosed or undiagnosed HIV infection and percentage knowledge of HIV infection as contextual information. Both the estimated rate of persons living with undiagnosed HIV infection and the rate of CDC-funded HIV tests were positively skewed (1.6 per 100,000 population and 2.3 per 1,000 population, respectively), showed high kurtosis (6.4 per 100,000 population and 8.5 per 1,000 population, respectively), and were shown to be non-normally distributed using a Shapiro-Wilk test (both $p<.0001$). The association between

the estimated rate of undiagnosed HIV infection and the rate of CDC-funded HIV tests was assessed using Spearman's rank correlation, a nonparametric test.

To examine the relationship between estimated rates of persons living with undiagnosed HIV infection and rates of CDC-funded HIV tests by jurisdiction, we ranked (highest to lowest) the jurisdictions by each variable. Then we subtracted the CDC-funded HIV tests ranking from the ranking of estimated rate of persons living with undiagnosed HIV to determine where the unfilled needs are. For example, if a jurisdiction was first (highest) in the estimated rate of persons living with undiagnosed HIV and 30th in rate of CDC-funded HIV tests, the rank difference would be −29. Negative rank differences indicate unfilled needs for HIV testing, with larger values (i.e., those further from zero) indicating greater magnitude. Although this approach does not fully capture the magnitude of differences between rankings, it does organize the relationships between the two variables and help identify which jurisdictions may benefit most from improving or expanding their HIV testing programs.

RESULTS

Overall, CDC-funded HIV tests per 1,000 population was positively correlated with estimated undiagnosed HIV infection per 100,000 population (rho=0.55, $p<0.001$) (Figure 1). Individual EHE jurisdictions, however, varied in their rank differences between the estimated undiagnosed HIV infection and CDC-funded HIV testing rates (Table 1).

The EHE jurisdictions with the negative rank differences had higher undiagnosed HIV infection per 100,000 population and lower CDC-funded HIV tests per 1,000 population, indicating greater unfilled needs for HIV testing. The five jurisdictions with the greatest magnitude of negative rank differences were Prince George's County, Maryland, with an estimated undiagnosed HIV infection rate of 129.6 per 100,000 population and CDC-funded HIV testing rate of 2.8 per 1,000 population; Mecklenburg County, North Carolina, with an estimated undiagnosed HIV infection rate of 92.9 per 100,000 population and CDC-funded HIV testing rate of 2.2 per 1,000 population; Hudson County, New Jersey, with an estimated undiagnosed HIV infection rate of 103.4 per 100,000 population and CDC-funded HIV testing rate of 3.9 per 1,000 population; Bronx County, New York, with an estimated undiagnosed HIV infection rate of 131.8 per 100,000 population and CDC-funded HIV testing rate of 5.5 per 1,000 population; and Hamilton County, Ohio, with an estimated undiagnosed HIV infection rate of 81.9 per 100,000 population and CDC-funded HIV testing rate of 3.4 per 1,000 population.

The EHE jurisdictions with the positive rank differences had lower undiagnosed HIV infection per 100,000 population and higher CDC-funded HIV tests per 1,000 population, indicating lower unfilled needs for HIV testing. The five jurisdictions with the greatest magnitude of positive rank differences were Alabama, with an estimated undiagnosed HIV infection rate of 63.2 per 100,000 population and CDC-funded HIV testing rate of 14.2 per 1,000 population; Maricopa County, Arizona with an estimated undiagnosed HIV infection rate of 58.7 per 100,000 population and CDC-funded HIV testing rate of 13.4 per 1,000 population; Tarrant County, Texas, with an estimated undiagnosed HIV infection rate of 77.6

per 100,000 population and CDC-funded HIV testing rate of 40.4 per 1,000 population; Suffolk County, Massachusetts, with an estimated undiagnosed HIV infection rate of 59.7 per 100,000 population and CDC-funded HIV testing rate of 47.9 per 1,000 population; and San Francisco County, California, with an estimated undiagnosed HIV infection rate of 40.9 per 100,000 population and CDC-funded HIV testing rate of 31.4 per 1,000 population.

DISCUSSION

In general, CDC-funded HIV testing was conducted in EHE jurisdictions with the greatest needs (i.e., jurisdictions with higher estimated undiagnosed HIV infection per 100,000 population). However, our findings indicate that some EHE jurisdictions had greater unfilled needs for HIV testing. Our findings may prompt jurisdictions to critically review all of their HIV testing efforts for service-related gaps and barriers and subsequently implement strategies to improve or expand their HIV testing services. There are several strategies that jurisdictions—and specifically health departments and CBOs within the jurisdictions—could implement to improve HIV testing, especially among persons at greater risk for HIV acquisition. Some of these strategies include using clinical decision support systems to expand or implement routine opt-out HIV screening in healthcare settings; implementing routine opt-out HIV screening in jails; integrating HIV screening in sexually transmitted disease clinics; offering HIV self-tests; promoting HIV testing in retail pharmacies; and expanding mobile/outreach testing programs [10].

Although our findings indicated greater unfilled needs for HIV testing among some EHE jurisdictions, it is important to note that our measure of HIV testing was based only on CDC-funded HIV testing and does not include HIV testing covered by other federal agencies (e.g., Health Resources & Services Administration [HRSA]), state or local governments, or public and private health insurance. Because CDC-funded HIV testing does not encompass all HIV testing in a jurisdiction, some jurisdictions may have different overall HIV testing rates than presented in this analysis, which may not necessarily align with the conclusions stated in this manuscript.

Additionally, HIV testing rates may have been impacted by interruptions in HIV prevention services due to the COVID-19 pandemic. Furthermore, the number of CDC-funded HIV tests conducted does not equate to the number of persons tested (i.e., persons tested multiple times via CDC funding would have multiple test records). Finally, the rank differences that we calculated did not necessarily assess the magnitude between ranked jurisdictions; however, it was able to provide a frame of reference for the relationship between the two measures.

Although CDC-funded HIV testing was generally being conducted in accordance with estimated rates of undiagnosed HIV infection in EHE jurisdictions, large-scale expansions in HIV testing programs are still needed within the EHE jurisdictions in order to reach the EHE goals [11]. Our findings provide programmatic insight for EHE jurisdictions to consider when reviewing their HIV testing services and estimated rates of undiagnosed HIV infection, which may serve as an impetus for them to expand or improve upon their HIV testing programs. This, in turn, would help to ensure that all PWH are tested and identified,

linked to care, and receiving HIV medical care to achieve viral suppression—ultimately leading to reduced HIV transmission.

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REFERENCES

1. Centers for Disease Control and Prevention. Estimated HIV incidence and prevalence in the United States, 2017–2021. HIV Surveillance Supplemental Report, 2023; 28 (No. 3). http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Published May 2023. Accessed July 24, 2023.
2. Li Z, Purcell DW, Sansom SL, Hayes D, Hall HI. Vital signs: HIV transmission along the continuum of care—United States, 2016. MMWR Morb Mortal Wkly Rep. 2019;68(11):267–272. [PubMed: 30897075]
3. Cohen MS, Chen YQ, McCauley M, et al. HPTN 052 Study Team. Antiretroviral therapy for the prevention of HIV-1 transmission. New Engl J Med. 2016;375:830–9. [PubMed: 27424812]
4. Fauci AS, Redfield RR, Sigounas G, Weahkee MD, Giroir BP. Ending the HIV Epidemic: A plan for the United States. JAMA 2019;321(9):844–845. [PubMed: 30730529]
5. Office of Infectious Disease and HIV/AIDS Policy. Ending the HIV Epidemic: Overview. https://www.hiv.gov/federal-response/ending-the-hiv-epidemic/overview/. Updated: August 2, 2023. Accessed August 11, 2023.
6. Centers for Disease Control and Prevention. Funding Opportunity Announcement: PS20–2010, Recipients. https://www.cdc.gov/hiv/funding/announcements/ps20-2010/recipients.html. Updated: July 27, 2020. Accessed August 11, 2023.
7. Centers for Disease Control and Prevention. HIV Statistics Center. https://www.cdc.gov/hiv/statistics/index.html. Updated: August 9, 2021. Accessed August 11, 2023.
8. Centers for Disease Control and Prevention. HIV Surveillance Report, 2021; vol. 34. http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html. Published May 2023. September 15, 2023.
9. Centers for Disease Control and Prevention. NCHHSTP AtlasPlus. https://www.cdc.gov/nchhstp/atlas/index.htm. Accessed August 11, 2023.
10. Delaney KP, DiNenno EA. HIV testing strategies for health departments to end the epidemic in the U.S. Am J Prev Med 2021;61(6 Suppl 1):S6–15. [PubMed: 34686292]
11. Nosyk B, Fojo AT, Kasaie P, et al. The testing imperative: Why the US Ending the Human Immunodeficiency Virus (HIV) Epidemic program needs to renew efforts to expand HIV testing in clinical and community-based settings. Clin Infect Dis 2023;76(12):2206–8. [PubMed: 36815334]

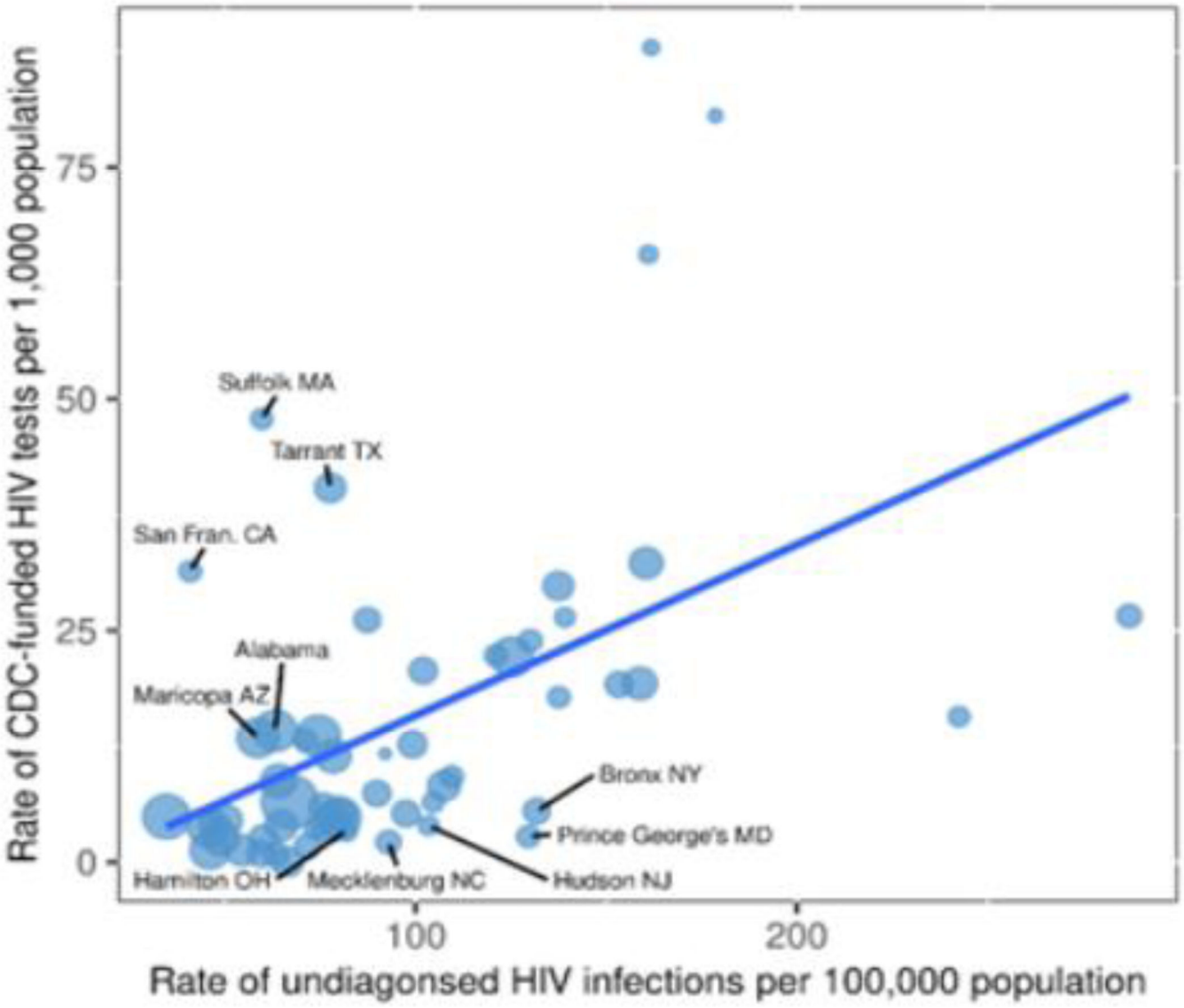

Figure 1.

Rate of CDC-Funded HIV Tests by Rate of Estimated Undiagnosed HIV Infection, *Ending the HIV Epidemic in the U.S* Jurisdictions, 2021

The five EHE jurisdictions with the greatest unfilled need for HIV testing are labeled below the line; the five EHE jurisdictions with the lowest unfilled need for HIV testing are labeled above the line. Bubble size represents the size of the jurisdiction population.

Table 1.

Rank Differences between Estimated Undiagnosed HIV Infection per 100,000 Population and CDC-Funded HIV Tests per 1,000 Population, *Ending the HIV Epidemic in the U.S* Jurisdictions, 2021

EHE Jurisdiction	Persons Living with Diagnosed or Undiagnosed HIV Infection[a]	Estimated Knowledge of HIV Infection[a] (%)	Estimated Persons Living with Undiagnosed HIV (#)[a]	Est. Persons Living with Undiagnosed HIV (rate per 100,000 population)	CDC-Funded HIV tests[b] (#)	CDC-Funded HIV Tests (rate per 1,000 population)	Est. Persons Living with Undiagnosed HIV Rate Rank	CDC-Funded HIV Testing Rate Rank	Rank Difference (Undiagosed Rate - HIV Testing Rate)
Prince George's County, MD	9,000	88.5	1,041	129.6	2,213	2.8	14	48	−34
Mecklenburg County, NC	7,100	87.6	873	92.9	2,026	2.2	24	51	−27
Hudson County, NJ	5,500	88.7	616	103.4	2,349	3.9	20	43	−23
Bronx County, NY	28,100	94.4	1,546	131.8	6,454	5.5	12	34	−22
Hamilton County, OH	3,700	84.1	565	81.9	2,345	3.4	28	47	−19
Dekalb County, GA	10,600	85.8	1,536	242.5	9,938	15.7	2	19	−17
San Bernardino County, CA	6,200	80.6	1,191	66.4	18	0.0	41	57	−16
Franklin County, OH	6,000	87.1	786	71.6	1,829	1.7	38	52	−14
Cobb County, GA	4,300	83.8	677	104.7	4,190	6.5	19	32	−13
Cuyahoga County, OH	5,600	88.0	677	63.4	850	0.8	44	56	−12
Palm Beach County, FL	9,300	86.8	1,266	97.5	6,809	5.2	23	35	−12
Clark County, NV	11,700	82.0	2,070	107.5	15,859	8.2	18	29	−11
Marion County, IN	5,800	84.8	873	109.5	7,327	9.2	17	27	−10
Bexar County, TX	8,200	83.7	1,325	79.5	7,216	4.3	31	40	−9
Gwinnett County, GA	3,900	84.6	585	73.9	2,877	3.6	37	46	−9
Miami-Dade County, FL	30,500	88.1	3,625	158.8	44,015	19.3	7	16	−9
Orange County, FL	11,100	83.7	1,848	153.3	23,101	19.2	8	17	−9
Cook County, IL	29,000	87.9	3,507	79.9	20,898	4.8	30	38	−8
Essex County, NJ	9,700	90.2	977	137.6	12,636	17.8	10	18	−8
Fulton County, GA	18,900	86.3	2,610	287.1	24,158	26.6	1	9	−8

EHE Jurisdiction	Persons Living with Diagnosed or Undiagnosed HIV Infection[a]	Estimated Knowledge of HIV Infection[a] (%)	Estimated Persons Living with Undiagnosed HIV (#)[a]	Est. Persons Living with Undiagnosed HIV (rate per 100,000 population)	CDC-Funded HIV tests[b] (#)	CDC-Funded HIV Tests (rate per 1,000 population)	Est. Persons Living with Undiagnosed HIV Rate Rank	CDC-Funded HIV Testing Rate Rank	Rank Difference (Undiagosed Rate - HIV Testing Rate)
San Diego County, CA	15,600	86.3	2,158	77.4	11,037	4.0	34	42	−8
Kings County, NY	27,300	93.6	1,762	80.1	11,422	5.2	29	36	−7
Sacramento County, CA	5,400	84.8	790	59.5	1,210	0.9	48	55	−7
Alameda County, CA	6,800	88.0	850	60.2	3,614	2.6	46	50	−4
Hillsborough County, FL	8,500	86.7	1,121	89.9	9,235	7.4	26	30	−4
Riverside County, CA	11,200	90.0	1,111	54.5	2,566	1.3	50	54	−4
New York County, NY	27,200	94.8	1,395	99.2	17,884	12.7	22	24	−2
Queens County, NY	17,200	92.5	1,291	64.8	7,849	3.9	42	44	−2
District of Columbia	14,300	94.2	796	139.2	15,115	26.4	9	10	−1
Dallas County, TX	22,900	85.3	3,395	160.5	68,310	32.3	6	6	0
San Juan Municipio, PR	3,900	92.3	278	92.0	3,534	11.7	25	25	0
Duval County, FL	7,500	85.3	1,087	130.1	19,947	23.9	13	12	1
Harris County, TX	32,400	85.2	4,815	125.2	85,172	22.1	15	14	1
Orleans Parish, LA	5,400	90.0	578	178.7	26,066	80.6	3	2	1
Oklahoma	8,400	81.7	1,522	46.0	4,171	1.3	54	53	1
Baltimore City, MD	10,900	92.5	791	161.1	32,227	65.6	5	3	2
Wayne County, MI	8,300	87.0	1,120	75.9	8,750	5.9	35	33	2
Broward County, FL	22,400	90.0	2,263	137.5	49,063	29.8	11	8	3
East Baton Rouge Parish, LA	4,700	86.7	614	161.8	33,368	87.9	4	1	3
Orange County, CA	8,500	84.2	1,319	49.0	6,948	2.6	52	49	3
Shelby County, TN	7,400	87.8	918	121.1	16,908	22.3	16	13	3
Philadelphia County, PA	17,900	92.6	1,354	102.0	27,425	20.7	21	15	6
Mississippi	11,700	83.2	1,936	78.4	28,235	11.4	32	26	6

EHE Jurisdiction	Persons Living with Diagnosed or Undiagnosed HIV Infection[a]	Estimated Knowledge of HIV Infection[a] (%)	Estimated Persons Living with Undiagnosed HIV (#)[a]	Est. Persons Living with Undiagnosed HIV (rate per 100,000 population)	CDC-Funded HIV tests[b] (#)	CDC-Funded HIV Tests (rate per 1,000 population)	Est. Persons Living with Undiagnosed HIV Rate Rank	CDC-Funded HIV Testing Rate Rank	Rank Difference (Undiagosed Rate - HIV Testing Rate)
Los Angeles County, CA	55,800	89.9	5,618	67.1	54,430	6.5	40	31	9
Kentucky	9,800	82.7	1,734	45.7	14,296	3.8	55	45	10
King County, WA	8,100	88.4	973	50.4	8,734	4.5	51	39	12
Montgomery County, MD	4,300	91.3	411	46.4	3,588	4.1	53	41	12
Arkansas	7,800	79.7	1,622	64.1	22,091	8.7	43	28	15
South Carolina	21,200	84.5	3,286	74.5	59,956	13.6	36	21	15
Pinellas County, FL	5,500	88.9	605	71.0	11,215	13.2	39	23	16
Travis County, TX	6,200	84.9	971	87.3	29,075	26.1	27	11	16
Missouri	14,800	87.6	1,801	34.7	25,437	4.9	57	37	20
Alabama	17,000	84.3	2,687	63.2	60,249	14.2	45	20	25
Maricopa County, AZ	14,500	84.6	2,214	58.7	50,647	13.4	49	22	27
Tarrant County, TX	7,700	82.7	1,354	77.6	70,466	40.4	33	5	28
Suffolk County, MA	6,000	93.6	406	59.7	32,540	47.9	47	4	43
San Francisco County, CA	11,900	97.5	299	40.9	22,947	31.4	56	7	49

[a] Data Source: National HIV Surveillance System via AtlasPlus

[b] Data Source: National HIV Prevention Program Monitoring & Evaluation system