Geographic Variation in HIV Testing Among Transgender and Nonbinary Adults in the United States

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Background: Transgender and nonbinary (TNB) populations are disproportionately affected by HIV and few local health departments or HIV surveillance systems collect/report data on TNB identities. Our objective was to estimate the prevalence of HIV testing among TNB adults by US county and state, with a focus on the Ending the HIV Epidemic (EHE) geographies.

Methods: We applied a Bayesian hierarchical spatial small area estimation model to data from the 2015 US Transgender Survey, a large national cross-sectional Internet-based survey. We estimated the county- and state-level proportion of TNB adults who ever tested or tested for HIV in the last year by gender identity, race/ethnicity, and age.

Results: Our analysis included 26,100 TNB participants with valid zip codes who resided in 1688 counties (54% of all 3141 counties that cover 92% of the US population). The median county-level proportion of TNB adults who ever tested for HIV was 44% (range 10%–80%) and who tested in the last year was 17% (range 4%–44%). Within most counties, testing was highest among transgender women, black respondents, and people aged ≥25 years. HIV testing was lowest among nonbinary people and young adults aged <25 years. The proportion of TNB adults who tested within the last year was very low in most EHE counties and in all 7 rural states.

Conclusions: HIV testing among TNB adults is likely below national recommendations in the majority of EHE geographies. Geographic variation in HIV testing patterns among TNB adults indicates that testing strategies need to be tailored to local settings.

Key Words: transgender and nonbinary, HIV testing, ending the HIV epidemic, small area estimation

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INTRODUCTION

HIV testing has long been an important component of HIV prevention. Knowledge of HIV status is important to reduce HIV-associated health outcomes through early diagnosis and linkage to care, as well as for prevention. Since 2006, the United States Centers for Disease Control (CDC) has recommended universal screening for HIV at least once in a person's lifetime and annually for persons at an increased risk of acquiring HIV.[1,2] In 2019, the US Department of Health and Human Services unveiled the Ending the HIV Epidemic (EHE) initiative, a federal strategy to reduce the number of new HIV diagnoses by 90% by 2030.[3] One of the 4 pillars of this initiative includes "diagnosing all individuals with HIV as early as possible" after HIV acquisition.

In the United States, transgender and nonbinary (TNB) people are disproportionally burdened by new HIV diagnoses.[3,4] In addition, approximately one-third to half of TNB adults report behaviors[4–6] that meet CDC recommendations for annual HIV testing, which includes anyone who had anal or vaginal sex with an HIV-positive partner; more than 1 sex partner since last HIV test; shared injection equipment; exchanged sex for drugs or money; diagnosed with another sexually transmitted infection (STI), hepatitis, or tuberculosis; or had sex with a man who has sex with men (MSM) or someone who fits the above criteria.[7] As a result of sociostructural stigma, institutional barriers, and fear of mistreatment, TNB people experience significant barriers to engaging in health care, including HIV prevention and care.[8–11] Because of intersecting marginalization and structural factors such as discrimination and violence, TNB people also disproportionately report syndemic conditions, such as homelessness, substance use, transactional sex, and poverty.[4,12–14] These factors play a role in increasing their vulnerability to HIV and pose additional barriers to accessing care.[15] Consequently, preexposure prophylaxis (PrEP) uptake, antiretroviral therapy coverage, and viral suppression are low in the TNB community relative to cisgender populations.[16–21] However, available data on HIV testing among TNB adults are mixed. A recent meta-analysis estimates that 75% of transgender women and 69% of

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transgender men have ever been tested for HIV.[4] A small national probability sample similarly found that 77% of sexually active TNB adults had ever tested for HIV.[5] In contrast, data from the Behavioral Risk Factor and Surveillance System (BRFSS) found that only 37% of TNB adults have ever been tested for HIV.[21]

To achieve the EHE initiative's ambitious target, the Department of Health and Human Services identified 50 local areas and 7 rural states in which more than 50% of the new HIV diagnoses occurred between 2016 and 2017 to be prioritized for additional resources that would support HIV prevention initiatives.[22] The EHE initiative necessitates the availability of reliable state- and county-level data on HIV testing, PrEP uptake, and other HIV prevention efforts to effectively target resources. However, few local or state health departments report information on TNB identities, and most HIV surveillance systems inconsistently measure TNB identities.[23] In addition, few national surveys or HIV/STI surveillance systems use validated trans-inclusive measures for ascertaining gender (eg, the 2-step method).[23–26] Therefore, although frequent HIV testing is a crucial tool for HIV prevention, there are few local data sources on HIV testing among TNB people.

The objective of this study was to estimate the proportion of TNB adults who have ever or recently tested for HIV, with a focus on the EHE geographies. To do this, we obtained county- and state-level estimates with the goal of addressing the need for local and regional data on HIV testing among TNB populations.

METHODS

Data Source

The 2015 US Transgender Survey (USTS), conducted by the National Center for Transgender Equality, is the largest and most comprehensive survey to date on the experiences of transgender people living in the United States.[8] The USTS was an anonymous, online, national survey that included 27,715 individuals aged 18 years and older who identified as transgender and lived in the 50 states, US territories, and military bases overseas at the time of the survey. The National Center for Transgender Equality conducted outreach though transgender and LGBTQ+ organizations and included social media campaigns, survey taking events, and an Advisory Committee composed of transgender individuals to increase community engagement and shared the survey through their professional networks. The USTS was administered through an online instrument available in English and Spanish. Data were collected over a 34-day period in 2015. The present secondary analysis of these data including zip codes received ethical approval from the University of Washington Institutional Review Board.

Measures

The survey included 324 questions across a broad range of topics, including health, discrimination, employment, education, housing, and demographics. Questions related to HIV testing included the following: "*Have you ever been tested for HIV?"* and "*What month/year did you receive your last HIV test?"* Nearly all participants (99.9%) responded to HIV testing questions. We used responses to these questions to create 2 analytic binary variables: (1) ever tested for HIV and (2) tested for HIV in the last year.

Our analysis included county-level measures of factors that we determined a priori to be associated with structural- and individual-level barriers and facilitators of HIV testing: the proportion of survey respondents who were black, Hispanic/Latinx, aged <25 years, completed a high school education or less, unemployed, and experienced discrimination or mistreatment (eg, denied service, harassed, attacked) in a place of public accommodation (eg, retail stores, hotels, public transportation, and government offices) in the past year. We also used the standard survey weights developed by the USTS to adjust for race, ethnicity, and age.

Geographic Units of Analysis

The primary geographic units of analysis were US counties or county equivalents. Valid zip codes were available for nearly all (96.8%) respondents. Our analysis excluded individuals without a valid zip code (See Supplemental Digital Content 1, http://links.lww.com/QAI/B794). Zip codes were attributed to a county using the Department of Housing and Urban Development's 2015 geographies crosswalk. When a zip code was split across more than 1 county, we allocated the zip codes to the county with the majority of residences. Each county was categorized as metropolitan, nonmetropolitan urban, or rural based on the urban–rural continuum codes by the US Department of Agriculture.[27] We also conducted state-level analyses for the 7 rural states identified by the EHE initiative.

Statistical Analysis

We conducted area-level small area estimation modeling to estimate the proportion of TNB adults who tested for HIV within each county for all counties for which the USTS had data. Direct estimators in areas with small sample size have large sampling variability and unstable estimates. To overcome this problem, we used a Bayesian hierarchical model that includes both random effects at the area-level and spatial random effects. We used a framework adapted from prior work by Chen et al, Mercer et al, Wakefield et al, and Song et al.[28–31] Our model includes a fixed overall level or "intercept," county-level random effects, spatial effects, and area-level covariates. Spatial effects were modeled using an Intrinsic Conditional Auto-Regressive model for spatial smoothing. Intrinsic Conditional Auto-Regressive models are a class of spatial models that smooth "noisy" area-level estimates by pooling information from neighboring counties.[29,30] Technical details are provided in Supplemental Digital Content 1, http://links.lww.com/QAI/B794.

We used complete-cases analysis because of minimal missingness among our variables of interest. For each county and state, we report modeled estimates of the mean and 95% credible intervals of the posterior distribution of the

proportion of all TNB adults who have ever tested for HIV and who tested for HIV in the last year. We conducted subgroup analyses by gender identity (transgender women, transgender men, nonbinary), race/ethnicity [Asian or Native Hawaiian/Pacific Islander (NHPI), black, Hispanic/Latinx, Native American/Alaska Native, white], and age (<25 and ≥25 years old). People who reported multiple races could be categorized in multiple groups. Because of the small number of respondents who reported an NHPI race, we aggregated this group with Asian participants. We do not report count data, point estimates, and credible intervals for geographic areas with fewer than 20 survey respondents. However, these estimates are included in figures (eg, maps, density plots) and aggregate statistics (eg, medians, ranges). All analyses were conducted in R statistical software version 3.6.2, and modeling was conducted using the SUMMER package.[32,33] Scripts are available at https://github.com/dianatordoff/ustssae.

RESULTS

Our sample included 26,100 participants who had a valid zip code. Participants resided in 1688 counties (54% of all 3141 US counties that cover 92% of the US population). The number of participants per county ranged from 1 to 783, although the majority of counties (n = 1,411, 84%) included <20 participants (See Supplemental Digital Content 1, http://links.lww.com/QAI/B794). Overall, 34% of the participants were transgender women, 30% were transgender men, and 36% were nonbinary (7% assigned male at birth and 29% assigned female at birth).

There was significant geographic variation in estimates of HIV testing. The median county-level proportion of TNB people who ever tested for HIV was 44.1% (range, 9.7%–80.2%; Fig. 1A) and who tested for HIV in the last year was 17.2% (4.2%–44.1%; Fig. 1B). Detailed state- and county-level maps and estimates are available in Supplemental Digital Content 2, http://links.lww.com/QAI/B795.

Among EHE priority geographies, Kings County, New York (80.2% ever tested; 44.1% tested in the last year), Washington, DC (74.3% ever tested; 42.9% tested in the last year), and San Francisco County, CA (77.5% ever tested; 37.9% tested in the last year) were among the top 5 counties for both ever and recent HIV testing (Table 1). Alabama and Mecklenburg County, NC, had the lowest proportion of TNB adults who had ever tested for HIV (41.7% and 41.5%, respectively) and Riverside County, CA, had the lowest proportion of TNB adults who had tested for HIV in the last year (14.9%). Notably, the estimated proportion of TNB adults who had been recently tested was very low—below 25%—in 28 of the 50 priority counties (located in Arizona, California, Florida, Georgia, Ohio, Nevada, and Texas) and in all 7 rural states.

We observed differences in ever HIV testing by gender identity, race/ethnicity, and age (Table 2). Generally, these differences were attenuated when we examined the proportion of people who had tested within the last year, compared with ever testing (Fig. 2). Among EHE priority geographies, HIV testing was usually highest among transgender women and lowest among nonbinary adults (median estimated difference of 18.3 percentage points). HIV testing among transgender men was similar to transgender women in some counties (eg, Cook County, IL, and King County, WA) and was between HIV testing estimates for transgender women and nonbinary adults in other counties (eg, Orange County, CA, and Tarrant County, TX). Within most EHE counties, HIV testing was the highest among black participants. HIV testing among Asian/NHPI respondents varied significantly between geographies: this proportion was the lowest in some counties (eg, Washington, DC, and Gwinnett County, GA) and the highest in others (eg, Pinellas County, FL, and Tarrant County, TX). Hispanic/Latinx and White participants showed similar variations in HIV testing across counties. Finally, we observed that TNB adults aged ≥25 years were significantly more likely to have ever tested for HIV or have been tested in the last year compared with young adults aged <25 years within nearly all counties (median estimated difference of 37.8 percentage points). We did not observe major differences in the county-level proportion of TNB adults who were tested for HIV by region of the United States or by urban/rural designation (See Supplemental Digital Content 1, http://links.lww.com/QAI/B794).

DISCUSSION

We estimated the county-level proportion of transgender adults who ever or recently tested for HIV by applying spatial small area estimation methods to the largest national survey of TNB adults conducted in the United States to date. We observed significant county-level variation in the estimated proportion of TNB adults who had ever tested for HIV (9%–80%) or tested for HIV in the last year (4%–44%). HIV testing was very low in many counties and in all 7 rural states prioritized by the EHE initiative. Subgroup analysis revealed that some patterns of HIV testing were consistent across geographies (eg, a lower proportion of young adults tested for HIV), whereas patterns of HIV testing by gender identity and race/ethnicity varied among counties. In many of the EHE geographies, transgender women and black participants were most likely to have tested for HIV, although this was not always the case. This further highlights the need for localized data for understanding disparities in HIV testing rates among subpopulations of TNB adults.

The HIV testing patterns observed in our study may reflect disparities in HIV prevalence among TNB people by gender, race, and ethnicity, which is the highest among transgender women of color. In 2019, the National HIV Surveillance System observed an HIV prevalence of 62% among black, 65% among Native American, and 35% among Latina transgender women living in 7 US cities.[34] In contrast, HIV prevalence among transgender men is estimated to be 2%.[4,35] Differences in HIV testing may reflect differences in perceived HIV risk as well as HIV testing and prevention efforts that have specifically sought to engage black TNB people given that they are disproportionately afected by HIV.[4] For example, 2 studies on PrEP uptake found that the majority of HIV-negative TNB adults (55%–90%) have low self-perceived HIV risk.[6,36] In contrast, another study among transgender MSM found

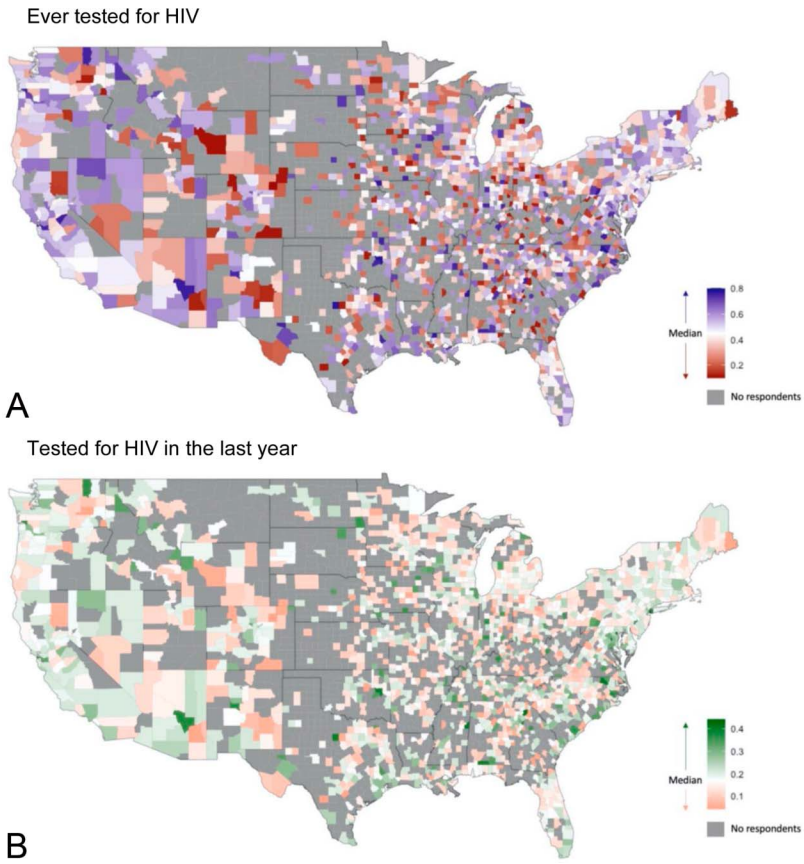

FIGURE 1. County-level map of the proportion of TNB adults who have tested for HIV, 2015 USTS. A, Ever tested for HIV. B, Tested for HIV in the last year.

congruency between high self-perceived HIV risk and PrEP indications.[37] Finally, it is notable that a very low proportion of young adults of <25 years have ever or recently tested for HIV because they account for 35% of all new HIV diagnoses among TNB people.[38]

Prior studies have not consistently reported differences in testing among transgender women and men; moreover, no studies have previously reported on HIV testing among nonbinary adults.[4,21,39] However, several studies have documented racial differences in HIV testing among TNB adults, similar to those observed in our analysis. Data from the BRFSS found that ever HIV testing is significantly higher among black transgender women and men (63% and 67%) compared with white transgender women and men (33% and 31%).[21] Another study of transgender women conducted across 23 US cities found that black and Hispanic/Latinx transgender women were more likely to test for HIV relative to white transgender women.[40] A third study found that TNB people of color were 8 times more likely to meet CDC's recommendations for annual HIV testing [odds ratio 8.2; 95% confidence interval (CI): 2.3 to 28.8].[5]

To date, only 2 national probability samples have collected data on HIV testing among TNB adults—the BRFSS and the TRANSPOP study, a 2-phase probability sample and telephone survey based on Gallup's random digit dialing. However, neither of these surveys have sufficient sample size or geographic scope to provide state- or county-level estimates of HIV testing among transgender populations. Overall, our estimate of ever HIV testing among TNB adults are higher than what was observed in the BRFSS (37%) and lower than what was observed in the TRANSPOP study (77%).[5,21] Comparing our results with estimates from the BRFSS is challenging. As demonstrated in our supplementary analyses (See Supplemental Digital Content 1, http://links.lww.com/QAI/B794), state-level estimates of HIV testing using BRFSS data in transgender adults are, on average, 17 percentage points lower than estimates using USTS data. Although the BRFSS is a probability sample, it is a telephone-based survey, does not assess transgender status using the validated/recommended 2-step question, uses outdated terminology, and excludes homeless and institutionalized populations.[24] Thus, inconsistencies between these 2 data sources are likely an artifact of differing target populations, methodologies, sampling, and response bias between the 2 surveys.

The proportion tested that is reported in the TRANSPOP study is similar to estimates from a recent meta-analysis of clinical and convenience samples by Becasen et al,[4] which reported that 73% of transgender women and men had ever tested for HIV. We found that only 12 EHE geographies have 95% credible intervals that fall within this range estimated by the TRANSPOP study or Becasen et al (ie, 73%–77%). These 12 geographies are all large metropolitan counties in or around the following cities: the greater New York area (New York, Kings, Queens, Bronx, and Hudson counties); the San Francisco Bay Area (San Francisco and Alameda counties); Washington, DC, and the neighboring Montgomery County, MD; Suffolk County, MA; Philadelphia County, PA; and

TABLE 1. Estimated Proportion of Transgender and Nonbinary Adults Who Have Tested for HIV Among Geographies Prioritized by the EHE Initiative, 2015 USTS

State	County	N	Ever Tested for HIV, % (95% CI)	Tested for HIV in the Last yr, % (95% CI)
49 county equivalents				
Arizona	Maricopa	295	47.8 (42.5 to 53.1)	19.7 (15.7 to 24.0)
California	Alameda	439	75.0 (71.2 to 78.7)	32.7 (28.6 to 37.0)
California	Los Angeles	701	59.2 (55.7 to 62.7)	27.8 (24.6 to 31.1)
California	Orange	172	47.2 (40.6 to 53.8)	17.4 (12.8 to 22.5)
California	Riverside	106	42.1 (34.4 to 50.0)	14.9 (10.1 to 20.5)
California	Sacramento	169	62.8 (56.4 to 69.0)	23.0 (17.7 to 28.7)
California	San Bernardino	91	47.0 (38.9 to 55.3)	20.4 (14.4 to 27.2)
California	San Diego	269	63.6 (58.3 to 68.9)	25.6 (21.0 to 30.5)
California	San Francisco	255	77.5 (72.6 to 82.1)	37.9 (32.4 to 43.5)
District of Columbia	Washington	206	74.3 (68.9 to 79.3)	42.9 (36.8 to 49.2)
Florida	Broward	71	60.6 (51.3 to 69.6)	27.2 (19.5 to 35.8)
Florida	Duval	52	48.0 (37.7 to 58.3)	22.2 (14.9 to 30.8)
Florida	Hillsborough	89	43.2 (34.9 to 51.6)	17.8 (12.3 to 24.4)
Florida	Miami-Dade	62	52.1 (42.1 to 62.1)	22.4 (15.2 to 30.7)
Florida	Orange	104	44.7 (36.9 to 52.6)	17.2 (11.9 to 23.2)
Florida	Palm Beach	47	48.2 (37.4 to 59.2)	18.7 (11.9 to 27.0)
Florida	Pinellas	84	55.2 (46.4 to 63.9)	17.1 (11.5 to 23.6)
Georgia	Cobb	58	44.7 (35.5 to 54.0)	17.9 (11.8 to 25.3)
Georgia	De Kalb	125	61.5 (54.2 to 68.5)	30.3 (23.7 to 37.5)
Georgia	Fulton	81	59.8 (51.4 to 67.9)	26.7 (19.5 to 34.7)
Georgia	Gwinnett	46	57.0 (47.0 to 66.6)	23.2 (15.4 to 32.2)
Illinois	Cook	533	63.9 (60.0 to 67.7)	33.5 (29.7 to 37.4)
Indiana	Marion	94	53.8 (45.7 to 61.9)	24.4 (17.9 to 31.8)
Louisiana	East Baton Rouge	53	50.2 (40.1 to 60.3)	22.0 (14.7 to 30.6)
Louisiana	Orleans	70	72.9 (64.5 to 80.6)	30.0 (21.9 to 38.7)
Maryland	Baltimore	85	56.7 (48.4 to 64.8)	22.9 (16.3 to 30.2)
Maryland	Montgomery	137	67.2 (60.4 to 73.6)	31.6 (25.0 to 38.5)
Maryland	Prince Georges	84	61.6 (53.3 to 69.4)	29.5 (22.0 to 37.7)
Massachusetts	Suffolk	204	69.1 (63.3 to 74.5)	38.2 (32.2 to 44.4)
Michigan	Wayne	98	45.0 (37.1 to 53.1)	20.4 (14.5 to 27.1)
Nevada	Clark	107	50.8 (42.9 to 58.7)	19.8 (14.1 to 26.2)
New Jersey	Essex	34	60.8 (50.4 to 70.6)	27.7 (18.6 to 38.0)
New Jersey	Hudson	33	64.0 (53.7 to 73.6)	25.9 (17.2 to 36.0)
New York	Bronx	49	67.5 (58.2 to 76.1)	30.9 (22.0 to 40.8)
New York	Kings	365	80.2 (76.2 to 83.9)	44.1 (39.3 to 49.1)
New York	New York	216	65.6 (59.7 to 71.3)	34.9 (29.1 to 40.8)
New York	Queens	116	65.3 (57.9 to 72.5)	38.3 (30.8 to 46.2)
North Carolina	Mecklenburg	67	41.5 (32.6 to 50.5)	20.8 (14.2 to 28.4)
Ohio	Cuyahoga	118	51.6 (44.1 to 59.1)	23.1 (17.2 to 29.7)
Ohio	Franklin	173	44.6 (38.2 to 51.1)	17.6 (13.0 to 22.6)
Ohio	Hamilton	82	46.3 (37.8 to 54.8)	18.8 (12.9 to 25.7)
Pennsylvania	Philadelphia	280	71.7 (66.8 to 76.4)	36.2 (31.0 to 41.5)
Tennessee	Shelby	34	61.4 (50.4 to 71.7)	27.1 (18.1 to 37.4)
Texas	Bexar	94	43.9 (35.7 to 52.3)	20.2 (14.2 to 27.2)
Texas	Dallas	152	50.1 (43.2 to 57.0)	21.9 (16.5 to 27.8)
Texas	Harris	219	57.2 (51.2 to 63.1)	27.9 (22.6 to 33.5)
Texas	Tarrant	108	42.6 (35.0 to 50.4)	19.4 (13.8 to 25.8)
Texas	Travis	242	57.8 (52.0 to 63.4)	20.2 (15.8 to 24.9)
Washington	King	783	62.4 (59.1 to 65.6)	28.3 (25.3 to 31.5)
7 rural states				
Alabama		212	41.7 (36.8 to 46.5)	16.2 (13.0 to 19.8)

(*continued on next page*)

TABLE 1. (*Continued*) Estimated Proportion of Transgender and Nonbinary Adults Who Have Tested for HIV Among Geographies Prioritized by the EHE Initiative, 2015 USTS

State	County	N	Ever Tested for HIV, % (95% CI)	Tested for HIV in the Last yr, % (95% CI)
Arkansas		214	43.0 (38.6 to 47.5)	15.9 (13.0 to 19.2)
Kentucky		254	47.1 (42.9 to 51.3)	19.6 (16.3 to 23.0)
Mississippi		80	49.0 (43.1 to 55.0)	20.9 (16.4 to 26.0)
Missouri		479	46.2 (42.7 to 49.6)	18.0 (15.4 to 20.7)
Oklahoma		203	44.6 (40.0 to 49.5)	17.1 (13.8 to 21.0)
South Carolina		220	42.3 (37.2 to 47.5)	19.8 (15.9 to 24.0)

Orleans Parish, LA. Thus, HIV testing among TNB adults among the remaining 37 counties and 7 rural states is significantly lower than what has been reported in these 2 studies. This may be because of differences in sampling and reporting. For instance, the TRANSPOP study restricted their analysis to 45% of their sample who were sexually active with cisgender men or transgender women. In addition, meta-analysis estimates are likely vulnerable to selection bias and over representation of transgender adults living in the above geographies. The authors reported that the majority (52%) of studies included in the meta-analysis were located in San Francisco, New York, Los Angeles, or Boston.

Our results suggest that a similar proportion of TNB people have been tested for HIV compared with the US general adult population but that this proportion is lower than what has been observed in other populations at vulnerable to HIV acquisition. Two recent studies used data from the BRFSS to estimate the overall proportion of adults who have been tested for HIV in EHE geographies using data from 2016 to 2017 as well as to estimate national temporal trends in HIV testing by race, age, and binary male/female categories.[41–43] The first of these studies found significant geographic variation in the proportion of all adults who had ever tested for HIV (30%–71%) and who tested for HIV in the last year (7%–26%).[41] Similar to our study, the authors concluded that HIV testing was suboptimal in most EHE geographies and was lowest in jurisdictions with low HIV diagnosis rates. The second of these 2 studies also found that proportion of all adults who had ever been tested for HIV was highest among black respondents (69%), followed by Hispanic/Latinx (48%) and white respondents (42%) and that young adults aged <25 years were significantly less likely to have ever tested for HIV (32%).[42] They also found that BRFSS respondents who self-reported any behaviors associated with an increased risk of HIV acquisition were more likely to have ever tested (65% versus 44%) or tested for HIV in the last year (34% versus 13%) compared with respondents who did not report these behaviors (which included injection drug use, transactional sex, condomless anal sex, STI diagnosis, or ≥ 4 partners in the past year).

TABLE 2. County-Level Variation in the Estimated Proportion of Transgender and Nonbinary Adults Who Have Tested for HIV Among all US Counties, by Gender Identity, Race/Ethnicity, and Age Subgroups, 2015 USTS

Demographic Subgroups	N*	Ever Tested for HIV % Median (Range)†	Tested for HIV in the Last yr % Median (Range)†
Overall	26,100	44.1 (9.7–80.2)	17.2 (4.2–44.1)
Gender identity			
Transgender women	8987	57.3 (22.3–84.6)	19.5 (9.0–55.7)
Transgender men	7679	45.9 (7.6–80.1)	18.0 (5.1–45.5)
Nonbinary	9434	32.5 (8.1–85.1)	13.4 (3.8–43.7)
Race/ethnicity‡			
Asian/NHPI	1122	46.3 (17.0–86.0)	21.4 (9.0–56.9)
Black	1231	66.7 (29.0–87.2)	32.6 (20.0–47.5)
Hispanic/Latinx	1940	48.0 (14.2–81.5)	22.3 (7.0–57.7)
Native American/Alaska Native	708	70.9 (24.4–82.9)	28.6 (17.5–41.1)
White	21,452	44.8 (10.0–80.1)	16.6 (3.9–44.3)
Age			
18–24 yr old	11,276	24.8 (10.4–58.5)	13.5 (5.1–37.2)
≥ 25 yr old	14,824	61.5 (39.8–87.9)	19.2 (12.7–48.1)

*Total number of participants with a valid zip code.

†Median and range across all US counties of the mean of the posterior distribution of the estimated proportion of participants who tested for HIV.

‡Participants who reported multiple races could be categorized in multiple groups; 75 participants did not provide a race/ethnicity.

In addition, a recent large online sample of transgender and cisgender MSM found that although transgender men reported high rates of ever HIV testing or testing in the last year (71% and 61%, respectively), transgender men tested less frequently than cisgender men in the same sample.[44] These findings are consistent with a systematic review of HIV testing among MSM that estimated that 63%–91% of MSM had ever tested for HIV while 39%–67% has been tested in the last year.[2] Finally, Antebi-Gruszka et al[44] also found that transgender MSM who lived in the South were significantly less likely to have tested for HIV compared with those who lived in the northeast, midwest, or west.

This analysis had several limitations. The 2015 USTS used nonprobability sampling and is vulnerable to sampling bias. Although the USTS is the largest and most comprehensive sample of TNB adults, there remained significant gaps in geographic coverage, particularly in rural regions of the midwest and southern United States. In addition, we were only able to obtain small area estimates for the contiguous United States and thus excluded Alaska, Hawaii, Puerto Rico, and Guam. This analysis also relied on self-reported HIV testing behaviors, which are vulnerable to recall and social desirability bias. Measures of recent HIV testing are more likely to be inflated as a result of

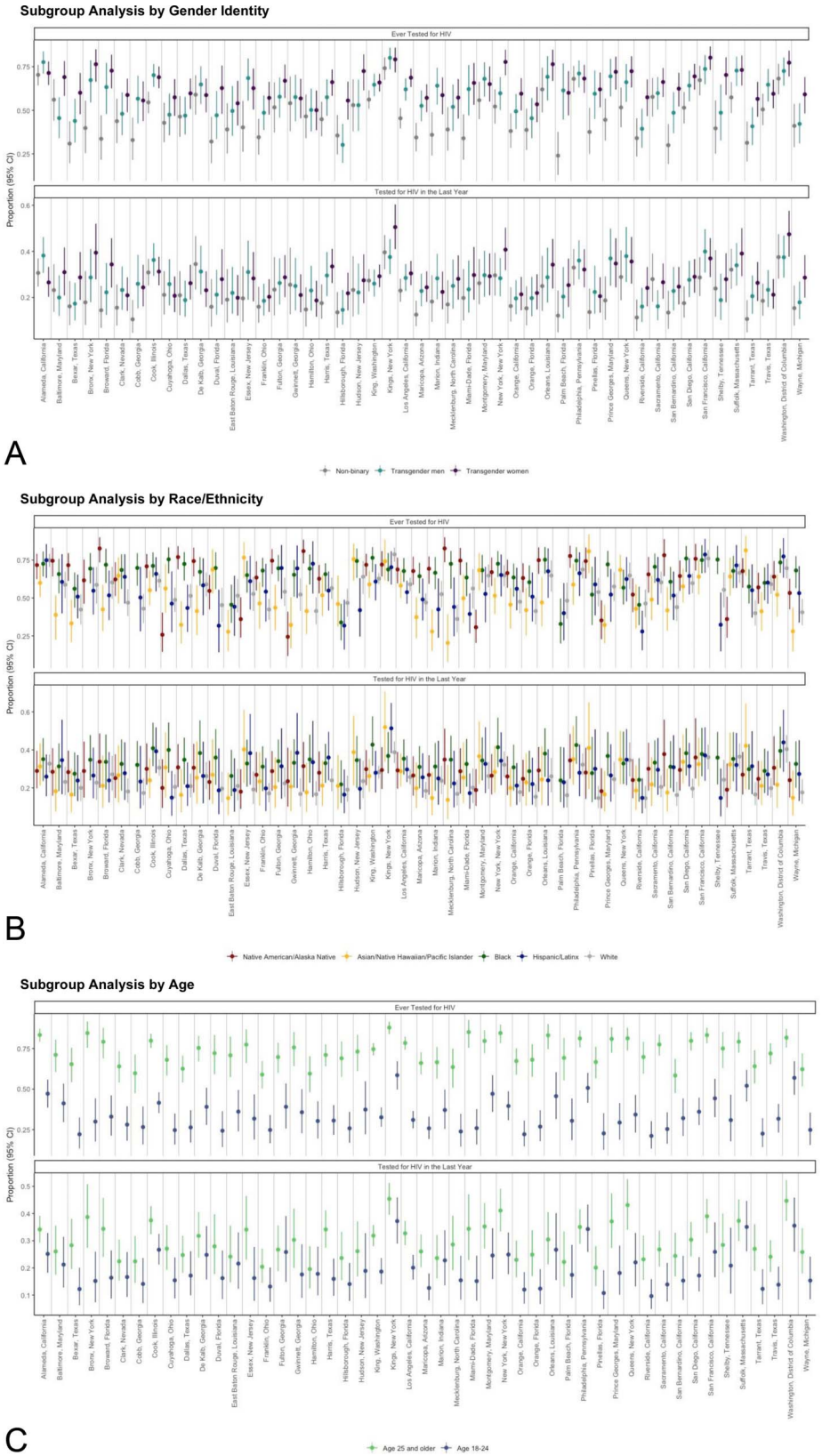

FIGURE 2. Proportion of TNB adults who have tested for HIV among counties prioritized by the Ending the HIV epidemic initiative, 2015 USTS. A, Subgroup analysis by gender identity. B, Subgroup analysis by race/ethnicity. C, Subgroup analysis by age.

these biases than measures of ever HIV testing. These data were collected in 2015 and may not be reflective of current HIV testing, although national data suggest that trends in HIV testing have not significantly changed between 2011 and 2017.[42] Finally, the USTS does not ask questions about the gender of sex partners or other sexual behaviors, which means we were unable estimate rates of HIV testing among sexually active TNB participants.

Despite these limitations, these county-level data may be invaluable to local health departments who likely lack data on HIV testing in their local TNB community and should be used to motivate HIV testing efforts that are inclusive and responsive to the needs of the TNB community. Trans-inclusive HIV prevention strategies must address stigma and structural barriers to accessing care, provide gender-affirming services, and center the strengths and priorities of local TNB communities.[45–47] Notably, peer support within trans communities improves engagement in HIV prevention, and these social networks can be leveraged to disseminate HIV innovations and reach individuals who are not currently engaged in HIV prevention services. In addition, trans-inclusive data collection and reporting are critical for monitoring the success and reach of these strategies.[48]

"Diagnosing all individuals with HIV as early as possible" after HIV acquisition is 1 of the 4 pillars of the EHE initiative, and HIV testing is a critical access point for a range of HIV prevention and treatment interventions (eg, PrEP and treatment as prevention). To our knowledge, this study is the first to provide state- and county-level estimates of HIV testing for TNB adults, filling a gap in jurisdiction-level data on TNB populations. We found that geographic variation in HIV testing among TNB adults mirrors patterns observed for all adults living in the United States and that ever and recent HIV testing is below recommended levels in most states and counties. In addition, differences in HIV testing by gender identity and race/ethnicity varied across geographies, suggesting that the HIV testing strategies may need to be tailored to meet local needs. Overall, these findings highlight the importance of trans-inclusive HIV testing and prevention strategies within the EHE geographies, to achieve a 90% reduction in new diagnoses by 2030.

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