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Access to HIV Prevention, Care, and Treatment Services in the US: The Role of Primary Care

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The Role of Primary Care

A dissertation submitted in partial fulfillment of the requirements for the combined MD-PhD degree (Doctor of Philosophy) at Virginia Commonwealth University.

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List of Abbreviations

ACS – American Community Survey

AIDS – Acquired Immunodeficiency Syndrome

CDC – US Centers for Disease Control and Prevention

HHS – US Department of Health and Human Services

HIV – Human Immunodeficiency Virus

HRSA – Health Resources and Services Administration

EHE – Ending the HIV Epidemic Initiative

FQHC – Federally Qualified Health Center

LGBT – Lesbian, gay, bisexual and transgender

MSA – Metropolitan Statistical Area

MUA – Medically underserved area

MUP – Medically underserved population

NHB – Non-Hispanic Black

NHW – Non-Hispanic White

PCP – Primary care provider

PCSA – Primary Care Service Area

PLWH – People living with HIV

PrEP – HIV pre-exposure prophylaxis

UDS – Uniform Data System

ZCTA – Zip Code Tabulation Area

Abstract

This dissertation examines the role of access to primary care in benefitting HIV outcomes through increased access to HIV prevention, care, and treatment services, among populations disproportionately affected by HIV in the US. Over 30,000 individuals are newly diagnosed with HIV annually in the US and diagnoses are concentrated in specific populations. At an individual-level, ~ 70% of new diagnoses are among gay and bisexual men and of those diagnoses, 70% are among Non-Hispanic Black and Hispanic gay and bisexual men. At a community-level, over 50% of new HIV diagnoses occur in less than 2% of US counties (48), Washington, DC, and San Juan, PR, with urban areas in the South disproportionately represented (23). Access to primary care may increase access to HIV services, benefitting HIV outcomes and reducing HIV transmission. However, research examining these relationships is limited. To gain insight into how primary care access may impact access to HIV services and HIV outcomes among individuals and communities most impacted, this dissertation addresses 3 research questions:

1) Are there disparities in ***access*** to primary care for Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White gay and bisexual men?
2) In a sample of urban communities in the US South experiencing high rates of new HIV diagnoses, is the ***presence*** (i.e., density**)** of highly accessible primary care sites, Federally Qualified Health Centers (FQHCs), associated with community-level indicators of HIV epidemic control and is the relationship sensitive to community racial composition?
3) Using the same sample, is FQHC ***use*** (i.e., penetration or percent low-income population using any FQHC), associated with community-level indicators of HIV epidemic control?

Our results suggest that individuals at highest risk of HIV, Non-Hispanic Black and Hispanic gay and bisexual men, have lower access to any primary care, compared to Non-

Hispanic White gay and bisexual men, which may result in less access to HIV services. Community-level analysis suggests that presence of FQHCs (i.e., density) benefits community late HIV diagnosis (lower), percent linked to care, and percent virally suppressed (both higher). Further, impact may be greatest in communities with fewer primary care or HIV resources and for communities with higher proportions of Black residents. Community FQHC use (i.e., penetration) was associated with greater viral suppression but no relationship to percent late diagnosis or percent linked to care. Further research to identify 1) barriers to primary care access specifically for Non-Hispanic Black and Hispanic gay and bisexual men and 2) barriers to HIV testing and linkage to care at FQHCs would benefit continued forward progress towards ending the HIV epidemic in the US.

Chapter 1: Introduction

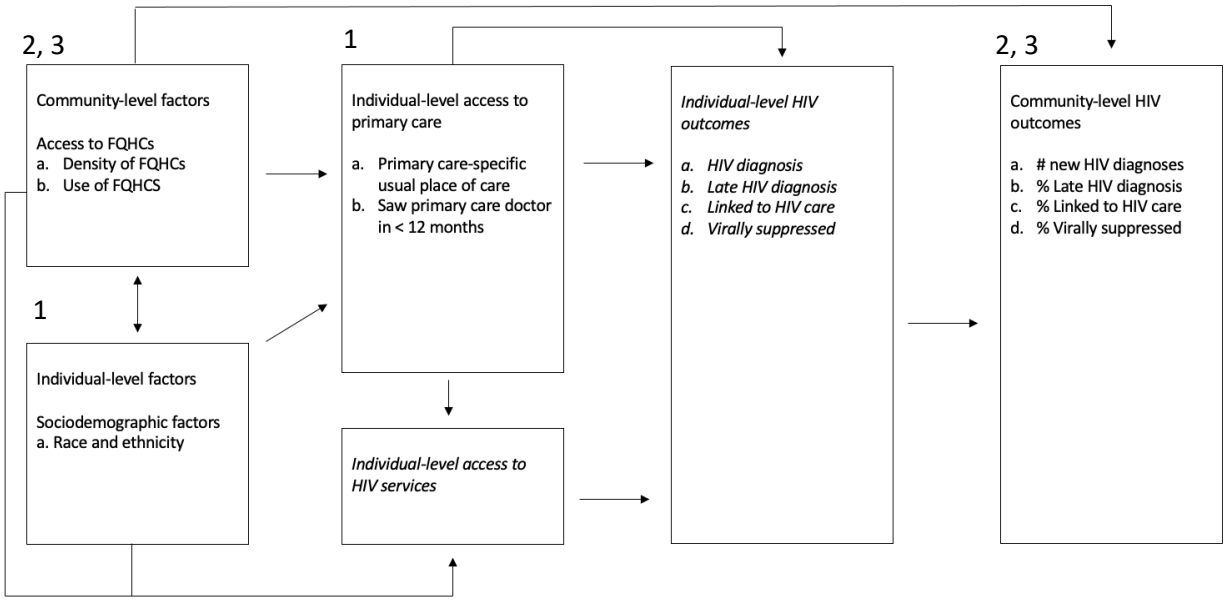
Despite advances in HIV prevention and treatment, over 30,000 individuals are newly diagnosed each year in the US.[1] The Southern US is the epicenter of today's HIV epidemic, accounting for over 50% of new diagnoses with significant racial disparities.[2] Multiple factors contribute to the burden of disease in the region including high rates of poverty, unemployment, and low median income, which are associated with higher HIV prevalence.[3–6] High rates of uninsurance with limited expansion of Medicaid, the largest source of insurance coverage for people living with HIV (PLWH), limit access to HIV prevention, care, and treatment, services.[7,8] For Black individuals, these factors are further compounded by historical and ongoing structural inequality in access to health services, contributing to the disproportionate burden of HIV-disease experienced by this population.[2,9,10]

Access to primary care may increase access to HIV services and benefit HIV outcomes. As providers of routine preventive care, primary care physicians deliver counseling on HIV-risk, provide HIV testing, and prescribe pre-exposure prophylaxis (PrEP) to prevent HIV transmission. In 2018, primary care providers issued 78% of all PrEP prescriptions in the US.[11,12] They are often the first contacts for people living with HIV, serving as a gateway into the healthcare system. Primary care physicians also provide quality HIV care, specifically when a provider is, or is supported by, an HIV-experienced clinician.[13–15] In 2010, primary care providers represented 55% of the HIV clinician workforce.[16]

As low-cost providers of primary care, Federally Qualified Health Centers (FQHCs) specifically are well-positioned to increase access to HIV services for populations that experience greater barriers to care. FQHCs are mandated to provide primary care to Medically Underserved Areas (MUAs) and Populations (MUPs).[17,18] In 2018, FQHCs provided care to over

28 million individuals, with 63% of their patient population self-identifying as a racial or ethnic minority.[19] They serve 1 in 3 people in poverty, 1 in 5 rural residents, 1 in 5 uninsured persons, and 1 in 6 Medicaid beneficiaries, populations at greater risk of HIV acquisition.[19–23] FQHCs also provide services to increase access to care, such as transportation, case management and care coordination.[24–26] In 2019, FQHCs provided care to 1 in 6 PLWH and FQHCs received almost $400 million to provide HIV prevention, care, and treatment services since 2020.[24,27]

Figure 1. Adapted Andersen's Behavioral Model of Health Service Use*[28]



* Listed are the community and individual-level factors examined in the dissertation. However, there are other key factors that impact access to care (e.g., household income, education) that are included as covariates in each analysis but are not listed in this framework.

This research seeks to understand the role of primary care in providing access to HIV services and benefitting HIV outcomes among populations disproportionately impacted by HIV. We use an adapted version of *Andersen's Behavioral Model of Health Service Use*[28] as a conceptual framework to identify the relationships examined in this dissertation (**Figure 1**). In this adapted framework, community- and individual-level factors each influence individual access to primary care, which influences individual access to HIV services. Access to HIV

services influences individual HIV-specific health outcomes, which influences community HIV-specific health outcomes. Representative explanatory and outcome measures examined at an individual- or community-level are listed under the constructs they represent (e.g., Individual Access to Primary Care). *Italicized* text represents relationships that are not examined in the dissertation. In this dissertation research, at the individual level, we examine the relationship between race and ethnicity and access to primary care (*indicated on the conceptual framework by '1'*). At the community-level, we examine the relationship between community-level access to primary care and community-level HIV outcomes (*indicated on the conceptual framework by '2' and '3')*.

Paper 1 examines racial and ethnic disparities in access to primary care among the highest risk group for HIV acquisition in the US, gay and bisexual men. Primary care providers play an important role providing HIV services.[11,15,16] However, disparities in access to primary for Non-Hispanic Black and Hispanic gay and bisexual men may contribute to increasing racial and ethnic disparities observed in new HIV diagnoses for these groups compared to Non-Hispanic White gay and bisexual men.[29] Paper 1 uses a nationally representative sample of gay and bisexual men to examine disparities in 1) having a primary care-specific usual place of care and 2) having seen a primary care physician in the past 12 months for Non-Hispanic Black and Hispanic, compared to Non-Hispanic White, gay and bisexual men.

The second and third paper examine the impact of accessible primary care sites, FQHCs, on community-level indicators of HIV epidemic control in a sample of urban communities in the US South with high rates of new HIV diagnoses. Paper 2 examines whether the presence of FQHCs (i.e., density or the number of FQHCs per low-income population) benefits community-level HIV epidemic indicators – number of new HIV diagnoses, percent late HIV diagnosis,

percent linked to care, and percent virally suppressed -- and whether the relationship varies based on community racial composition. FQHCs disproportionately serve populations at higher risk of HIV acquisition, low-income, uninsured, and racial and ethnic minority populations.[20,30,31] A higher density of FQHCs may, thus, increase access to HIV services, specifically for at risk populations, and benefit community-level indicators of HIV epidemic control. Further, FQHCs may have greater impact in communities with higher proportions of Black residents given these communities face additional barriers to care due to structural and systematic inequity in access to health care resources.[32,33]

Paper 3 examines the relationship between FQHC use (i.e., penetration or the percent low-income residents using any FQHC) and community-level HIV indicators of epidemic control. Higher FQHC penetration among a group at higher risk of HIV acquisition may approximate greater access to (and use of) HIV services and benefit community-level indicators of HIV epidemic control. FQHC use reflects separate considerations of access (e.g., ability to take time off to see a physician) than captured by the density of FQHCs, which may provide separate and specific into the role of primary care in benefiting HIV outcomes in communities.

Chapter 2: *Disparities in Access to Primary Care, a Key Site for HIV Prevention Services, among Gay and Bisexual Men in the United States*

Abstract

U.S. HIV diagnoses disproportionately affect Non-Hispanic Black (NHB) and Hispanic gay and bisexual men. Using data from the National Health Interview Survey (2013-2018), we examined race and ethnicity and primary care access, an HIV prevention resource, among gay and bisexual men. The explanatory variable was NHB, Hispanic or Non-Hispanic White (NHW). Outcomes were primary care-specific usual place of care (potential access) and saw general doctor <12 months (realized access). We used multivariable logistic regression, adjusting for individual sociodemographic characteristics, health status, and care barriers. In sensitivity analysis, we examined general access (any place/doctor) and subgroups 1) NHB 2) has usual place of care. The sample included 1,858 adult, gay and bisexual men (unweighted). Nearly one-third self-identified as NHB or Hispanic. Compared to NHW men, NHB and Hispanic men were younger, with lower household income, and more care barriers (p<0.05). NHB and Hispanic men had lower realized access (aOR 0.7058, p=0.030) than NHW men. Potential access was lower for NHB only (versus NHW) and, among those with any usual place of care, NHB and Hispanic men versus NHW men. Lower primary care access for NHB or Hispanic, rather than NHW, gay and bisexual men, may reduce HIV prevention access.

Key words: HIV prevention, primary care, disparities

Word Count: 198/200

Introduction

Despite advances in HIV prevention, almost 37,000 individuals are newly diagnosed with HIV annually in the US.[29] Gay and bisexual men account for nearly 70% of new diagnoses and over two-thirds of those diagnoses occur in Non-Hispanic Black or Hispanic gay and bisexual men.[29] While new HIV diagnoses are decreasing nationally, racial and ethnic disparities in new diagnoses are increasing. Recent estimates of new diagnoses (5-year) have remained stable for Non-Hispanic Black and Hispanic gay and bisexual men, while decreasing nearly 20% for Non-Hispanic White gay and bisexual men.[29] Racial and ethnic disparities in access to HIV prevention may be a contributing factor.[34,35]

Primary care providers are key resources for HIV prevention and treatment (i.e., secondary prevention) services.[36,37] Primary care providers issued 78% of prescriptions for HIV pre-exposure prophylaxis (PrEP) in 2018 and represented 55% of the HIV clinician workforce in 2010.[12,38] A study of Medicaid beneficiaries in the US South (2009-2011) found that 77% of routine HIV care providers practiced in primary care specialties.[39] In 2021, community-based, federally funded providers of primary care, Federally Qualified Health Centers, received over $100 million in HIV prevention funding for the *Ending the HIV Epidemic (EHE)* initiative.[27,40]

Increases in both the importance of primary care providers in HIV prevention and racial and ethnic disparities in new HIV diagnoses, may indicate racial and ethnic disparities in access to primary care among US gay and bisexual men, mirroring disparities in primary care access in the general population.[41,42] This analysis leverages national-level survey data to examine disparities in primary care access for Non-Hispanic Black and Hispanic gay and bisexual men compared to Non-Hispanic White gay and bisexual men.

Methods

Data

Data came from the National Health Interview Survey (NHIS, 2013-2018) (https://www.cdc.gov/nchs/nhis/index.htm). The NHIS is a cross-sectional household interview survey that collects person-level information on health, health care access, and health behaviors of the civilian, non-institutionalized US population. The survey uses a complex, multistage probability design that incorporates stratification and clustering to select a nationally representative sample of households and interviews all individuals at a household. Annual NHIS data were accessed using a custom data extract from IPUMS (formerly the Integrated Public Use Microdata Series, International), which harmonizes area-level census and survey microdata.[43] Information available (i.e., person-level access to primary care, race and ethnicity, sexual orientation), availability of multiple years of data, and geographic reach of the survey (national) made the NHIS an ideal data source.

Sample Selection

The analytic sample consisted of males, aged 18-64 years, Non-Hispanic Black, Hispanic (any race), or Non-Hispanic White, who identified as gay or bisexual (**see – Appendix A**). Age was restricted to 18-64 years given that a small percentage (1.4%) of new diagnoses occur in gay and bisexual men >64 years.[29] Further, access to public insurance—namely, Medicare for individuals >64 years and Medicaid/Children's Health Insurance Plan (CHIP) for individuals <19 years—may reduce disparities in access to primary care.[44–46] We restricted the sample to Non-Hispanic Black, Non-Hispanic White, and Hispanic gay and bisexual men, which together make up 95% of new HIV diagnoses among gay and bisexual men.[29] While other racial and ethnic groups with increasing or stable rates of new HIV diagnoses were considered (e.g., Native

Hawaiian or other Pacific Islander), we did not include these groups due to small sample size or inability to identify specific groups within the data.[29] Exclusion criteria were any missing covariates or outcomes, or conditions, syndromes or disorders requiring intensive lifelong medical management.

Outcome Variables

Outcome variables were potential access and realized access to primary care. Potential access represents enabling factors that can increase health service use, such as health insurance or having a usual place/source of care.[47,48] We used primary care-specific usual place of care, clinic or health care center, doctor's office, or HMO, as the measure of potential access. For individuals living with HIV, having a usual source of care has been associated with reduced time to care following HIV diagnosis and higher odds of viral suppression.[49,50] Relatedly, access to a community nurse has been associated with increased viral suppression and median CD4 cell count in a clinical and community-based intervention.[51]

Realized access represents actual use of services.[47] We used having seen a general doctor in the past 12 months as the measure of realized access. "General doctor" refers to general practice, family medicine, or an internal medicine doctor, specialties that manage common and long-term illnesses in adults, focusing on overall health and well-being.[52] We chose this measure given recommendations that all men receive periodic health assessments and that sexually active men who have sex with men, which may include men who identify as gay and bisexual, obtain certain screenings (e.g., HIV) at least annually.[53,54]

Explanatory Variable

The explanatory variable was self-reported race and ethnicity, identified using a categorical question about individual's race and a separate binary question on Hispanic ethnicity.

Race and ethnicity were used to examine racial and ethnic disparities in each outcome and represent structural and systematic inequities, rooted in racism and discrimination, that decrease access to services[41,55] Our group of interest was gay and bisexual men who identified as 'Black/African American, not Hispanic' and 'Hispanic' (any race). The reference group was gay and bisexual men who identified as 'White, not Hispanic.'

Covariates

We controlled for individual-level predisposing, enabling and need-based characteristics. Predisposing characteristics included categorical age, employment status, household income, and education[56–60] Enabling factors included whether individuals reported having health insurance (any), experienced one or more organizational barriers to care (i.e., ability to contact a physician, physician hours, appointment or office wait times), or one or more socially determinant barriers to care (i.e., food insecurity, housing insecurity, no transportation).[61–64] Self-determined health status was a proxy for individual overall health, which influences care needs and service use.[60]

We controlled for region of residence to account for region-specific differences in health care systems and/or policy (e.g., Medicaid expansion), which may be correlated with both race and ethnicity (explanatory) and access to primary care (outcome) variables.[65] Geographic units of analysis smaller than region (e.g., state) were unavailable.

Statistical Analysis

We used an individual-level pooled cross-section of all years included. We used a two-sided hypothesis ($p<0.05$) to test for differences in sample characteristics using a Pearson X^2 statistic that was corrected and converted into an F-statistic to account for complex survey design.[66] We used multivariable logistic regression to examine race and ethnicity and measures of healthcare access, adjusted for individual sociodemographic (i.e., predisposing), enabling, and

need-based factors, with region and year fixed effects. An F-adjusted mean residual test was used to assess goodness-of-fit and to account for survey sampling design[67] NHIS household and person-level weights were used to produce nationally representative estimates, correct for the unequal probability of selection in the NHIS sample, and account for survey non-response.[68] Survey sampling units and survey weights were applied to the estimation of standard errors and tests of statistical significance.[69] Analyses were conducted using STATA/IC 16.0.

Sensitivity Analysis

We used general measures of potential and realized access (any usual place of care, any doctor in the past 12 months) to examine if associations were primary care specific. We examined the subgroup at highest risk of acquiring HIV, Non-Hispanic Black gay and bisexual men (versus Non-Hispanic White). We also examined differences in type of usual place of care among men with (any) usual place of care.

Results

Summary Statistics

The sample included 1,858 men self-identifying as gay or bisexual. Nearly 30% identified as Non-Hispanic Black (n=204) or Hispanic (n=316) (**Table 1**). Almost 78% reported potential access (primary care-specific usual place of care) and 69% reported realized access (saw general doctor in the past 12 months). Fewer Non-Hispanic Black and Hispanic men reported potential access (69.1%) compared to Non-Hispanic White men (81.4%, $p<0.0001$). Similarly, fewer Non-Hispanic Black and Hispanic men reported realized access (60.7%) than Non-Hispanic White men (72.7%, $p=0.0003$). Non-Hispanic Black and Hispanic men were significantly younger ($p=0.0008$), with less education ($p<0.0001$), and household income ($p=0.0004$). A higher percentage of Non-Hispanic Black and Hispanic men reported one or more

socially determinant barriers to care (p<0.0001), being uninsured (p<0.0001), and lived in the South (p=0.0020).

Main Analysis

In adjusted analysis, we found no statistically significant relationship between Non-Hispanic Black and Hispanic race and ethnicity and potential access (i.e., having a primary care-specific usual place of care) (adjusted odds ratio, 0.76; 95% confidence interval, 0.55-1.06) (**Table 2**). However, Non-Hispanic Black and Hispanic men had nearly 30% lower odds of having seen a general doctor in the past 12 months (0.71; 0.52-0.97), compared to Non-Hispanic White men. Having (any) insurance was significantly associated with greater odds of both potential and realized access (6.35; 4.39-9.17; 4.61; 2.99-7.11). Experiencing one or more organizational barriers to care was also associated with higher odds of potential and realized access (1.72; 1.04-2.86; 2.03; 1.25-3.28) but there was no relationship for socially determinant barriers to care.

Sensitivity Analysis

When we examined an alternate definition of realized access—having seen *any* doctor (versus a general doctor) in the past 12 months—the relationship was not significant. When examining potential access—having *any* usual place of care (versus a primary-care-specific usual place of care) —no significant relationship was observed, similar to baseline analysis. Among Non-Hispanic Black and Non-Hispanic White gay and bisexual men only, Non-Hispanic Black men had 46% lower odds of a primary care-specific usual place of care (0.57; 0.34-0.94) compared to Non-Hispanic White men; there was no statistically significant relationship for realized access in this subgroup. Among those with any usual place of care, Non-Hispanic Black and Hispanic men had almost 60% lower odds, compared to Non-Hispanic White men, of a

primary care-specific usual place of care (0.42; 0.89-1.92). Finally, compared to Non-Hispanic White men, Non-Hispanic Black men (only) had almost 80% lower odds of reporting a primary care-specific usual place (0.21; 0.10-0.45) (**Figure 2**).

Discussion

This study found disparity in realized access for Non-Hispanic Black and Hispanic, compared to Non-Hispanic White, gay and bisexual men. Disparity in potential access was observed for Non-Hispanic Black men compared to Non-Hispanic White men, and among those with any usual place of care, Non-Hispanic Black and Hispanic men and Non-Hispanic Black men (only), compared to Non-Hispanic White men.

The association between race and ethnicity and realized access to primary care mirrors disparities observed for Non-Hispanic Black and Hispanic men in the general U.S. population.[42] Our findings were consistent with a Chicago study of 871 men who have sex with men, where African American race and Latino ethnicity were associated with limited access to care.[70] However, our results differed from a survey of 800 young adult, gay men in New York City (NYC) recruited at multiple LGBT-friendly venues. The study found men from multiple, self-identified racial and ethnic groups had higher odds of one or more primary care visits in the preceding 12 months, compared to Non-Hispanic White men.[71] Differences in sample characteristics, including younger age, may contribute to alternate findings. Additionally, a sample that is nationally representative, versus from NYC, an urban area with multiple low-cost or free care sites, may also contribute to differences in findings. Notably, we did not observe a relationship for realized access to primary care for Non-Hispanic Black men compared to Non-Hispanic White men. This may be due to low sample size limiting the power to detect

differences but could also indicate the disparity in the main analysis is most likely to impact Hispanic men.

We did not observe a relationship for potential access, which may indicate other factors may be stronger predictors than race or ethnicity (e.g., patient/provider relationship). The finding is consistent with the NYC study (mentioned above) but is inconsistent with existing research documenting racial and ethnic disparities in potential access among the general US population.[72] However, the significance of potential access for Non-Hispanic Black men only, versus Non-Hispanic White men, may suggest disparities in potential access are more likely to impact Non-Hispanic Black men rather than Hispanic men. Among men with any usual place of care, we observed significant differences for both Non-Hispanic Black and Hispanic men and Non-Hispanic Black men only, compared to Non-Hispanic White men. The finding is consistent with studies in the general US population where African American and Hispanic men were more likely to use emergency (ED) and hospital outpatient departments as a usual place of care.[41,72] Further, Hsieh et al. found Non-White gay men were significantly more likely to report using the ED as a usual place of care, compared to White heterosexual men.[73]

Our findings suggest that the factors represented by race and ethnicity—that is, the systematic and structural barriers to care resulting from legacies of and ongoing racism and discrimination—influence type of place for usual care versus having a usual place. If less access to primary care for Non-Hispanic Black and Hispanic gay and bisexual men is not addressed, reliance on primary care to deliver HIV prevention may perpetuate racial and ethnic disparities in new HIV diagnoses. However, HIV prevention funding delivered to Federally Qualified Health Centers specifically, which are primary care sites that serve a majority patient population (63%) self-identifying as a racial or ethnic minority, may lessen this disparity.[31] Connecting individuals

to primary care at organizations dedicated to serving gay and bisexual men, for example local LGBT-community centers, may reduce racial and ethnic disparities in access to primary care and, thus, access to HIV prevention. While many LGBT organizations offer linkage to HIV care following a diagnosis, connections to primary care may reduce risk of HIV acquisition and provide an entry point to rapidly establish HIV care should individuals receive an HIV diagnosis. Separately, non-primary care sites (e.g., ED) could also serve as valuable entry points for accessing HIV services, given our finding that populations at high risk of HIV may utilize non-primary care sites as a usual place of care. Providing HIV services at these sites could improve access for populations with less access to primary care.[74]

Our results also emphasize the role of other key factors in access to primary care. Insured individuals had ~6 and ~5 times the odds of potential and realized access, respectively, compared to uninsured individuals. Conversely, experiencing one or more organizational barriers to care was positively associated with potential and realized access, suggesting limited impact on access among this population. While not significant in our model results, previous studies have found a relationship between experiencing socially determinant barriers to care and lower access to care.[61,63] Further research examining the influence of race and ethnicity on the relationship between socially determinant barriers and access to care among gay and bisexual men may be valuable.

Limitations

We acknowledge several limitations. First, we combined two distinct groups of men with higher risk of HIV that may have different associations with access to care**,** which is a finding suggested in our own analysis. We captured some differences in subgroup analysis for Non-Hispanic Black men but may have been limited by the relatively small sample (n=204). Second,

we could not capture other critical factors that may impact potential and realized access to primary care, including experiences of racism and/or homophobia in patient/provider relationships and provider knowledge and competency.[75–78] Third, we were unable to account for contextual characteristics, except for region of residence and year of survey, due to data limitations. Thus, we may be omitting other factors that could drive disparities in access to primary care, including state-level differences in access to health insurance and rurality. There were also limitations inherent to study design, including the potential for selection bias in men most likely to participate in the survey may be different than a similar population in the US and the potential for recall bias in self-reporting the last time an individual saw a doctor.

Conclusion

Racial and ethnic disparities in access to primary care may contribute to disparity in access to HIV prevention and treatment and, thus, new HIV diagnoses among US gay and bisexual men. Efforts should promote entry of these populations into primary care and continue to provide HIV prevention, or linkage to HIV prevention, where need for these services is most likely to be encountered. If HIV prevention efforts are not both inclusive and responsive to the realities of access for Non-Hispanic Black and Hispanic gay and bisexual men, the objective of ending the HIV epidemic in the US cannot be met.

Table 1. Descriptive Statistics, Full Sample and by Race and Ethnicity*

Characteristic	Full sample (n=1,858)	Non-Hispanic White (n=1,338)	Non-Hispanic Black or Hispanic (n=520)	*p*-value
Main Analysis (%)				
Primary Care-Specific Usual Place of Care	77.6	81.4	69.1	<0.0001
Saw General Doctor in Past 12 months	69.0	72.7	60.7	0.0003
Individual-Level Characteristics				
Age Group (%)				
18-34	41.9	39.7	47.6	
35-44	16.7	15.8	18.9	0.0008
45-64	41.5	44.5	33.5	
Educational Level (%)				
High school education or less	23.1	19.2	33.2	<0.0001
Some college or higher	76.9	80.8	66.8	
Employment Status† (%)				
Employed‡	73.9	75.5	69.8	0.0449
Unemployed	26.1	24.5	30.2	
Household Income Level (%)				
<$35,000	38.4	35.4	46.2	
$35,000–$74,999	29.4	30.0	27.9	0.0004
>$75,000	32.2	34.6	26.0	
Health Status (%)				
Excellent/Very Good	62.2	63.0	60.0	
Good	24.0	23.9	24.1	0.3754
Fair/Poor	13.9	13.1	15.9	
Enabling Factors and Barriers				
Health Insurance§ (%)				
Any Insurance	85.8	89.5	77.6	<0.0001

Uninsured or unknown	14.2	10.5	22.5	
Organizational Barriers to Care[l] (%)				
Presence of 1 or more barriers	15.0	14.6	15.9	0.6323
Presence of 0 barriers	85.0	85.4	84.1	
Socially Determinant Barriers to Care[¶] (%)				
Presence of 1 or more barriers	28.9	22.8	42.5	<0.0001
Presence of 0 barriers	71.1	77.2	57.5	
Contextual Characteristics				
Region (%)				
Northeast	17.9	18.0	17.8	
North and Midwest	21.4	23.3	15.8	0.0020
South	32.3	30.1	40.9	
West	27.8	28.6	25.6	

[*] A Pearson chi-squared test was used to test for differences in proportions between Non-Hispanic Black and Hispanic vs. Non-Hispanic White gay and bisexual men and significance was determined using a (survey corrected) F-statistic at the $p<0.05$ level.
[†] Employment was assessed using the previous two-week period.
[‡] Employed individuals were those who identified as working for pay or with job, but not at work. Unemployed individuals were those who identified as working without pay, not employed, or not in the labor force.
[§] Insured individuals were those individuals who identified that they had insurance vs. individuals who identified they did not have insurance or did not know.
[l] Organizational barriers to care included experiencing delays in care due to wait time for an appointment, wait time in doctor's office, not being able to get through by phone, or the doctor's office was not open.
[¶] Socially determinant barriers to care included whether an individual reported experiencing low or very low 30-day food security, being moderately or very worried about paying rent/mortgage/housing costs, and whether individuals had to delay care due to lack of transportation.

Table 2. Access to Primary Care for Non-Hispanic Black and Hispanic vs. Non-Hispanic White Gay and Bisexual Men*

Characteristic	Primary Care-Specific Usual Place of Care			Saw a General Doctor in Past 12 Months		
	aOR	95% CI	*p*-value	aOR	95% CI	*p*-value
Individual-Level Characteristics						
Race and Ethnicity						
Non-Hispanic White	Reference	----	----	Reference	----	----
Non-Hispanic Black or Hispanic	0.76	(0.55-1.06)	0.107	0.71	(0.52-0.97)	0.031
Age Group						
18-34	Reference	----	----	Reference	----	----
35-44	2.85	(1.68-4.82)	0.000	1.26	(0.88-1.79)	0.205
45-64	2.99	(2.09-4.26)	0.000	1.49	(1.09-2.06)	0.014
Education Level						
High school education or less	Reference	----	----	Reference	----	----
Some college or higher	1.56	(1.11-2.21)	0.012	1.21	(0.87-1.70)	0.260
Employment Status†						
Unemployed	Reference	----	----	Reference	----	----
Employed‡	0.82	(0.56-1.19)	0.294	0.56	(0.39-0.79)	0.001
Household Income Level						
<$35,000	Reference	----	----	Reference	----	----
$35,000–$74,999	1.03	(0.70-1.52)	0.886	1.11	(0.78-1.56)	0.569
>$75,000	1.95	(1.17-3.25)	0.010	1.60	(1.12-2.30)	0.011
Health Status						
Excellent/Very Good	Reference	----	----	Reference	----	----
Good	1.06	(0.71-1.60)	0.769	0.83	(0.59-1.17)	0.286
Fair/Poor	0.87	(0.53-1.41)	0.567	1.19	(0.74-1.93)	0.469
Enabling Factors and Barriers						
Health Insurance						
Uninsured or unknown	Reference	----	----	Reference	----	----
Any Insurance§	6.35	(4.39-9.17)	0.000	4.61	(2.99-7.11)	<0.001

Organizational Barriers to Care[l]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	1.72	(1.04-2.86)	0.036	2.03	(1.25-3.28)	0.004
Socially Determinant Barriers to Care[¶]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	0.85	(0.57-1.26)	0.411	1.09	(0.77-1.55)	0.630
Contextual Characteristics						
Region						
Northeast	Reference	----	----	Reference	----	----
North and Midwest	0.72	(0.40-1.29)	0.267	0.73	(0.45-1.20)	0.219
South	0.72	(0.43-1.19)	0.202	0.75	(0.48-1.17)	0.206
West	0.66	(0.39-1.13)	0.128	0.78	(0.49-1.25)	0.305

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval

[*] Multivariable logistic regression was used to calculate the odds of 1) having a primary care-specific usual place of care and 2) having seen a general doctor in the past 12 months for our group of interest, Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White and adjusting for all individual and contextual characteristics.

[†] Employment was assessed using the previous two-week period.

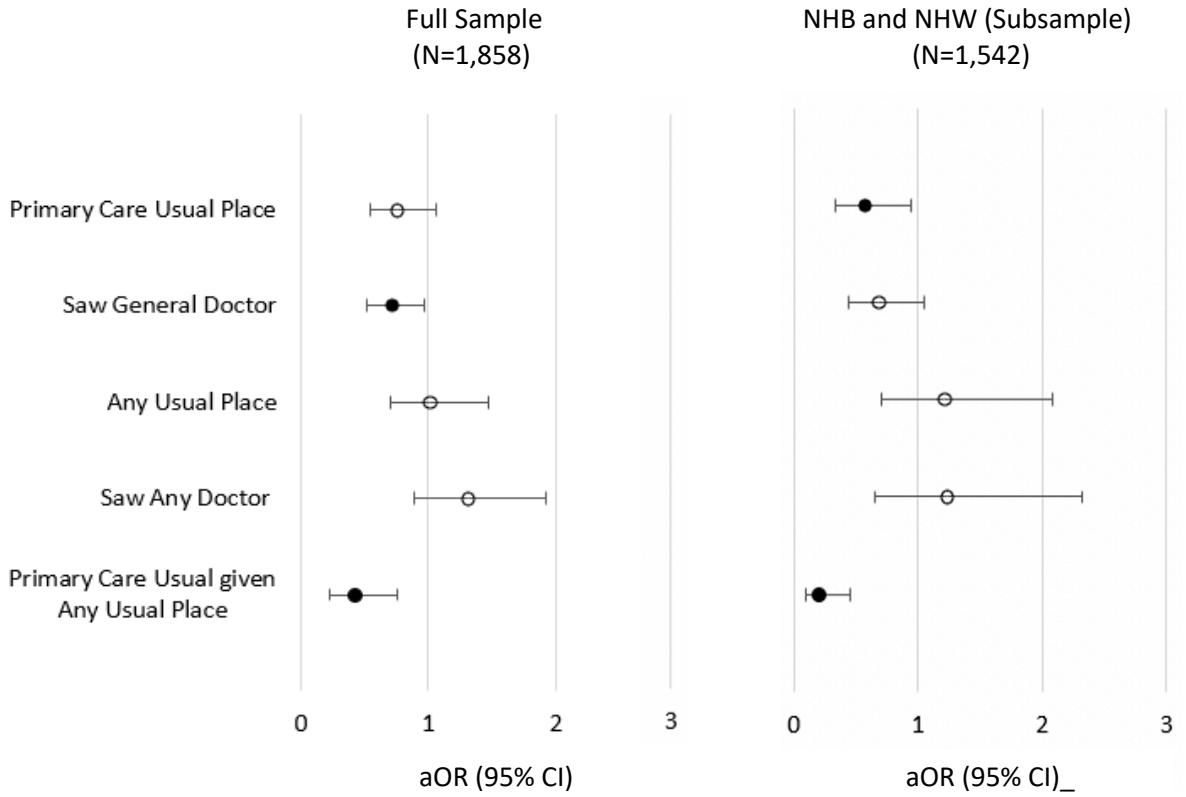
[‡] Employed individuals were those who identified as working for pay or with job, but not at work. Unemployed individuals were those who identified as working without pay, not employed, or not in the labor force.

[§] Insured individuals were those individuals who identified that they had insurance vs. individuals who identified they did not have insurance or did not know.

[l] Organizational barriers to care included experiencing delays in care due to wait time for an appointment, wait time in doctor's office, not being able to get through by phone, or the doctor's office was not open.

[¶] Socially determinant barriers to care included whether an individual reported experiencing low or very low 30-day food security, being moderately or very worried about paying rent/mortgage/housing costs, and whether individuals had to delay care due to lack of transportation.

Figure 2. Racial and Ethnic Disparities in Access to Primary Care among US Gay and Bisexual Men, Summary of Analyses



Abbreviations: NHB=Non-Hispanic Black; NHW=Non-Hispanic White; aOR=adjusted odds ratio; 95% CI=95% Confidence Interval
Legend: Reported are the adjusted odds of potential and realized access to primary care and any care associated with race and ethnicity for non-institutionalized gay and bisexual men, 18-64 years old (unless noted). The definition of male "sex," individual's assigned sex at birth versus their gender identity, was not specified. The odds ratio for the full sample compares Non-Hispanic Black and Hispanic vs. Non-Hispanic White gay and bisexual men. The odds ratio for the subgroup Non-Hispanic Black compares Non-Hispanic Black vs. Non-Hispanic White gay and bisexual men. Primary care measures were having a primary care-specific usual place of care, seeing a general doctor in the past 12 months, and having a primary care-specific usual place among those who identified having a usual place (sensitivity analysis). General measures were having any usual place of care or seeing any doctor in the past 12 months. The regression controlled for individual characteristics (employment, education, income, and health status), insurance coverage and barriers (organizational or socially determinant barriers to care), contextual characteristics (region of residence) and time (year) fixed effects.

Chapter 3: *Federally Qualified Health Centers and Community-Level HIV Outcomes among High HIV-Burden Urban Communities across the US South*

Abstract

Federally Qualified Health Centers (FQHCs) may increase access to HIV prevention, care, and treatment for at-risk populations. We used a pooled cross-section of Zip Code Tabulation Areas (ZCTAs) from cities in the US South with high HIV diagnoses to examine FQHC density and indicators of HIV epidemic control. The explanatory variable was FQHC density (high vs. medium/low) defined by number of FQHCs in a ZCTA's Primary Care Service Area (PCSA) per low-income population of the service area. Outcomes were 5-year 1) number of new HIV diagnoses, 2) percent late diagnosis, 3) percent linked to care, and 1-year 4) percent virally suppressed. We used multivariable linear regression to examine the relationship, including ZCTA-level sociodemographic and city-level HIV funding variables with state fixed-effects. In sensitivity analysis, we examined the impact of supply of (non-FQHC) primary care providers (PCPs) by 1) examining a subset of ZCTAs with fewer PCPs, and 2) controlling for county-level density of PCPS. We also examined ZCTAs with likely fewer community-level HIV resources by 3) excluding highest HIV prevalence ZCTAs, and 4) excluding Florida ZCTAs (highest Ryan White state funding). We also examined high versus medium/low FQHC density among communities with less than average (<20%), disproportionate (≥20%), and majority (≥60%) Black residents, using an interaction term to identify the composition-specific relationship. The sample included 1,383 ZCTAs. High density ZCTAs had lower percent late diagnosis and virally suppressed, higher percent linked to care, and no differences in new HIV diagnoses (p<0.05). In adjusted analysis, high, compared to medium/low, density was associated with greater number new diagnoses (number or percent, 6.39; 95% CI, 3.57, 9.21), lower percent late diagnosis (-3.86%: -6.08, -1.63), higher percent virally suppressed (1.41%; 0.09, 2.74), and

no association to percent linked to care. Findings were robust across sensitivity analyses, except percent linked to care was significant in (each) sensitivity analysis. Examining relationships by community racial composition, percent linked to care and virally suppressed were significant only for disproportionate or majority Black resident ZCTAs. Results suggest access to FQHCs may benefit epidemic indicators among communities with high HIV burden. FQHCs should be prioritized in future HIV funding.

Key words: Federally Qualified Health Centers, prevention, HIV

Word Count: 349/350

Introduction

Despite advances in HIV prevention and treatment, over 36,000 individuals are newly diagnosed with HIV each year in the US.[29] The South accounts for over 50% of new diagnoses, with significant racial disparities.[29] Greater socioeconomic disadvantage, higher rates of poverty, unemployment, and lower median income, contribute to the disproportionate burden of HIV disease in communities across the region.[2–6] High rates of uninsurance and limited expansion of Medicaid, the largest source of coverage for people living with HIV, may limit access to HIV prevention, care, and treatment, compounding disease burden.[7,8] Further, historical and ongoing systemic and structural inequality in distribution of health care services and resources for communities with a disproportionate composition of Black residents, may create additional barriers to accessing HIV prevention, care, and treatment and contribute to racial disparities in new HIV diagnoses and HIV outcomes (e.g., viral suppression) within these communities.[32,33,79–83]

Federally Qualified Health Centers (FQHCs) are well-positioned to increase access to HIV prevention, care, and treatment, because they are low or no-cost primary care providers mandated to serve medically underserved areas and populations.[17,18] FQHCs serve 1 in 3 people in poverty, 1 in 5 uninsured persons, and 1 in 6 Medicaid beneficiaries in the US, all of which are populations at greater risk of acquiring HIV infection.[20–22,24,31,84] Further, studies of HIV-specific programs implemented at FQHCs observed increased HIV testing and high percent linked to care (93%) and virally suppressed (79%) among their patient population.[85–88] In 2019, FQHCs provided care to 1 in 6 individuals living with HIV and, in 2021, FQHCs received over 100 million in HIV prevention funding as part of the federal initiative, *Ending the HIV Epidemic*.[24,27]

The U.S. Centers for Disease Control and Prevention (CDC) has identified community-level HIV indicators to quantify and track progress towards ending the epidemic in high HIV-

burden areas across the US.[89] Examining the relationship between FQHCs and community-level HIV indicators can inform whether primary care investment, specifically in high burden areas and for communities with additional barriers to care, may improve progress towards ending the epidemic.[24] This study examines the impact of access to FQHCs on community-level indicators of HIV epidemic control in a sample of high HIV-burden urban communities across the US South and whether relationships are sensitive to the racial composition of those communities.

Methods

Data

We integrated multiple secondary data sources for Zip Code Tabulation Areas (ZCTAs) from cities with high rates of HIV diagnoses (defined by AIDSVu) across the US (**see Appendix B**).[90] ZCTAs are geographic units created by the US Census Bureau to aggregate census boundaries into ZIP code–like areas and were previously used to examine HIV outcomes at a community-level.[91–94] To approximate community access to FQHCs, we used FQHC density within the contiguous ZCTAs making up a Primary Care Service Areas (PCSA). ZCTAs making up each PCSA were identified using the Dartmouth Health Atlas ZCTA to PCSA crosswalk (2010).[95] FQHC density was the number of FQHCs in a PCSA, from the Health Resources and Services Administration's (HRSA) Uniform Data System (UDS) Mapper Tool (2020), per 10,000 low-income residents of a PCSA, calculated by summing total low-income resident data from the American Community Survey (ACS, 2015-2019) for all ZCTAs within a PCSA.[95] Study outcomes—number of new HIV diagnoses, percent late HIV diagnosis, percent linked to HIV care, and percent virally suppressed—came from AIDSVu (2014-2019),[96] which curates ZIP Code-level HIV epidemic data from state or local public health departments.[97] ZIP Code-level data was converted to ZCTA-level using a crosswalk from the UDS Mapper.[98] Sociodemographic

characteristics at the ZCTA-level came from the American Community Survey (ACS) (2015-2019), a nationwide annual survey conducted by the US Census Bureau with information on social, economic, housing, and demographic characteristics for communities.[99] Ryan White Part A HIV funding came from HRSA (2014-2019).[100] Ryan White Part A funding provides grants to eligible metropolitan statistical areas (MSA) and transitional grant areas to support core medical and essential support services for individuals living with HIV.[101]

Sample

The sample included 1,383 ZCTAs from 21 cities in the US South: Atlanta (GA), Austin, Dallas, Fort Worth, Houston, San Antonio (TX), Baton Rouge, New Orleans (LA), Broward County, Jacksonville, Miami-Dade County, Orlando, Palm Beach, Tampa (FL), Charleston, Columbia (SC), Charlotte, Raleigh (NC), Hampton Roads (VA), Jackson (MS), and Washington, DC. The ZCTAs represent cities in the US with a high rate of HIV diagnoses, as defined by AIDSVu,[90] and all but two (Hampton Roads, Raleigh) are in jurisdictions or states that were subsequently prioritized for HIV resources through the *Ending the HIV Epidemic* initiative.[102] We used all ZCTAs provided for each city in the US South (listed above), but excluded ZCTAs where HIV data were suppressed due to small ZCTA population (<500 total population) or low HIV prevalence (<5 individuals living with HIV) (n=87). We also excluded ZCTAs with missing sociodemographic data (n=19). Finally, for each outcome, we excluded ZCTAs where outcome data were unavailable (**Figure 3).**

Outcomes

We used four community-level HIV epidemic indicators to assess HIV epidemic control: number of new HIV diagnoses, percent late HIV diagnosis, percent linked to care, and percent virally suppressed. We included number of new diagnoses (5-year), percent linked to care (5-year),

and percent virally suppressed (1-year) because they are used to track progress towards epidemic targets and direct HIV-specific resources (**Definitions – see Appendix B**).[103] We included percent late HIV diagnosis as it represents multiple missed opportunities to diagnose and treat HIV[104] and has been used to identify geographic areas for enhanced HIV screening.[94,105,106]

Explanatory Variable

The explanatory variable used, FQHC density, represents access to FQHCs within a ZCTA's Primary Care Service Area (PCSA).[42–45] PCSAs were defined through utilization data (Medicare claims) and represent geographic approximations of markets for primary care services.[107] We used PCSAs given they are defined at the ZCTA-level, they account for travel time outside individual ZCTAs, and they represent an area from which the population of a ZCTA seeks the plurality of their primary care.[107] We categorized the variable into high (≥75th percentile), medium (<75th to ≥25th percentiles), and low (<25th percentile) FQHC density to examine the relationship for high versus all other (lower) density ZCTAs in baseline analysis and specific densities (e.g., medium) in sensitivity analysis.

Covariates

We included ZCTA-level covariates to control for factors that may influence the relationship with one or more HIV epidemic indicators. We included percent of the population aged 15-44 years because this age block has the highest number new HIV diagnoses[29] and lowest percent linked to care and virally suppressed, compared to older age groups.[108] We used percent of the population age >25 years with a high school education, percent total population living below the poverty threshold, and percent (over 16 years) unemployed to account for ZCTA-level socioeconomic factors associated with number of new HIV diagnoses, late diagnosis, linkage to care, and viral suppression.[20–23,109,110] We also included total low-income population (200% poverty

threshold) for the outcome "number of new HIV diagnoses" only to account for higher risk of HIV acquisition among low-income individuals.[5] Finally, we controlled for percent total, non-institutionalized, population without any health insurance (i.e., uninsured) given a relationship with number of new HIV diagnosis, late diagnoses, linkage to care, and viral suppression.[21–23,109,110] Ryan White Part A funding was summed across all years each outcome variable was assessed to control for city-level HIV funding.

Community Racial Composition

We used percent Black residents of the total ZCTA population (i.e., community composition of Black residents) to account for additional barriers accessing HIV prevention, care, and treatment, due to historical and ongoing systemic and structural inequities in access to health care and resources.[33,80,81,111] We also include this variable because FQHCs are distributed, in part, by area primary care need. Associations have been observed between community composition of Black residents and lower access to primary care.[32,79,112] Therefore, greater composition of Black residents may be correlated with higher FQHC density and dually act as a confounding variable. In baseline and sensitivity analysis, we control for additional barriers using a threshold of ≥20% Black residents, given a mean of 19.3% Black population in the US South.[113] We also examine outcomes at different thresholds of ZCTA composition Black residents using an interaction term to identify the relationship of high versus medium/low density specific to each threshold.

Statistical Analysis

We used an individual pooled cross-section of all available ZCTAs. To describe the sample, we calculated the median and interquartile range for number of new HIV diagnoses, HIV prevalence, total low-income population, percent living in poverty, percent high school education, and percent Black residents, given non-normal (right skewed) distribution of these variables. The

mean and standard deviation were calculated for all other variables. Wilcoxon Rank Sum and two-sample t-tests were used to compare medians and means, respectively, for high versus medium/low FQHC density ZCTAs. Multiple linear regression was used to examine the association of high FQHC density with each HIV epidemic indicator, controlling for ZCTA sociodemographic and HIV funding variables. All models included state fixed effects to control for state-specific differences in healthcare systems and delivery of care. We used two-sided tests with a threshold of $p<0.05$ to test for statistical significance and all analyses were conducted using STATA 17 (College Station, TX: StataCorp LLC).

Additional Analyses

We examined whether associations where sensitive to the supply of (non-FQHC) primary care providers or (non-FQHC) local HIV resources, to observe whether baseline results may be approximating access to (any) primary care or other HIV resources. We excluded low density ZCTAs (*High vs. Medium FQHC Density*), which may have additional primary care providers, given FQHCs are distributed, in part, by primary care need.[112] We, separately, used population-weighted county-level density of primary care providers (*Controlling for County PCP supply*) to control for non-FQHC primary care providers in a ZCTA. To examine whether findings were sensitive among ZCTAs with fewer community-level HIV-resources, we excluded ZCTAs with highest (i.e., >75th percentile) HIV prevalence (*Exclude ZCTAs with Highest HIV Prevalence*). We also examined relationships after excluding ZCTAs from Florida (one-third of ZCTAs), which has the highest Ryan White state-level funding and Ryan White AIDS Drug Assistance Program clients of any state in the South (*Exclude Florida ZCTAs*).[9] We also examined the impact of FQHCs for communities with additional or greater barriers to health care services using thresholds to identify ZCTAs with less than average (<20%), disproportionate (≥20%), and majority (≥60%)

Black residents and an interaction term to identify relationships specific to each threshold.[51,52,57] Finally, we applied community-level coefficients obtained in regression analysis (e.g., difference in percent virally suppressed) to the population of individuals newly diagnosed with or living with HIV (depending on the outcome), to estimate the number of individuals that may benefit from increased access to FQHCs in medium and low density ZCTAs.

Results

Descriptive Statistics

The sample included 1,383 ZCTAs, including 339 high and 1,044 medium/low FQHC density ZCTAs (**Table 3**). Compared to medium/low density ZCTAs, high density ZCTAs had a similar number of new HIV diagnoses, significantly lower percent late HIV diagnosis ($p<0.0001$, significantly higher percent linked to care ($p<0.0001$), and significantly lower percent virally suppressed ($p=0.0240$). High and medium/low density ZCTAs had similar HIV prevalence, percent population aged 15-44 years, percent unemployed, and percent Black residents. High FQHC density ZCTAs had significantly lower total low-income population, percent uninsured, percent with a high school education, higher percent living in poverty, and greater Ryan White Part A funding ($p<0.05$).

Baseline Analysis

In baseline analysis, high FQHC density was associated with greater 5-year new HIV diagnoses (6.39; 95% Confidence Interval, 3.57, 9.21), lower percent 5-year late HIV diagnosis (of all new HIV diagnoses) (-3.86%; -6.08, -1.63), and greater 1-year percent virally suppressed (of all individuals living with HIV) (1.41%; 0.09, 2.74), compared to medium/low density. The relationship for 5-year percent linked to care (of all new HIV diagnoses) for high FQHC density, compared to medium/low, was not significant (1.81%, -0.06, 3.68). (**Table 4**).

Sensitivity Analysis

Results were similar for number of new HIV diagnoses, percent late diagnosis, and percent virally suppressed for high versus medium density (only) ZCTAs. However, percent linked to care was also significant (2.10%; 0.18, 4.03) (**Figure 4**). When we controlled for the number of primary care physicians at the county-level using a binary variable (≥50th, <50th percentile), findings were also consistent with baseline analysis with the exception of percent linked to care (also significant) (2.52%; 0.62, 4.42). Similarly, when we examined ZCTAs with (likely) fewer community-level HIV resources by 1) excluding highest HIV prevalence ZCTAs and, separately, 2) excluding ZCTAs from Florida, the association of high versus medium/low density was consistent except for percent linked to care which was, again, significant (2.85%, 0.34, 5.35) (3.24%; 0.69, 5.79). When we included an interaction term in the model to identify relationships specific to community racial composition, high FQHC density (versus medium/low) was associated with percent linked to care and percent virally suppressed only among ZCTAs with disproportionate (≥20%, percent virally suppressed only) and majority (≥60%) Black residents but was not significant among ZCTAs with <20% Black residents (**Figure 5)**. Conversely, number of new diagnoses and percent late diagnosis was not significant among ZCTAs with disproportionate and majority Black residents but was significant among <20% Black resident ZCTAs.

Impact within Communities

If individuals newly diagnosed with HIV in medium/low density ZCTAs resided in high density ZCTAs, a 3.86% reduction suggests ~1,400 late diagnoses could be averted and, while not statistically significant, an additional ~650 individuals could be linked to care (+1.81%) over a 5-year period. Among people living with HIV in medium/low density ZCTAs, a 1.41% increase suggests ~2,300 additional individuals could be virally suppressed over a 1-year period.

Discussion

Our analysis provides support for the role of FQHCs in benefiting three of four community-level HIV outcomes, including after examining lower and controlling for supply of non-FQHC primary care providers and among ZCTAs with likely fewer local HIV resources.[18,49] Results also suggest that FQHCs may play an important role in linking individuals to care and providing access to antiretroviral treatment, specifically among ZCTAs with a higher proportion of Black residents.

Fewer late diagnoses may result from FQHC's ability to mitigate cost and insurance barriers of HIV testing and/or programs at FQHCs to increase uptake of HIV testing, including integration of HIV testing into routine preventive care services.[85–87,114] An association with percent virally suppressed may indicate FQHCs increase access to combination antiretroviral therapy (ART), necessary for viral suppression. While Ryan White program services reduce cost-associated barriers to ART, ancillary services at FQHCs may help individuals obtain Ryan White program benefits. FQHCs may directly increase ART uptake by supplying additional providers for HIV care and treatment and/or by decreasing barriers to accessing HIV care and treatment (e.g., providing care to uninsured). Further, FQHC primary care settings may help mitigate fear of HIV-related stigma associated with HIV clinics for some populations.[115] No observed relationship to percent linked to care may signify additional barriers to rapidly engaging in HIV care following diagnosis (e.g., internalized stigma) and may represent an area deserving prioritization.[116]

Similar findings among ZCTAs with fewer (non-FQHC) primary care providers, high and medium density ZCTAs only, may indicate the importance of access to FQHCs specifically (versus non-FQHC primary care) on community-level HIV outcomes. The importance of FQHCs is also supported by similar findings when controlling for primary care provider supply at a county-level. Again, this may be due to the ability of FQHCs to mitigate insurance and cost-related barriers to

care and, thus, reach groups of individuals at higher risk of HIV acquisition (e.g., individuals living at or below the poverty threshold). Further, significance of percent linked to care among ZCTAs with fewer primary care providers or after controlling for primary care supply, suggests FQHCs specifically may play an important role in linking individuals to and/or providing HIV care to newly diagnosed individuals. The significance of percent linked to care and persistence of other findings after excluding highest HIV prevalence ZCTAs, suggests the relationships are specific to FQHC density versus approximating other local HIV resources that may be correlated with FQHC density. Further, while we did not test for differences, coefficients for percent late diagnosis, linked to care, and virally suppressed, may suggest FQHC density is more impactful in ZCTAs with fewer HIV resources. This explanation is further supported by percent linked to care and percent virally suppressed coefficients almost 2 and over 3 times greater than baseline analysis after excluding Florida ZCTAs, which has the highest number of Ryan White program clients and Ryan White state-level funding of any state in the South.[117]

When we used an interaction term to identify relationships specific to community racial composition, the association of high FQHC density with percent linked to care and percent virally suppressed only among communities with disproportionate (≥20%, virally suppressed only) and majority (≥60%) Black residents, suggests FQHC density has greater impact on the delivery of HIV care and treatment among these ZCTAs versus ZCTAs with <20% Black residents. This finding may indicate lower access (i.e., fewer and/or greater barriers) to non-FQHC HIV care, previously documented by Gaskin et al,[32] due to structural and systemic racism and inequity in access to health care and related resources (e.g., health insurance).[32,33] Access to FQHCs (i.e., high density) may be more important for the delivery of HIV care and treatment within these communities and for equity in the distribution of HIV services more broadly. No relationship to

percent late HIV diagnoses among disproportionate and majority Black resident ZCTAs may suggest use of other sites (e.g., emergency or health departments) for HIV testing or additional barriers to testing (e.g., HIV-stigma) within these communities unaddressed by FQHCs.

Our results align with previous studies reporting (unadjusted) increased HIV testing and higher than average (national) percent linked to care (93%) and virally suppressed (79%) after implementation of HIV-specific programs at FQHCs.[85–88] However, results were specific to FQHC patients and did not allow for isolation of effect. Our findings extend FQHC impact to the community-level and suggest thousands of individuals living with HIV may benefit from increased access to FQHCs. However, our findings differed from a study of census tracts in Philadelphia, PA, where no relationship was observed between 'poor' viral suppression tracts and access to an HIV-specific care provider.[118] Differences in geographic area studied, access measure (distance to provider), use of categorical definition of low viral suppression, and specificity of an HIV physician, may contribute to differences in findings. Our results also align with studies examining access to FQHCs and non-HIV population-level outcomes. In separate studies, presence of an FQHC among rural counties was associated with lower all-cause emergency department visits, specifically for the uninsured, and lower hospitalization rates for select preventable conditions for both working age and older (>65 years) adults.[119,12058,59] While study populations differ between studies (rural vs. urban residents living with HIV), greater barriers to (non-FQHC) care for both populations may contribute to significant findings at a population-level.[121,122]

Limitations

This study has limitations. First, we use Medicare administrative claims-defined PCSAs to identify accessible FQHCs for a ZCTA.[107] While Medicare recipients differ from those at higher risk of HIV (young to middle age, low income, uninsured adults), there is evidence of

generalizability of PCSAs to non-Medicare populations using Medicaid and commercial claims.[123] PCSAs have also previously been used to examine access to care for low-income and uninsured populations.[121,124] Second, the ZCTA to PCSA crosswalk is from 2010, 4 years prior to the first year of data of other variables in the analysis. Changes to primary care markets over this period, specifically given passage of the Affordable Care Act (ACA) and Medicaid expansion, could change a ZCTA's PCSA assignment. However, market changes may be less likely for the Medicare population (used to define PCSAs) given pre-existing insurance coverage and high pre-ACA access to primary care.[125] Additionally, <4% of sample ZCTAs were in states that expanded Medicaid prior to 2019 (last year of data in our sample), which may result in fewer changes to primary care markets. Third, due to unavailability of data, we were unable to account for two important variables, community-level 1) HIV resources and 2) HIV-related stigma. However, we were able to account for city-specific variations in funding for HIV services (Ryan White Part A) and examined ZCTAs with fewer local HIV resources in sensitivity analysis with similar results to baseline findings. Additionally, we did control for structural HIV-related stigma at a state-level using state-fixed effects.[126] Using a sample of high HIV burden urban ZCTAs likely reduces the potential bias that could be introduced by omitting these variables. However, this does limit generalizability of our findings, specifically for rural areas where there is likely greater variability in both HIV-related stigma and community-level HIV resources.[39,127]

Conclusions

HIV disease continues to disproportionally affect communities in the US South and more evidence is needed examining the indicators used to track progress on the epidemic at a community-level. Among high HIV-burden urban ZCTAs in the US South, our results suggest FQHC density may benefit community-level epidemic indicators, including potential greater

impact in ZCTAs with fewer primary care or HIV resources. Additionally, access to FQHCs may be more important to benefiting HIV care and treatment for communities impacted by structural and systemic racism. These findings should be considered for future allocation of HIV-specific resources to ensure continued, equitable, progress towards ending the HIV epidemic in the US.

Figure 3. Sample Derivation

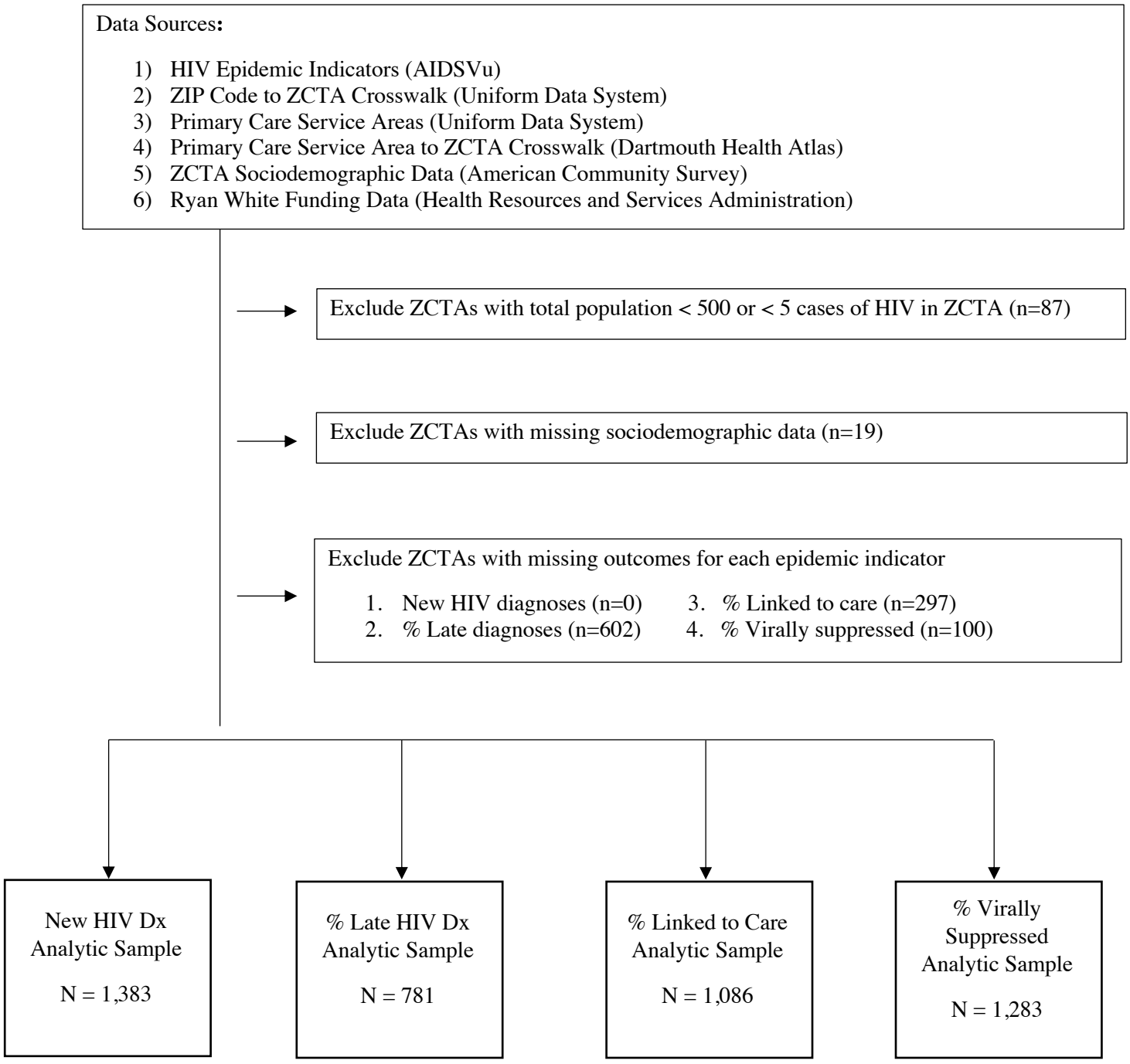


Table 3. Description of High vs. Medium/Low FQHC Density ZCTAs in High HIV-Burden Urban Areas in the US South[*†‡]

	High Density n=339	**Medium and Low Density** n=1,044	**p-value**
HIV Epidemic Indicators			
New HIV Dx, Median (IQR)	22 (5-58)	22 (9-49)	0.7131
% Late Dx, Mean (std. dev.)	18.3% (9.6)	22.2% (10.4)	0.0000
% Linked to Care, Mean (std. dev.)	73.8% (9.9)	68.4% (11.1)	0.0000
% Virally Supp.[†], Mean (std. dev.)	63.7% (13.3)	65.2% (9.1)	0.0240
Sociodemographic Characteristics			
HIV Prevalence (cases/ZCTA), Median (IQR)	110 (23-284)	99 (45-212.5)	0.5615
Total Low-Income Population, Median (IQR)	5,683 (2,293-11,446)	7,984.5 (3844.5-13,609.5)	0.0000
% Age 15-44, Mean (std. dev.)	41.4% (10.7)	41.1% (9.0)	0.5150
% Uninsured, Mean (std. dev.)	12.0% (6.3)	13.7% (7.8)	0.0003
% Unemployed, Mean (std. dev.)	6.0% (3.9)	5.3% (2.6)	0.2754
% Living in Poverty†, Median (IQR)	13.3% (8.6-21.1)	11.9% (7.5-18.5)	0.0010
% High School Educ, Median (IQR)	87.4% (81.7-93)	90% (83.3-94.5)	0.0078
% Black Residents, Median (IQR)	14.6% (3.3-43.8)	13.1% (5.9-25.6)	0.2888
Ryan White Funding (in millions)			
Ryan White Funding Part A, Mean (std. dev.)	64.5 (55.6)	58.6 (38.5)	0.0286

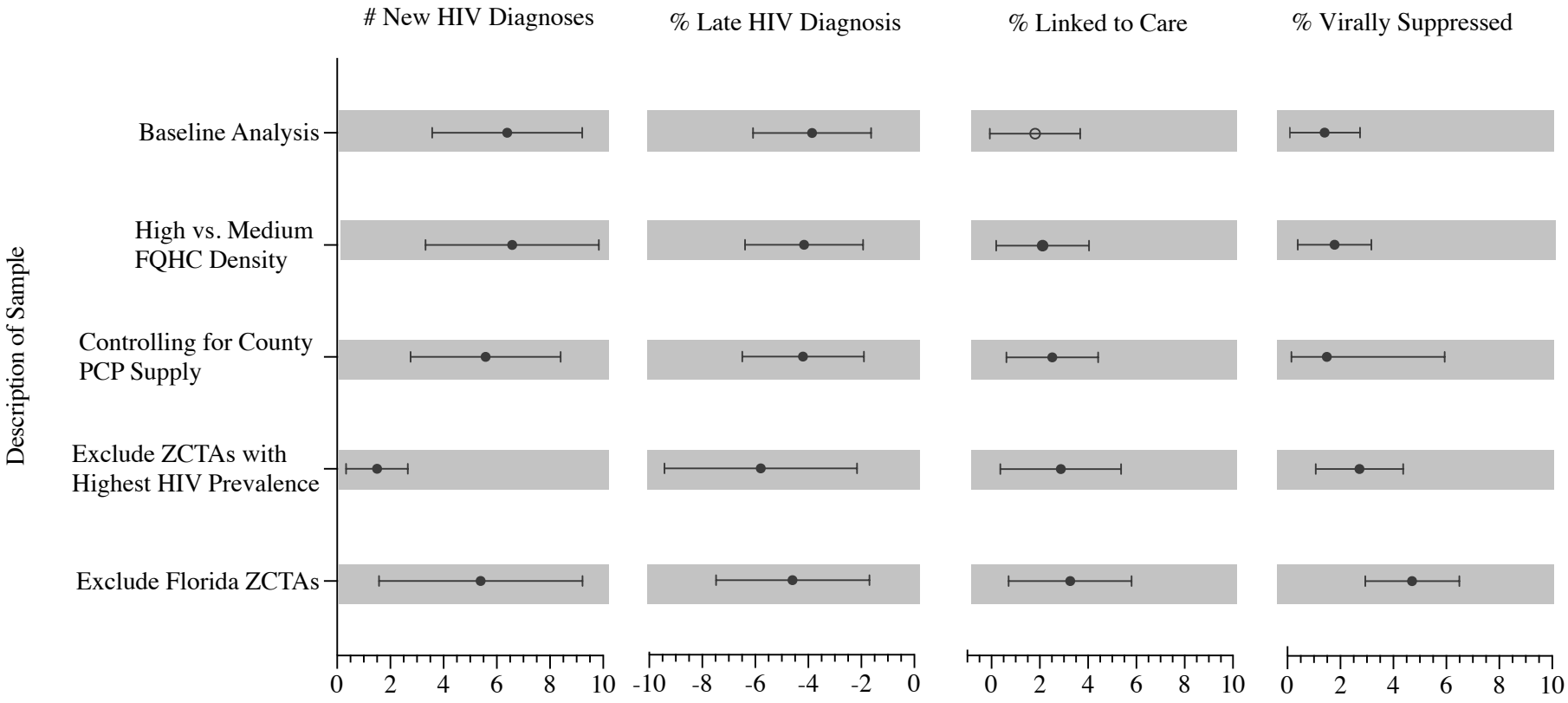
[*] High density ZCTAs were defined as those ZCTAs with ≥ 75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]Wilcoxon Rank Sum test was used to test for differences in medians between groups. Two-sample t-test was used to test for differences in means between groups. [‡]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Table 4. Baseline Analysis, Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South [*†]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	6.39	3.57, 9.21	0.000	-3.86	-6.08, -1.63	0.001	1.81	-0.06, 3.68	0.058	1.41	0.09, 2.74	0.036
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.102	0.000	-0.003	-0.007, -0.0002	0.040	-0.0001	-0.003, 0.002	0.932	0.001	-0.001, 0.003	0.323
Total Low-Income Pop. (thousands)	1.87	1.69, 2.05	0.000	--	--	--	--	--	--	--	--	--
% Age 15-44	0.39	0.27, 0.51	0.000	-0.02	-0.13, 0.10	0.796	0.02	-0.07, 0.11	0.631	-0.22	-0.28, -0.15	0.000
% Uninsured	0.34	0.06, 0.62	0.018	-0.05	-0.27, 0.16	0.625	-0.18	-0.37, 0.01	0.064	0.08	-0.05, 0.22	0.236
% Unemployed	-0.19	-0.61, 0.24	0.386	0.12	-0.26, 0.49	0.542	-0.20	-0.52, 0.12	0.218	0.08	-0.15, 0.31	0.495
% Living in Poverty	0.43	0.24, 0.63	0.000	-0.15	-0.30, 0.01	0.060	-0.17	-0.30, -0.04	0.010	-0.26	-0.36, -0.16	0.000
% High School Educated	0.66	0.47, 0.85	0.000	-0.21	-0.37, -0.04	0.013	-0.11	-0.25, 0.03	0.111	0.03	-0.06, 0.13	0.505
Non-Hispanic Black Population ≥20%	2.84	0.14, 5.49	0.039	0.15	-1.61, 1.90	0.871	-1.68	-3.24, -0.13	0.034	-1.69	-2.90, -0.48	0.006
MSA-Level Characteristics												
Ryan White Part A (millions)	0.12	0.08, 0.15	0.000	-0.008	-0.03, 0.02	0.539	0.05	0.03, 0.07	0.000	-0.07	-0.08, -0.05	0.006

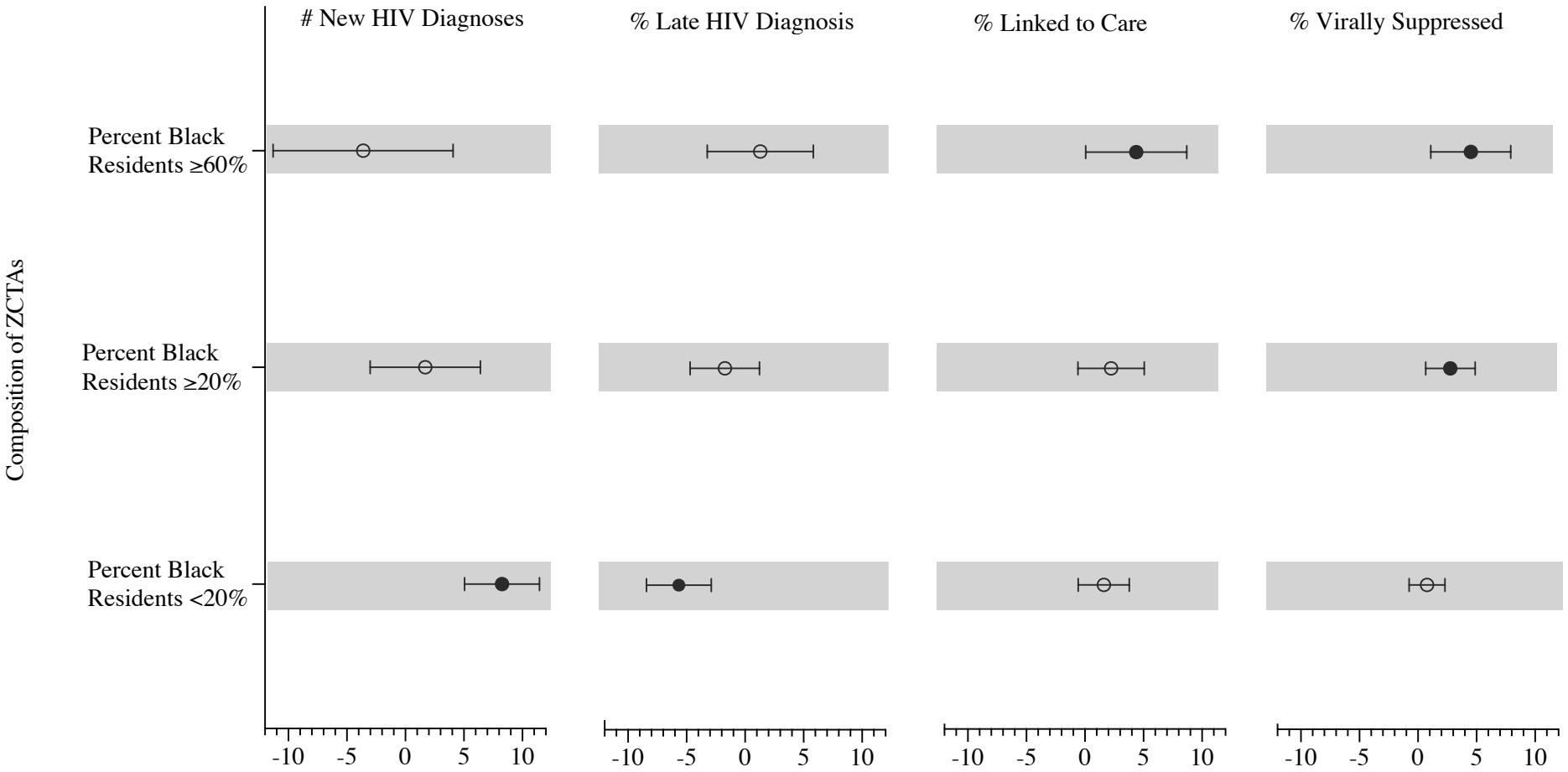
[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Figure 4. Summary of Sensitivity Analyses, HIV Epidemic Indicators and FQHC Density in High-Burden Urban ZCTAs in the South*†‡§



* High density ZCTAs were defined as those ZCTAs with ≥ 75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile PCSA FQHC density (<1.182, ≥ 0.069); low density was defined as those ZCTAs number of new HIV diagnoses, a negative percent (i.e., lower) for late HIV diagnosis, and a positive percent for linked to care and virally suppressed. §New HIV diagnoses, percent late diagnosis, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Figure 5. Summary of Interaction Analyses, HIV Epidemic Indicators and FQHC Density in 21 Urban ZCTAs in the US South[*†‡§‖]



[*] The baseline definition (high versus medium and low FQHC density) was used to examine the relationship between density and HIV epidemic indicators. [†] ●Filled circle indicates results are significant at value $p < 0.05$. [‡]The x-axis represents a count for number of new HIV diagnoses, a negative percentage (i.e., lower) for late HIV diagnoses, and a positive percentage for linkage to care and viral suppression. [§]New HIV diagnoses, percent late diagnosis, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). [‖]An interaction term was

used to identify the relationship for high versus medium/low FQHC density specific to communities with ≥20% Black residents identified by the beta coefficient for the 'High Density' variable in the model.

Chapter 4: *Use of Federally Qualified Health Centers and HIV Epidemic Indicators in Urban Communities with High Rates of HIV Diagnoses in the US South*

Abstract

Use of Federally Qualified Health Centers (FQHCs) may increase access to HIV services and benefit community-level HIV outcomes. We used a pooled cross-section of Zip Code Tabulation Areas (ZCTAs) from cites in the US South with high rates of annual new HIV diagnoses to examine FQHC use and community-level indicators of HIV epidemic control. The explanatory variable was a 10-percentage point increase in FQHC penetration, the percent ZCTA low-income population served by any FQHC. Outcomes were 5-year 1) number of new HIV diagnoses, 2) percent late diagnosis, 3) percent linked to care, and 1-year 4) percent virally suppressed. We used multivariable linear regression to examine the relationship with ZCTA-level sociodemographic and city-level HIV funding covariates and state fixed-effects. In sensitivity analysis, we examined penetration among ZCTA uninsured population. We also examined subsamples of ZCTAs where there may be greater reliance on FQHCs for HIV services, higher poverty ZCTAs and ZCTAs with fewer local HIV resources. We also examined whether supply of primary care may influence outcomes by controlling for (any) primary care supply and, separately, FQHC supply. The sample included 1,383 ZCTAs with 22 new HIV diagnoses (5-year). Approximately 20% of individuals newly diagnosed had a late diagnosis, 70% were linked to care and, among those living with HIV, 65% were virally suppressed. A 10-percentage point increase in FQHC penetration was associated with greater percent virally suppressed (0.42%; 95% Confidence Interval, 0.12, 0.72) and no association to other outcomes. A 10-percentage point increase in penetration of the uninsured was associated with lower percent late HIV diagnosis but no relationship to percent virally suppressed. This finding was also observed for (low-income) penetration among higher poverty ZCTAs. FQHC use may increase

access to HIV care and treatment and benefit community viral suppression – essential for reducing community HIV transmission.

Key words: Federally Qualified Health Centers, prevention, HIV

Word count: 300/300

Introduction

Despite a renewed call to action to end the HIV epidemic in the US and domestic federal funding for HIV exceeding 20 billion annually, over 30,000 individuals are newly diagnosed in the US each year.[1,128] Over 50% of all new HIV diagnoses occur in the South.[1] While multiple factors contribute to disproportionate new diagnoses in the region, structural barriers to HIV prevention, care, and treatment play an important role.[129,130] Communities in the South experience greater socioeconomic disadvantage, high uninsurance, limited expansion of Medicaid, and access to fewer HIV-experienced clinicians, which may limit access to HIV services.[6,8,39,131,132]

Federally Qualified Health Centers (FQHCs) could increase access to HIV services for communities that experience greater barriers to care. FQHCs provide primary care and support services (e.g., case management, transportation) to underserved communities regardless of insurance status or ability to pay. Previous studies suggest FQHCs may increase access to primary care for populations at higher risk of HIV, including low-income and racial and/or ethnic minority populations.[23,112] Accordingly, FQHCs in communities with high rates of new HIV diagnoses have received almost 400 million in federal funding to increase access to HIV services since 2020.[133]

While FQHCs may be a critical resource for HIV services in communities with high rates of new HIV diagnoses, the impact of FQHC use on community-level HIV outcomes is not known.[89] Assessing community-level outcomes can provide information about the impact of FQHCs on the indicators used to track progress towards ending the epidemic. Examining these relationships are particularly important given considerable HIV funding allocated to FQHCs for HIV services in communities experiencing high rates of new diagnoses. Associations observed can inform policy decisions for future allocation of HIV funding in these areas. This analysis examines

the relationship between FQHC use in a community and 4 community-level indicators of HIV epidemic control.

Previous Supporting Analysis

In previous analysis, we examined the relationship between a measure of *potential* access, density of FQHCs, and community-level HIV epidemic indicators.[134] In this analysis, we use the same sample of urban Zip Code Tabulation Areas (ZCTAs) to represent communities to examine a measure of *realized* access, use of FQHCs, with HIV epidemic indicators to further characterize the role of access to FQHCs and community-level HIV outcomes.

Methods

Data

We created a dataset from multiple secondary data sources for ZCTAs from southern cities with high rates of annual new HIV diagnoses, as defined by AIDSVu.[90,134] ZCTAs are geographic units created by the US Census Bureau that represent administrative ZIP Codes used by the US Postal Service and have previously been used to examine community-level HIV outcomes.[21,91,93,135] FQHC use identified by the percent of low-income (<200% Federal Poverty Threshold) ZCTA residents served by any FQHC (i.e., FQHC penetration) was from the Uniform Data System (UDS) Mapper, 2019.[95] HIV epidemic indicators, 5-year number of new HIV diagnoses, percent late HIV diagnosis, percent linked to HIV care, and 1-year percent virally suppressed, were at the ZIP Code-level and available from AIDSVu (2014-2019).[96] We used a ZIP-ZCTA crosswalk available from the UDS Mapper (2019) for data reported at the ZIP Code-level.[98] HIV prevalence was obtained from AIDSVu (2018 or 2019). All other ZCTA sociodemographic characteristics were obtained from The American Community Survey (ACS) (2015-2019), a nationwide annual survey conducted by the US Census Bureau at various geographic levels, including the ZCTA.[99] HIV

Ryan White Part A funding data was from HRSA (2014-2019) and represents federal funding grants provided to eligible metropolitan and transitional areas to support core medical and essential support services for individuals living with HIV in areas most affected by the HIV epidemic.[100,101] In sensitivity analysis, county-level data on primary care provider supply was from HRSA's Area Health Resource Files (2019).[136] The Missouri Census Data Center Geocorr tool (2019) was used to assign county to ZCTA correlations for weighting county provider supply.[137] ZCTA-level FQHC supply was identified using the UDS Mapper (2019)[95] and calculated as previously described.[134]

Sample

We used a sample of ZCTAs from cities with high rates of new HIV diagnoses in the US South (**Figure 6**), as determined by AIDSVu and described previously.[134] Cities represented include: Atlanta (GA); Austin, Dallas, Fort Worth, Houston, San Antonio (TX); Baton Rouge, New Orleans (LA); Broward County, Jacksonville, Miami-Dade County, Orlando, Palm Beach, Tampa (FL); Charleston, Columbia (SC); Charlotte, Raleigh (NC); Hampton Roads (VA); Jackson (MS) and Washington, DC. Each city, except for Hampton Roads and Raleigh, has been prioritized at the county or state-level for focused HIV resources, expertise, and technology as part of the federal strategy to end the US HIV epidemic.[102] We used all ZCTAs from each city after excluding ZCTAs where HIV data were suppressed due to population size (<500 total population) or low HIV prevalence (<5 individuals living with HIV) (n=87).[134] We also excluded ZCTAs with missing sociodemographic data (n=19).[134] Given all outcomes were not always available for a ZCTA, we excluded ZCTAs with missing outcomes in the analysis for that outcome.

Outcomes

We used four HIV epidemic indicators to assess HIV epidemic control: number of new HIV diagnoses, percent late HIV diagnosis, percent linked to care, and percent virally suppressed in a ZCTA (**see – Appendix C**). ZCTA outcomes were used to represent community-level outcomes as has been done in previous analyses and is further supported by ZCTA-specific variation in new HIV diagnoses.[21,93,135] Number of new diagnoses (5-year), percent linked to care (5-year), and percent virally suppressed (1-year) are used by the US Centers for Disease Control and Prevention (CDC) to track progress towards ending the HIV epidemic in priority areas.[103,134] We used percent late HIV diagnosis as it represents multiple missed opportunities to diagnose and treat HIV[104] and has been used to identify geographic areas for enhanced HIV screening.[94,134]

Explanatory Variable

The explanatory variable was FQHC penetration, defined as the percent of ZCTA low-income residents using any FQHC from FQHCs that report 11 or more patients residing in that ZCTA. FQHC penetration represents use of FQHC services in a ZCTA and may approximate access to and use of HIV services. We used penetration among low-income ZCTA residents, versus all ZCTA residents, given >90% of FQHC patients are low-income (<200% poverty threshold) and the higher risk of HIV acquisition and higher HIV prevalence among low-income individuals.[31,138] We used a continuous (versus categorical) representation of FQHC penetration given there is no defined threshold for FQHC (or primary care) use within a community. However, a threshold of 20% FQHC penetration has been used in previous analysis at the state-level.[139]

Covariates

ZCTA-level covariates were used to control for factors that may influence HIV epidemic indicators within communities.[134] We included percent of the population aged 15–44 years because this age group has higher rates of new HIV diagnoses[29] and lower percent linked to care and virally

suppressed, compared to individuals aged >44 years.[108] Sociodemographic characteristics including percent of the population aged >25 years with a high school education, percent total population living below the poverty threshold, and percent (over 16 years) unemployed have previously been associated HIV epidemic indicators.[20–23,109,110] To account for higher risk of HIV acquisition among low-income individuals (200% poverty threshold), we included ZCTA total low-income population for new HIV diagnoses only.[5] We also controlled for percent total, non-institutionalized population without any health insurance given the relationship between uninsurance and multiple epidemic indicators.[21–23,109,110] As in previous analysis, we used percent Black residents of the total ZCTA population to account for additional barriers encountered in access to HIV prevention, care, and treatment services for these communities due to historical and ongoing systemic and structural inequities in access to health care and resources.[33,111] Ryan White Part A funding was summed across all years each outcome variable was assessed to control for city-level HIV funding.

Statistical Analysis

We used a pooled cross-section of all available ZCTAs. To describe the sample, we calculated the median and interquartile range for all variables with non-normal distributions: number of new HIV diagnoses, HIV prevalence, total low-income population, percent living in poverty, percent high school education, and percent Black residents. We calculated the mean and standard deviation for all other normally distributed variables. Multiple linear regression was used to examine the association of a 10-percentage-point increase in FQHC penetration with each HIV epidemic indicator, controlling for ZCTA sociodemographic and HIV funding. We used a 10-percentage point increase in FQHC penetration to represent a tractable increase in FQHC penetration among sample ZCTAs.

All models included state fixed effects to control for differences in state healthcare systems and delivery of care. We used two-sided tests with a threshold of $p<0.05$ to test for statistical significance and analyses were conducted using STATA 17 (College Station, TX: StataCorp LLC).

Additional Analyses

In sensitivity analysis, we examined penetration among ZCTA's uninsured population (*penetration uninsured*) as this group may be more representative of individuals living with HIV given low uninsurance among individuals aged < 20 and > 65 years.[22,109,140] Next, we examined how supply of primary care providers impacted outcomes by including county density of primary care providers (*Control County PCP Supply*) weighted by the proportion of ZCTA residents in a county and, separately, density of FQHCs in the contiguous ZCTAs that make-up a primary care service area (*Control FQHC Supply*) (**See - Appendix C)**. We excluded highest HIV prevalence ZCTAs (>75th percentile) (*Exclude Highest HIV Prevalence ZCTAs*) and, separately, ZCTAs from Florida (*Exclude Florida ZCTAs*), the state with the highest Ryan White Part B (state) funding in the South, to examine the relationship among ZCTAs with likely fewer community-level HIV resources. Finally, we excluded lowest poverty rate ZCTAs (<25th percentile) (*Exclude Lowest Poverty Rate ZCTAs*) to identify if FQHC use may have more impact in communities with higher poverty and likely greater structural barriers to care.[141]

Results

Descriptive Statistics

Among 1,383 ZCTAs, median FQHC penetration was 12.6% (interquartile range (IQR) 5.7%, 24.4%). Median 5-year number of new HIV diagnoses was 22 (8, 52) and mean 5-year percent late diagnosis and percent linked to care were 21.3% (standard deviation (SD), 10.3%) and 69.6% (11.0%), respectively. Mean 1-year percent virally suppressed was 64.9% (10.2%). Median

HIV prevalence was 100 (42, 229) and median low-income population was 7,433 (3,366.5, 12,983). Less than half of ZCTA residents were aged 15-44 years (41.2%), 1 in 8 were uninsured (13.2%) or living in poverty (12.4%), and 5.4% were unemployed. 89.5% of ZCTA residents had completed a high school education and 13.3% were Black residents. Mean 5-year Ryan White city-level funding was $60.0 (43.4) million.

Baseline Analysis

A 10-percentage-point increase in FQHC penetration of ZCTA low-income population was significantly associated with a 0.42% increase in percent of individuals virally suppressed in a ZCTA (0.42%; 95% Confidence Interval, 0.12, 0.72) (**Table 6**). The associations for number of new HIV diagnoses, percent late diagnoses, and percent linked to care were not significant.

Sensitivity Analysis

Percent late diagnosis was sensitive and significant (-0.39%; -0.72, -0.05) and percent virally suppressed was sensitive and not significant (0.08%; -0.17, 0.33) when examining a 10-percentage point increase in penetration of the uninsured population. This finding was also observed for percent late diagnosis (-0.68%; -1.23, -0.14) and percent virally suppressed (0.15%; -0.18, 0.48) when examining higher poverty ZCTAs. All other findings were robust (**Figure 7**)**.**

Discussion

FQHCs may reduce structural barriers to HIV services and benefit community-level HIV outcomes. Our analysis found a positive association between FQHC penetration and community-level viral suppression, lower percent late diagnosis using penetration among the uninsured and, separately, among a subset of higher poverty communities, but no relationship to percent linked to care in any analysis.

The findings in main analysis suggest that FQHCs play a role in the ongoing care and treatment of individuals living with HIV but may be less impactful in early detection of HIV and timely linkage to care. Despite subsidized HIV care and treatment available through the federal Ryan White Program, costs of care, insurance coverage, eligibility requirements for Ryan White, wait times for Ryan White clinics, lack of transportation to care, and limited clinic hours may serve as barriers to HIV services.[49,142–147] FQHCs may address these barriers by providing subsidized care with fewer eligibility requirements, greater appointment availability, and access to ancillary services, such as transportation, which may benefit viral suppression in a community. Using FQHCs as HIV care providers may also mitigate individuals concerns about stigma given they are primary care versus HIV-specific care sites.[115] Additionally, FQHCs may benefit viral suppression by facilitating connections to HIV-specific care after diagnosis versus providing care directly.

Greater FQHC use among low-income residents may not impact late HIV diagnoses due to the presence of other HIV testing resources, such as health departments, community partners, or other health care sites in these communities. Alternatively, there may be additional barriers to HIV testing that are unaddressed by FQHCs, such as patient's internalized HIV stigma, which may negatively impact testing behavior.[148] Programs and trainings to integrate HIV testing as part of routine preventive care at FQHCs may benefit late HIV diagnoses in these communities. Similarly, no relationship to percent linked to care may suggest additional barriers to the timely initiation of HIV care for newly diagnosed individuals. Individuals are considered "linked to care" if they have evidence of HIV care within 30-days of an HIV diagnosis, including same-day (as diagnosis) care.[89] There may be wait times for patients newly entering HIV care at FQHCs, time required for referrals to HIV-specific care, and/or time needed to fulfill/document eligibility requirements for Ryan White benefits, which can impede timely access.[143,146,149] At an individual-level, patients may

be struggling with a new diagnosis and not yet ready to engage in care or may not be able to take time off work to immediately engage in care within 30 days.[143,145,148,150] The adoption of same-day linkage even for individuals subsequently referred to HIV-specific care sites and the availability of HIV counseling and support services may increase FQHC impact on linkage in communities.[151]

In sensitivity analysis, the robustness of percent virally suppressed further supports the importance of FQHCs in HIV care and treatment with two exceptions. No relationship to viral suppression using penetration of the uninsured may indicate FQHCs are less important to the receipt of HIV care and treatment for uninsured individuals. This may be due to greater reliance of uninsured individuals on HIV programs, such as the Ryan White AIDS Drug Assistance Program (ADAP), which provides support to over 80% of uninsured individuals living with HIV.[152] No relationship to viral suppression among higher poverty ZCTAs could similarly suggest reliance on other HIV programs or care sites but it may also suggest additional barriers accessing HIV care and treatment that are not addressed by FQHC use. However, significance of percent late diagnosis using penetration of the uninsured and among higher poverty ZCTAs suggests FQHCs may benefit early HIV diagnoses through the delivery of routine preventive care for both populations.

While few studies examine FQHC use, our findings align with a study conducted by Ford et. al. that found an association between increasing FQHC penetration and lower COVID-19 mortality for ZCTAs in four major US cities.[135] Similar to our analysis, the authors attributed the relationship to FQHCs increasing access to care among communities most vulnerable to COVID-19.[135] Further, a larger at-risk population for COVID-19 mortality as a novel respiratory pathogen, versus a sexually transmitted infection, may contribute to findings at a community-level. Except for viral suppression, our results differed from previous analysis examining potential access to

FQHCs and community HIV epidemic outcomes.[134] We had found greater density of FQHCs was associated with greater new HIV diagnoses, lower percent late diagnosis, greater percent linked to care, and greater percent virally suppressed. Differences may be due to use of a larger geographic area to identify access, a primary care service area made up of multiple ZCTAs, which may more accurately approximate access to FQHCs versus the ZCTA alone. However, when we controlled for FQHC supply within this analysis percent virally suppressed remained significant and may indicate that FQHC use, versus presence alone, contributes to receipt of HIV care and treatment within these communities.

Limitations

There are several limitations to this analysis. First, the explanatory variable, FQHC penetration does not account for the individuals who may have received services at multiple FQHCs, which may overestimate FQHC penetration and was exemplified by 21 ZCTAs with penetration exceeding 100%. While this represented 1.5% of the sample, we did re-code penetration so no ZCTA could exceed 100%. Second, some outcomes (new diagnoses, percent late diagnosis, and percent linked to care) were defined over 5-years, while FQHC penetration was defined over one year due to data availability. Thus, real-world year-to-year variability in FQHC-use, specifically with the growing expansion of FQHCs and FQHC services, may explain no significant relationships specifically for 5-year outcomes.[153] Third, we were unable to account for local HIV resources, which may impact community-level HIV outcomes.[134] To address this limitation, we accounted for city-specific variations in funding for HIV services (Ryan White Part A) and examined findings after excluding highest prevalence ZCTAs and ZCTAs from Florida, which may have greater local HIV resources. Finally, we were unable to account for differing levels of HIV-related stigma within communities, but do account for stigma at a state-level using

state fixed effects.[126] Restriction of the sample to urban ZCTAs with a high rates of new HIV diagnoses may limit potential bias introduced by omitting local HIV resources and HIV-related stigma, but also limits generalizability of findings to urban (versus rural) ZCTAs in the region.[39,127]

Conclusions

In urban communities with high rates of new HIV diagnoses in the US South, FQHC use may increase access to HIV care and treatment services, benefitting community viral suppression. However, the lack of impact on prevention of late HIV diagnosis or linkage to care, outcomes that most closely align with the role of primary care in communities, requires further examination to understand factors (e.g., structural barriers, policies) that may influence receipt of these services at FQHCs in these communities. Findings should be considered in the future allocation of HIV-specific funding for FQHCs to support continued progress towards ending the US HIV epidemic.

Figure 6. Sample Derivation

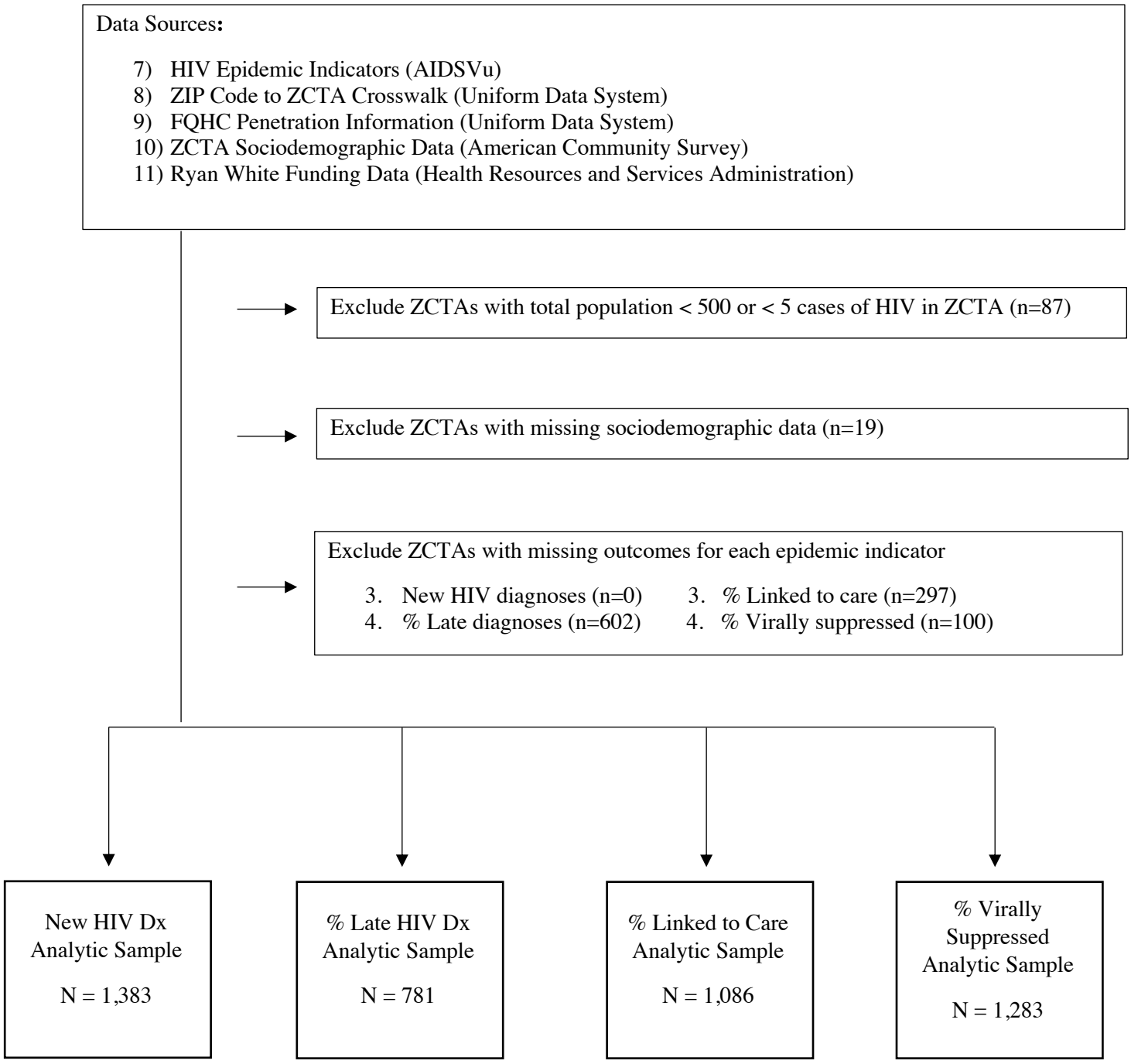


Table 5. Description of HIV and Sociodemographic Characteristics of Urban ZCTAs with High Rates of HIV Diagnoses in the US South*†‡

	Total Sample N=1,383
ZCTA-Level	
HIV Epidemic Indicators	
New HIV Dx, Median (IQR)	22 (8, 52)
% Late Dx, Mean (std. dev.)	21.3 (10.3)
% Linked to Care, Mean (std. dev.)	69.6 (11.0)
% Virally Supp., Mean (std. dev.)	64.9 (10.2)
Sociodemographic Characteristics	
HIV Prevalence (cases/ZCTA), Median (IQR)	100 (42, 229)
Total Low-Income Population, Median (IQR)	7,433 (3,366.5, 12,983)
% Age 15-44 years, Mean (std. dev.)	41.2 (9.4)
% Uninsured, Mean (std. dev.)	13.2 (7.5)
% Unemployed, Mean (std. dev.)	5.4 (3.0)
% Living in Poverty†, Median (IQR)	12.4 (7.8, 19.1)
% High School Educ, Median (IQR)	89.5 (82.8, 94.3)
% Black Residents, Median (IQR)	13.3 (5.4, 29.1)
City-Level	
Ryan White Funding *(in millions)*	
Ryan White Funding Part A, Mean (std. dev.)	60.0 (43.4)

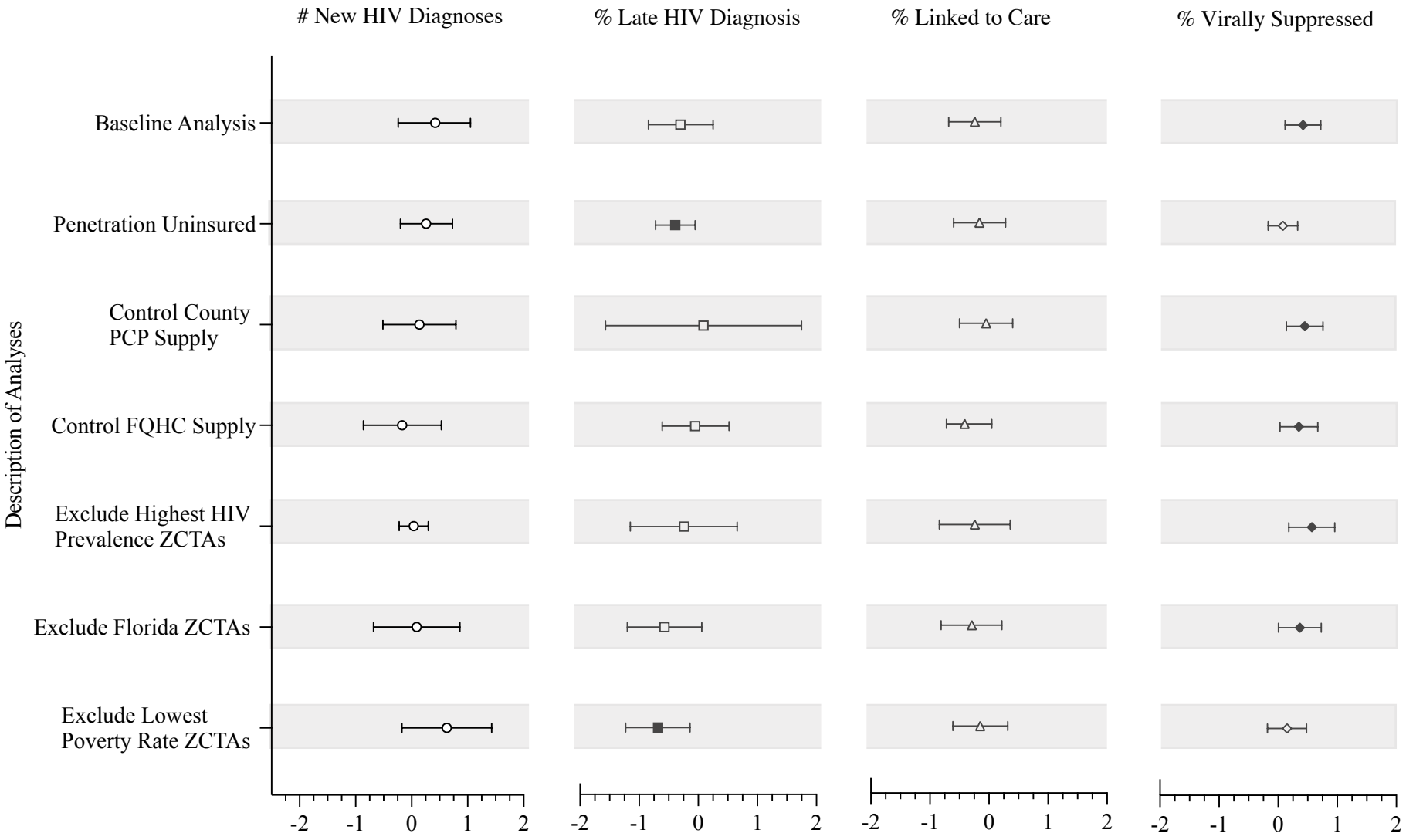
* The mean and standard deviation (std. dev.) was reported for all normally distributed variables and the median and interquartile range IQR) was reported for all variables with non-normal distribution. †New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). ‡ Complete variable definitions are available in the appendix.

Table 6. Baseline Analysis, Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration*

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	0.42	-0.24, 1.05	0.219	-0.30	-0.84, 0.25	0.287	-0.24	-0.68, 0.20	0.280	0.42	0.12, 0.72	0.006
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	-0.004	-0.01, -0.0003	0.034	0.0003	-0.002, 0.003	0.818	0.001	-0.001, 0.003	0.522
Total Low-Income Pop. (thousands)	1.83	1.65, 2.02	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.38	0.26, 0.50	<0.001	-0.02	-0.14, 0.10	0.781	0.03	-0.06, 0.12	0.470	-0.22	-0.28, -0.16	<0.001
% Uninsured	0.30	0.01, 0.58	0.04	-0.02	-0.24, 0.20	0.862	-0.22	-0.41, -0.03	0.021	0.08	-0.05, 0.21	0.239
% Unemployed	-0.22	-0.65, 0.21	0.318	0.15	-0.22, 0.53	0.419	-0.19	-0.51, 0.13	0.247	0.05	-0.18, 0.28	0.643
% Living in Poverty	0.47	0.27, 0.67	<0.001	-0.17	-0.33, -0.02	0.025	-0.16	-0.29, -0.03	0.016	-0.25	-0.35, -0.15	<0.001
% High School Educated	0.64	0.45, 0.84	<0.001	-0.20	-0.37, -0.04	0.016	-0.14	-0.28, 0.005	0.058	0.04	-0.05, 0.14	0.375
Percent of Black ZCTA Residents ≥20%	2.45	-0.24, 5.13	0.074	0.37	-1.39, 2.14	0.676	-1.99	-3.54, -0.44	0.012	-1.70	-2.91, -0.50	0.006
City-Level Characteristics												
Ryan White Part A (millions)	0.14	0.10, 0.17	<0.001	-0.03	-0.05, -0.003	0.02	0.05	0.03, 0.07	<0.001	-0.06	-0.08, -0.05	<0.001

* New HIV diagnoses, percent late diagnosis, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Figure 7. Summary of Analyses, HIV Epidemic Indicators and a 10-percentage point increase in FQHC Penetration*†



* New HIV diagnoses, percent late diagnosis, and percent linked to care represent a 5-year period (2014-2018 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). † Filled symbols (●) indicate results were significant at value $p<0.05$.

Chapter 5: Conclusion

Despite four decades since the emergence of HIV in the US and the availability of pharmacological interventions to prevent HIV transmission, there are still 30,000 new HIV diagnoses in the US each year.[1] Disproportionate burden of new diagnoses is experienced at an individual-level, for Non-Hispanic Black and Hispanic gay and bisexual men, and at a community-level, in urban areas across the US South.[2,3] Limited access to prevention, care, and treatment services may play a role for these populations and communities. Access to primary care, specifically Federally Qualified Health Centers (FQHCs), may increase access to HIV services and benefit HIV outcomes. To better understand the role of primary care for populations disproportionately impacted by HIV, this dissertation examined racial and ethnic disparities in access to (any) primary care for Non-Hispanic Black and Hispanic, compared to Non-Hispanic White, gay and bisexual men and examined the impact of presence and use of FQHCS on community-level HIV indicators used to track progress towards ending the HIV epidemic.

While primary care may increase access to HIV services, lower access to primary care for Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White gay and bisexual men, may contribute to disparities in access to HIV services and new HIV diagnoses. We found that Non-Hispanic Black and Hispanic gay and bisexual men had 30% lower odds of having seen a primary care doctor within the past year compared to Non-Hispanic White gay and bisexual men. However, the most concerning disparity was among those with (any) usual place of care where Non-Hispanic Black and Hispanic gay and bisexual men had 60% lower odds and Non-Hispanic Black (only) gay and bisexual men had 80% lower odds of reporting a primary care specific usual place of care, both compared to Non-Hispanic White gay and bisexual men. These findings highlight the importance of both understanding and addressing

disparities in primary care access for Non-Hispanic Black and Hispanic gay and bisexual men and the need for HIV services or linkage to HIV services at other sites to increase equity in access to HIV services.

At a community-level, increased presence (i.e., density) of FQHCs in communities with high rates of new HIV diagnoses may provide additional, low-barrier, sites for accessing HIV prevention, care, and treatment services and, thus, benefit community-level HIV outcomes. We found that high (75^{th} percentile) compared to lower FQHC density ($\leq 75^{th}$ percentile) was associated with fewer late HIV diagnoses, greater percent linked to care, and greater percent virally suppressed, suggesting a public health impact benefiting HIV outcomes for thousands of individuals in urban communities with high rates of new HIV diagnoses across the US South. Further, additional analyses suggest benefits may be greatest for communities with fewer primary care or HIV resources or among communities with a higher proportion of Black residents. Results support the role of presence of FQHCs in these communities in increasing access to HIV services and benefitting community HIV outcomes.

However, when we examined FQHC use (i.e., penetration) within a community, we found limited benefit to community-level HIV outcomes. A 10-percentage point increase in FQHC penetration (i.e., the percent of a community's low-income individuals using any FQHC) was associated with a modest increase in percent virally suppressed but was not associated with late diagnosis or percent linked to care. These findings may suggest additional barriers to early HIV testing and linkage to care, unaddressed by FQHC use, that warrant further investigation. Alternatively, given HIV risk is highest for a specific group of individuals within a community, gay and bisexual men, FQHC penetration among low-income individuals in a community may not accurately approximate access to HIV services for this population.

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APPENDIX A

Disparities in Access to Primary Care, a Key Site for HIV Prevention Services, among Gay and Bisexual Men in the United States

Supplementary Material

Figure A1. Sample Selection Process

From the sample of all NHIS respondents from 2013-2018, we identified male (sex) individuals (note - the definition of male 'sex' as sex assigned at birth versus gender identity was not specified), 18-64 years, who identified as gay or bisexual and either Non-Hispanic Black, Hispanic (any race), or Non-Hispanic White. We created an exclusion for those who had conditions, syndromes, or disorders including Downs Syndrome, Muscular Dystrophy, Cerebral Palsy, and Cystic Fibrosis, that are diagnosed in childhood and require specialized care through the life course.

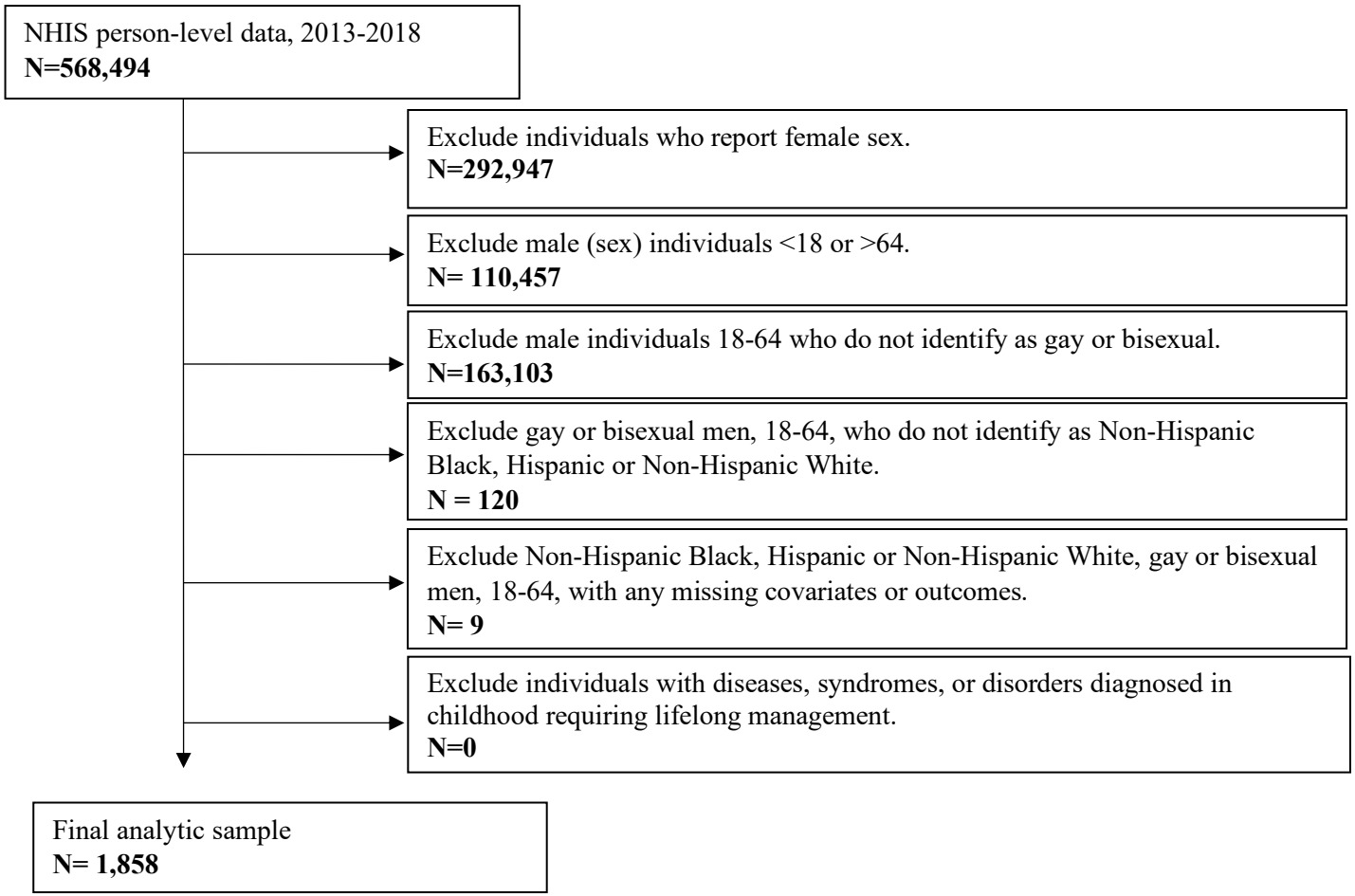

Figure A2. Conceptual Framework

We use the 6th version of the Andersen and Davidson Behavioral Model of Health Service Use.[28] The model illustrates that access to care is determined by contextual and individual characteristics, with each characteristic further subdivided into the predisposing, enabling and need-based factors that define the characteristic. While we use the model's nomenclature to present factors influencing health service use (i.e., individual and contextual characteristics), race and ethnicity in this model are meant to identify socially defined constructs and do not represent biologically inherent characteristics.[154] We include race and ethnicity as both an individual and contextual characteristic to illustrate the impacts of systematic and structural racism and inequality that operate at both an individual and contextual level to influence access to care.[155] The outcomes for this analysis are within the box of 'Health Behaviors,' as opposed to 'Health Outcomes' (gray box), not examined in this analysis. Health outcomes would include downstream effects of health behaviors, for example, development of specific conditions.

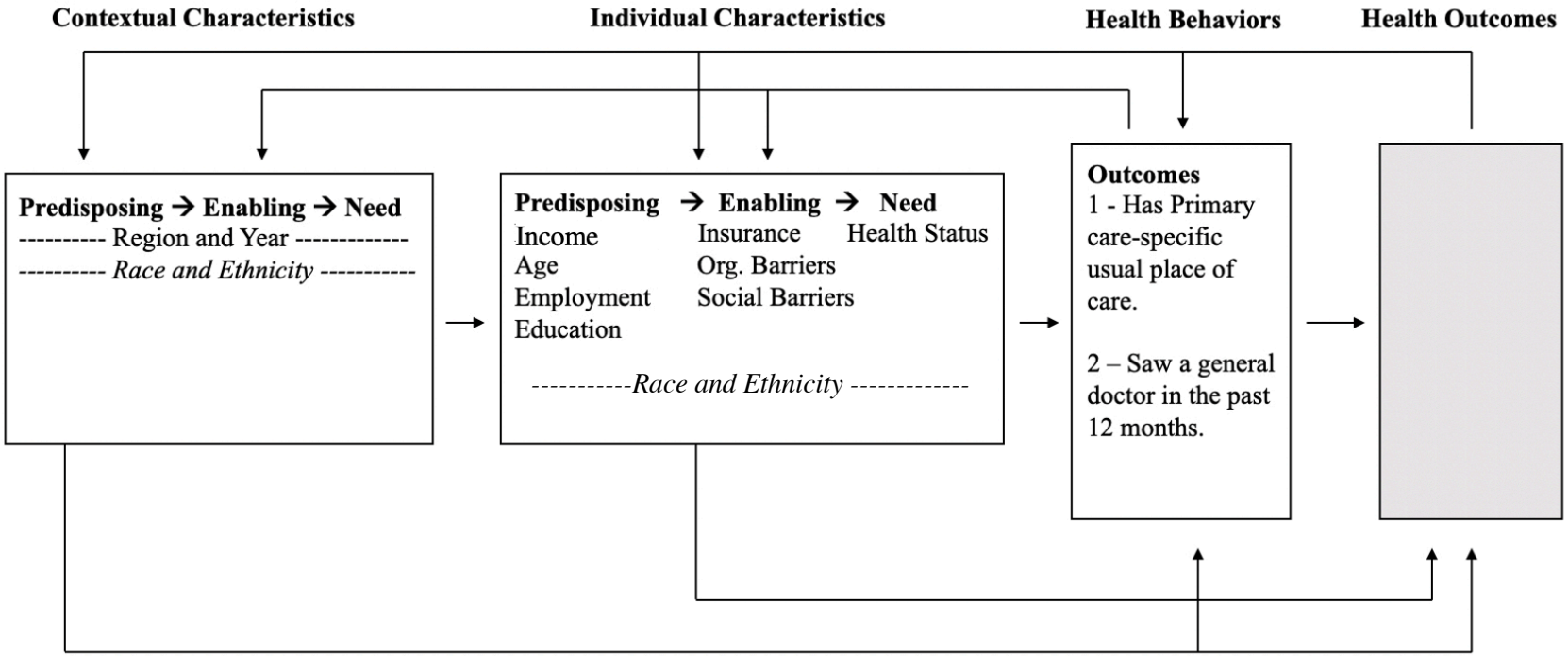

Figure A3. Model Specification

$$\boldsymbol{logistic}(\boldsymbol{P}(\boldsymbol{y_{it}})) = \boldsymbol{\beta_0} + \boldsymbol{\beta_1 NHB\ or\ Hispanic_i} + \boldsymbol{\beta_x X_{it}} + \boldsymbol{\beta_P P_{it}} + \boldsymbol{\beta_\tau \tau_{it}} + \boldsymbol{\beta_2 Region_{it}} + \boldsymbol{\beta_3 Year_i} + \boldsymbol{\varepsilon_{it}}$$

$\boldsymbol{y_{it}}$, binary measure of access for individual, *i*, in year, *t*.
$\boldsymbol{\beta_1}$, coefficient of interest; dummy variable indicating individual self-reports as Non-Hispanic Black and/or Hispanic; represents systemic and structural inequity in access to care.
$\boldsymbol{\beta_x}$, represents a separate coefficient for predisposing sociodemographic variables ($\boldsymbol{X_{it}}$)
$\boldsymbol{X_{it}}$, all individual-level predisposing sociodemographic control variables for individual, *i*, in year, *t*
$\boldsymbol{\beta_P}$, represents a separate coefficient for each enabling factor ($\boldsymbol{P_{it}}$)
$\boldsymbol{P_{it}}$, all individual-level enabling factor control variables for individual, *i*, in year, *t*
$\boldsymbol{\beta_\tau}$, represents a coefficient for individual's health need-based control variable ($\boldsymbol{\tau_{it}}$)
$\boldsymbol{\tau_{it}}$, self-reported health status for individual, *i*, in year, *t*
$\boldsymbol{\beta_2}$, represents region-specific fixed effects for individual, *i*, in year, *t*
$\boldsymbol{\beta_3}$, represents year (time)-specific fixed effects for individual, *i*

Table A1. Access to Any Care for Non-Hispanic Black/Hispanic vs. Non-Hispanic White Gay or Bisexual Men, Sensitivity Analysis*

	Any Usual Place of Care (N=1,858)			Saw Any Doctor in Past 12 Months (N=1,858)		
Characteristic	**aOR**	**95% CI**	***p*-value**	**aOR**	**95% CI**	***p*-value**
Individual-Level Characteristics						
Race						
Non-Hispanic White	Reference	----	----	Reference	----	----
Non-Hispanic Black/Hispanic	1.01	(0.70-1.47)	0.954	1.31	(0.89-1.92)	0.178
Age Group						
18-34	Reference	----	----	Reference	----	----
35-44	2.68	(1.51-4.77)	0.001	1.60	(1.00-2.55)	0.050
45-64	2.85	(1.89-4.30)	0.000	1.51	(1.01-2.25)	0.044
Education Level						
High school education or less	Reference	----	----	Reference	----	----
Some college or greater	1.40	(0.94-2.07)	0.094	1.44	(1.00-2.05)	0.048
Employment Status†						
Unemployed	Reference	----	----	Reference	----	----
Employed‡	0.75	(0.50-1.13)	0.170	0.61	(0.40-0.94)	0.024
Household Income Level						
<$35,000	Reference	----	----	Reference	----	----
$35,000–$74,999	1.09	(0.69-1.72)	0.703	0.66	(0.45-0.99)	0.042
>$75,000	2.27	(1.25-4.10)	0.007	1.18	(0.75-1.86)	0.474
Health Status						
Excellent/Very Good	Reference	----	----	Reference	----	----
Good	1.12	(0.73-1.71)	0.618	0.99	(0.64-1.55)	0.971
Fair/Poor	1.01	(0.56-1.83)	0.964	1.71	(0.88-3.32)	0.113
Enabling Factors and Barriers						
Health Insurance						
Uninsured or unknown	Reference	----	----	Reference	----	----
Any Insurance§	7.49	(5.12-10.97)	0.000	4.74	(3.10-7.25)	0.000

Organizational Barriers to Care[‖]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	1.88	(1.06-3.34)	0.031	4.54	(2.19-9.43)	0.000
Socially Determinant Barriers to Care[¶]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	0.90	(0.57-1.42)	0.639	0.70	(0.46-1.06)	0.094
Contextual Characteristics						
Region						
Northeast	Reference	----	----	Reference	----	----
North and Midwest	0.76	(0.38-1.50)	0.431	0.79	(0.46-1.34)	0.377
South	0.68	(0.38-1.20)	0.184	0.88	(0.54-1.43)	0.605
West	0.50	(0.27-0.93)	0.028	0.75	(0.45-1.25)	0.268

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval

[*] Multivariable logistic regression was used to calculate the odds of 1) having a primary care-specific usual place of care and 2) having seen a general doctor in the past 12 months for our group of interest, Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White and adjusting for all individual and contextual characteristics.

[†] Employment was assessed using the previous two-week period.

[‡] Employed individuals were those who identified as working for pay or with job, but not at work. Unemployed individuals were those who identified as working without pay, not employed, or not in the labor force.

[§] Insured individuals were those individuals who identified that they had insurance vs. individuals who identified they did not have insurance or did not know.

[‖] Organizational barriers to care included experiencing delays in care due to wait time for an appointment, wait time in doctor's office, not being able to get through by phone, or the doctor's office was not open.

[¶] Socially determinant barriers to care included whether an individual reported experiencing low or very low 30-day food security, being moderately or very worried about paying rent/mortgage/housing costs, and whether individuals had to delay care due to lack of transportation.

Table A2. Access to Primary Care for Non-Hispanic Black vs. Non-Hispanic White Gay or Bisexual Men, Subsample Analysis*

	Primary Care-Specific Usual Place of Care (N=1,542)			Saw a General Doctor in Past 12 Months (N=1,542)		
Characteristic	**aOR**	**95% CI**	***p*-value**	**aOR**	**95% CI**	***p*-value**
Individual-Level Characteristics						
Race						
Non-Hispanic White	Reference	----	----	Reference	----	----
Non-Hispanic Black	0.57	(0.34-0.94)	0.029	0.68	(0.44-1.05)	0.080
Age Group						
18-34	Reference	----	----	Reference	----	----
35-44	2.50	(1.45-4.34)	0.001	1.21	(0.79-1.83)	0.382
45-64	2.97	(2.00-4.42)	0.000	1.28	(0.90-1.82)	0.169
Education Level						
High school education or less	Reference	----	----	Reference	----	----
Some college or greater	1.43	(0.96-2.13)	0.079	1.23	(0.84-1.80)	0.281
Employment Status†						
Unemployed	Reference	----	----	Reference	----	----
Employed‡	0.70	(0.46-1.06)	0.091	0.64	(0.45-0.93)	0.018
Household Income Level						
<$35,000	Reference	----	----	Reference	----	----
$35,000–$74,999	1.24	(0.81-1.90)	0.313	0.98	(0.67-1.43)	0.905
>$75,000	1.81	(1.02-3.24)	0.044	1.70	(1.13-2.56)	0.012
Health Status						
Excellent/Very Good	Reference	----	----	Reference	----	----
Good	0.97	(0.62-1.51)	0.892	0.93	(0.64-1.35)	0.697
Fair/Poor	0.75	(0.45-1.27)	0.285	1.34	(0.78-2.30)	0.297
Enabling Factors and Barriers						
Health Insurance§						
Uninsured or unknown	Reference	----	----	Reference	----	----
Any Insurance	7.74	(5.02-11.95)	0.000	5.63	(3.62-8.76)	0.000

Organizational Barriers to Care[l]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	1.91	(1.03-3.53)	0.040	2.19	(1.23-3.90)	0.008
Socially Determinant Barriers to Care[¶]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	1.03	(0.64-1.65)	0.908	1.11	(0.76-1.64)	0.587
Contextual Characteristics						
Region						
Northeast	Reference	----	----	Reference	----	----
North and Midwest	0.82	(0.42-1.59)	0.560	0.71	(0.41-1.23)	0.220
South	0.75	(0.42-1.34)	0.324	0.70	(0.42-1.18)	0.179
West	0.58	(0.33-1.03)	0.064	0.66	(0.39-1.12)	0.122

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval

[*] Multivariable logistic regression was used to calculate the odds of 1) having a primary care-specific usual place of care and 2) having seen a general doctor in the past 12 months for our group of interest, Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White and adjusting for all individual and contextual characteristics.

[†] Employment was assessed using the previous two-week period.

[‡] Employed individuals were those who identified as working for pay or with job, but not at work. Unemployed individuals were those who identified as working without pay, not employed, or not in the labor force.

[§] Insured individuals were those individuals who identified that they had insurance vs. individuals who identified they did not have insurance or did not know.

[l] Organizational barriers to care included experiencing delays in care due to wait time for an appointment, wait time in doctor's office, not being able to get through by phone, or the doctor's office was not open.

[¶] Socially determinant barriers to care included whether an individual reported experiencing low or very low 30-day food security, being moderately or very worried about paying rent/mortgage/housing costs, and whether individuals had to delay care due to lack of transportation.

Table A3. Access to Any Care for Non-Hispanic Black vs. Non-Hispanic White Gay or Bisexual Men, Subsample Sensitivity Analysis*

	Any Usual Place of Care (N=1,542)			Saw Any Doctor in Past 12 Months (N=1,542)		
Characteristic	**aOR**	**95% CI**	***p*-value**	**aOR**	**95% CI**	***p*-value**
Individual-Level Characteristics						
Race						
Non-Hispanic White	Reference	----	----	Reference	----	----
Non-Hispanic Black	1.21	(0.71-2.08)	0.483	1.23	(0.65-2.32)	0.530
Age Group						
18-34	Reference	----	----	Reference	----	----
35-44	2.13	(1.15-3.94)	0.016	1.68	(0.98-2.88)	0.060
45-64	2.79	(1.80-4.29)	0.000	1.56	(0.99-2.46)	0.053
Education Level						
High school education or less	Reference	----	----	Reference	----	----
Some college or greater	1.11	(0.72-1.72)	0.638	1.34	(0.87-2.08)	0.182
Employment Status†						
Unemployed	Reference	----	----	Reference	----	----
Employed‡	0.59	(0.38-0.92)	0.019	0.78	(0.49-1.22)	0.275
Household Income Level						
<$35,000	Reference	----	----	Reference	----	----
$35,000–$74,999	1.53	(0.94-2.47)	0.086	0.57	(0.36-0.92)	0.020
>$75,000	2.29	(1.19-4.38)	0.013	0.95	(0.57-1.58)	0.845
Health Status						
Excellent/Very Good	Reference	----	----	Reference	----	----
Good	0.96	(0.60-1.52)	0.855	1.13	(0.69-1.85)	0.634
Fair/Poor	1.10	(0.60-2.02)	0.765	1.68	(0.79-3.58)	0.178
Enabling Factors and Barriers						
Health Insurance						
Uninsured or unknown	Reference	----	----	Reference	----	----

Any Insurance[§]	9.15	(5.84-14.32)	0.000	5.34	(3.35-8.52)	0.000
Organizational Barriers to Care[‖]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	2.52	(1.21-5.22)	0.013	4.94	(2.11-11.57)	0.000
Socially Determinant Barriers to Care[¶]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	1.00	(0.58-1.74)	0.987	0.70	(0.43-1.13)	0.146
Contextual Characteristics						
Region						
Northeast	Reference	----	----	Reference	----	----
North and Midwest	0.88	(0.41-1.87)	0.731	0.81	(0.44-1.49)	0.493
South	0.59	(0.30-1.15)	0.121	0.85	(0.48-1.50)	0.566
West	0.43	(0.21-0.85)	0.016	0.62	(0.35-1.10)	0.100

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval

[*] Multivariable logistic regression was used to calculate the odds of 1) having a primary care-specific usual place of care and 2) having seen a general doctor in the past 12 months for our group of interest, Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White and adjusting for all individual and contextual characteristics.

[†] Employment was assessed using the previous two-week period.

[‡] Employed individuals were those who identified as working for pay or with job, but not at work. Unemployed individuals were those who identified as working without pay, not employed, or not in the labor force.

[§] Insured individuals were those individuals who identified that they had insurance vs. individuals who identified they did not have insurance or did not know.

[‖] Organizational barriers to care included experiencing delays in care due to wait time for an appointment, wait time in doctor's office, not being able to get through by phone, or the doctor's office was not open.

[¶] Socially determinant barriers to care included whether an individual reported experiencing low or very low 30-day food security, being moderately or very worried about paying rent/mortgage/housing costs, and whether individuals had to delay care due to lack of transportation.

Table A4. Access to Primary Care for (1) Non-Hispanic Black/Hispanic vs. Non-Hispanic White and (2) Non-Hispanic Black vs. Non-Hispanic White Subsample, among Individuals with a Usual Place of Care*

	Primary Care Usual Place given Any Usual Place (N=1,518)			Primary Care Usual Place given Any Usual Place (N=1,280)		
Characteristic	**aOR**	**95% CI**	***p*-value**	**aOR**	**95% CI**	***p*-value**
Individual-Level Characteristics						
Race						
Non-Hispanic White	Reference	----	----	Reference	----	----
Non-Hispanic Black/Hispanic	0.42	(0.23-0.75)	0.004	----	----	-----
Non-Hispanic Black				0.21	(0.10-0.45)	0.000
Age Group						
18-34	Reference	----	----	Reference	----	----
35-44	3.01	(1.21-7.54)	0.018	3.91	(1.29-11.84)	0.016
45-64	2.93	(1.71-5.01)	0.000	3.22	(1.70-6.12)	0.000
Education Level						
High school education or less	Reference	----	----	Reference	----	----
Some college or greater	1.95	(1.08-3.52)	0.026	2.17	(1.10-4.28)	0.025
Employment Status†						
Unemployed	Reference	----	----	Reference	----	----
Employed‡	1.17	(0.62-2.19)	0.626	1.18	(0.59-2.36)	0.648
Household Income Level						
<$35,000	Reference	----	----	Reference	----	----
$35,000–$74,999	0.71	(0.34-1.46)	0.351	0.67	(0.30-1.50)	0.330
>$75,000	1.09	(0.47-2.54)	0.844	0.91	(0.35-2.38)	0.851
Health Status						
Excellent/Very Good	Reference	----	----	Reference	----	----
Good	0.91	(0.45-1.83)	0.794	0.87	(0.39-1.91)	0.724
Fair/Poor	0.51	(0.24-1.08)	0.081	0.33	(0.59-3.46)	0.007
Enabling Factors and Barriers						
Health Insurance						

Uninsured or unknown	Reference	----	----	Reference	----	----
Any Insurance[§]	2.94	(1.41-6.12)	0.004	4.55	(1.93-10.76)	0.001
Organizational Barriers to Care[ǀ]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	1.57	(0.66-3.75)	0.310	1.38	(0.53-3.60)	0.515
Socially Determinant Barriers to Care[¶]						
No Barriers	Reference	----	----	Reference	----	----
Presence of 1 or more barriers	0.76	(0.41-1.39)	0.373	1.09	(0.56-2.12)	0.793
Contextual Characteristics						
Region						
Northeast	Reference	----	----	Reference	----	----
North and Midwest	0.63	(0.27-1.51)	0.304	0.78	(0.32-1.89)	0.584
South	0.91	(0.41-2.04)	0.822	1.29	(0.52-3.20)	0.577
West	1.60	(0.66-3.86)	0.295	1.43	(0.59-3.46)	0.424

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval

[*] Multivariable logistic regression was used to calculate the odds of 1) having a primary care-specific usual place of care and 2) having seen a general doctor in the past 12 months for our group of interest, Non-Hispanic Black and Hispanic gay and bisexual men, compared to Non-Hispanic White and adjusting for all individual and contextual characteristics.

[†] Employment was assessed using the previous two-week period.

[‡] Employed individuals were those who identified as working for pay or with job, but not at work. Unemployed individuals were those who identified as working without pay, not employed, or not in the labor force.

[§] Insured individuals were those individuals who identified that they had insurance vs. individuals who identified they did not have insurance or did not know.

[ǀ] Organizational barriers to care included experiencing delays in care due to wait time for an appointment, wait time in doctor's office, not being able to get through by phone, or the doctor's office was not open.

[¶] Socially determinant barriers to care included whether an individual reported experiencing low or very low 30-day food security, being moderately or very worried about paying rent/mortgage/housing costs, and whether individuals had to delay care due to lack of transportation.

Table A5. Definitions of Key Variables

Variable	Definition	Justification for inclusion	Source	Reference
Outcome Variables – Main Analysis				
Potential Access Primary Care-specific Usual Place of Care	Binary variable 1= individual has a usual place of care and it is a clinic or health care center, doctor's office, or HMO. 0=individual either does not have a usual place of care or the usual place is not primary care-specific.	Primary care providers are responsible for a majority of HIV Pre-Exposure Prophylaxis (i.e., PrEP) prescriptions. For individuals living with HIV, having a usual source of care has been associated with reduced time to care following HIV diagnosis and higher odds of viral suppression.	NHIS Data File	[49,50]
Realized Access Saw General Doctor <12 months	Binary variable 1= individual saw a general practice, family medicine, or an internal medicine doctor in the past 12 months. 0= individual did not see a doctor from one of those practices in <12 months.	Primary care guidelines state that all men receive periodic health assessments and that sexually active men who have sex with men, which may include men who identify as gay and bisexual, obtain certain screenings (e.g., HIV) at least annually.	NHIS Data File	[53,54]
Outcome Variables – Sensitivity Analysis				
Potential Access Any usual place of care	Binary variable 1= individual has any usual place of care 0=individual does not have a usual place of care	Used as a comparator to observe if relationships for primary care-specific potential access were also observed for any potential access, indicating disparities for any (versus primary) care.	NHIS Data File	
Realized Access Saw any doctor <12 months	1= individual saw any doctor in <12 months 0= individual did not see any doctor in <12 months	Used as a comparator to observe if relationships for primary care-specific realized access were also observed for any realized access, indicating disparities for any (versus primary) care.	NHIS Data File	
Explanatory Variable				
Race and Ethnicity	Binary Variable	Race and ethnicity are used to examine racial and ethnic disparities in each	NHIS Data File	[41,55]

	1= individual identifies as Black, Non-Hispanic, or Hispanic (any race). 0= individual identifies as White, Non-Hispanic.	outcome and represent structural and systematic inequities, rooted in racism and discrimination, that decrease access to services.		
Individual Characteristics – Predisposing Factors				
Age	Categorical variable 0=18-34; 1=35-49; 2=50-64	Age is a known determinant of access to healthcare and primary care with younger adults often reporting less access to care vs. older adults.	NHIS Data File	56–60
Educational attainment	Categorical variable 0= high school education or less; 1= any college or more education	Greater than high school education has been associated with increased access to care, including primary care.	NHIS Data File	56–60
Employment Status	Categorical Variable 0= not employed for pay including not looking for work; 1=employed for pay	Employment status affects healthcare access in providing the financing resources to afford care both directly and indirectly through provision of employer-based health insurance. However, if individuals are unable to take time off to attend appointments this could negatively impact receipt of primary care.	NHIS Data File	56–60
Annual Household Income	Categorical Variable 0=<$35,000; 1=$35,000–$74,999; 2= ≥$75,000	Previous studies have documented that access/use of primary care increases as income increases. In the U.S. significant disparities in primary care access have been reported for individuals with below vs. above average income.	NHIS Data File	56–60
Individual Characteristics – Need-based Factors				

Health Status (self-identified)	Categorical Variable 0=Fair/Poor 1=Good 2=Very Good/Excellent	Self-determined health status is a proxy for individual overall health, which influences care needs and service use.	NHIS Data File	[60]
Individual Characteristics – Enabling Factors				
Health Insurance	Binary variable 0= no health insurance 1= any (type) health insurance	Having health insurance has been associated with having greater access, both potential and realized, to primary care.	NHIS Data File	[60–64]
Socially Determinant Barriers	Binary variable 0= has not experienced barriers, food insecurity, housing insecurity, or lack of transportation to doctor, in the past 12 months. 1= has experienced one or more barriers in the past 12 months.	Socially determinant barriers have been identified as factors that can decrease access to care, including primary care.	NHIS Data File	[60–64]
Organizational Barriers	Binary variable 0= has not had to delay care due to barriers, inability to contact a physician, physician hours, appointment or office wait times, in the past 12 months. 1= has had to delay care in the past 12 months due to one or more barriers.	Organizational barriers have been identified as factors that can decrease access to care, including primary care.	NHIS Data File	[60–64]
Contextual Characteristics				
Region of Residence	Categorical Variable Groups: Northeast, North Central/Midwest, South and West	We included region to control for region-specific differences in health care systems and/or policy (e.g., Medicaid expansion) that may impact access to primary care.	NHIS Data File	[65]

APPENDIX B

Federally Qualified Health Centers and Community-Level HIV Outcomes among High HIV-Burden Urban Communities across the US South

Supplementary Material

Figure B1. Detailed Data Preparation and Sample Derivation

HIV Epidemic Indicators from 1,489 urban ZIP Codes in the US South (AIDSVu, 2014-18, 2015-19)

Data Preparation

Step 1, data conversion: Import and merge ZCTA values using ZIP code to ZCTA-level crosswalk from UDS Mapper (John Snow Inc., 2020)

Step 2, add ZCTA sociodemographic data: Import/merge 5-year estimates by ZCTA from American Community Survey subject tables (US Census, 2015-2019).

Step 3, add covariate (funding) data: Import/merge Ryan White Part A funding data by year and city (HRSA, 2014-2019). Create variable to represent 5-year funding.

Step 4, create explanatory variable, FQHC Density in Primary Care Service Area:

1. Import Primary Care Service Area (PCSA) designation for ZCTAs in dataset using PCSA to ZCTA crosswalk (Dartmouth Health Atlas, 2010).
2. Identify all ZCTAs, including those not in AIDSVu data, associated with each PCSA using PCSA to ZCTA crosswalk (Dartmouth Health Atlas, 2010).
3. Import and merge the low-income population (< 200% Federal Poverty Level) for each ZCTA included in the PCSA (US Census, 2015-2019).
4. Calculate low-income population of PCSA by summing low-income population of all ZCTAs that are part of the PCSA.
5. Identify the number of FQHCs in each PCSA (Uniform Data System, 2020).
6. Derive FQHC density of ZCTA's PCSA (per 10,000) by dividing number of FQHCs in the PCSA by the low-income population of the PCSA and multiplying by 10,000.

Sample Preparation

→ Exclude ZCTAs with population < 500, HIV data suppressed (n=87)

→ Exclude ZCTAs with missing sociodemographic data (n=19)

→ Exclude ZCTAs with missing outcomes, specific to each HIV epidemic indicator

1. New HIV diagnoses (n=0)
2. % Late diagnoses (n=602)
3. % Linked to care (n=297)
4. % Virally suppressed (n=100)

Analytic Sample Population by HIV Epidemic Indicator

1. New HIV diagnoses, n = 1,383
2. % Late diagnoses, n = 781
3. % Linked to care, n = 1,086
4. % Virally suppressed, n = 1,283

Figure B2. Model Specification

Cross-sectional analysis using linear regression model:

$$y_i = \beta_0 + \beta_1 FQHC\ Density_i + \beta_z Z_i + \mu + \varepsilon_i$$

Outcome y_i is a continuous variable representing the HIV epidemic indicator (e.g., new HIV diagnoses) for that ZCTA (*i*).

The explanatory variable is represented by *FQHC Density* for ZCTA (*i*) and β_1, represents the difference in outcome, y, associated with high FQHC density, compared to medium/low density.

ZCTA-level sociodemographic and Ryan White HIV funding variables are represented by Z_i, where β_z, represents the difference in outcome, y, associated with a one unit increase in sociodemographic and HIV funding variable.

μ, indicates a state-specific effect.

Table B1. Summary of Analyses, HIV Epidemic Indicators and FQHC Density in 21 Urban ZCTAs in the US South[*†]

	New HIV Diagnoses 5-Year		% Late Diagnosis 5-Year		% Linked to Care 5-Year		% Virally Suppressed 1-Year	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Baseline Analysis	6.39***	3.57, 9.21	-3.86**	-6.08, -1.63	1.81	-0.06, 3.68	1.41*	0.09, 2.74
High vs. Medium FQHC Density	6.57***	3.31, 9.83	-4.16***	-6.39, -1.94	2.10*	0.18, 4.03	1.79*	0.40, 3.18
Controlling for County PCP Supply	5.58***	2.76, 8.40	-4.20***	-6.49, -1.90	2.52**	0.62, 4.42	1.49**	0.15, 5.94
Exclude ZCTAs with Highest HIV Prevalence	1.51*	0.36, 2.67	-5.79**	-9.43, -2.16	2.85*	0.34, 5.35	2.73**	1.07, 4.38
Exclude Florida ZCTAs	5.40**	1.58, 9.21	-4.59**	-7.48, -1.69	3.24*	0.69, 5.79	4.72***	2.94, 6.49

[*]High density ZCTAs were defined as those ZCTAs with ≥ 75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile PCSA FQHC density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†] $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table B2. Summary of Interaction Analyses, HIV Epidemic Indicators and FQHC Density in 21 Urban ZCTAs in the US South[*†‡]

	New HIV Diagnoses 5-Year		% Late Diagnosis 5-Year		% Linked to Care 5-Year		% Virally Suppressed 1-Year	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
<20% Composition Black Residents	8.26***	5.06, 11.46	-5.65***	-8.41, -2.89	1.61	-0.57, 3.80	0.78	-0.75, 2.31
≥20% Composition Black Residents	1.71	-3.00, 6.42	-1.72	-4.68, 1.23	2.24	-0.58, 5.06	2.77**	0.65, 4.89
≥60% Composition Black Residents	-3.61	-11.30, 4.07	1.31	-3.22, 5.83	4.39*	0.07, 8.71	4.51**	1.10, 7.92

[*]High density ZCTAs were defined as those ZCTAs with ≥ 75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile PCSA FQHC density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†] $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ [‡]An interaction term was used to identify the relationship for high versus medium/low FQHC density specific to communities with <20% Black residents identified by the beta coefficient for the 'High Density' variable in the model

Table B3. High versus Medium Density ZCTAs, Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South [*†]

	New HIV Diagnoses (n=1,032)			% Late Diagnoses (n=596)			% Linked to Care (n=808)			% Virally Suppressed (n=950)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density												
Medium Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	6.57	3.13, 9.83	<0.001	-4.16	-6.39, -1.94	<0.001	2.10	0.18, 4.03	0.033	1.79	0.40, 3.18	0.012
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.09	0.085, 0.10	<0.001	-0.004	-0.008, -0.001	0.012	0.001	-0.002, 0.003	0.779	0.001	-0.001, 0.003	0.195
Total Low-Income Pop. (thousands)	2.04	1.81, 2.26	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.37	0.22, 0.52	<0.001	0.007	-0.11, 0.13	0.909	0.01	-0.09, 0.11	0.821	-0.20	-0.27, -0.13	<0.001
% Uninsured	0.35	0.02, 0.68	0.039	-0.04	-0.26, 0.18	0.698	-0.06	-0.27, 0.14	0.558	0.05	-0.10, 0.20	0.479
% Unemployed	-0.21	-0.71, 0.29	0.415	0.10	-0.28, 0.48	0.605	-0.12	-0.47, 0.22	0.473	0.04	-0.22, 0.29	0.765
% Living in Poverty	0.40	0.16, 0.64	0.001	-0.11	-0.27, 0.04	0.160	-0.15	-0.29, -0.001	0.048	-0.27	-0.38, -0.16	<0.001
% High School Educated	0.66	0.43, 0.89	<0.001	-0.20	-0.37, -0.03	0.022	0.03	-0.12, 0.18	0.731	0.01	-0.10, -0.07	<0.001
Non-Hispanic Black Population ≥20%	3.90	0.40, 7.40	0.029	0.64	-1.32, 2.59	0.523	-2.01	-3.85, -0.17	0.033	-1.40	-2.86, 0.06	0.060
MSA-Level Characteristics												
Ryan White Part A (millions)	0.12	0.08, 0.17	<0.001	-0.0003	-0.03, 0.03	0.984	0.05	0.03, 0.07	<0.001	-0.08	-0.10, -0.07	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Table B4. Controlling for County PCP Supply, Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South[*†]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	5.58	2.76, 8.40	<0.001	-4.20	-6.49, -1.90	<0.001	2.52	0.62, 4.42	0.009	1.49	0.15, 2.83	0.029
ZCTA Characteristics												
County PCP Supply	5.58	2.76, 8.40	<0.001	1.16	-0.70, 3.02	0.220	-2.89	-4.42, -1.35	<0.001	-0.39	-1.50, 0.72	0.486
HIV Prevalence (cases /100k)	5.12	2.72, 7.53	<0.001	-0.004	-0.007, -0.0002	0.038	0.0001	-0.002, 0.003	0.930	0.001	-0.0009, 0.003	0.303
Total Low-Income Pop. (thousands)	1.85	1.67, 2.03	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.35	0.23, 0.47	<0.001	-0.02	-0.14, 0.09	0.681	0.04	-0.05, 0.13	0.363	-0.22	-0.28, -0.15	<0.001
% Uninsured	0.40	0.12, 0.68	0.005	-0.04	-0.26, 0.18	0.730	-0.22	-0.41, -0.03	0.025	0.08	-0.06, 0.21	0.268
% Unemployed	-0.17	-0.59, 0.26	0.437	0.11	-0.26, 0.49	0.546	-0.22	-0.53, 0.10	0.175	0.08	-0.16, 0.31	0.523
% Living in Poverty	0.40	0.20, 0.59	<0.001	-0.16	-0.31, -0.001	0.048	-0.14	-0.27, -0.01	0.033	-0.26	-0.35, -0.16	<0.001
% High School Educated	0.65	0.46, 0.84	<0.001	-0.20	-0.37, -0.04	0.015	-0.12	-0.26, 0.02	0.085	0.03	-0.06, 0.13	0.503
Non-Hispanic Black Population ≥20%	3.03	-5.68, -0.37	0.026	0.24	-1.52, 2.00	0.790	-2.06	-3.61, -0.51	0.009	-1.70	-2.91, -0.49	0.006
MSA-Level Characteristics												
Ryan White Part A (millions)	0.13	0.10, 0.17	<0.001	-0.004	-0.03, 0.02	0.772	0.04	0.02, 0.06	0.001	-0.07	-0.09, -0.05	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Table B5. Exclude Highest HIV Prevalence ZCTAs, Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South[*†]

	New HIV Diagnoses (n=1,036)			% Late Diagnoses (n=451)			% Linked to Care (n=742)			% Virally Suppressed (n=937)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	1.51	0.36, 2.67	0.010	-5.79	-9.43, -2.16	0.002	2.85	0.34, 5.35	0.026	2.73	1.07, 4.38	0.001
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.19	0.18, 0.20	<0.001	0.02	-0.01, 0.04	0.154	-0.04	-0.05, -0.02	<0.001	-0.02	1.07, -0.01	<0.001
Total Low-Income Pop. (thousands)	0.69	0.57, 0.81	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.12	0.07, 0.17	<0.001	-0.04	-0.24, 0.15	0.665	0.04	-0.08, 0.16	0.496	-0.16	-0.24, -0.08	<0.001
% Uninsured	0.10	-0.02, 0.22	0.093	-0.03	-0.42, 0.36	0.874	-0.14	-0.43, 0.14	0.322	0.15	-0.03, 0.33	0.108
% Unemployed	-0.07	-0.24, 0.10	0.448	0.23	-0.39, 0.84	0.470	-0.28	-0.70, 0.14	0.184	-0.001	-0.29, 0.29	0.995
% Living in Poverty	0.001	-0.08, 0.08	0.973	-0.09	-0.34, 0.15	0.460	-0.11	-0.28, 0.06	0.216	-0.26	-0.38, -0.13	<0.001
% High School Educated	0.11	0.03, 0.19	0.005	-0.12	-0.39, 0.16	0.400	-0.12	-0.31, 0.08	<0.001	0.04	-0.08, 0.17	0.472
Non-Hispanic Black Population ≥20%	-0.30	-1.52, 0.92	0.629	-0.34	-3.34, 2.66	0.822	-0.78	-2.96, 1.40	0.483	0.03	-1.60, 1.65	0.975
MSA-Level Characteristics												
Ryan White Part A (millions)	0.03	0.02, 0.05	<0.001	-0.003	-0.05, 0.04	0.892	0.05	0.03, 0.08	<0.001	-0.06	-0.08, -0.03	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Table B6. Exclude Florida ZCTAs, Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South[*†]

	New HIV Diagnoses (n=1,032)			% Late Diagnoses (n=596)			% Linked to Care (n=808)			% Virally Suppressed (n=950)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	5.40	1.58, 9.21	0.006	-4.59	-7.48, -1.69	0.002	3.24	0.69, 5.79	0.013	4.72	2.94, 6.49	<0.001
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.08	0.07, 0.08	<0.001	-0.01	-0.01, -0.002	0.005	-0.002	-0.005, 0.001	0.273	0.002	-0.0003, 0.004	0.092
Total Low-Income Pop. (thousands)	2.06	1.83, 2.28	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.41	0.26, 0.57	<0.001	-0.02	-0.16, 0.12	0.795	0.12	0.01, 0.23	0.028	-0.21	-0.29, -0.13	<0.001
% Uninsured	0.14	-0.21, 0.48	0.441	-0.18	-0.42, 0.07	0.154	-0.21	-0.44, 0.01	0.066	0.13	-0.04, 0.29	0.136
% Unemployed	0.11	-0.39, 0.61	0.662	0.13	-0.27, 0.53	0.521	-0.21	-0.57, 0.15	0.249	0.17	-0.10, 0.44	0.210
% Living in Poverty	0.42	0.19, 0.65	<0.001	-0.13	-0.30, 0.04	0.120	-0.20	-0.35, -0.05	0.008	-0.32	-0.43, -0.20	<0.001
% High School Educated	0.57	0.33, 0.80	<0.001	-0.25	-0.43, -0.07	0.008	-0.20	-0.36, -0.04	0.014	0.05	-0.07, 0.17	0.438
Non-Hispanic Black Population ≥20%	3.36	0.14, 6.57	0.041	-1.50	-3.50, 0.51	0.143	-1.15	-2.95, 0.65	0.209	-0.93	-2.35, 0.49	0.200
MSA-Level Characteristics												
Ryan White Part A (millions)	0.10	0.06, 0.15	<0.001	-0.01	-0.04, 0.02	0.630	0.04	0.01, 0.07	0.002	-0.06	-0.08, -0.04	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019).

Table B7. Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South, Relationships for ZCTAs with <20% Black Residents [*†‡]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density for <20% Black Resident ZCTAs												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	8.26	5.06, 11.46	<0.001	-5.65	-8.41, -2.89	<0.001	1.57	-0.61, 3.76	0.158	0.79	-0.74, 2.32	0.309
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	-0.004	-0.007, -0.0003	0.035	-0.0001	-0.003, 0.002	0.913	0.001	-0.001, 0.003	0.497
Total Low-Income Pop. (thousands)	1.83	1.65, 2.02	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.38	0.26, 0.50	<0.001	-0.02	-0.13, 0.10	0.755	0.02	-0.07, 0.11	0.627	-0.22	-0.28, -0.15	<0.001
% Uninsured	0.34	0.06, 0.61	0.019	-0.04	-0.26, 0.17	0.697	-0.18	-0.37, 0.01	0.070	0.09	-0.05, 0.22	0.205
% Unemployed	-0.16	-0.59, 0.26	0.450	0.06	-0.31, 0.44	0.743	-0.20	-0.52, 0.12	0.221	0.06	-0.17, 0.29	0.593
% Living in Poverty	0.44	0.25, 0.64	<0.001	-0.14	-0.30, 0.01	0.065	-0.17	-0.30, -0.04	0.010	-0.26	-0.36, -0.16	<0.001
% High School Educated	0.65	0.45, 0.84	<0.001	-0.20	-0.36, -0.03	0.019	-0.11	-0.25, 0.03	0.122	0.04	-0.06, 0.13	0.439
Interaction High Density X <20% Black Residents	-6.55	-11.84, -1.26	0.015	3.93	0.35, 7.51	0.032	0.67	-2.58, 3.91	0.686	1.98	-0.44, 4.40	0.109
MSA-Level Characteristics												
Ryan White Part A (millions)	0.12	0.08, 0.15	<0.001	-0.004	-0.03, 0.02	0.756	0.05	0.03, 0.07	<0.001	-0.07	-0.08, -0.05	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). [‡] An interaction term was used to identify the relationship for high versus medium/low FQHC density specific to communities with <20% Black residents identified by the beta coefficient for the 'High Density' variable in the model.

Table B8. Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South, Relationships for ZCTAs with ≥20% Black Residents [*†‡]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density for ≥20% Black Resident ZCTAs												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	1.71	-3.00, 6.42	0.476	-1.72	-4.68, 1.23	0.253	2.24	-0.58, 5.06	0.120	2.77	0.65, 4.89	0.010
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	-0.004	-0.007, -0.0003	0.035	-0.0001	-0.003, 0.002	0.913	0.001	-0.001, 0.003	0.497
Total Low-Income Pop. (thousands)	1.83	1.65, 2.02	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.38	0.26, 0.50	<0.001	-0.02	-0.13, 0.10	0.755	0.02	-0.07, 0.11	0.627	-0.22	-0.28, -0.15	<0.001
% Uninsured	0.34	0.06, 0.61	0.019	-0.04	-0.26, 0.17	0.697	-0.18	-0.37, 0.01	0.070	0.09	-0.05, 0.22	0.205
% Unemployed	-0.16	-0.59, 0.26	0.450	0.06	-0.31, 0.44	0.743	-0.20	-0.52, 0.12	0.221	0.06	-0.17, 0.29	0.593
% Living in Poverty	0.44	0.25, 0.64	<0.001	-0.14	-0.30, 0.01	0.065	-0.17	-0.30, -0.04	0.010	-0.26	-0.36, -0.16	<0.001
% High School Educated	0.65	0.45, 0.84	<0.001	-0.20	-0.36, -0.03	0.019	-0.11	-0.25, 0.03	0.122	0.04	-0.06, 0.13	0.439
Interaction High Density X ≥20% Black Residents	6.55	1.26, 11.84	0.015	-3.93	-7.51, -0.35	0.032	-0.67	-3.91, 2.58	0.686	-1.98	-4.40, 0.44	0.109
MSA-Level Characteristics												
Ryan White Part A (millions)	0.12	0.08, 0.15	<0.001	-0.004	-0.03, 0.02	0.756	0.05	0.03, 0.07	<0.001	-0.07	-0.08, -0.05	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). [‡] An interaction term was used to identify the relationship for high versus medium/low FQHC density specific to communities with ≥20% Black residents identified by the beta coefficient for the 'High Density' variable in the model.

Table B9. Association of HIV Epidemic Indicators and FQHC Density in High HIV-Burden Urban ZCTAs in the South, Relationships for ZCTAs with ≥60% Black Residents [*†‡]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
FQHC Density for ≥60% Black Resident ZCTAs												
Medium/Low Density	ref	--	--	ref	--	--	ref	--	--	ref	--	--
High Density	-3.61	-11.30, 4.07	0.357	1.31	-3.22, 5.83	0.572	4.39	0.07, 8.71	0.047	4.51	1.10, 7.92	0.010
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	-0.004	-0.007, -0.0004	0.028	-0.0002	-0.003, 0.002	0.882	0.00005	-0.002, 0.002	0.963
Total Low-Income Pop. (thousands)	1.87	1.69, 2.05	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.43	0.31, 0.55	<0.001	-0.006	-0.12, 0.11	0.925	0.006	-0.08, 0.10	0.888	-0.22	-0.28, -0.16	<0.001
% Uninsured	0.39	0.11, 0.67	0.006	-0.04	-0.26, 0.17	0.709	-0.21	-0.40, -0.02	0.029	0.08	-0.06, 0.22	0.248
% Unemployed	-0.29	-0.72, 0.15	0.197	0.07	-0.31, 0.45	0.734	-0.21	-0.53, 0.12	0.208	-0.03	-0.26, 0.21	0.817
% Living in Poverty	0.40	0.20, 0.60	<0.001	-0.15	-0.30, 0.005	0.058	-0.17	-0.30, -0.04	0.012	-0.27	-0.37, -0.18	<0.001
% High School Educated	0.65	0.46, 0.84	<0.001	-0.20	-0.36, -0.04	0.016	-0.12	-0.26, 0.02	0.091	0.03	-0.07, 0.13	0.528
Interaction High Density X ≥60% Black Residents	10.50	2.77, 18.22	<0.001	-6.05	-10.65, -1.45	0.010	-2.63	-6.99, 1.73	0.237	-3.23	-6.66, 0.21	0.066
MSA-Level Characteristics												
Ryan White Part A (millions)	0.12	0.08, 0.15	<0.001	-0.005	-0.03, 0.02	0.731	0.05	0.03, 0.07	<0.001	-0.07	-0.09, -0.05	<0.001

[*]High density ZCTAs were defined as those ZCTAs with ≥75th percentile PCSA FQHC density (≥ 1.182 FQHCs per 10,000 PCSA low-income population); medium density was defined as those ZCTAs with <75th and ≥ 25th percentile density (<1.182, ≥ 0.069); low density was defined as those ZCTAs with <25th percentile PCSA FQHC density (<0.069). [†]New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). [‡] An interaction term was used to identify the relationship for high versus medium/low FQHC density specific to communities with ≥20% Black residents identified by the beta coefficient for the 'High Density' variable in the model.

Table B10. Definition of Key Variables

Variable Name	Definition		Reference
Outcome Variables			
Number of new HIV Diagnoses	Total persons aged 13 years and older newly diagnosed with HIV infection (any stage) during a given 5-year time period.	AIDSVu	97
Percent Late HIV Diagnosis	Number of individuals aged 13 years and older who were diagnosed with HIV during a given five-year time period and were diagnosed with stage 3 HIV (AIDS) within 3 months of initial HIV diagnosis, divided by the number of individuals aged 13 years and older newly diagnosed with HIV in that period.	AIDSVu	97
Percent Linked to Care	Number of individuals aged 13 years and older diagnosed with HIV during a five-year period with a CD4 or HIV viral load within one month of initial diagnosis, per all individuals 13 years and older newly diagnosed with HIV over the same period.	AIDSVu	97
Percent Virally Suppressed	Number of individuals aged 13 years and older living with HIV in a given year (diagnosed as of year-end the previous year) and alive at the end of that year, whose most recently reported HIV viral load count in that year was <200 copies per ml. This was divided by individuals 13 years and older living with diagnosed HIV in a given year (excluding those newly diagnosed that year).	AIDSVu	97
Explanatory Variable			
FQHC Density	Number of FQHCs in the contiguous ZCTAs making up a primary care service area (PCSA) per 10,000 low-income population of the service area. The variable was categorized into high (≥75th percentile) and medium/low (<75th to ≥25th; <25th percentiles) FQHC density.	UDS Mapper	48,107,156,157
Control Variables			
HIV Prevalence	Number of persons aged 13 years and older living with HIV infection or persons living with HIV infection ever classified as stage 3 HIV (AIDS) at the end of a given year.	AIDSVu	
Percent aged 15-44 years	Percent of ZCTA population that is between 15-44 years old.	ACS	29,108

Percent with a high school education	Percent of the ZCTA population >25 years old with a high school (or equivalent) education.	ACS	.21–23,109,110
Percent living in poverty	Percent of the total population living below the poverty threshold for whom poverty is assessed, excluding persons living in institutional group quarters (e.g., prisons or nursing homes), college dormitories, military barracks, situations without conventional housing (and who are not in shelters), and unrelated individuals <15 years.	ACS	20–23,109
Total low-income population	Total population living below 200% of the poverty threshold.	ACS	5
Percent uninsured	Percent of the total, non-institutionalized population without any form of health insurance coverage.	ACS	21–23,109,110
Percent unemployed	Percent of all civilians 16 years old who were 1) neither "at work" nor "with a job but not at work" during the reference week, and (2) were actively looking for work during the last 4 weeks, and (3) were available to start a job. Also included as unemployed are civilians who did not work at all during the reference week, were waiting to be called back to a job from which they had been laid off, and were available for work except for temporary illness.	ACS	21–23,109,110
Percent African American Composition	Percent of the ZCTAs total population that identified as Non-Hispanic Black. In baseline and sensitivity analysis, we used ≥20% African American composition and also examined the relationship at differing thresholds of composition of Black residents using an interaction term.	ACS	33,80,81,111
Ryan White Part A	The amount of Ryan White program funding (in millions) provided to a given Metropolitan Statistical Area each year. For five-year outcomes, funding was summed across all years.	HRSA	
Primary Care Provider Supply	The number of primary care providers in a county divided by the population of the county available from HRSA's Area Health Resource Files. For ZCTAs in more than one county, supply was weighted by the population of the ZCTA in each county. The variable was then categorized into high (≥50th percentile) versus low (<50th percentile) non-FQHC primary care supply.	HRSA	158

APPENDIX C

Use of Federally Qualified Health Centers and HIV Epidemic Indicators in Urban Communities with High Rates of HIV Diagnoses in the US South

Supplementary Material

Figure C1. Detailed Data Preparation and Sample Derivation

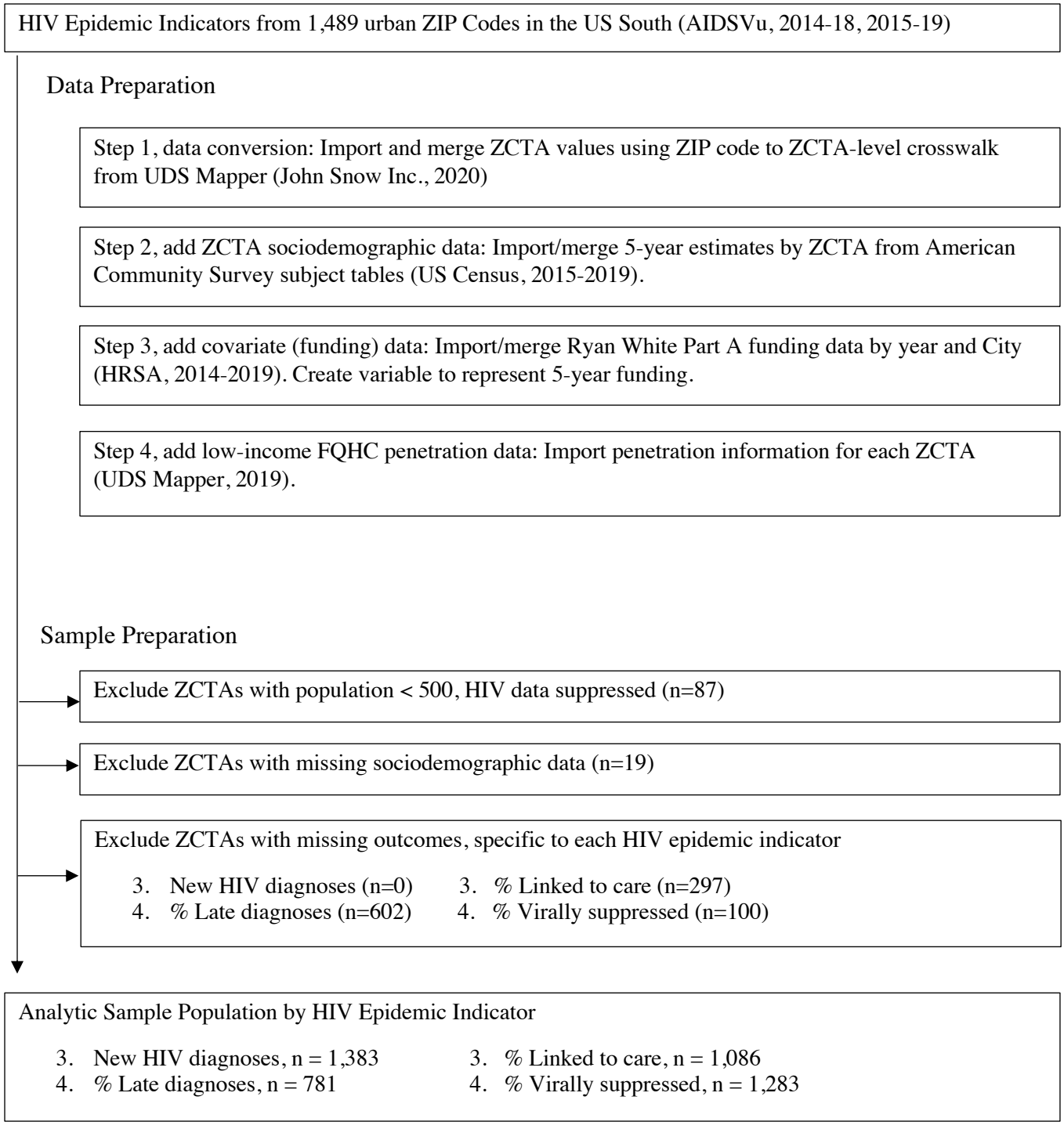

Figure C2. Model Specification

Cross-sectional analysis using linear regression model:

$$y_i = \beta_0 + \beta_1 FQHC\ Penetration_i + \beta_z Z_i + \mu + \varepsilon_i$$

Outcome y_i is a continuous variable representing the HIV epidemic indicator (e.g., new HIV diagnoses) for that ZCTA (i).

The explanatory variable is represented by *FQHC Penetration* for ZCTA (i) and β_1, represents the difference in outcome, y, associated with a 10%-point increase in FQHC penetration.

ZCTA-level sociodemographic and Ryan White HIV funding variables are represented by Z_i, where β_z, represents the difference in outcome, y, associated with a one unit increase in sociodemographic and HIV funding variable.

μ, indicates a state-specific effect.

Table C1. Summary of Analyses, HIV Epidemic Indicators and FQHC Penetration[*†]

	New HIV Diagnoses 5-Year		% Late Diagnosis 5-Year		% Linked to Care 5-Year		% Virally Suppressed 1-Year	
	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI	Coef.	95% CI
Baseline Analysis								
10-Percentage Point Increase, Penetration of Low-Income Population	0.42	-0.24, 1.05	-0.30	-0.84, 0.25	-0.24	-0.68, 0.20	0.42**	0.12, 0.72
Sensitivity Analyses								
Penetration of Uninsured	0.26	-0.20, 0.73	-0.39*	-0.72, -0.05	-0.16	-0.60, 0.28	0.08	-0.17, 0.33
Control County PCP Supply (Non-FQHC)	0.14	-0.51, 0.79	0.09	-1.57, 1.75	-0.05	-0.50, 0.40	0.45**	0.14, 0.76
Control FQHC Supply	-0.17	-0.86, 0.53	-0.05	-0.61, 0.52	-0.41	-0.87, 0.05	0.35*	0.03, 0.67
Exclude Highest HIV Prevalence ZCTAs	0.04	-0.22, 0.30	-0.24	-1.15, 0.66	-0.24	-0.84, 0.36	0.57**	0.18, 0.96
Exclude Florida ZCTAs	0.09	-0.68, 0.86	-0.57	-1.20, 0.06	-0.29	-0.81, 0.22	0.37*	0.005, 0.73
Exclude Lowest Poverty Rate ZCTAs	0.63	-0.17, 1.43	-0.68*	-1.23, -0.14	-0.15	-0.61, 0.32	0.15	-0.18, 0.48

[*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

[†] FQHC penetration represents the percent of the low-income population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C2. Uninsured Penetration, Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration[*†]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	0.26	-0.20, 0.73	0.269	-0.39	-0.72, -0.05	0.026	-0.16	-0.60, 0.28	0.470	0.08	-0.17, 0.33	0.547
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	-0.004	-0.007, -0.0002	0.037	0.0002	-0.002, 0.003	0.889	0.001	-0.001, 0.003	0.307
Total Low-Income Pop. (thousands)	1.82	1.64, 2.00	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.38	0.26, 0.50	<0.001	-0.02	-0.14, 0.10	0.749	0.03	-0.06, 0.12	0.475	-0.22	-0.28, -0.16	<0.001
% Uninsured	0.32	0.03, 0.60	0.028	-0.04	-0.26, 0.18	0.704	-0.22	-0.42, -0.03	0.022	0.07	-0.07, 0.21	0.323
% Unemployed	-0.19	-0.62, 0.24	0.389	0.12	-0.25, 0.49	0.522	-0.20	-0.51, 0.12	0.228	0.07	-0.16, 0.31	0.524
% Living in Poverty	0.45	0.25, 0.65	<0.001	-0.15	-0.31, -0.001	0.049	-0.16	-0.29, -0.02	0.020	-0.25	-0.35, -0.16	<0.0001
% High School Educated	0.64	0.45, 0.84	<0.001	-0.21	-0.37, -0.04	0.014	-0.13	-0.27, 0.008	0.064	0.03	-0.07, 0.13	0.558
Percent of Black ZCTA Residents ≥20%	2.43	-0.26, 5.12	0.076	0.36	-1.39, 2.12	0.685	-1.98	-3.53, -0.42	0.013	-1.77	-2.97, -0.56	0.004
City-Level Characteristics												
Ryan White Part A (millions)	0.14	0.10, 0.17	<0.001	-0.03	-0.05, -0.002	0.032	0.05	0.03, 0.07	<0.001	-0.06	-0.08, -0.05	<0.001

[*] New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). [†] Penetration of the uninsured represents the percent of the uninsured population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C3. Controlling for County-Level Primary Care Supply, Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration[*†]

	New HIV Diagnoses (n=1,383)			% Late Diagnoses (n=781)			% Linked to Care (n=1,086)			% Virally Suppressed (n=1,283)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	0.14	-0.51, 0.79	0.673	-0.35	-0.92, 0.21	0.222	-0.05	-0.50, 0.40	0.826	0.45	0.14, 0.76	0.004
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	0.69	-1.21, 2.58	0.476	0.0003	-0.002, 0.003	0.816	0.001	-0.001, 0.003	0.503
High PCP Supply[†]	5.64	3.20, 8.08	<0.001	-0.004	-0.007, -0.0003	0.033	-2.43	-4.00, -0.86	0.002	-0.56	-1.68, 0.57	0.331
Total Low-Income Pop. (thousands)	1.80	1.62, 1.99	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.34	0.22, 0.46	<0.001	-0.02	-0.14, 0.10	0.734	0.05	-0.04, 0.14	0.311	-0.22	-0.28, -0.16	<0.001
% Uninsured	0.37	0.09, 0.65	0.010	-0.01	-0.23, 0.21	0.928	-0.26	-0.45, -0.07	0.008	0.07	-0.06, 0.21	0.286
% Unemployed	-0.17	-0.60, 0.26	0.431	0.16	-0.22, 0.53	0.413	-0.23	-0.55, 0.09	0.160	0.05	-0.19, 0.28	0.700
% Living in Poverty	0.42	0.22, 0.62	<0.001	-0.18	-0.33, -0.03	0.022	-0.13	-0.26, 0.001	0.051	-0.24	-0.34, -0.15	<0.001
% High School Educated	0.63	0.44, 0.83	<0.001	-0.20	-0.37, -0.04	0.017	-0.14	-0.28, -0.0006	0.049	0.04	-0.05, 0.14	0.369
Percent of Black ZCTA Residents ≥20%	2.70	0.02, 5.37	0.048	0.44	-1.33, 2.22	0.623	-2.19	-3.74, -0.64	0.006	-1.73	-2.94, -0.53	0.005
City-Level Characteristics												
Ryan White Part A (millions)	0.15	0.11, 0.18	<0.001	-0.03	-0.05, -0.001	0.041	0.05	0.03, 0.07	<0.001	-0.06	-0.07, -0.05	<0.001

[*] New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). [†] High PCP Supply was defined as ZCTAs with county-level non-FQHC PCP Supply >50th percentile of county-level non-FQHC PCP supply for all ZCTAs (versus ≤ 50th percentile supply). [†] FQHC penetration represents the percent of the low-income population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C4. Control for ZCTA FQHC Supply, Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration*†

	New HIV Diagnoses (n=1,036)			% Late Diagnoses (n=451)			% Linked to Care (n=742)			% Virally Suppressed (n=937)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	-0.17	-0.86, 0.53	0.635	-0.05	-0.61, 0.52	0.872	-0.41	-0.87, 0.05	0.077	0.35	0.03, 0.67	0.033
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.09, 0.10	<0.001	-0.003	-0.01, -0.0001	0.041	0.0003	-0.002, 0.003	0.821	0.001	-0.001, 0.003	0.511
FQHC Supply	6.66	3.62, 9.71	<0.001	-3.81	-6.12, -1.49	0.001	2.36	0.39, 4.33	0.019	0.89	-0.52, 2.30	0.218
Total Low-Income Pop. (thousands)	1.86	1.67, 2.04	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.39	0.27, 0.51	<0.001	-0.01	-0.13, 0.10	0.822	0.03	-0.06, 0.12	0.506	-0.22	-0.28, -0.16	<0.001
% Uninsured	0.34	0.06, 0.62	0.017	-0.06	-0.27, 0.16	0.618	-0.19	-0.38, -0.0008	0.049	0.09	-0.04, 0.23	0.188
% Unemployed	-0.18	-0.61, 0.24	0.397	0.12	-0.25, 0.49	0.533	-0.16	-0.48, 0.16	0.326	0.06	-0.17, 0.29	0.600
% Living in Poverty	0.43	0.24, 0.63	<0.001	-0.15	-0.30, 0.01	0.061	-0.18	-0.31, -0.05	0.008	-0.26	-0.35, -0.16	<0.001
% High School Educated	0.65	0.46, 0.85	<0.001	-0.21	-0.38, -0.05	0.013	-0.13	-0.27, 0.01	0.079	0.05	-0.05, 0.14	0.350
Percent of Black ZCTA Residents ≥20%	2.88	0.20	5.56	0.13	-1.62, 1.89	0.881	-1.86	-3.42, -0.31	0.019	-1.65	-2.86, -0.44	0.007
City-Level Characteristics												
Ryan White Part A (millions)	0.12	0.08, 0.15	<0.001	-0.01	-0.03, 0.02	0.530	0.04	0.02, 0.07	<0.001	-0.06	-0.08, -0.05	<0.001

* New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). † FQHC penetration represents the percent of the low-income population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C5. Exclude Highest HIV Prevalence (>75th percentile) ZCTAs, Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration*†

	New HIV Diagnoses (n=1,036)			% Late Diagnoses (n=451)			% Linked to Care (n=742)			% Virally Suppressed (n=937)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	0.04	-0.22, 0.30	0.777	-0.24	-1.15, 0.66	0.597	-0.24	-0.84, 0.36	0.436	0.57	0.18, 0.96	0.004
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.19	0.18, 0.20	<0.001	0.02	-0.004, 0.04	0.101	-0.04	-0.05, -0.02	<0.001	-0.02	-0.03, -0.01	<0.001
Total Low-Income Pop. (thousands)	0.68	0.55, 0.80	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.12	0.07, 0.17	<0.001	-0.07	-0.27, 0.13	0.474	0.06	-0.06, 0.17	0.356	-0.16	-0.24, -0.08	<0.001
% Uninsured	0.09	-0.03, 0.21	0.127	0.02	-0.38, 0.42	0.934	-0.23	-0.52, 0.06	0.117	0.14	-0.05, 0.32	0.142
% Unemployed	-0.07	-0.24, 0.10	0.446	0.28	-0.35, 0.91	0.379	-0.27	-0.70, 0.15	0.206	-0.04	-0.33, 0.25	0.797
% Living in Poverty	0.005	-0.08, 0.09	0.896	-0.12	-0.37, 0.13	0.347	-0.10	-0.27, 0.07	0.264	-0.25	-0.37, -0.13	<0.001
% High School Educated	0.10	0.03, 0.18	0.009	-0.11	-0.39, 0.17	0.457	-0.16	-0.36, 0.03	0.104	0.05	-0.07, 0.18	0.390
Percent of Black ZCTA Residents ≥20%	-0.40	0.02, 0.05	0.519	-0.24	-3.27, 2.80	0.879	-0.92	-3.11, 1.26	0.408	-0.05	-1.67, 1.58	0.954
City-Level Characteristics												
Ryan White Part A (millions)	0.04	0.02, 0.05	<0.001	-0.03	-0.07, 0.01	0.202	0.06	0.03, 0.09	<0.001	-0.05	-0.07, -0.02	<0.001

* New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). † FQHC penetration represents the percent of the low-income population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C6. Exclude Florida ZCTAs, Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration*†

	New HIV Diagnoses (n=1,036)			% Late Diagnoses (n=451)			% Linked to Care (n=742)			% Virally Suppressed (n=937)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	0.09	-0.68, 0.86	0.820	-0.57	-1.20, 0.06	0.075	-0.29	-0.81, 0.22	0.263	0.37	0.005, 0.73	0.047
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.08	0.07, 0.09	<0.001	-0.01	-0.01, -0.002	0.004	-0.001	-0.004, 0.002	0.460	0.002	-0.001, 0.004	0.167
Total Low-Income Pop. (thousands)	2.00	1.76, 2.22	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.41	0.25, 0.56	<0.001	-0.01	-0.15, 0.14	0.936	0.14	0.03, 0.25	0.013	-0.21	-0.29, -0.13	<0.001
% Uninsured	0.13	-0.22, 0.48	0.474	-0.18	-0.43, 0.07	0.164	-0.27	-0.50, -0.04	0.019	0.10	-0.07, 0.27	0.246
% Unemployed	0.13	-0.37, 0.63	0.617	0.16	-0.24, 0.56	0.436	-0.18	-0.54, 0.18	0.328	0.15	-0.12, 0.42	0.264
% Living in Poverty	0.44	0.21, 0.67	<0.001	-0.17	-0.34, -0.0002	0.05	-0.19	-0.34, -0.05	0.012	-0.29	-0.40, -0.17	<0.001
% High School Educated	0.56	0.32, 0.80	<0.001	-0.27	-0.46, -0.09	0.004	-0.22	-0.39, -0.06	0.007	0.06	-0.06, 0.18	0.341
Percent of Black ZCTA Residents ≥20%	3.02	-0.20, 6.24	0.07	-1.18	-3.19, 0.83	0.249	-1.34	-3.14, 0.46	0.144	-1.19	-2.63, 0.24	0.104
City-Level Characteristics												
Ryan White Part A (millions)	0.10	0.05, 0.14	<0.001	-0.01	-0.04, 0.02	0.480	0.04	0.008, 0.06	0.011	-0.06	-0.08, -0.04	<0.001

* New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). † FQHC penetration represents the percent of the low-income population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C7. Exclude Lowest Poverty ZCTAs (≤25th percentile), Association of HIV Epidemic Indicators with a 10-percentage point increase in FQHC Penetration*†

	New HIV Diagnoses (n=1,036)			% Late Diagnoses (n=451)			% Linked to Care (n=742)			% Virally Suppressed (n=937)		
	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value	Coef.	95% CI	p-value
ZCTA FQHC Penetration												
10-percentage point increase in penetration	0.63	-0.17, 1.43	0.123	-0.68	-1.23, -0.14	0.014	-0.15	-0.61, 0.32	0.536	0.15	-0.18, 0.48	0.375
ZCTA Characteristics												
HIV Prevalence (cases /100k)	0.10	0.10, 0.11	<0.001	-0.004	-0.007, -0.001	0.022	-0.0002	-0.003, 0.002	0.886	0.001	-0.001, 0.003	0.523
Total Low-Income Pop. (thousands)	1.79	1.58, 2.01	<0.001	--	--	--	--	--	--	--	--	--
% Age 15-44	0.53	0.37, 0.69	<0.001	-0.02	-0.14, 0.10	0.765	-0.02	-0.12, 0.09	0.761	-0.20	-0.27, -0.12	<0.001
% Uninsured	0.24	-0.11, 0.59	0.184	-0.02	-0.24, 0.19	0.848	-0.14	-0.35, 0.06	0.159	-0.03	-0.18, 0.12	0.685
% Unemployed	-0.10	-0.64, 0.43	0.709	0.19	-0.19, 0.57	0.331	-0.21	-0.53, 0.12	0.209	0.10	-0.13, 0.34	0.393
% Living in Poverty	0.45	0.21, 0.70	<0.001	-0.19	-0.34, -0.03	0.018	-0.08	-0.22, 0.06	0.272	-0.28	-0.39, -0.18	<0.001
% High School Educated	0.59	0.35, 0.83	<0.001	-0.20	-0.36, -0.04	0.014	-0.07	-0.22, 0.08	0.349	-0.05	-0.16, 0.06	0.368
Percent of Black ZCTA Residents ≥20%	1.59	-1.64, 4.83	0.335	-0.41	-2.20, 1.37	0.648	-2.63	-4.27, -0.98	0.002	-2.31	-3.60, -1.01	<0.001
City-Level Characteristics												
Ryan White Part A (millions)	0.16	0.11, 0.20	<0.001	-0.02	-0.05, -0.001	0.042	0.06	0.04, 0.08	<0.001	-0.06	-0.07, -0.04	<0.001

* New HIV diagnoses, percent late diagnoses, and percent linked to care represent a 5-year period (2014-2019 or 2015-2019); percent virally suppressed represents a 1-year period (2018 or 2019). † FQHC penetration represents the percent of the low-income population in a ZCTA receiving services at any FQHC from FQHCs that saw 11 or more patients from that ZCTA.

Table C8. Definition of Key Variables

Variable Name	Definition	Source	References
Outcome Variables			
Number of new HIV Diagnoses	Total persons aged 13 years and older newly diagnosed with HIV infection (any stage) during a given 5-year time period.	AIDSVu	[97]
Percent Late HIV Diagnosis	Number of individuals aged 13 years and older who were diagnosed with HIV during a given five-year time period and were diagnosed with stage 3 HIV (AIDS) within 3 months of initial HIV diagnosis, divided by the number of individuals aged 13 years and older newly diagnosed with HIV in that period.	AIDSVu	[97]
Percent Linked to Care	Number of individuals aged 13 years and older diagnosed with HIV during a five-year period with a CD4 or HIV viral load within one month of initial diagnosis, per all individuals 13 years and older newly diagnosed with HIV over the same period.	AIDSVu	[97]
Percent Virally Suppressed	Number of individuals aged 13 years and older living with HIV in a given year (diagnosed as of year-end the previous year) and alive at the end of that year, whose most recently reported HIV viral load count in that year was <200 copies per ml. This was divided by individuals 13 years and older living with diagnosed HIV in a given year (excluding those newly diagnosed that year).	AIDSVu	[97]
Explanatory Variable			
FQHC Penetration	The percent of low-income individuals in a ZCTA that visited any FQHC for a service in 2019 of all estimated low-income individuals that resided in that ZCTA (2015-2019).	UDS Mapper	[135,139]
Control Variables			
HIV Prevalence	Number of persons aged 13 years and older living with HIV infection or persons living with HIV infection ever classified as stage 3 HIV (AIDS) at the end of a given year.	AIDSVu	
Percent aged 15-44 years	Percent of ZCTA population that is between 15-44 years old.	ACS	[29,108]
Percent with a high school education	Percent of the ZCTA population >25 years old with a high school (or equivalent) education.	ACS	[21–23,109,110]
Percent living in poverty	Percent of the total population living below the poverty threshold for whom poverty is assessed, excluding persons living in institutional group quarters (e.g., prisons or nursing homes), college dormitories, military barracks, situations without conventional housing (and who are not in shelters), and unrelated individuals <15 years.	ACS	[20–23,109]

Total low-income population	Total population living below 200% of the poverty threshold.	ACS	[5]
Percent uninsured	Percent of the total, non-institutionalized population without any form of health insurance coverage.	ACS	[21–23,109,110]
Percent unemployed	Percent of all civilians 16 years old who were 1) neither "at work" nor "with a job but not at work" during the reference week, and (2) were actively looking for work during the last 4 weeks, and (3) were available to start a job. Also included as unemployed are civilians who did not work at all during the reference week, were waiting to be called back to a job from which they had been laid off, and were available for work except for temporary illness.	ACS	[21–23,109,110]
Percent of Black ZCTA residents	Percent of the ZCTAs total population that identified as Non-Hispanic Black. The variable was codified to represent ZCTAs that had ≥20% Black residents; greater than composition of Black residents in the US South (19%).	ACS	[33,80,81,111]
Ryan White Part A	The amount of Ryan White program funding (in millions) provided to a ZCTA's associated Metropolitan Statistical Area each year. For five-year outcomes, funding was summed across all years.	HRSA	
Non-FQHC Primary Care Supply	The number of non-FQHC primary care providers in a county divided by the population of the county available from HRSA's Area Health Resource Files. For ZCTAs in more than one county, supply was weighted by the population of the ZCTA in each county. The variable was then categorized into high (≥50th percentile) versus low (<50th percentile) non-FQHC primary care supply.	HRSA	
FQHC Supply	The number of FQHCs per low-income population in the contiguous ZCTAs making up a ZCTA's Primary Care Service Area. The variable was then categorized into high (≥75th percentile) versus medium/low (< 75th percentile) FQHC density.	UDS Mapper	[107]

Appendix D

Stata code for all analyses

Paper 1 Data Preparation and Analysis

```
clear
cd"U:\Desktop data dump\NHIS Data Sets"
use "U:\Desktop data dump\NHIS Data Sets\nhis_00019.dta"
*Creation and recoding of variables of interest*

*Categorical var for year*
gen year_n=0 if year==2013
replace year_n=1 if year==2014
replace year_n=2 if year==2015
replace year_n=3 if year==2016
replace year_n=4 if year==2017
replace year_n=5 if year==2018

*Dummy variable for sexual orientation - gay or bisexual versus not gay or bisexual*
gen LGBT =0 if sexorien==2
replace LGBT=1 if sexorien==1|sexorien==3

*Region categorical variable
gen region1=1 if region==1
replace region1=2 if region==2
replace region1=3 if region==3
replace region1=4 if region==4

*Age categorical variable
gen age1=1 if age>17 & age<35
replace age1=2 if age>34 & age<45
replace age1=3 if age>44 & age<65

*Race and ethnicity variable
gen race1=. if racea==580
replace race1=1 if racea==100 & hispyn==1
replace race1=2 if racea==200 & hispyn==1
replace race1=4 if racea==310 & hispyn==1|racea==411 & hispyn==1|racea==412 &
hispyn==1|racea==416 & hispyn==1|racea==434 & hispyn==1|racea==600 & hispyn==1
replace race1=3 if hispyn==2

*Education categorical variable
gen educ1=. if educrec2==00|educrec2==97|educrec2==98|educrec2==99
replace educ1=1 if educrec2==51|educrec2==54|educrec2==60
replace educ1=0 if
educrec2==10|educrec2==20|educrec2==31|educrec2==32|educrec2==41|educrec2==42
```

```
*Employment categorical variable
gen employed1=. if empstat==0|empstat==997|empstat==998|empstat==999
replace employed1=1 if empstat==111|empstat==120
replace employed1=0 if empstat==112|empstat==200|empstat==220

* Health Insurance Dummy Variable
gen healthins=. if hinotcove==9
replace healthins=1 if hinotcove==1
replace healthins=0 if hinotcove==2|hinotcove==9

*Org based barriers*
gen delaywait1=. if delaywait==0|delaywait==7|delaywait==8|delaywait==9
replace delaywait1=1 if delaywait==2
replace delaywait1=0 if delaywait==1
gen delayphone1=. if delayphone==0|delayphone==7|delayphone==8|delayphone==9
replace delayphone1=1 if delayphone==2
replace delayphone1=0 if delayphone==1
gen delayhrs1=. if delayhrs==0|delayhrs==7|delayhrs==8|delayhrs==9
replace delayhrs1=1 if delayhrs==2
replace delayhrs1=0 if delayhrs==1
gen delayappt1=. if delayappt==0|delayappt==7|delayappt==8|delayappt==9
replace delayappt1=1 if delayappt==2
replace delayappt1=0 if delayappt==1

*Composite Org Barrier
gen OrgBasedBarriers=delaywait1+delayphone1+delayhrs1+delayappt1
gen OrgBasedBarriers1=1 if OrgBasedBarriers>0
replace OrgBasedBarriers1=0 if OrgBasedBarriers==0
replace OrgBasedBarriers1=. if delaywait1==.|delayphone1==.|delayhrs1==.|delayappt1==.

*Socially Determinant Variables
gen foodinsecurity=.
replace foodinsecurity=1 if fsstat==2|fsstat==3
replace foodinsecurity=0 if fsstat==1
gen housinginsec=. if wryhous==0|wryhous==7|wryhous==8|wryhous==9
replace housinginsec=1 if wryhous==1|wryhous==2
replace housinginsec=0 if wryhous==3|wryhous==4
gen delaytrans1=. if delaytrans==0|delaytrans==7|delaytrans==8|delaytrans==9
replace delaytrans1=1 if delaytrans==2
replace delaytrans1=0 if delaytrans==1

*Composite Socially Determinant Variable
```

```
gen SocDetBarrier=foodinsecurity+housinginsec+delaytrans1
replace SocDetBarrier=. if foodinsecurity==.|housinginsec==.|delaytrans1==.
gen SocDetBarrier1=1 if SocDetBarrier>0
replace SocDetBarrier1=0 if SocDetBarrier==0
replace SocDetBarrier1=. if SocDetBarrier==.
gen SocDetBarrier2=1 if SocDetBarrier>1
replace SocDetBarrier2=0 if SocDetBarrier<2
replace SocDetBarrier2=. if SocDetBarrier==.

*Outcome Measures Main Analysis

*Has any usual place of care*
gen hasusualpl=. if usualpl==7|usualpl==8|usualpl==9
replace hasusualpl=1 if usualpl==2|usualpl==3
replace hasusualpl=0 if usualpl==1

*Primary Care Specific Usual Place of Care
gen usualpl_PC=1 if hasusualpl==1 & typplsick==110|hasusualpl==1 & typplsick==120
replace usualpl_PC=0 if hasusualpl==0|hasusualpl==1 & typplsick==200|hasusualpl==1 &
typplsick==300|hasusualpl==1 & typplsick==480|hasusualpl==1 & typplsick==500

*Type of usual place
gen typeusualsource1=. if typplsick==000|typplsick==997|typplsick==998|typplsick==999
replace typeusualsource1=1 if typplsick==110
replace typeusualsource1=2 if typplsick==120
replace typeusualsource1=3 if typplsick==200
replace typeusualsource1=4 if typplsick==300
replace typeusualsource1=5 if typplsick==480|typplsick==500

*Last saw primary care doctor < 12 months variable
gen sawgen1=1 if sawgen==2
replace sawgen1=0 if sawgen==1
replace sawgen1=. if sawgen==0|sawgen==7|sawgen==8|sawgen==9

*Sensitivity Analysis
*Usual Place Clinic Health Center Dr Office or HMO among has usual place
gen Clinic_HC_Dr_HMO=1 if typplsick==110|typplsick==120
replace Clinic_HC_Dr_HMO=0 if
typplsick==200|typplsick==300|typplsick==480|typplsick==500
replace Clinic_HC_Dr_HMO=. if typeusualsource1==.

*Interval since last saw physician variable
gen anydr=1 if dvint==203|dvint==204
```

```
replace anydr=0 if dvint==302|dvint==305|dvint==400|dvint==100
replace anydr=. if dvint==997|dvint==998|dvint==999

*Analysis*

*SET POPULATION AND WEIGHTING BY YEAR*
*weighting adjustments for multiple years
gen adjweight_p=perweight/6
gen adjweight_s=sampweight/6
gen adjweight_hh=hhweight/6

*COMBINING RACE AND ETHNICITY
*Defining Non-Hispanic Black and Hispanic individuals*
gen minority=. if racea==580
replace minority=1 if racea==200|hispyn==2
replace minority=0 if racea==100 & hispyn==1
count if minority==1

*DEFINING SAMPLE POPULATION MAIN ANALYSIS*
*Population of interest
gen Minority_and_White_MSM_18to64_i=1 if (racea==100 &
hispyn==1|racea==200|hispyn==2) & LGBT==1 & age>17 & age<65 & sex==1
replace Minority_and_White_MSM_18to64_i=0 if Minority_and_White_MSM_18to64_i==.
count if Minority_and_White_MSM_18to64_i==1

*Initial exclusions and counts
count if Minority_and_White_MSM_18to64_i==1 & cerebpalev==2
count if Minority_and_White_MSM_18to64_i==1 & cysticfiev==2
count if Minority_and_White_MSM_18to64_i==1 & downsynev==2
count if Minority_and_White_MSM_18to64_i==1 & muscdystev==2
count if Minority_and_White_MSM_18to64_i==1 & sicklcelev==2

*Counts for missing sociodemographic variables*
count if Minority_and_White_MSM_18to64_i==1 & educ1==.
count if Minority_and_White_MSM_18to64_i==1 & employed1==.
count if Minority_and_White_MSM_18to64_i==1 & income1==.
count if Minority_and_White_MSM_18to64_i==1 & age1==.
count if Minority_and_White_MSM_18to64_i==1 & minority==.
count if Minority_and_White_MSM_18to64_i==1 & region1==.
count if Minority_and_White_MSM_18to64_i==1 & healthstatus1==.
count if Minority_and_White_MSM_18to64_i==1 & MHstatus1==.
count if Minority_and_White_MSM_18to64_i==1 & chronicdiseasetotal==.
count if Minority_and_White_MSM_18to64_i==1 & healthins==.
```

```
count if Minority_and_White_MSM_18to64_i==1 & OrgBasedBarriers1==.
count if Minority_and_White_MSM_18to64_i==1 & SocDetBarrier1==.
count if Minority_and_White_MSM_18to64_i==1 & hasusualpl==.
count if Minority_and_White_MSM_18to64_i==1 & typeusualsource1==.
count if Minority_and_White_MSM_18to64_i==1 & sawgen1==.
count if Minority_and_White_MSM_18to64_i==1 & anydr==.


*FINAL SAMPLE*
gen Minority_and_White_MSM_18to64=1 if (racea==100 & hispyn==1|racea==200|hispyn==2)
& LGBT==1 & age>17 & age<65 & sex==1 & educ1!=. & employed1!=. & hasusualpl!=. &
OrgBasedBarriers1!=. & SocDetBarrier1!=. & sawgen1!=. & anydr!=.
replace Minority_and_White_MSM_18to64=0 if Minority_and_White_MSM_18to64==.
count if Minority_and_White_MSM_18to64==1

*INITIAL DATA ANALYSIS *

*Frequency weighted usual and  type of place
svyset psu [pweight=adjweight_s], strata(strata)
summarize usualpl
svy, subpop(Minority_and_White_MSM_18to64):tab usualpl minority, column
svy, subpop(Minority_and_White_MSM_18to64):tab usualpl, column
svy, subpop(Minority_and_White_MSM_18to64):tab hasusualpl minority, column
svy, subpop(Minority_and_White_MSM_18to64):tab hasusualpl, column
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick minority, column
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick, column
svy, subpop(Minority_and_White_MSM_18to64):tab usualpl_PC, column

*Percentage type of place of usual care by usual place status
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick usualpl, column
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick usualpl if minority==0, column
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick usualpl if minority==1, column

*Usual place by Dr/HMO/CHC place
svy, subpop(Minority_and_White_MSM_18to64): tab Clinic_HC_Dr_HMO usualpl, column
count if Minority_and_White_MSM_18to64==1 & minority==1 & typplsick==0
count if Minority_and_White_MSM_18to64==1 & minority==0 & typplsick==0
svy, subpop(Minority_and_White_MSM_18to64): tab Clinic_HC_Dr_HMO usualpl if
minority==1,column
svy, subpop(Minority_and_White_MSM_18to64): tab Clinic_HC_Dr_HMO usualpl if
minority==0, column

*Frequency (weighted) saw general doctor and any doctor*
```

```
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen, column
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen minority, column
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen1, column
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen1 minority, column

*Saw a general doctor by usual place*
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen hasusualpl, column
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen hasusualpl if minority==1, column
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen hasusualpl if minority==0, column

*interval since last saw any physician by race/ethnicity*
svy, subpop(Minority_and_White_MSM_18to64):tab dvint minority,column
svy, subpop(Minority_and_White_MSM_18to64):tab anydr minority,column

*Frequency saw general doctor and any doctor cross tab*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab dvint sawgen, column
svy, subpop(Minority_and_White_MSM_18to64):tab dvint sawgen, column
svy, subpop(Minority_and_White_MSM_18to64):tab dvint sawgen if minority==1, column
svy, subpop(Minority_and_White_MSM_18to64):tab dvint sawgen if minority==0, column

*Usual source of care, no sawgen but have utilized care in < 12 months*
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick minority if sawgen1==0 &
(dvint==23|dvint==24), column

*Type of usual source of care for those who saw a general physician in past 12 months*
svy, subpop(Minority_and_White_MSM_18to64):tab typplsick minority if sawgen1==1, column

*Any dr vs. sawgen*
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen anydr, row
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen anydr if minority==0, row
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen anydr if minority==1, row

*Frequency of sample populations by year and total count
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority
svy, subpop(Minority_and_White_MSM_18to64):tab minority if year==2013
svy, subpop(Minority_and_White_MSM_18to64):tab minority if year==2014
svy, subpop(Minority_and_White_MSM_18to64):tab minority if year==2015
svy, subpop(Minority_and_White_MSM_18to64):tab minority if year==2016
svy, subpop(Minority_and_White_MSM_18to64):tab minority if year==2017
svy, subpop(Minority_and_White_MSM_18to64):tab minority if year==2018
```

```
count if Minority_and_White_MSM_18to64==1 & minority==1
count if Minority_and_White_MSM_18to64==1 & minority==1 & year==2013
count if Minority_and_White_MSM_18to64==1 & minority==1 & year==2014
count if Minority_and_White_MSM_18to64==1 & minority==1 & year==2015
count if Minority_and_White_MSM_18to64==1 & minority==1 & year==2016
count if Minority_and_White_MSM_18to64==1 & minority==1 & year==2017
count if Minority_and_White_MSM_18to64==1 & minority==1 & year==2018

*Frequency and count of variables of interest by race*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority hasusualpl, column
svy, subpop(Minority_and_White_MSM_18to64):tab minority sawgen1, column
svy, subpop(Minority_and_White_MSM_18to64):tab minority anydr, column

*Age distribution and histogram weighted with final basic annual weight*
gen int_adjweight=int(adjweight)
histogram age if Minority_and_White_MSM_18to64==1 [fw=int_adjweight], percent bin (50)
histogram age if Minority_and_White_MSM_18to64==1 & minority==0 [fw=int_adjweight],
percent bin (50)
histogram age if Minority_and_White_MSM_18to64==1 & minority==1 [fw=int_adjweight],
percent bin (50)

sum age if Minority_and_White_MSM_18to64==1 [weight=adjweight], detail
sum age if Minority_and_White_MSM_18to64==1 & minority==1 [weight=adjweight], detail
sum age if Minority_and_White_MSM_18to64==1 & minority==0 [weight=adjweight], detail

*Histogram Income original*
histogram incimp1 if Minority_and_White_MSM_18to64==1, percent bin(10)
histogram incimp1 if Minority_and_White_MSM_18to64==1 [fw=int_adjweight], percent bin
(10)
histogram incimp1 if Minority_and_White_MSM_18to64==1 & minority==0
[fw=int_adjweight], percent bin (10)
histogram incimp1 if Minority_and_White_MSM_18to64==1 & minority==1
[fw=int_adjweight], percent bin (10)
sum incimp1 if Minority_and_White_MSM_18to64==1 [weight=adjweight], detail
sum incimp1 if Minority_and_White_MSM_18to64==1 & minority==1 [weight=adjweight],
detail
sum incimp1 if Minority_and_White_MSM_18to64==1 & minority==0 [weight=adjweight],
detail

*Histogram Income recode*
```

```
histogram income1 if Minority_and_White_MSM_18to64==1 [fw=int_adjweight], percent
bin(5) xlabel(1 "<15k" 2 "15-34,999" 3 "35-54999" 4 "55-74999" 5 "75-99999" 6 ">100")
histogram income1 if Minority_and_White_MSM_18to64==1 & minority==0
[fw=int_adjweight], percent bin(5) xlabel(1 "<15k" 2 "15-34,999" 3 "35-54999" 4 "55-74999" 5
"75-99999" 6 ">100")
histogram income1 if Minority_and_White_MSM_18to64==1 & minority==1
[fw=int_adjweight], percent bin(5) xlabel(1 "<15k" 2 "15-34,999" 3 "35-54999" 4 "55-74999" 5
"75-99999" 6 ">100")

*Recode Income by percentage*
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab income1 minority, column
svy, subpop(Minority_and_White_MSM_18to64):tab income1, column

*Distribution and summary stats HH size*
svyset psu [pweight=adjweight], strata(strata)
gen int_adjweight=int(adjweight)
histogram numprec if Minority_and_White_MSM_18to64==1 [fw=int_adjweight], percent bin
(10)
histogram numprec if Minority_and_White_MSM_18to64==1 & minority==0
[fw=int_adjweight], percent bin (10)
histogram numprec if Minority_and_White_MSM_18to64==1 & minority==1
[fw=int_adjweight], percent bin (10)
sum numprec if Minority_and_White_MSM_18to64==1 [weight=adjweight], detail
sum numprec if Minority_and_White_MSM_18to64==1 & minority==1 [weight=adjweight],
detail
sum numprec if Minority_and_White_MSM_18to64==1 & minority==0 [weight=adjweight],
detail
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab numprec, column
svy, subpop(Minority_and_White_MSM_18to64):tab numprec minority, column

*Organization based barriers*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64): tab OrgBasedBarriers1 minority, column
svy, subpop(Minority_and_White_MSM_18to64): tab delayappt1 minority, column
svy, subpop(Minority_and_White_MSM_18to64): tab delayhrs1 minority, column
svy, subpop(Minority_and_White_MSM_18to64): tab delayphone1 minority, column
svy, subpop(Minority_and_White_MSM_18to64): tab delaywait1 minority, column

*Social det based barriers*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64): tab SocDetBarrier1 minority, column
```

```
svy, subpop(Minority_and_White_MSM_18to64): tab foodinsecurity minority, column
svy, subpop(Minority_and_White_MSM_18to64): tab housinginsec minority, column
svy, subpop(Minority_and_White_MSM_18to64): tab delaytrans1 minority, column

**DESCRIPTIVE STATISTICS**

*Descriptives Weight Set and Pop Defined
*Weight adjustment for each type of sampling weight over 6 years of data
gen adjweight_p=perweight/6
gen adjweight_s=sampweight/6
gen adjweight_hh=hhweight/6

*Descriptive Statistiics, full sample
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab age1, ci
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab educ1, ci
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab employed1, ci
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab income1, ci
svyset psu [pweight=adjweight_hh], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab region1, ci
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab healthstatus1, ci
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab healthins, ci
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab OrgBasedBarriers1, ci
svy, subpop(Minority_and_White_MSM_18to64):tab SocDetBarrier1, ci

*Outcome Measures Unadjusted NH White and NH Black/Hispanic MSM Main analysis
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab usualpl_PC, ci
svy, subpop(Minority_and_White_MSM_18to64):tab sawgen1, ci

*Outcome Measures Unadjusted NH White and NH Black/Hispanic MSM Sensitivity Analysis
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab Clinic_HC_Dr_HMO, ci row
svy, subpop(Minority_and_White_MSM_18to64):tab hasusualpl, ci row
svy, subpop(Minority_and_White_MSM_18to64):tab anydr, ci row

*Descriptive Statistics, F-test MSM NH White and NH Black/Hispanic
```

```
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority age1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority educ1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority employed1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority income1, ci row
svyset psu [pweight=adjweight_hh], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority region1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority healthstatus1, ci row
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority healthins, ci row
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority OrgBasedBarriers1, ci row
svy, subpop(Minority_and_White_MSM_18to64):tab minority SocDetBarrier1, ci row

*Outcome Measures Unadjusted NH White and NH Black/Hispanic MSM Main analysis
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority usualpl_PC, ci row
svy, subpop(Minority_and_White_MSM_18to64):tab minority sawgen1, ci row

*Outcome Measures Unadjusted NH White and NH Black/Hispanic MSM Sensitivity Analysis
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):tab minority hasusualpl, ci row
svy, subpop(Minority_and_White_MSM_18to64):tab minority anydr, ci row
svy, subpop(Minority_and_White_MSM_18to64):tab minority Clinic_HC_Dr_HMO, ci row

*Adjusted Outcomes - Logistical Regression
gen adjweight_p=perweight/6
gen adjweight_s=sampweight/6
gen adjweight_hh=hhweight/6

*Regression -- Main Analysis

** Primary Care Specific Usual Place of Care*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):logistic usualpl_PC i.minority i.age1
i.employed1 i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1
i.SocDetBarrier i.healthins
svylogitgof
```

```
*Saw General Doctor < 12 months*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):logistic sawgen1 i.minority i.age1
i.employed1 i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1
i.SocDetBarrier1 i.healthins
svylogitgof

*Sensitivity Analysis*
*Has ANY Usual Place of Care*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):logistic hasusualpl i.minority i.employed1
i.age1 i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1 i.SocDetBarrier1
i.healthins
svylogitgof

*Has seen ANY doctor <12 months*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(Minority_and_White_MSM_18to64):logistic anydr i.minority i.age1 i.employed1
i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1 i.SocDetBarrier1 i.healthins
svylogitgof

*Has Usual Place AND is primary care specific*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop (Minority_and_White_MSM_18to64):logistic Clinic_HC_Dr_HMO i.minority
i.age1 i.employed1 i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1
i.SocDetBarrier1 i.healthins
svylogitgof

*Subsample analysis - NHB NHW*
*Sample Population Derivation -- NHB versus NHW*
gen NHB_NHW_MSM_18to64=1 if (racea==100 & hispyn==1|racea==200 & hispyn==1) &
LGBT==1 & age>17 & age<65 & sex==1 & educ1!=. & employed1!=. & hasusualpl!=. &
OrgBasedBarriers1!=. & SocDetBarrier1!=. & sawgen1!=. & anydr!=.
replace NHB_NHW_MSM_18to64=0 if NHB_NHW_MSM_18to64==.
count if NHB_NHW_MSM_18to64==1
count if NHB_NHW_MSM_18to64==1 & minority==1

*Descriptive Statistics, F-test MSM NH White and NH Black*
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority age1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority educ1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
```

```
svy, subpop(NHB_NHW_MSM_18to64):tab minority employed1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority income1, ci row
svyset psu [pweight=adjweight_hh], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority region1, ci row
svyset psu [pweight=adjweight_p], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority healthstatus1, ci row
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority healthins, ci row
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority OrgBasedBarriers1, ci row
svy, subpop(NHB_NHW_MSM_18to64):tab minority SocDetBarrier1, ci row

*Outcome Measures Unadjusted NH White and NH Black/Hispanic MSM Main analysis*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority usualpl_PC, ci row
svy, subpop(NHB_NHW_MSM_18to64):tab minority sawgen1, ci row

*Outcome Measures Unadjusted NH White and NH Black/Hispanic MSM Sensitivity Analysis*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):tab minority hasusualpl, ci row
svy, subpop(NHB_NHW_MSM_18to64):tab minority anydr, ci row
svy, subpop(NHB_NHW_MSM_18to64):tab minority Clinic_HC_Dr_HMO, ci row

*Adjusted Outcomes - Logistical Regression
gen adjweight_p=perweight/6
gen adjweight_s=sampweight/6
gen adjweight_hh=hhweight/6

*Main outcomes NHB vs NHW*
*Usual Place Primary Care*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):logistic usualpl_PC i.minority i.age1 i.employed1
i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1 i.SocDetBarrier1 i.healthins
svylogitgof

*Saw Primary Care < 12 months*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop(NHB_NHW_MSM_18to64):logistic sawgen1 i.minority i.age1 i.employed1 i.educ1
i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1 i.SocDetBarrier1 i.healthins
svylogitgof

*Sensitivity Analysis*
```

```
*Any usual place*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop (NHB_NHW_MSM_18to64):logistic hasusualpl i.minority i.age1 i.employed1
i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1 i.SocDetBarrier1 i.healthins
svylogitgof

*Any doctor*
svy, subpop(NHB_NHW_MSM_18to64):logistic anydr i.minority i.age1 i.employed1 i.educ1
i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1 i.SocDetBarrier1 i.healthins
svylogitgof

*Primary Care doctor if have a usual place*
svyset psu [pweight=adjweight_s], strata(strata)
svy, subpop (NHB_NHW_MSM_18to64):logistic Clinic_HC_Dr_HMO i.minority i.age1
i.employed1 i.educ1 i.income1 i.region i.healthstatus1 i.year i.OrgBasedBarriers1
i.SocDetBarrier1 i.healthins
svylogitgof

*Sample Count*
*total sample all years*
clear
cd"C:\Users\kiernanjs\Desktop\NHIS Data Sets"
use "C:\Users\kiernanjs\Desktop\NHIS Data Sets\nhis_00019.dta"
*run full code from above
drop if year==2010|year==2011|year==2012
drop if sex==2
drop if age<18|age>64
keep if sexorien==1|sexorien==3
keep if race1==1|race1==2|race1==3
drop if
educ1==.|employed1==.|hasusualpl==.|OrgBasedBarriers1==.|SocDetBarrier1==.|sawgen1==.|an
ydr==.

*Final sample excluding observations with missing variables
gen Minority_and_White_MSM_18to64=1 if (racea==100 & hispyn==1|racea==200|hispyn==2)
& LGBT==1 & age>17 & age<65 & sex==1 & educ1!=. & employed1!=. & hasusualpl!=. &
OrgBasedBarriers1!=. & SocDetBarrier1!=. & sawgen1!=. & anydr!=.
replace Minority_and_White_MSM_18to64=0 if Minority_and_White_MSM_18to64==.
count if Minority_and_White_MSM_18to64==1

*Exclusion criteria -- COUNT
count if Minority_and_White_MSM_18to64_i==1 & cerebpalev==2
count if Minority_and_White_MSM_18to64_i==1 & cysticfiev==2
```

```
count if Minority_and_White_MSM_18to64_i==1 & downsynev==2
count if Minority_and_White_MSM_18to64_i==1 & muscdystev==2
```

Paper 2 and Paper 3 – Data Assembly and Cleaning

```
*Dissertation Data Set*
*Paper 1 and 2*

*Data Merging/Cleaning*
*Import ZIP to ZCTA Crosswalk
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\ZIP to ZCTA.xlsx",
sheet("ziptozcta2020") firstrow clear

*Save as DTA
save "U:\Projects_and_Assignments\Dissertation\Data Resources\ZIP to ZCTA.dta"
*destring ZIP and ZCTA okay bc not using zips that start with zero
destring ZIPCODE, replace
ZIPCODE: all characters numeric; replaced as long
destring ZCTA, replace
ZCTA: all characters numeric; replaced as long
save "U:\Projects_and_Assignments\Dissertation\Data Resources\ZIP to ZCTA.dta"

 *Import AIMS Data Set from Excel
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1
and 2.xlsx", sheet("Sheet1") cellrange(A1:W1491) firstrow clear
*identify duplicates
sort ZIPCODE
quietly by ZIPCODE: gen dup = cond(_N==1,0,_n)
tabulate dup

*Delete duplicate observation where ZIP 78655 is included for both San Antonio and Austin
drop if ZIPCODE==78655 & CITY=="San Antonio"
drop dup
drop ZCTA

*Merge with ZIP/ZCTA crosswalk
merge 1:m ZIPCODE using "U:\Projects_and_Assignments\Dissertation\Data Resources\ZIP to
ZCTA.dta"

*drop string variables for ZIP code and ZCTA
drop ZIPCODE_1
drop ZCTA_1
drop _merge
```

```
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ZCTA.dta

*import population data, total by age by race
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS POP EST TOTAL AGE RACE ETH.xlsx", sheet("ACS POP EST TOTAL AGE RACE ETH") firstrow

* destring values
destring ZCTAonly, replace
destring TPMOE, replace force
destring PercentSEXANDAGETotalpopu, replace force
destring PercentMarginofErrorSEXAND, replace force
destring MEDIANYRS, replace force
destring MEDMOE, replace force
destring PERCWHITE, replace force
destring WHITEMOE, replace force
destring PERCBLACK, replace force
destring BLACKMOE, replace force
destring PERCHISP, replace force
destring HISPMOE, replace force
*drop variables not needed
drop G H I J K L

*rename ZCTA variables
gen ZCTA=ZCTAonly
*Merge POP Data with existing data set
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\AIMS merged_1.xls", sheet("Sheet1") firstrow clear
merge 1:1 ZCTA using "U:\Projects_and_Assignments\Dissertation\Data Resources\POP DATA FOR MERGER.dta"

*Drop data not matched to ZCTA
drop if ZIPCODE==.
*drop merged var
drop _merge

*Save file
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ZCTA_POP.dta"

*Merge Poverty and Med Income data
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ZCTA_POP.dta"
```

```
merge 1:1 ZCTA using "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS MED
INC.dta"
drop _merge
drop if ZIPCODE==.
merge 1:1 ZCTA using "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS PERC
POV.dta"
drop if ZIPCODE==.
sort CITY

*drop variables that aren't needed
drop NAME
drop _merge
drop X
drop GeographicAreaName
drop PercentSEXANDAGETotalpopu
drop PercentMarginofErrorSEXAND

*rename var for margin of error 15-44 perc of pop.
gen PERC15to44MOE=to44MOE
drop to44MOE

*Import Uninsured File ACS
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS
UNInSURED.xlsx", sheet("ACSST5Y2019.S2701_data_with_ove") firstrow
*Destring variables
destring ZCTA, replace force
destring PERCUNINS, replace force
destring MOEUNS, replace force
save "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS UNINSURED.dta"

*merge to existing dataset
clear
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_ZCTA_POP_INC_POV"
merge 1:1 ZCTA using "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS
UNINSURED.dta"

*drop ZCTAs not used
drop if ZIPCODE==.
*drop variables not needed
drop NAME
drop _merge
```

```
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_ZCTA_POP_INC_POV_UNINS.dta"

*import unemployment dataset
clear
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS UNEMP.xlsx",
sheet("ACSST5Y2019.S2301_data_with_ove") firstrow
*destring variables
destring ZCTA, replace force
destring UNEMPRATE16PLUS, replace force
destring MOEUNEMP, replace force
save "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS UNEMP.dta"

*merge with existing datata
clear
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_ZCTA_POP_INC_POV_UNINS.dta"
merge 1:1 ZCTA using "U:\Projects_and_Assignments\Dissertation\Data Resources\ACS
UNEMP.dta"

*drop ZCTAs not used
drop if ZIPCODE==.
*drop variables not needed
drop NAME
drop _merge

*SAVE ACS Merger Complete
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_ACS_merged.dta"

*drop variables included in AIDSVU
drop PERCPOV
drop POVMOE
drop MEDINC
save

*import RUCA codes
import excel "U:\Projects_and_Assignments\Dissertation\Data
Resources\RUCA2010zipcode.xlsx", sheet("Data") firstrow clear

*drop ZIPCODE field that designates type of area
drop ZIPCODE
*rename ZIP_CODE to ZIPCODE
```

```
gen ZIPCODE=ZIP_CODE
*destring ZIPCODE
destring ZIPCODE, replace force

*save file
save "U:\Projects_and_Assignments\Dissertation\Data Resources\RUCA2010zipcode.dta"
*Merge with current dataset by ZIPCODE
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_ACS_merged.dta"
merge 1:1 ZIPCODE using "U:\Projects_and_Assignments\Dissertation\Data
Resources\RUCA2010zipcode.dta"

*drop variables not needed
drop ZIP_CODE
drop _merge
drop if ZCTA==.
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_ACS_merged with RUCA.dta"

*create categorical variable for CITY'
gen CITY_CAT=1 if CITY=="Washington"
replace CITY_CAT=2 if CITY=="Hampton Roads"
replace CITY_CAT=3 if CITY=="Raleigh"
replace CITY_CAT=4 if CITY=="Charlotte"
replace CITY_CAT=5 if CITY=="Columbia"
replace CITY_CAT=6 if CITY=="Charleston"
replace CITY_CAT=7 if CITY=="Atlanta"
replace CITY_CAT=8 if CITY=="Jacksonville"
replace CITY_CAT=9 if CITY=="Orlando"
replace CITY_CAT=10 if CITY=="Broward County"
replace CITY_CAT=11 if CITY=="Miami-Dade"
replace CITY_CAT=12 if CITY=="Palm Beach County"
replace CITY_CAT=13 if CITY=="Tampa"
replace CITY_CAT=14 if CITY=="Jackson"
replace CITY_CAT=15 if CITY=="New Orleans"
replace CITY_CAT=16 if CITY=="BatonRouge"
replace CITY_CAT=17 if CITY=="Dallas"
replace CITY_CAT=18 if CITY=="Fort Worth"
replace CITY_CAT=19 if CITY=="Austin"
replace CITY_CAT=20 if CITY=="Houston"
replace CITY_CAT=21 if CITY=="San Antonio"

*Import Ryan White Variables
```

```
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\RW Funding by MSA.xlsx", sheet("Sheet1") firstrow clear
save "U:\Projects_and_Assignments\Dissertation\Data Resources\RW Funding by MSA.dta"

*Merge data by MSA
clear
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ACS_merged with RUCA.dta"
merge m:1 CITY_CAT using "U:\Projects_and_Assignments\Dissertation\Data Resources\RW Funding by MSA.dta"

*Set unmatched MSAs to 0 dollars
replace RW_A_2014=0 if RW_A_2014==.
replace RW_A_2015=0 if RW_A_2015==.
replace RW_A_2016=0 if RW_A_2016==.
replace RW_A_2017=0 if RW_A_2017==.
replace RW_A_2018=0 if RW_A_2018==.
replace RW_A_2019=0 if RW_A_2019==.
replace RW_A_2014to2018=0 if RW_A_2014to2018==.
replace RW_A_2015to2019=0 if RW_A_2015to2019==.

*Drop variables not needed
drop _merge
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ACS_merged with RUCA_RWA.dta"

*import UDS Mapper dataset
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\UDSMapper_ZCTA_11-1-2021_1032am_Exp VARS.xlsx", sheet("UDSMapper_ZCTA_11-1-2021_1032am") firstrow clear

*destring variables
destring HCPPenetrationofLowIncome, replace force
destring HCPPenetrationofTotalPopula, replace force

*Set null values to 0
replace HCPPenetrationofLowIncome=0 if HCPPenetrationofLowIncome==.
replace HCPPenetrationofTotalPopula=0 if HCPPenetrationofTotalPopula==.
save "U:\Projects_and_Assignments\Dissertation\Data Resources\EXP_VARS.dta"

*merge to existing dataset
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ACS_merged with RUCA_RWA.dta"
```

```
merge 1:1 ZCTA using "U:\Projects_and_Assignments\Dissertation\Data Resources\EXP_VARS.dta"

*drop unused variables
drop if ZIPCODE==.

*remove extra vars
drop _merge

*save dataset
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_ACS_merged with RUCA_RWA_EXP VAR.dta"

*export to excel
export excel using "U:\Projects_and_Assignments\Dissertation\Data Resources\Final Data Set_1.xls"

*import Ryan White Part B funding
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\RW Funding by MSA.xlsx", sheet("Sheet2") firstrow clear

*save as DTA
save "U:\Projects_and_Assignments\Dissertation\Data Resources\RW Funding by MSA_and B.dta"

*import current version of full dataset
import excel "U:\Projects_and_Assignments\Dissertation\Data Resources\Final Data Set_1.xls", sheet("Sheet1") firstrow clear

*save as dta
save "U:\Projects_and_Assignments\Dissertation\Data Resources\Almost Final.dta"
use "U:\Projects_and_Assignments\Dissertation\Data Resources\Almost Final.dta"
gen State_Code=1 if STATE=="DC"
replace State_Code=2 if STATE=="VA"
replace State_Code=3 if STATE=="NC"
replace State_Code=4 if STATE=="SC"
replace State_Code=5 if STATE=="GA"
replace State_Code=6 if STATE=="FL"
replace State_Code=7 if STATE=="MS"
replace State_Code=8 if STATE=="LA"
replace State_Code=9 if STATE=="TX"

*merge Part B Data by State_code
```

```
merge m:1 State_Code using "U:\Projects_and_Assignments\Dissertation\Data Resources\RW Funding by MSA_and B.dta"

*drop variables not used or repeat
drop State
drop _merge

*save dataset
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_Final Data Set.dta"

use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_Final Data Set.dta"
sort STATE

*Defining Exclusions*
use "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and 2_Final Data Set.dta"
count if TotalPopulation<500
gen Exclude_1=1 if TotalPopulation<500
replace Exclude_1=0 if TotalPopulation>=500
count if PREVBYZIP==-1 & Exclude_1!=1
gen Exclude_2=1 if PERCUNINS==.|UNEMPRATE16PLUS==.|MEDIANHHI==-9|PERCPOVERTY==-9
replace Exclude_2=0 if Exclude_2==.
count if Exclude_2==1
count if Exclude_1==1
count if Exclude_1==1 & Exclude_2==1
gen Exclude_3=1 if Exclude_1==1|Exclude_2==1
replace Exclude_3=0 if Exclude_3==.
count if Exclude_3==1
replace PREVBYZIP=0 if PREVBYZIP==-1 & TotalPopulation>500
replace YRCUMCASES=0 if YRCUMCASES==-1 & TotalPopulation>500
replace PREVBYZIP=. if PREVBYZIP==-1
replace YRCUMCASES=. if YRCUMCASES==-1
replace YRLATEDXPERC=. if YRLATEDXPERC==-1
replace YRLINKPERC=. if YRLINKPERC==-1
replace YEARVSPERC=. if YEARVSPERC==-1

*Exclusion for any missing variables and missing prevalence
gen Exclude_4=1 if PREVBYZIP==.|Exclude_3==1
replace Exclude_4=0 if Exclude_4==.
count if Exclude_4==1
```

```
*Exclusion for any missing variables and missing incidence
gen Exclude_5=1 if YRCUMCASES==.|Exclude_3==1
replace Exclude_5=0 if Exclude_5==.
count if Exclude_5==1
*Exclusion for missing LateDx data
gen Exclude_6=1 if YRLATEDXPERC==.|Exclude_3==1
replace Exclude_6=0 if Exclude_6==.
count if Exclude_6==1
*Exclusion for missing YRLINKPERC
gen Exclude_7=1 if YRLINKPERC==.|Exclude_3==1
replace Exclude_7=0 if Exclude_7==.
count if Exclude_7==1
*Exclusion for missing VS data
gen Exclude_8=1 if YEARVSPERC==.|Exclude_3==1
replace Exclude_8=0 if Exclude_8==.
count if Exclude_8==1
*save file
save "U:\Projects_and_Assignments\Dissertation\Data Resources\DATASET_AIMS 1 and
2_Final Data Set.dta", replace

*Examine missingness within the data*

*calculate unique ZCTA values by state
egen tag = tag(ZCTA)
egen distinct = total(ZCTA), by(STATE)
bysort STATE: gen freq = _N

*Calculate number of missing covariates by State
by STATE: count if Exclude_3==1

*Calculate missing Outcomes by state no other missing covariates
by STATE: count if YRCUMCASES==. & Exclude_3==0
by STATE: count if YRLATEDXPERC==. & Exclude_3==0
by STATE: count if YRLINKPERC==. & Exclude_3==0
by STATE: count if YEARVSPERC==. & Exclude_3==0
*drop vars not needed
drop tag
drop distinct
drop freq

*Calculate unique values by city
sort CITY
egen tag = tag(ZCTA)
```

```
egen distinct = total(ZCTA), by(CITY)
bysort CITY:gen freq= _N
*Calculate number of missing covariates by State
by CITY: count if Exclude_3==1
*Calculate missing Outcomes by state no other missing covariates
by CITY: count if YRCUMCASES==. & Exclude_3==0
by CITY: count if YRLATEDXPERC==. & Exclude_3==0
by CITY: count if YRLINKPERC==. & Exclude_3==0
by CITY: count if YEARVSPERC==. & Exclude_3==0
*drop vars not needed
drop tag
drop distinct
drop freq
```

Paper 2 Analysis

```
*Additional Data Prep*
*Identifying Explanatory Variable*
*MERGE PCSA FQHC Data from Excel*
use "U:\Documents\PhD Documents\Dissertation\Paper1\Data Prep
PCSA\PCSA_ZIP_FINAL.dta"
drop _merge
merge 1:1 ZIPCODE using "U:\Projects_and_Assignments\Dissertation\Data
Resources\DATASET_AIMS 1 and 2_Final Data Set.dta"
drop dup
drop _merge
drop if ZCTA==.

*PCSA Variable*
destring PCSA_1, replace force
sort PCSA_1
egen PCSA_200FPL=sum(POP_200PERC_FPL), by (PCSA_1)
gen FQHC_DENS_PCSA_10K=(FQHCs_IN_PCSA/PCSA_200PERC_FPL)*10000
summarize FQHC_DENS_PCSA_10K, detail, if Exclude_4==0

egen FQHCs_IN_PCSA1=sum(PRES)

*race/ethnicity variable - categorical
gen RACE_ETH=1 if PERCWHITE>50
replace RACE_ETH=2 if PERCBLACK>50
replace RACE_ETH=3 if PERCHISP>50
replace RACE_ETH=4 if RACE_ETH==.
drop nonAA20
```

```
*Adding variables*
gen AA50=1 if PERCBLACK>=50 & Exclude_4==0
replace AA50=0 if PERCBLACK<=50 & Exclude_4==0
gen AA20=1 if PERCBLACK>=20 & Exclude_4==0
replace AA20=0 if PERCBLACK<20 & Exclude_4==0
gen nonAA20=1 if PERCBLACK<20
replace nonAA20=0 if PERCBLACK>=20
gen AA60=1 if PERCBLACK>=60 & Exclude_4==0
replace AA60=0 if PERCBLACK<60 & Exclude_4==0
gen nonAA60=1 if PERCBLACK<60 & Exclude_4==0
replace nonAA60=0 if PERCBLACK>=60 & Exclude_4==0

*Generate Total Ryan White Funding for 5-year vars*
gen Ryan_White_A_Total= RW_A_2014to2018 if YEAR==2018
replace Ryan_White_A_Total=RW_A_2015to2019 if YEAR==2019
gen Ryan_White_B_Total= PART_B_2014to2018 if YEAR==2018
replace Ryan_White_B_Total=PART_B_2015to2019 if YEAR==2019
*Generate one year variable for Viral Suppression
gen RW_A_1Year=RW_A_2018 if YEAR==2018
replace RW_A_1Year=RW_A_2019 if YEAR==2019

*Ryan White in Millions
gen Ryan_White_A_Total_Mill=Ryan_White_A_Total/1000000
gen Ryan_White_B_Total_Mill=Ryan_White_A_Total/1000000

*DROP Measurement Error VARS*
drop TPMOE MEDMOE WHITEMOE BLACKMOE HISPMOE PERC15to44MOE MOEUNS
MOEUNEMP tag distinct freq GeographicAreaName
drop ZIP_TYPE zip_join_type

*Identifying Explanatory Variable*

* Distribution of FQHC Density*
histogram FQHC_DENS_PCSA_10K if Exclude_4==0, percent
summarize FQHC_DENS_PCSA_10K if Exclude_4==0, detail
centile FQHC_DENS_PCSA_10K, centile(33,66)

*Different definitions of FQHC Density*
gen PCSA_QUARTILES=1 if FQHC_DENS_PCSA_10K<0.069
replace PCSA_QUARTILES=2 if FQHC_DENS_PCSA_10K>=0.069 &
FQHC_DENS_PCSA_10K<0.513
```

```
replace PCSA_QUARTILES=3 if FQHC_DENS_PCSA_10K>=0.513 &
FQHC_DENS_PCSA_10K<1.182
replace PCSA_QUARTILES=4 if FQHC_DENS_PCSA_10K>=1.182

gen PCSA_HIGH_BIN=1 if FQHC_DENS_PCSA_10K>=1.182
replace PCSA_HIGH_BIN=0 if FQHC_DENS_PCSA_10K<1.182

gen PCSA_LOW_BIN=1 if FQHC_DENS_PCSA_10K<0.069
replace PCSA_LOW_BIN=0 if FQHC_DENS_PCSA_10K>=0.069

gen PCSA_50_BIN=1 if FQHC_DENS_PCSA_10K>=0.513
replace PCSA_50_BIN=0 if FQHC_DENS_PCSA_10K<0.513

gen PCSA_TERTS=1 if FQHC_DENS_PCSA_10K<0.280
replace PCSA_TERTS=2 if FQHC_DENS_PCSA_10K>=0.280 &
FQHC_DENS_PCSA_10K<0.960
replace PCSA_TERTS=3 if FQHC_DENS_PCSA_10K>=0.960

gen PCSA_LMH_TERTS=1 if FQHC_DENS_PCSA_10K<0.0689
replace PCSA_LMH_TERTS=2 if FQHC_DENS_PCSA_10K>=0.0689 &
FQHC_DENS_PCSA_10K<1.182
replace PCSA_LMH_TERTS=3 if FQHC_DENS_PCSA_10K>=1.182

****HIGH BINARY DENSITY*****

*Descriptives High vs. Medium/Low FQHC Density*

summarize PREVBYZIP, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PREVBYZIP, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize YRCUMCASES, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize YRCUMCASES, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize YRLATEDXPERC, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize YRLATEDXPERC, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize YRLINKPERC, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize YRLINKPERC, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize YEARVSPERC, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize YEARVSPERC, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
ranksum YRCUMCASES, by (PCSA_HIGH_BIN), if Exclude_4==0
ttest YRLATEDXPERC, by(PCSA_HIGH_BIN), if Exclude_4==0
ttest YRLINKPERC, by(PCSA_HIGH_BIN), if Exclude_4==0
ttest YEARVSPERC, by (PCSA_HIGH_BIN), if Exclude_4==0
ranksum PREVBYZIP , by (PCSA_HIGH_BIN), if Exclude_4==0
summarize PERC15to44, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
```

```
summarize PERC15to44, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize PERCUNINS, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PERCUNINS, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize UNEMPRATE16PLUS, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize UNEMPRATE16PLUS, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize PopLowIncome20152019, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PopLowIncome20152019, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize PERCPOVERTY, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PERCPOVERTY, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize PERCHSEDU, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PERCHSEDU, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
summarize Ryan_White_A_Total_Mill, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize Ryan_White_A_Total_Mill, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
tab AA50 PCSA_HIGH_BIN, column, if Exclude_4==0
summarize PERCBLACK, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PERCBLACK, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0
ranksum PREVBYZIP, by (PCSA_HIGH_BIN), if Exclude_4==0
ranksum PopLowIncome20152019, by (PCSA_HIGH_BIN), if Exclude_4==0
ttest PERC15to44, by(PCSA_HIGH_BIN), if Exclude_4==0
ttest PERCUNINS, by(PCSA_HIGH_BIN), if Exclude_4==0
ttest UNEMPRATE16PLUS, by(PCSA_HIGH_BIN), if Exclude_4==0
ranksum PERCPOVERTY, by (PCSA_HIGH_BIN), if Exclude_4==0
ranksum PERCHSEDU, by (PCSA_HIGH_BIN), if Exclude_4==0
ttest Ryan_White_A_Total_Mill, by(PCSA_HIGH_BIN), if Exclude_4==0
ranksum PERCBLACK, by (PCSA_HIGH_BIN), if Exclude_4==0
summarize PCSA_HIGH_BIN, detail, if PCSA_HIGH_BIN==0 & Exclude_4==0
summarize PCSA_HIGH_BIN, detail, if PCSA_HIGH_BIN==1 & Exclude_4==0

*Regression High vs. Medium/Low FQHC Density*

reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code if Exclude_4==0

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP  PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0

reg YRLINKPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0
```

```
reg YEARVSPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0


*Sensitivity Exclude Low Density ZCTAs Regression*
reg YRCUMCASES i.PCSA_LMH_TERTS PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code if Exclude_4==0 & PCSA_LMH_TERTS>1

reg YRLATEDXPERC i.PCSA_LMH_TERTS PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & PCSA_LMH_TERTS>1

reg YRLINKPERC i.PCSA_LMH_TERTS PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & PCSA_LMH_TERTS>1

reg YEARVSPERC i.PCSA_LMH_TERTS PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & PCSA_LMH_TERTS>1

*PCP Density Adjusted*
use "U:\Documents\PhD
Documents\Dissertation\Paper1\Analysis\ZIP_TO_COUNTY_MERGE.dta"
merge 1:1 ZIPCODE using "U:\Projects_and_Assignments\Dissertation\Data
Resources\DATASET_AIMS 1 and 2_Final Data Set.dta"
drop dup
drop _merge
drop if ZCTA==.
summarize PCP_PER_THOUS if Exclude_4==0, detail
gen PCP_BIN=0 if PCP_PER_THOUS<0.76
replace PCP_BIN=1 if PCP_PER_THOUS>=0.76

reg YRCUMCASES i.PCSA_HIGH_BIN i.PCP_BIN PREVBYZIP POP_200PERCFPL_K
PERC15to44 PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code if Exclude_4==0

reg YRLATEDXPERC i.PCSA_HIGH_BIN i.PCP_BIN PREVBYZIP PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code if Exclude_4==0
```

```
reg YRLINKPERC i.PCSA_HIGH_BIN i.PCP_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0


reg YEARVSPERC i.PCSA_HIGH_BIN i.PCP_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0

*Regression Exclude Highest Prev ZCTAs*

reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code if Exclude_4==0 & PREVBYZIP<229

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & PREVBYZIP<229

reg YRLINKPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & PREVBYZIP<229

reg YEARVSPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & PREVBYZIP<229

*Exclude Florida*
reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code if Exclude_4==0 & STATE!="FL"

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & STATE!="FL"

reg YRLINKPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & STATE!="FL"

reg YEARVSPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.State_Code if Exclude_4==0 & STATE!="FL"
```

```
*Interaction to Examine Relationships based on community racial comopsition*

*<20% Black Resident ZCTAs*
reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.AA20 i.State_Code i.AA20##i.PCSA_HIGH_BIN if
Exclude_4==0

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.State_Code i.AA20 i.AA20##i.PCSA_HIGH_BIN if Exclude_4==0

reg YRLINKPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.State_Code i.AA20 i.AA20##i.PCSA_HIGH_BIN if Exclude_4==0

reg YEARVSPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill i.AA20
i.AA20##i.PCSA_HIGH_BIN i.State_Code  if Exclude_4==0

*>=20% Black Resident ZCTAs*
reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.State_Code i.nonAA20 i.nonAA20##i.PCSA_HIGH_BIN if
Exclude_4==0

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.nonAA20 i.State_Code i.nonAA20##i.PCSA_HIGH_BIN if Exclude_4==0

reg YRLINKPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.nonAA20 i.nonAA20##i.PCSA_HIGH_BIN i.State_Code if Exclude_4==0

reg YEARVSPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.State_Code i.nonAA20 i.nonAA20##i.PCSA_HIGH_BIN if Exclude_4==0

*>= 60% Black Resident ZCTAs*
reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
```

```
Ryan_White_A_Total_Mill i.nonAA60 i.nonAA60##i.PCSA_HIGH_BIN i.State_Code if
Exclude_4==0

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.nonAA60 i.nonAA60##i.PCSA_HIGH_BIN i.State_Code if Exclude_4==0

reg YRLINKPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.nonAA60 i.nonAA60##i.PCSA_HIGH_BIN i.State_Code if Exclude_4==0

reg YEARVSPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.nonAA60 i.nonAA60##i.PCSA_HIGH_BIN i.State_Code if Exclude_4==0

*** Public Health Impact ***
sort PCSA_HIGH_BIN
by PCSA_HIGH_BIN: egen NEW_HIV_DX_5YR=total(YRCUMCASES)
by PCSA_HIGH_BIN: egen TOTAL_HIV_CASES_BY_DENS=total(PREVBYZIP)

reg YRCUMCASES i.PCSA_HIGH_BIN PREVBYZIP POP_200PERCFPL_K2 PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU
Ryan_White_A_Total_Mill i.nonAA20 i.State_Code i.nonAA20##i.PCSA_HIGH_BIN if
Exclude_4==0

reg YRLATEDXPERC i.PCSA_HIGH_BIN PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU Ryan_White_A_Total_Mill
i.nonAA20 i.State_Code i.nonAA20##i.PCSA_HIGH_BIN if Exclude_4==0
```

Paper 3 Analysis

```
* Paper 3*

*Recode the variable so that penetration of low-income is 100% max i.e., can't be >100%

*Recode Penetration Variable*
generate HCPPenetrationofLowIncome_COR=HCPPenetrationofLowIncome
replace HCPPenetrationofLowIncome_COR=1 if HCPPenetrationofLowIncome>=1

* Examine distribution of FQHC Penetration among low-income individuals*
histogram HCPPenetrationofLowIncome_COR if Exclude_4==0, percent
summarize HCPPenetrationofLowIncome_COR if Exclude_4==0, detail
centile HCPPenetrationofLowIncome_COR, centile(33,66)
```

```
*Examining different defintions of explanatory variable*
*Quartile Variable*
gen PenQuarts=0 if HCPPenetrationofLowIncome<0.0566
replace PenQuarts=1 if HCPPenetrationofLowIncome>=0.0566 &
HCPPenetrationofLowIncome<0.1263
replace PenQuarts=2 if HCPPenetrationofLowIncome>=0.1263 &
HCPPenetrationofLowIncome<0.2445
replace PenQuarts=3 if HCPPenetrationofLowIncome>=0.2445

*Tertiles Variable*
gen PenTerts=0 if HCPPenetrationofLowIncome<0.0678
replace PenTerts=1 if HCPPenetrationofLowIncome>=0.0678 &
HCPPenetrationofLowIncome<0.1802
replace PenTerts=2 if HCPPenetrationofLowIncome>=0.1802

*Low vs. Med/High Variable*
gen PenLowQuarts=0 if HCPPenetrationofLowIncome<0.0566
replace PenLowQuarts=1 if HCPPenetrationofLowIncome>=0.0566

*50th Variable*
gen PenMidQuart=0 if HCPPenetrationofLowIncome<0.1263
replace PenMidQuart=1 if HCPPenetrationofLowIncome>=0.1263

*Low/Med vs. High Variable (<75th versus >= 75th)*
gen PenHighQuart=0 if HCPPenetrationofLowIncome <0.2445
replace PenHighQuart=1 if HCPPenetrationofLowIncome>=0.2445

*Very High Penetration Variable (<90th versus >=90th)*
gen PenVeryHigh=0 if HCPPenetrationofLowIncome<0.4148
replace PenVeryHigh=1 if HCPPenetrationofLowIncome>=0.4148

*Quartile defined Tertiles*
gen PenHMLQuarts=0 if HCPPenetrationofLowIncome<0.0566
replace PenHMLQuarts=1 if HCPPenetrationofLowIncome>=0.0566 &
HCPPenetrationofLowIncome<0.2445
replace PenHMLQuarts=2 if HCPPenetrationofLowIncome>=0.2445

*Deriving Explanatory Variable 10-percentage point increase in FQHC penetration*
gen Penetration_10=Penetration_COR/10

*Descriptive Statistics*
*Distribution of variables*
histogram PREVBYZIP if Exclude_4==0, percent
```

```
histogram YRCUMCASES if Exclude_4==0, percent
histogram YRLATEDXPERC if Exclude_4==0, percent
histogram YRLINKPERC if Exclude_4==0, percent
histogram YEARVSPERC if Exclude_4==0, percent
histogram PERC15to44 if Exclude_4==0, percent
histogram PERCUNINS if Exclude_4==0, percent
histogram UNEMPRATE16PLUS if Exclude_4==0, percent
histogram PopLowIncome20152019 if Exclude_4==0, percent
histogram PERCPOVERTY if Exclude_4==0, percent
histogram PERCHSEDU if Exclude_4==0, percent
histogram Ryan_White_A_Total_Mill if Exclude_4==0, percent
histogram PERCBLACK if Exclude_4==0, percent

*Descriptive Statistics Full Sample*
summarize PREVBYZIP, detail, if Exclude_4==0
summarize YRCUMCASES, detail, if Exclude_4==0
summarize YRLATEDXPERC, detail, if Exclude_4==0
summarize YRLINKPERC, detail, if Exclude_4==0
summarize YEARVSPERC, detail, if Exclude_4==0
summarize PERC15to44, detail, if Exclude_4==0
summarize PERCUNINS, detail, if Exclude_4==0
summarize UNEMPRATE16PLUS, detail, if Exclude_4==0
summarize PopLowIncome20152019, detail, if Exclude_4==0
summarize PERCPOVERTY, detail, if Exclude_4==0
summarize PERCHSEDU, detail, if Exclude_4==0
summarize Ryan_White_A_Total_Mill, det+ail, if Exclude_4==0
summarize PERCBLACK, detail, if Exclude_4==0

*Regression Analysis*
reg YRCUMCASES Penetration_10 PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0

reg YRLATEDXPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

reg YRLINKPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0
```

```
reg YEARVSPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

*Sensitivity Analysis*
*Join UNINS data*
merge 1:1 ZIPCODE using "U:\Projects_and_Assignments\Dissertation\Paper
2\UNINS_RATE.dta"
summarize PEN_UNINSURED if Exclude_4==0, detail

*Examine distribution of penetration of the uninsured*
histogram PEN_UNINSURED if Exclude_4==0, percent
summarize PEN_UNINSURED if Exclude_4==0, detail
centile PEN_UNINSURED, centile(33,66)

*Define Sensitivity Explanatory Var -- 10-percentage point increase in penetration of the
Uninsured*
gen PEN_UNINSURED_10 = (PEN_UNINSURED*100)/10

*Analysis Penetration of the Uninsured*

reg YRCUMCASES PEN_UNINSURED_10 PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0

reg YRLATEDXPERC PEN_UNINSURED_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

reg YRLINKPERC PEN_UNINSURED_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

reg YEARVSPERC UNINS_COR PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

*Analysis Exclude Highest (>75th percentile) HIV Prevalence ZCTAs*
reg YRCUMCASES Penetration_10 PREVBYZIP i.PCP_MED POP_200PERCFPL_K
PERC15to44 PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0 & PREVBYZIP<229
```

```
reg YRLATEDXPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & PREVBYZIP<229

reg YRLINKPERC Penetration_10 PREVBYZIP i.PCP_MED PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & PREVBYZIP<229

reg YEARVSPERC Penetration_10 PREVBYZIP i.PCP_MED PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & PREVBYZIP<229


*Control for FQHC Density*
reg YRCUMCASES Penetration_10 PREVBYZIP i.PCSA_HIGH_BIN  POP_200PERCFPL_K
PERC15to44 PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0


reg YRLATEDXPERC Penetration_10 PREVBYZIP i.PCSA_HIGH_BIN PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0

reg YRLINKPERC Penetration_10 PREVBYZIP i.PCSA_HIGH_BIN PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0

reg YEARVSPERC Penetration_10 PREVBYZIP PCSA_HIGH_BIN PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0

*Control for PCP Density*
reg YRCUMCASES Penetration_10 PREVBYZIP i.PCP_MED POP_200PERCFPL_K
PERC15to44 PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0


reg YRLATEDXPERC Penetration_10 PREVBYZIP i.PCP_MED PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0
```

```
reg YRLINKPERC Penetration_10 PREVBYZIP i.PCP_MED PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

reg YEARVSPERC Penetration_10 PREVBYZIP i.PCP_MED PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0

*Exclude Florida ZCTAs*
reg YRCUMCASES Penetration_10 PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0 & STATE!="FL"

reg YRLATEDXPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU   i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & STATE!="FL"

reg YRLINKPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU   i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & STATE!="FL"

reg YEARVSPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & STATE!="FL"

*Exclude lower poverty ZCTAs (<25th percentile) examining higher poverty ZCTAs (>=25th
percentile)

reg YRCUMCASES Penetration_10 PREVBYZIP POP_200PERCFPL_K PERC15to44
PERCUNINS UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20
Ryan_White_A_Total_Mill i.State_Code if Exclude_4==0 & PERCPOVERTY>7.8

reg YRLATEDXPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & PERCPOVERTY>7.8

reg YRLINKPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU  i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & PERCPOVERTY>7.8

reg YEARVSPERC Penetration_10 PREVBYZIP PERC15to44 PERCUNINS
UNEMPRATE16PLUS PERCPOVERTY PERCHSEDU i.AA20 Ryan_White_A_Total_Mill
i.State_Code if Exclude_4==0 & PERCPOVERTY>7.8
```