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ORIGINAL PAPER

Racial, Ethnic, and Rural/Urban Disparities in HIV and Sexually Transmitted Infections in South Carolina

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Abstract

Examining the current incidence rates of HIV and STIs among racial and ethnic minority and rural residents is crucial to inform and expand initiatives and outreach efforts to address disparities and minimize the health impact of these diseases. A retrospective, cross-sectional study was conducted using Medicaid administrative claims data over a 2-year period (July 2019-June 2021) in South Carolina. Our main outcomes of interest were claims for chlamydia, gonorrhea, syphilis, and HIV. Any beneficiary with at least one claim for a relevant diagnosis throughout the study period was considered to have one of these diseases. Descriptive analyses and multivariable regression models were used to estimate the association between STIs, HIV, race and ethnicity, and rurality. Overall, 158,731 Medicaid beneficiaries had at least one medical claim during the study period. Most were female (86.6%), resided in urban areas (66.6%), and were of non-Hispanic Black race/ethnicity (42.6%). In total, 6.3% of beneficiaries had at least one encounter for chlamydia, 3.2% for gonorrhea, 0.5% for syphilis, and 0.8% for HIV. In multivariable models, chlamydia, gonorrhea, and HIV claims were significantly associated with non-Hispanic Black or other minority race/ethnicity compared to non-Hispanic white race/ethnicity. Rural residents were more likely to have a claim associated with chlamydia and gonorrhea compared to urban residents. The opposite was observed for syphilis and HIV. Providing updated evidence on disparities in STIs and HIV among racial/ethnic minority and rural populations in a southern state is essential for shaping state Medicaid policies to address health disparities.

Keywords Disparities · Minorities · Rurality · HIV · Sexually transmitted infections

Introduction

Sexually transmitted infections (STIs) have increased dramatically in the past 10 years and in 2019 reached an all-time high in the United States (US), totaling almost $16 billion in direct medical costs. [1, 2] Currently, it is estimated that nearly 20% of individuals in the US have an STI on any given day. [2] The increasing rates of STIs are not distributed equally across racial and ethnic groups. Racial and ethnic minority populations, particularly Black populations, experience incidence rates for STIs that are around six times higher than White populations (1,233 versus 210 per 100,000). [1, 3] Striking racial and ethnic disparities are also prevalent for human immunodeficiency virus (HIV), which has remained a persistent public health problem in the US, with 36,801 new HIV cases in 2019. [4] Specifically, the HIV incidence rate among Black populations in the US was eight times higher compared to White populations. Black populations also accounted for almost one-third of chlamydia, syphilis,

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and gonorrhea cases although they make up only 12% of the US population in 2020. [5] In addition, STIs have also disproportionately increased among rural residents compared to urban residents in the past 20 years, [6] and the rural South is a key target of the new federal Ending the HIV Epidemic (EHE) initiative due to disproportionate HIV rates among rural residents. [7]

Racial, ethnic, and rural/urban disparities in HIV and STIs exist for a variety of reasons. [8] Poverty, structural inequities (e.g., in housing, transportation, education), racism, mistrust in healthcare providers, barriers to preventive care and testing, lack of access to comprehensive sexual education, and concerns about confidentiality and quality of care are commonly cited factors that drive disparities in the incidence and prevalence of HIV and STIs among minoritized individuals and rural residents. [6, 9–11] Health beliefs and cultural factors such as perceptions of limited susceptibility and variation in sexual networks are likely to also contribute to heterogeneity in the incidence and prevalence of HIV and STIs among racially and ethnically minoritized populations. [11, 12]

Disparities in HIV and STIs may be especially driven by differences in the social determinants of health (SDoH), which are the conditions and environments in which individuals work, live, and play that may affect lifelong health outcomes. [12] Geographic residence is itself a social determinant of health, with life expectancy among rural residents lower than their urban peers. [13] Rural residents face unique challenges to accessing care due to structural urbanism, where current public health funding and infrastructures may be skewed towards large urban areas due to market oriented healthcare services which necessitate larger population volumes to make services viable. [14] These challenges are often exacerbated among racial and ethnic minority residents, with minoritized rural populations experiencing worse health outcomes than minoritized urban groups. [15] Current policy efforts are attempting to address these disparities; for example, the Centers for Medicare and Medicaid Services (CMS) has asked state Medicaid agencies to address social determinants of health when designing programs and policies. [16] Additionally, Medicaid has been identified as a significant payor of claims for STIs. [17] Examining the current rates of HIV and STIs among racial and ethnic minority residents, as well as among rural residents, is crucial to inform and expand initiatives and outreach efforts such as these put forth by CMS to better address disparities and minimize the health impact of STIs.

Therefore, the purpose of this study was to estimate the associations between chlamydia, gonorrhea, syphilis, HIV, race and ethnicity, and rurality among Medicaid beneficiaries in South Carolina using the most recent data available (July 2019 to June 2021). South Carolina is a demographically unique state with almost twice the number of Black residents as well as rural residents compared to national averages, and it is among the top five states with the highest incidence rates of STIs in the US. [18] It is also a target state within the federal EHE plan due to persistently high HIV incidence rates. [7] Our study expands upon and updates prior literature by presenting updated evidence on racial, ethnic, and rural/urban disparities in HIV and STIs in a highly rural southern state, with important implications for stakeholders and public health authorities.

Materials and Methods

Study Design and Data Source

We conducted a retrospective study using South Carolina Medicaid administrative claims data. In South Carolina, private health insurance plans administered by managed care organizations provide the majority of Medicaid services and are paid a per-capita dollar amount per enrollee for these services. [19] We used the two most recent and complete state fiscal years of data available for our study (fiscal year 1: July 2019 to June 2020; fiscal year 2: July 2020 to June 2021). All Medicaid beneficiaries with at least one medical claim during the study period were included in our analysis. Using a unique identifier, we identified all claims for unique beneficiaries across each fiscal year.

Outcomes

Our main outcomes of interest were frequencies of chlamydia, gonorrhea, syphilis, and HIV claims. We included HIV in our analyses due to the clinical and testing linkages between HIV and bacterial STIs. [20] Any patient with at least one claim for a relevant diagnosis throughout the two-year study period was considered to have one of these diseases. Given the clinical differences across the diseases, we used the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) codes across all available diagnostic codes to identify chlamydia and gonorrhea and only the primary diagnosis for syphilis and HIV (Appendix 1). Similar to previous work, a claim only for medical services and procedures such as laboratory tests was deemed insufficient to be classified as a confirmatory diagnosis, as these tests might yield a negative result. [21] Hence, Current Procedural Terminology (CPT) codes for services and procedures related to these diseases were used in conjunction with ICD-10-CM codes to increase accuracy when available.

Main Independent Variables

The two main independent variables of interest were race/ethnicity and rurality. Based on the racial and ethnic composition of South Carolina and the limited nature of how this information is captured in claims data, we grouped race/ethnicity into three categories: non-Hispanic white, non-Hispanic Black, and other/unknown. We defined rurality as a dichotomous variable (0 = Urban, 1 = Rural) according to the United States Department of Agriculture Economic Research Service rural–urban commuting area (RUCA) codes.

Covariates

We included patients' sociodemographic and clinical characteristics as well as county-level variables as controls. At the patient level, sociodemographic information included age and gender, while clinical information included an overall comorbidity score for each patient based on the Elixhauser Comorbidity index [22] across all available diagnoses and all claims. We also included the six most common comorbidities from the same index as separate dichotomous categories, which indicated whether an individual had at least one claim for each of those conditions (congestive heart failure, hypertension, obesity, COPD, depression, and substance and alcohol use). County-level information and characteristics were obtained from publicly available sources, using data from HRSA and the Census Bureau, and included poverty rates, unemployment rates, medical underserved area index scores, and the sociodemographic composition of each county (racial composition, gender composition, age-groups composition). [23, 24]

Statistical Analyses

We initially conducted a descriptive analysis to characterize the study population. We further stratified our population by the four outcomes of interest to compare characteristics of individuals with and without the three STIs and HIV. We tested for statistical significance using Pearson's χ^2 for categorical variables and Student's t or Mann Whitney tests for numerical variables depending on their distributions. We then conducted four separate multivariable logistic regressions (one for each outcome) at the patient level to estimate the association of the outcomes and the two main independent variables of interest (race, ethnicity, rurality). All models controlled for the covariates mentioned above. Data were managed in SAS version 9.4 (SAS Institute) and statistical analyses were conducted using Stata version 17.0 (StataCorp).

Results

Our study included 158,731 Medicaid beneficiaries with at least one medical claim during the study period (Table 1). The average age was 27.0 years (standard deviation = 10.1), and the majority of Medicaid recipients were female (86.6%) and resided in urban areas (66.6%). Approximately 42.6% were of non-Hispanic Black race/ethnicity. Overall, the most common comorbidities were congestive heart failure (3.6%), hypertension (2.9%), and obesity (2.2%).

In total, 9,985 (6.3%) beneficiaries had at least one encounter for chlamydia, 5,009 (3.2%) for gonorrhea, 870 (0.5%) for syphilis, and 1,281 (0.8%) for HIV. Across all 46 counties, the adjusted rates per 100,000 population were 1,089.3 (st.d. = 424.9) for chlamydia, 532.5 (st.d. = 244.6) for gonorrhea, 77.3 (st.d. = 34.0) for syphilis, and 129.5 (st.d. = 89.2) for HIV. Figure 1 presents the geographic distribution of population-adjusted rates for each STI and HIV in each county in the state in quartiles. Among counties in the two highest quartiles of population-adjusted rates for all STIs and HIV, the majority were rural counties (chlamydia = 73.9%; gonorrhea = 72.7%; HIV = 60.9%; syphilis = 52.2%) (Fig. 1).

Those with at least one claim for chlamydia and gonorrhea were disproportionately younger on average (chlamydia: -4.9 years; gonorrhea: -2.9 years) compared to those without these diagnoses, while the opposite was observed for those with syphilis or HIV (syphilis: + 5.3 years; HIV: + 19.0 years). In particular, 18- to 24-year-old beneficiaries had higher shares of chlamydia and gonorrhea, while beneficiaries aged 45 or more had the highest shares of HIV. Gender-related differences were mostly observed among beneficiaries with syphilis and HIV, with higher shares of male beneficiaries being diagnosed with these conditions (syphilis: Yes = 35.5%; No = 13.3%; HIV: Yes = 48.3%; No = 13.1%). Non-Hispanic Black beneficiaries had higher proportions of each type of STI and HIV, compared to their non-Hispanic White counterparts. Chlamydia and gonorrhea were more prevalent among rural residents, while syphilis and HIV were more prevalent among those residing in urban locations. Beneficiaries with substance and alcohol use also had higher proportions of any of these diagnoses.

The results of the multivariable logistic regression analyses are presented in Table 2. Non-Hispanic Black residents were more likely to have at least one claim for chlamydia, gonorrhea, and HIV (chlamydia: aOR = 1.88, 95% CI = 1.74–2.03, $p < 0.001$; gonorrhea: aOR = 1.99, 95% CI = 1.76–2.25, $p < 0.001$; HIV: aOR = 2.51, 95% CI = 1.94–3.23, $p < 0.001$) compared to non-Hispanic whites. The same associations were also observed among

Table 1 Descriptive characteristics of Medicaid beneficiaries and stratified analyses by STI and HIV incidence in South Carolina from July 2019 to June 2021

	All	Gonorrhea		Gonorrhea		Syphilis		HIV	
		Yes	No	Yes	No	Yes	No	Yes	No
N	158,731	9,985	148,746	5,009	153,722	870	157,861	1,281	157,450
%		6.3%	93.7%	3.2%	96.8%	0.5%	99.5%	0.8%	99.2%
Age—average (SD)	27.0 (10.1)	22.4 (6.2)	27.3 (10.4)	24.2 (7.6)	27.1 (10.3)	33.2 (14.1)	26.9 (10.2)	45.8 (12.8)	26.8 (10.1)
Age groups									
0 to 17	17.3	20.9	17.1	16.7	17.3	5.4	17.4	1.3	17.4
18 to 24	29.9	52.0	28.4	44.9	29.4	25.1	29.9	6.0	30.1
25 to 34	33.2	22.7	33.9	29.6	33.4	34.9	33.2	16.1	33.4
35 to 44	13.5	3.6	14.2	6.8	13.7	14.9	13.5	19.4	13.5
45 +	6.0	0.8	6.4	2.0	6.2	19.7	5.9	57.2	5.6
Gender									
Male	13.4	11.4	13.5	15.0	13.3	35.5	13.3	48.3	13.1
Female	86.6	88.6	86.5	85.0	86.7	64.5	86.7	51.7	86.9
Race/ethnicity									
Non-Hispanic White	24.5	17.2	25.0	15.6	24.8	18.8	24.5	8.2	24.6
Non-Hispanic Black	42.6	50.4	42.1	53.5	42.2	46.8	42.6	56.4	42.5
Other	32.9	32.5	32.9	30.9	33.0	34.4	32.9	35.4	32.9
Area (location) of residence									
Urban	66.6	61.4	66.9	62.2	66.7	73.2	66.5	69.1	66.5
Rural	33.4	38.6	33.1	37.8	33.3	26.8	33.5	30.9	33.5
Elixhauser comorbidity index									
Average (SD)	0.2 (0.8)	0.2 (0.9)	0.2 (0.8)[¥]	0.3 (1.1)	0.2 (0.8)	0.7 (1.9)	0.2 (0.8)	1.7 (1.6)	0.2 (0.8)
Top comorbidities									
Congestive heart failure	3.6	2.1	3.7	3.3	3.6[¥]	8.4	3.6	11.7	3.5
Hypertension	2.9	1.5	2.9	2.6	2.9[¥]	6.9	2.8	10.5	2.8
Obesity	2.2	2.5	2.2[¥]	2.6	2.2[¥]	3.0	2.2[¥]	2.0	2.2[¥]
COPD	1.9	2.6	1.8	3.4	1.8	3.2	1.9	2.4	1.9[¥]
Depression	1.8	3.0	1.8	2.8	1.8	4.4	1.8	3.0	1.8
Substance & alcohol use	1.3	2.1	1.3	2.4	1.3	4.3	1.3	2.8	1.3

All bivariate comparisons were statistically significant at the $p < 0.01$ level, except for associations with [¥]$p < 0.05$

other minority ethnic/racial groups compared to their non-Hispanic white counterparts. Rural residents were more likely to have a claim associated with chlamydia (aOR = 1.14, 95% CI = 1.05–1.24, p = 0.002) and gonorrhea (aOR = 1.14, 95% CI = 1.04–1.25, p = 0.007) compared to urban residents. In contrast, individuals residing in rural locations had a lower likelihood of having a medical claim for syphilis (aOR = 0.80. 95% CI = 0.65–0.99, p = 0.042) and a lower likelihood of having a medical claim for HIV (aOR = 0.74, 95% CI = 0.56–0.97, p = 0.031) compared to those residing in urban locations.

In terms of other covariates, concurrent claims related to depression, and substance and alcohol use were consistently associated with having at least one claim for all 3 STIs and HIV. Females also exhibited increased likelihood of chlamydia infections (aOR = 1.39, 95% CI = 1.23–1.56, p < 0.001) compared to males, while the opposite association was observed for gonorrhea (aOR = 0.86, 95% CI = 0.77–0.97, p = 0.012), syphilis (aOR = 0.23, 95% CI = 0.20–0.27, p < 0.001), and HIV (aOR = 0.17, 95% CI = 0.14–0.21, p < 0.001).

Discussion

To the best of our knowledge, this is the most up-to-date study to examine the associations between chlamydia, gonorrhea, syphilis, HIV, race and ethnicity, and rurality in a southern state with high national prevalence of STIs and high proportions of rural racial/ethnic minority populations. The timeliness of this analysis is important, as CMS has recently called for the inclusion of social determinants of health, which may disproportionately affect rural and racial/ethnic minority populations, in designing programs, policies,

Fig. 1 Geographic distribution of population-adjusted rates in quartiles for each STI and HIV across all counties in South Carolina (rates per 100,000)

and interventions. [25] The examination of current rates of STIs among racial/ethnic minority populations in a rural southern state is essential for shaping state Medicaid polices around STIs, as the findings from this study can be used to maximize efforts to address disparities and minimize the health impact of STIs.

Our findings of higher likelihoods of chlamydia and gonorrhea among rural beneficiaries compared to urban beneficiaries, as well as higher likelihoods of chlamydia, gonorrhea, and HIV among racial/ethnic minority residents, highlight the need for programming and interventions specific to both rural and racial/ethnic minority residents, particularly in the rural South. For decades, rates of gonorrhea and syphilis have been higher in the Southern United States. [5] Most Southern states did not expand Medicaid under the Affordable Care Act, so treatment for STIs may be relatively lower for Southern residents, both due to limited expansion of STI treatment services [25] as well as overall higher rates of uninsured individuals in the South, particularly for men. [26]

Black residents in the South face compounding challenges to accessing healthcare, including racial discrimination, higher rates of poverty, and lower levels of access to transportation, further exacerbating disparities in STI prevalence. [27] Our study highlights these disparities, with Black beneficiaries more likely to have chlamydia, gonorrhea, and HIV than white beneficiaries. These disparities in access to care among racial/ethnic minority residents were further highlighted by the ongoing COVID-19 pandemic. [15, 28]

Addressing disparities in outcomes among rural and racial/ethnic minority populations will require interventions that address factors at multiple levels, and are scaled to work in rural environments especially those that are focused on the structural barriers these populations face in seeking services. [29] While primary prevention can reduce the burden of these diseases, there is currently an opportunity to improve access to and coordination of patient care among health departments and health care payors that supports the reduction of STIs. This is especially critical in rural areas where services overall are often limited. Other interventions are

Table 2 Multivariable regression estimates of the association between having at least one claim for chlamydia, gonorrhea, syphilis, or HIV and sociodemographic individual and county-level factors among Medicaid beneficiaries in South Carolina from July 2019 to June 2021

	Chlamydia		Gonorrhea		Syphilis		HIV	
	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Race/ethnicity								
Non-Hispanic White	Ref		Ref		Ref		Ref	
Non-Hispanic Black	1.88 (1.74–2.03)	< 0.001	1.99 (1.76–2.25)	< 0.001	1.25 (0.98–1.61)	0.077	2.51 (1.94–3.23)	< 0.001
Other	1.34 (1.23–1.46)	< 0.001	1.39 (1.24–1.56)	< 0.001	1.22 (0.98–1.51)	0.069	2.31 (1.82–2.93)	< 0.001
Area (location) of residence								
Urban	Ref							
Rural	1.14 (1.05–1.24)	0.002	1.14 (1.04–1.25)	0.007	0.80 (0.65–0.99)	0.042	0.74 (0.56–0.97)	0.031
Age groups								
25 to 34	Ref							
0 to 17	2.01 (1.78–2.27)	< 0.001	1.06 (0.89–1.26)	0.500	0.17 (0.11–0.25)	< 0.001	0.07 (0.04–0.13)	< 0.001
18 to 24	2.87 (2.67–3.01)	< 0.001	1.75 (1.58–1.93)	< 0.001	0.68 (0.56–0.83)	< 0.001	0.32 (0.26–0.41)	< 0.001
35 to 44	0.38 (0.35–0.42)	< 0.001	0.55 (0.48–0.62)	< 0.001	0.97 (0.76–1.23)	0.795	2.76 (2.25–3.40)	< 0.001
45 +	0.19 (0.14–0.24)	< 0.001	0.35 (0.28–0.44)	< 0.001	2.02 (1.55–2.63)	< 0.001	14.28 (11.29–18.07)	< 0.001
Gender								
Male	Ref							
Female	1.39 (1.23–1.56)	< 0.001	0.86 (0.77–0.97)	0.012	0.23 (0.20–0.27)	< 0.001	0.17 (0.14–0.21)	< 0.001
Top comorbidities								
Substance & alcohol use	1.97 (1.73–2.24)	< 0.001	1.98 (1.66–2.37)	< 0.001	2.12 (1.26–2.88)	< 0.001	1.18 (0.85–1.62)	0.326
Depression	1.66 (1.46–1.88)	< 0.001	1.44 (1.20–1.73)	< 0.001	2.22 (1.39–3.54)	0.001	1.83 (1.21–2.77)	0.004
COPD	1.31 (1.19–1.45)	< 0.001	1.65 (1.37–1.99)	< 0.001	1.33 (0.82–2.16)	0.240	1.06 (0.76–1.48)	0.743
Congestive Heart Failure	1.09 (0.91–1.31)	0.333	1.02 (0.69–1.52)	0.912	1.40 (0.79–2.48)	0.252	0.74 (0.51–1.06)	0.104
Obesity	1.09 (0.94–1.26)	0.264	1.04 (0.84–1.30)	0.718	1.23 (0.88–1.71)	0.221	0.85 (0.58–1.25)	0.415
Hypertension	0.85 (0.67–1.06)	0.159	1.12 (0.70–1.78)	0.632	0.75 (0.35–1.60)	0.463	0.92 (0.57–1.48)	0.726
County-level variables								
Poverty rate	1.00 (0.97–1.04)	0.807	0.99 (0.96–1.03)	0.693	1.06 (0.99–1.15)	0.103	0.98 (0.91–1.05)	0.520
Underserved area score	0.98 (0.89–1.09)	0.715	0.98 (0.86–1.11)	0.719	0.96 (0.80–1.16)	0.705	1.12 (0.81–1.55)	0.495
% non-Hispanic Whites	0.97 (0.93–1.01)	0.176	1.02 (0.97–1.07)	0.460	0.98 (0.87–1.10)	0.697	1.13 (0.96–1.33)	0.156
% non-Hispanic Blacks	0.97 (0.94–1.02)	0.227	1.03 (0.97–1.08)	0.361	0.97 (0.86–1.09)	0.584	1.16 (0.98–1.38)	0.079
% Females	1.06 (1.02–1.11)	0.002	1.05 (1.01–1.10)	0.026	1.03 (0.95–1.13)	0.468	1.00 (0.90–1.12)	0.978
Unemployment rate	0.94 (0.86–1.03)	0.193	0.88 90.78–0.99)	0.039	0.93 (0.77–1.14)	0.505	0.94 (0.65–1.35)	0.727
% 18 to 24 years	0.99 (0.98–1.00)	0.159	0.98 (0.97–1.00)	0.013	1.00 (0.98–1.03)	0.770	0.99 (0.96–1.03)	0.685
% 25 or older	1.03 (1.01–1.09)	0.002	1.03 (1.01–1.05)	0.017	0.96 (0.92–1.00)	0.066	0.97 (0.93–1.02)	0.199

needed at the community level. Efforts such as the CDC's Community Approaches to Reducing Sexually Transmitted Disease (CARS) initiative have demonstrated how community engagement can be a powerful tool in supporting STI prevention, screening, and treatment. [30] However, to date, most of the implementation sites for CARS have been in urban settings.

The strengths of the study include the examination of rural/urban and racial/ethnic differences in STI and HIV rates in the rural South using the most recent data available. Limitations of this study include using claims measures of STIs, which may be imperfect measures of STI prevalence due to provider coding. Specifically, these data may undercount the true prevalence of STI rates as providers may be uncertain of diagnosis before further evaluation and testing. [29] Further, we could not estimate incidence rates, given the nature of our data. The data also had large counts of missing race/ethnicity data, limiting our race/ethnicity categories to just three.

The findings of this study may be useful for policymakers and program officials as they design interventions to prevent and treat HIV and STIs, particularly in rural communities in the Southeast. Use of state Area Health Education Center programs to train providers on the prevention and

management of STIs may be beneficial. Disease burdens may be reduced by more effective contract tracing and targeted distribution of prevention methods.

Disclaimer The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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Data Availability Data for this study was from South Carolina Medicaid administrative claims data, using the two most recent and complete state fiscal years of data available for our study (fiscal year 1: July 2019 to June 2020; fiscal year 2: July 2020 to June 2021). This data is available for purchase from the South Carolina Office of Revenue and Fiscal Affairs.

Declarations

Conflict of interest Not applicable.

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent for Publication Not applicable.

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