

# **The Impact of Demographic Variables on the Acquisition of HIV and Sexually Transmitted Diseases**

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## **Abstract**

The objective of this study was to calculate and analyze the community sex ratio and other demographic variables for counties in six Southeastern states (Alabama, Mississippi, Louisiana, Georgia, South Carolina, and Tennessee) for patterns and associations with the rate of HIV and sexually transmitted diseases (STDs). The demographic variables were analyzed as: race and age-specific community sex ratios, percent below the poverty level, educational attainment (divided into 2 groups—those with a high school diploma or equivalent and less, and those with greater than a high school diploma), and race distribution of African Americans and Whites. Data derived from the American Community Survey (ACS) 2008-12 five-year sample at the census tract level for counties in six Southeastern states (Alabama, Mississippi, Louisiana, Georgia, South Carolina, and Tennessee) were combined to calculate composite, county-level measures. County-level rates of HIV and STD diagnoses in 2012 were derived from data collated by the Centers for Disease Control and Prevention (CDC) National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention (NCHHSTP) interactive atlas. Descriptive statistics, bivariate correlation, and multiple regression analysis were conducted using SPSS statistical software package. From the statistical analysis, it was found that STDs are highly correlated with one another indicating that the prevalence of any one STD is associated with the prevalence of all others. Poverty, race distribution and low educational attainment (i.e. high school diploma, GED, or below) were significantly associated with the acquisition of HIV, chlamydia, gonorrhea, and syphilis. The community sex ratio was not significantly correlated with the acquisition of HIV and STDs. Education and poverty may play an integral role in HIV and STD acquisition, and more research should be conducted to explore the influence of these demographics.

**Keywords: Demographics, Sexually Transmitted Diseases, Southeast United States**

## **1. Introduction**

African Americans are disproportionately impacted by poverty, HIV, and sexually transmitted diseases (STDs)<sup>1</sup>. In 2013, the poverty rate disproportionately impacted African Americans at a rate of 27.2 percent compared to 9.6 percent for Whites<sup>2</sup>. In 2010, 62 percent of HIV-infected people in the South were African Americans<sup>3</sup>. In 2012, African Americans represented only 12 percent of the population and accounted for 41 percent of new HIV cases<sup>3</sup>. In 2013, the rate of chlamydia among African-American women was 5.8 times the rate among White women, and the rate among African-American men was 8 times the rate among White men<sup>2</sup>. In 2013, 58.4 percent of gonorrhea cases occurred in African Americans, and the rate of gonorrhea among African Americans was 12.4 times greater than the rate among their White counterparts<sup>2</sup>.

Several studies have hypothesized a link between certain community level factors and the occurrence of HIV among black women<sup>4,5</sup>. One such community level factor is the community sex ratio, which is defined as the ratio of men to

women in a given geographic area<sup>5</sup>. A balanced sex ratio is 1 indicating that for every one woman in a community, there is one man. When the community sex ratio is imbalanced, women may partner with men they otherwise would not partner with if the sex ratio were balanced. Prior research has shown that sex ratios in predominantly Black communities are substantially more imbalanced than sex ratios in predominantly White communities<sup>5</sup>.

Forms of Black community dislocation (Black male incarceration, unemployment, higher mortality rates, and residential segregation) have distorted the normal patterns of family dynamics and intimate relationships in Black communities<sup>5-8</sup>. With fewer men in Black communities, there may be higher partner concurrency, with men having multiple female sex partners<sup>7, 8</sup>. Higher partner concurrency is a risky sexual behavior that increases the risk of acquiring a sexually transmitted disease<sup>7, 8</sup>.

The purpose of this study was to examine the association of an imbalanced community sex ratio and other demographic variables including poverty levels, educational attainment, and race distribution on the acquisition of HIV and other sexually transmitted diseases in counties of Alabama, Mississippi, Louisiana, Georgia, South Carolina, and Tennessee

## 2. Methods

### 2.1 Sex Ratio

Data derived from the American Community Survey (ACS) 2008-12 five-year sample at the census tracts level for counties in six Southeastern states (Alabama, Mississippi, Louisiana, Georgia, South Carolina, and Tennessee) were combined to calculate composite, county-level measures. Multiple iterations of the community sex ratio were calculated to encompass variability among race and age distributions. First, sex ratios were calculated for the total county population including males and females of all races and ethnicities between the ages of 15 to 44 years. Next, race-specific sex ratios were calculated accounting for two specific races, Black and White, within the age range of 15 to 44 years. All four of these county-level ratios were weighted to the total corresponding population of each census tract to calculate a composite county level measure.

Each of the four ratios calculated excluded outliers. Outliers were identified as census tracts with less than or equal to 10 counts of males or females, or a census tract level sex ratio of less than or equal to 0.25 or greater than or equal to 1.75.

### 2.2 Demographic Variables

Demographic data (race distribution, educational attainment, and poverty) were obtained from the American Community Survey (ACS) 2008-12 five-year sample at the census tracts level for counties in six Southeastern states (Alabama, Mississippi, Louisiana, Georgia, South Carolina, and Tennessee) and were combined to calculate composite, county-level measures weighted to the population. The specific demographic measures used in the analysis were distribution of Blacks ages 15-44, distribution of Whites ages 15-44, educational attainment greater than a high school diploma or equivalent, and income below the federal poverty level.

### 2.3 HIV and STD Rates

Data on HIV, chlamydia, all types of syphilis, and gonorrhea rates in the counties of the six Southeastern states studied were obtained from the Centers for Disease Control and Prevention (CDC) National Center for HIV/AIDS, Viral Hepatitis, STD, and TB prevention (NCHHSTP) interactive atlas. The 2012 disease data rates by county included total HIV, HIV among Blacks, HIV among Whites, chlamydia, gonorrhea, and syphilis.

### 2.4 Calculation of Outcome Variable

Multiple regression analysis models were generated for analysis. Disease status was the outcome variable with rate of population below poverty level, corresponding race distribution, rate of educational attainment, and corresponding community sex ratio as explanatory variables.

### 3. Results

#### 3.1 Bivariate Correlations among Study Variables

Statistically significant bivariate correlations were found between all sexually transmitted diseases, indicating that the prevalence of any one STD is associated with the prevalence of all others. Educational attainment was significantly correlated with most (with the exception of chlamydia) sexually transmitted diseases and significant correlations were negative, as educational attainment increased the prevalence of most sexually transmitted diseases decreased (HIV  $p < .01$ , gonorrhea  $p < .05$ , syphilis  $p < .05$ ). Percent of the population below the federal poverty line was positively correlated with all sexually transmitted diseases (HIV  $p < .05$ , chlamydia  $p < .05$ , gonorrhea  $p < .05$ , syphilis  $p < .01$ ). Correlations with the varying iterations of the community sex ratios were mostly insignificant and incompatible.

Table 1. Bivariate correlations among study variables.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. HIV	1											
2. HIVB	.65**	1										
3. HIVW	.78**	.48**	1									
4. CHLA	.47**	-.03 <sup>NS</sup>	.29**	1								
5. GONO	.51**	.03 <sup>NS</sup>	.34**	.85**	1							
6. SYPH	.44**	.21**	.44**	.27**	.33**	1						
7. EDA	-.11*	-.02 <sup>NS</sup>	-.23**	-.03 <sup>NS</sup>	-.12**	-.14**	1					
8. INC	.34**	.07 <sup>NS</sup>	.11*	.60**	.49**	.10*	.45**	1				
9. CSRW	.09*	-.01 <sup>NS</sup>	.06 <sup>NS</sup>	.11**	.09 <sup>NS</sup>	.03 <sup>NS</sup>	.15**	.15**	1			
10. DISW	-.61**	-.01 <sup>NS</sup>	-.36**	-.79**	-.74**	-.30**	-.03 <sup>NS</sup>	-.59**	-.16**	1		
11. CSRB	-.08 <sup>NS</sup>	-.03 <sup>NS</sup>	-.09*	-.07 <sup>NS</sup>	-.07 <sup>NS</sup>	-.02 <sup>NS</sup>	.10*	-.03 <sup>NS</sup>	.12**	.06 <sup>NS</sup>	1	
12. DISB	.61**	.01 <sup>NS</sup>	.36**	.79**	.74**	.30**	.04*	.59**	.16**	<b>-.99**</b>	-.06 <sup>NS</sup>	1

*Note:* HIV = Prevalence of HIV, HIVB = Prevalence of HIV Black, HIVW = Prevalence of HIV White, HIVF = Prevalence of HIV Female, HIVM = Prevalence of HIV Male, CHLA = Chlamydia, GONO = Gonorrhea, SYPH = Syphilis, EDA = Educational Attainment, INC = Income Below Poverty, CSRW = Community Sex Ratio White, DISW = Distribution of Whites, CSRB = Community Sex Ratio Black, DISB = Distribution of Blacks, <sup>NS</sup>not significant, \*  $p < .05$ , \*\*  $p < .01$ .

#### 3.2 Multiple Regression Analysis

The multiple regression models were set with each sexually transmitted disease as the outcome variable and corresponding demographic variables as explanatory variables. Corresponding demographic variables are demographic variables that are related to the group specific data being analyzed. For example, HIV in the Black population is an outcome variable with the corresponding demographic variables of population distribution of Blacks and the community sex ratio of Blacks ages 15-44. Backward elimination was performed by removing the most insignificant explanatory variable to verify the model obtained.

The race-specific community sex ratios were insignificant in association with all sexually transmitted diseases. As the distribution of Blacks in a county increased, the rate of chlamydia, gonorrhea, and syphilis increased ( $\alpha < .01$ ). As the distribution of Whites increased in a county, the rate of chlamydia, gonorrhea, and syphilis decreased ( $\alpha < .01$ ). As the percent of the population below the federal poverty line increased, the rate of HIV, chlamydia and gonorrhea increased ( $\alpha < .01$ ). As the percent of the population with above a high school diploma or equivalent increased, the rate of HIV, chlamydia, gonorrhea, and syphilis decreased ( $\alpha < .01$ ).

Table 2. Summary of Multiple Regression Models.

Predictor Variables	HIV1	HIV2	CHLA1	CHLA2	GONO1	GONO2	SYPH
CSRB	-.03 <sup>NS</sup> (-.70)		-.01 <sup>NS</sup> (-.26)		-.01 <sup>NS</sup> (-.03)		-.02 <sup>NS</sup> (-.41)
CSRW		.07 <sup>NS</sup> (1.64)		-.01 <sup>NS</sup> (-.22)		-.01 <sup>NS</sup> (-.36)	
DISB			.56** (15.66)		.56** (13.68)		.32** (5.48)
DISW				-.60** (-18.14)		-.59** (-15.89)	
INC	.48** (10.25)	.48** (10.61)	.37** (9.06)	.33** (9.02)	.29** (6.23)	.27** (6.60)	-.03 <sup>NS</sup> (-.52)
EDA	-.31** (-6.54)	-.34** (-7.52)	-.19** (-6.14)	-.19** (-6.23)	-.25** (-7.11)	-.26** (-7.77)	-.16** (-3.19)
R <sup>2</sup>	.195	.207	.661	.676	.562	.598	.108
DF	467	496	475	509	475	509	475

Note: HIV = Prevalence of HIV, CHLA = Chlamydia, GONO = Gonorrhea, SYPH = Syphilis, EDA = Educational Attainment, INC = Income Below Poverty Level, CSRW = Community Sex Ratio White, DISW = Distribution of Whites, CSRB = Community Sex Ratio Black, DISB = Distribution of Blacks, Standardized regression coefficients are reported and *t*-values are in parentheses, \*Significant at  $\alpha=.05$ , \*\*Significant at the  $\alpha=.01$  level, <sup>NS</sup> Not significant.

## 4. Discussion

This study found poverty to be associated with HIV and STDs. Prior research found that poverty, HIV, and STDs disproportionately impact African Americans<sup>4</sup>. Prior research suggests African-American women's impoverishment increases their vulnerability of STD acquisition by compromising condom use. With constrained economic resources, women place less priority on STD prevention<sup>9, 10</sup>. A possible contributor for the association of poverty and education with HIV and STDs may be the high Black male incarceration rate. Prior research has found that previously incarcerated men face economic insecurities and reduced opportunities for educational advancement<sup>11-13</sup>. Black men are incarcerated at a higher rate than any other race<sup>13</sup>. In 2013, Black men were imprisoned at a rate 2.5 times greater than Hispanic males and 6 times greater than white males<sup>13</sup>. High Black male incarceration removes the men from society resulting in a shortage of men and an imbalanced community sex ratio<sup>4, 5</sup>.

### 4.1 Study Strengths

The study focuses on demographics and sexually transmitted diseases, which is a public health concern that has not received much research interest. Prior studies have stated the rates of HIV and STDs among races, but there is not much literature on possible explanatory variables for the sexual health disparity between races and socioeconomic standing.

## 4.2 Study Limitations

The data from this study were analyzed simultaneously looking at all counties in the six Southeastern states of concern. A limitation to this approach could be that it does not take into account the demographic variability across Southeastern states. State-specific analyses may yield different results.

## 4.3 Next Steps

The next step is to dive deeper into the research by conducting state specific analyses to account for demographic and social variability across Southeastern states. The study will also look closer at South Carolina to investigate the association of the disproportionately high rates of black male incarceration with HIV and STD rates and demographic trends.

## 5. Conclusions

This study found that as the percent of the county population below the federal poverty line increases the rate of sexually transmitted diseases increases. This study also found that as the percent of the population with an educational attainment higher than a high school diploma or equivalent decreases the rate of sexually transmitted diseases decreases. Education and poverty may play an integral part in HIV and STD acquisition and more research should be conducted to explore the influence of these demographics.

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## 7. References

1. Fiscella, K., & Williams, D. R. (2004). Health disparities based on socioeconomic inequities: implications for urban health care. *Academic Medicine*, 79(12), 1139-1147.
2. Centers for Disease Control and Prevention. 2013 Sexually Transmitted Diseases Surveillance: STDs in Racial and Ethnic Minorities. <http://www.cdc.gov/std/stats13/minorities.htm>. Accessed June 24, 2015.
3. Centers for Disease Control and Prevention. HIV and AIDS in the United States by Geographic Distribution. <http://www.cdc.gov/hiv/statistics/basics/geographicdistribution.html>. Accessed June 24, 2015.
4. Adimora, A. A., & Schoenbach, V. J. (2002). Contextual factors and the black-white disparity in heterosexual HIV transmission. *Epidemiology*, 13(6), 707-712.
5. Pouget ER, Kershaw TS, Nicolai LM, Ickovics JR, Blankenship KM. Associations of sex ratios and male incarceration rates with multiple opposite-sex partners: potential social determinants of HIV/STI transmission. *Public Health Rep*. 2010;125 Suppl 4:70-80.
6. Lane SD, Rubinstein RA, Keefe RH, Webster N, Cibula DA, Rosenthal A, et al. Structural violence and racial disparity in HIV transmission. *J Health Care Poor Underserved*. 2004;15(3):319-335.
7. Adimora AA, Schoenbach VJ, Doherty IA. HIV and African Americans in the southern United States: sexual networks and social context. *Sex Transm Dis*. 2006;33(7 Suppl):S39-45.
8. Lemelle AJ, Jr. Racialized social system and HIV infection: the case of African Americans. *International Journal of Sociology and Social Policy*. 2002;22(4-6):133-158.
9. Wingood, G. M., & DiClemente, R. J. (1998). Partner influences and gender-related factors associated with noncondom use among young adult African American women. *American journal of community psychology*, 26(1), 29-51.

10. Dunkle, K. L., Wingood, G. M., Camp, C. M., & DiClemente, R. J. (2010). Economically motivated relationships and transactional sex among unmarried African American and white women: results from a US national telephone survey. *Public Health Reports*, 125(Suppl 4), 90.
11. Harawa, N., & Adimora, A. (2008). Incarceration, African Americans, and HIV: Advancing a research agenda. *Journal of the National Medical Association*, 100(1), 57.
12. Blankenship, K. M., Smoyer, A. B., Bray, S. J., & Mattocks, K. (2005). Black-white disparities in HIV/AIDS: the role of drug policy and the corrections system. *Journal of Health Care for the Poor and Underserved*, 16(4 Suppl B), 140.
13. Carson, E. A. (2014). Prisoners in 2013. *Bureau of Justice Statistics*, September.
14. United States Census Bureau / American FactFinder. "S1701 Poverty Status in the Past 12 months", "S1501 Educational Attainment", "B01001A Age and Sex (White Alone)", "B01001B Age and Sex (Black Alone)." *2008 – 2012 American Community Survey*. U.S. Census Bureau's American Community Survey Office, 2012. [http://factfinder.census.gov/faces/nav/jsf/pages/download\\_center](http://factfinder.census.gov/faces/nav/jsf/pages/download_center). Accessed June 2015
15. Centers for Disease Control and Prevention. 2008-2012 National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention (NCHHSTP) Interactive Atlas. <http://gis.cdc.gov/GRASP/NCHHSTPAtlas/main.html>. Accessed May 12, 2015
16. IBM Corp. Released 2015. IBM SPSS Statistics for Mac, Version 24.0. Armonk, NY: IBM Corp.