Race/Ethnicity Is Associated With Disparities in Gonorrhea Rates in NYC, 2009

ABSTRACT

Sexually transmitted infections (STIs) pose significant public health problems with implications such as reducing the spread of HIV in the population. Gonorrhea is the second reported STI in the United States as well as in New York City (NYC). Blacks are the racial/ethnic group that bear the greatest burden of gonorrhea infection. We examined whether missing data on race/ethnicity would explain black-white disparities in gonorrhea rates and whether neighborhood race/ethnic composition would explain any black-white disparities observed. We found that proportion of unknown race/ethnicity explained black-white disparities in gonorrhea rates for females. Next, neighborhoods with a higher composition of black residents had higher gonorrhea rates overall, and had higher mean black-white disparities in gonorrhea for females. More complete information on race/ethnicity among persons diagnosed with gonorrhea is critical to elucidate possible structural/neighborhood determinants of black-white disparities. STI prevention should focus on to communities with high proportion of black residents.

Keywords: Gonorrhea, Race/Ethnicity, STIs Disparity, Individual-level and Neighborhood-level

INTRODUCTION

Addressing disparities in sexually transmitted infections (STIs) is an important public health priority as indicated in Healthy People 2020. (United States Department of Health and Human Services, 2013) Gonorrhea is the second most reported sexually transmitted infection in the United States, with estimates of 321,849 new infections in 2011. (Center for Disease Control and Prevention, 2012d) Disparities in gonorrhea are evident across race/ethnicity and sex. For instance, a CDC report showed that from 2002, blacks are the race/ethnic group that have bore the brunt of gonorrhea infection. (Center for Disease Control and Prevention, 2012b) National data from 2011 showed that gonorrhea rates among all those with known race/ethnicity were 428.3 and 425.4 per 100,000 for black males and females respectively, which was 17 times the rate among white males and females respectively at 22.1 and 28.0 per 100,000. (Center for Disease Control and Prevention, 2012c)

In New York City (NYC), there are also wide disparities in rates of gonorrhea across race/ethnicity and sex. For instance, in 2009 the citywide rates were 301.4 and 151.9 per 100,000 for black males and black females respectively, compared to 29.2 and 3.0 for white males and white females, respectively. (New York City Department of Health and Mental Hygiene, 2012c) Gonorrhea is concentrated in pockets of NYC neighborhoods, (New York City Department of Health and Mental Hygiene, 2012b) which are also characterized by disadvantaged socioeconomic position. (Karpati et al., 2004) Finally, the size of black-white disparities in gonorrhea rates vary across NYC neighborhoods, (New York City Department of Health and Mental Hygiene, 2012c) however, little is known about what factors are associated with such variation.

Identifying predictors of racial/ethnic disparities in gonorrhea are important for several reasons. At the individual level, STIs such as gonorrhea increase individuals risk for HIV infection by disrupting mucosal barriers, as well as directing HIV infected inflammatory cells to the genital tract as part of the normal immune response in the presence of an underlying infection. (Fleming & Wasserheit, 1999) Some studies estimate the risk of acquiring HIV from a single act of intercourse is at least eight times greater for women than men through heterosexual sex (De Vincenzi, 1994; Padian et al., 1987) because women have a larger reproductive mucosal surface area by way of the vagina and cervix that allows greater opportunity for infection to occur. (Moscicki, Ma, Holland, & Vermund, 2001) Untreated STIs such as gonorrhea can lead to other long term health consequences such as infertility, pelvic inflammatory diseases in women, and epididymitis in men. (Center for Disease Control and Prevention, 2012a)

At the population level, untreated STIs have high economic costs, especially related to HIV co-infection. (Harrell W Chesson & Pinkerton, 2000) For example, one study estimated the lifetime medical costs per case of STIs among 15 to 24 year olds was six and half billion dollars. (Harrell W. Chesson, Blandford, Gift, Tao, & Irwin, 2004) More importantly, treatment of STI have been identified as an important HIV prevention strategy. (Galvin & Cohen, 2004; Kamali et al., 2003) Given that blacks are the race/ethnic group most affected by HIV infection and mortality, addressing racial/ethnic disparities in gonorrhea infection rates may be a crucial step to eliminating racial/ethnic disparities in HIV. (Center for Disease Control and Prevention, 2010)

Several factors shape racial/ethnic disparities in gonorrhea infection rates at the individual level such as income, education, and risky sexual behaviors like concurrent sexual partners. (Annang, Walsemann, Maitra, & Kerr, 2010; Morris, Kurth, Hamilton, Moody, & Wakefield, 2009) Those factors, however, do not fully explain racial/ethnic disparities in STIs. (Hallfors, Iritani, Miller, & Bauer, 2007) While socioeconomic status and sexual behavioral factors are known individual level predictors of race/ethnic disparities in health, missing race/ethnicity data pose significant problems in STI surveillance registries. (Chen, Etkind, Coman, Tang, & Whelan, 2003) Little is known about whether missing data on race/ethnicity is associated disparities in health outcomes (Corbie-Smith, St George, Moody-Ayers, & Ransohoff, 2003) such as STIs. Community level factors such as sex ratio among African Americans, concentrated poverty, and racial residential segregation have also been purported as factors that explain black-white disparities in health, (Williams & Collins, 2001) including STIs (Adimora & Schoenbach, 2002; Biello et al., 2012) and HIV. (Adimora & Schoenbach, 2002)

Contextual factors shape racial/ethnic disparities in STI rates through constraining the sexual networks from which are partners are available to choose from. (Adimora, Schoenbach, & Floris-Moore, 2009) For example, one study of an African American sample found that residents living in neighborhoods with concentrated poverty had increased odds of being in a high risk sexual network, which was six to seven times more likely to contain an infected partner than a low risk group. (Fichtenberg, Jennings, Glass, & Ellen, 2010)

Given the health and social implications of racial/ethnic disparities in STIs, this study had one broad question: is race/ethnicity at the individual level, and at the neighborhood level associated with black-white disparities in gonorrhea rates? We sought to answer this question with two specific aims. In the first aim, we determined whether missing data on race/ethnicity is associated with black-white disparities in gonorrhea rates in NYC. The second aim determined whether neighborhood race/ethnic composition is associated with any black-white disparities observed. We hypothesized first that black-white disparity would be wider in neighborhoods with higher proportion of black residents. We had no prior hypotheses for the effect of missing race/ethnicity

data on black-white disparity in gonorrhea rates. For this paper, we limit our analyses to the year 2009 given that disparities by race/ethnicity and sex were widest in New York City and is was the latest year for which data are publicly available.

METHODS

Dependent variable

Black-white differences in rates of gonorrhea per 100,000 persons was the outcome variable. Data were downloaded from the NYC Sexually Transmitted Diseases Registry from the STD EpiQuery Online module for the years 2000 to 2009. Data were available for download stratified by race/ethnicity, sex and 42 United Hospital Fund (UHF) neighborhoods. (New York City Department of Health and Mental Hygiene, 2012c) The data set included number of reported cases, and rate per 100, 000 population. We calculated the absolute difference in rate for non-Hispanic blacks minus the rate for non-Hispanic whites. A total of 84 data points were available for analyses.

Exposure variables

Proportion of cases with unknown race/ethnicity data was the first exposure variable. Data on race and ethnicity are based on an "ordered selection rule" that first classifies a person as "Hispanic" ethnicity, regardless of race. Those of unknown ethnicity are then classified by race as non-Hispanic Asian, non-Hispanic white, non-Hispanic black, non-Hispanic Native American/Alaskan Native, and non-Hispanic other, or non-Hispanic Unknown race. (New York City Department of Health and Mental Hygiene, 2012a) We calculated the proportion of missing race/ethnicity (within male and female sex, and each neighborhood) as the number of non-Hispanic unknown race divided by the total of number of cases. Proportion of black residents in the neighborhood, was the second exposure variable. These data were downloaded from the American Community Survey 5-year estimate (2006-2010) and calculated as the proportion of non-Hispanic blacks divided by the total population within each of the 42 UHF neighborhoods. (Infoshare Associates LLC, 2000) Both exposure variables were grouped into quartiles because of their non-linear association with the outcome.

Analyses

We conducted descriptive analyses first by plotting the trends of gonorrhea rates by race and sex from 2000 to 2009 (Figure 1). Next, we mapped: a) the absolute black-white difference in gonorrhea rates per 100,000, b) the mean gonorrhea rate, c) the proportion of black residents in the neighborhood, and d) the proportion of gonorrhea cases with unknown race/ethnicity across the 42 UHF neighborhoods (Figures 2a through 2d). Categories were created using the quintile method with four cut points. We then tested for spatial clustering patterns using Moran' I statistic based on a spatial weights matrix with five nearest neighbors. All maps and statistics were conducted in Arc Map 10.0. (ESRI, 2011) Next, we conducted t-tests to investigate whether there were sex differences in absolute black-white differences in gonorrhea rates and in cases with unknown race/ethnicity. Finally, we conducted analyses of variance (ANOVA) stratified by sex to investigate whether proportion of unknown race/ethnicity, and proportion of black residents were associated with the outcome. We conducted post-hoc analyses adjusted for pairwise comparisons (UCLA Institute for

Digital Research and Education) to test for group differences in the proportion of unknown race/ethnicity variable since these analyses were exploratory. Statistics were conducted in Stata 10.0.(StataCorp, 2007)

RESULTS

Since year 2000, the pattern in racial/ethnic disparities in gonorrhea rates in NYC have remained steady, with black males reporting the highest gonorrhea rates, followed by black females, white males and white females. Black males had almost five times higher rate of gonorrhea than white males (316.3 per 100,000, vs. 56.8 per 100,000) (Figure 1). There were two outlier cases in the data set where the black-white difference in gonorrhea rates among males was exceedingly large so they were removed leaving 82/84 cases for the final analyses.

The mean black-white difference in gonorrhea rates overall was 130.48 per 100,000 persons, inter-quartile range (IQR=22 to 220.2). The mean black-white difference in gonorrhea rates was 220 and 44.5 per 100, 000 for males and females respectively and that difference was statistically significant ($p<.0001$). Proportion of cases with unknown race/ethnicity also differed across sex (39% for men vs. 58% for female) and was statistically significant, $p<.0001$.

Figures 2a through 2d document the spatial properties of the variables. Black-white differences in gonorrhea rates showed statistically significant clustering patters, Moran's $I=0.15$, ($z=2.6$, $p<.01$) and largest differences were in pockets of the South Bronx, Lower Manhattan, Long Island City, Ridgewood in Queens, and Bensonhurst in Brooklyn. Gonorrhea rates also had high degree of clustering with Moran's $I=0.38$, ($z=4.99$, $p<.001$).Areas with the largest proportion of cases with unknown race/ethnicity were mostly in Staten Island and in a few neighborhoods in Brooklyn and Queens. Spatial clustering was also significant, Moran's $I= 0.38$, ($z= 4.92$ $p>.001$). Black residents were largely concentrated in areas of Brooklyn and Queens and spatial autocorrelation was statistically significant, Moran's $I=0.28$, ($z=3.51$ $p<.001$).

Table 1 Shows the group means of absolute black-white differences in gonorrhea rates across NYC in 2009 for females only. There were no significant differences in black-white gonorrhea rates across quartiles of unknown race/race ethnicity, overall ($F=0.53$, $p=0.66$) or for males ($F=0.85$, $p=0.48$). Neighborhoods in the highest quartile, where 55% to 87% data with unknown data for race/ethnicity had a statistically significant lower black-white difference in gonorrhea rates, compared to neighborhoods in the second quartile where 41% to 48% of cases with unknown race/ethnicity. The mean difference was 43 per 100,000; $p<.05$. Proportion of black residents in a neighborhood was not associated with black-white differences in gonorrhea rates overall ($F=0.37$, $p=0.78$), and for males ($F=0.67$, $p=0.57$). For females, neighborhoods within the highest quartile of black residents (35% to 76%) had a statistically significant higher black-white difference in gonorrhea rates compared to neighborhoods in the lowest quartile where only one to four percent were persons were black. ($F=10.12$, $p<.001$).

DISCUSSION

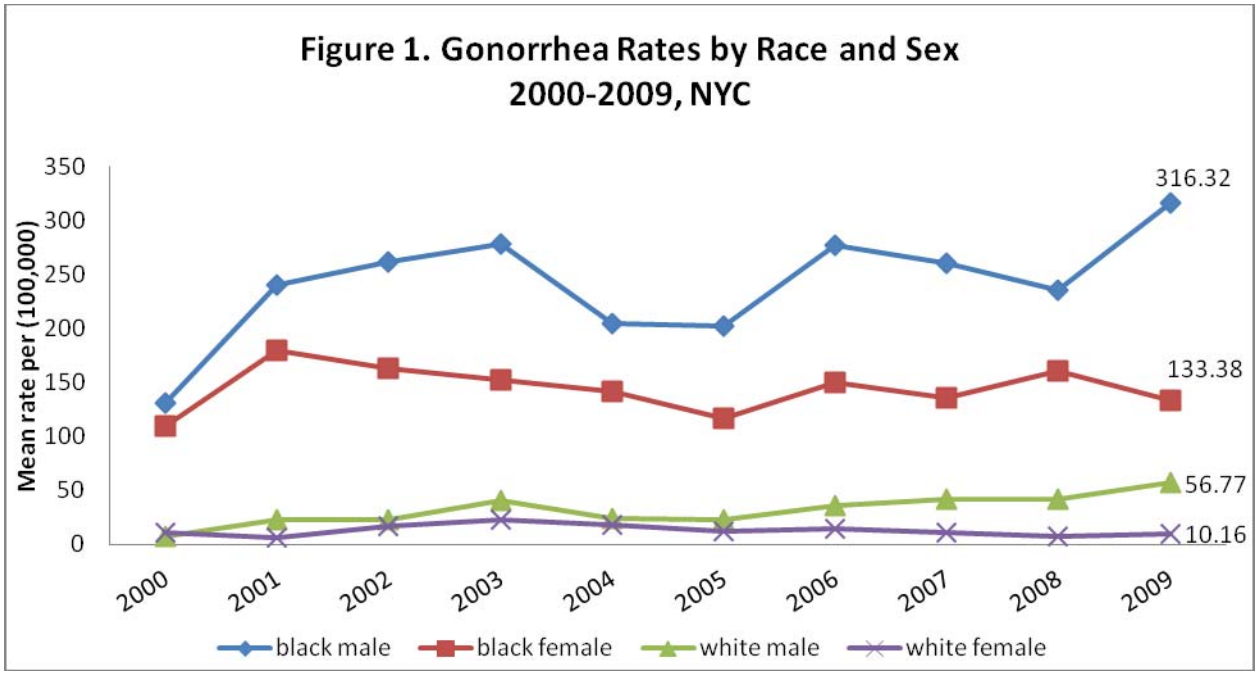
Even though gonorrhea rate declined as of 2012, still blacks disproportionately experience the highest burden of infection. We found significant black-white differences in gonorrhea rates and the size of those differences varied across NYC neighborhoods with clustering patterns evident by high spatial autocorrelation. There was a moderate degree of overlap in neighborhoods between black-white differences and overall gonorrhea rates, which suggest that blacks are that group that are driving overall gonorrhea patterns. While males reported higher gonorrhea rates, females had higher percent of unknown data on race/ethnicity, and that was associated with black-white differences in gonorrhea rates. Research suggest that women, especially African American women, may be vulnerable to practicing safe sexual behaviors that prevent STIs because of fear of abuse and other factors related to gender. (Raiford, DiClemente, & Wingood, 2009) These and other factors such as STI-stigma may also be related to the underreporting of race/ethnicity especially for African American women. (Lichtenstein, 2003) Therefore providers should work towards better collecting these race/ethnicity data for women, especially to better assess the magnitude of racial/ethnic disparities.

Gonorrhea rates visually appear to be concentrated in areas with high proportion of blacks as found in another study. (Newman, 2008) Race/ethnicity may represent a proxy for socioeconomic disadvantage (Jones, 2000) and research suggest that the brunt of racial/ethnic STI disparities are likely the result of socioeconomic factors like poverty. (Center for Disease Control and Prevention, 2013) Next, we found our neighborhood measure of concentration of blacks in neighborhoods explained black-white differences in gonorrhea rates for females. Our results differ from a most recent study that examined the association between racial residential segregation on gonorrhea. First, in that study, the centralization index of racial residential segregation was associated with gonorrhea rates among males but not females. Some dimensions of racial segregation including unevenness were associated with gonorrhea rates while others such as concentration and clustering were not. (Biello, et al., 2012) While our study did not use these official indices of racial residential segregation, our rough proxy showed a strong degree of predictive validity.

There are several limitations with this research. According to NYC DOHMH, all diseases are subject to underreporting especially if providers do not perform diagnostic testing and instead treat presumptively. Next, race/ethnicity is recorded for the majority of cases diagnosed in NYC DOHMH clinics, but private sector providers often lack data. (New York City Department of Health and Mental Hygiene, 2012a) These data limitations, however, are beyond our control.

Next, although evidence indicate that gonorrhea rates exhibit age patterns, and especially high among 15 to 24 year olds, we were not able to stratify these data by age groups. We also did not control for other factors that might be associated with race/ethnic composition in neighborhoods and STIs, such as socioeconomic status. Finally, we removed two cases from the data due to exceedingly high black-white differences in rates which we believe might be related to unreliable

population denominators in the calculation of those rates. Despite these limitations, we have contributed to the literature in significant ways. First, we extend prior analyses by modeling the racial/ethnic differences in gonorrhea rates as the outcome, as prior research mainly focused on overall gonorrhea rates. (Biello, et al., 2012) Next, we have demonstrated that measures of race/ethnicity both at the individual and neighborhood level are associated with black-white differences in gonorrhea rates. We recommend that surveillance systems increase efforts to collect data on race/ethnicity especially for females and intervention efforts be targeted to neighborhoods with high proportion of black residents.



Figures 2a to 2d, Spatial properties of black-white differences in gonorrhea, gonorrhea rates, proportion of black residents and cases of unknown race/ethnicity, NYC 2009

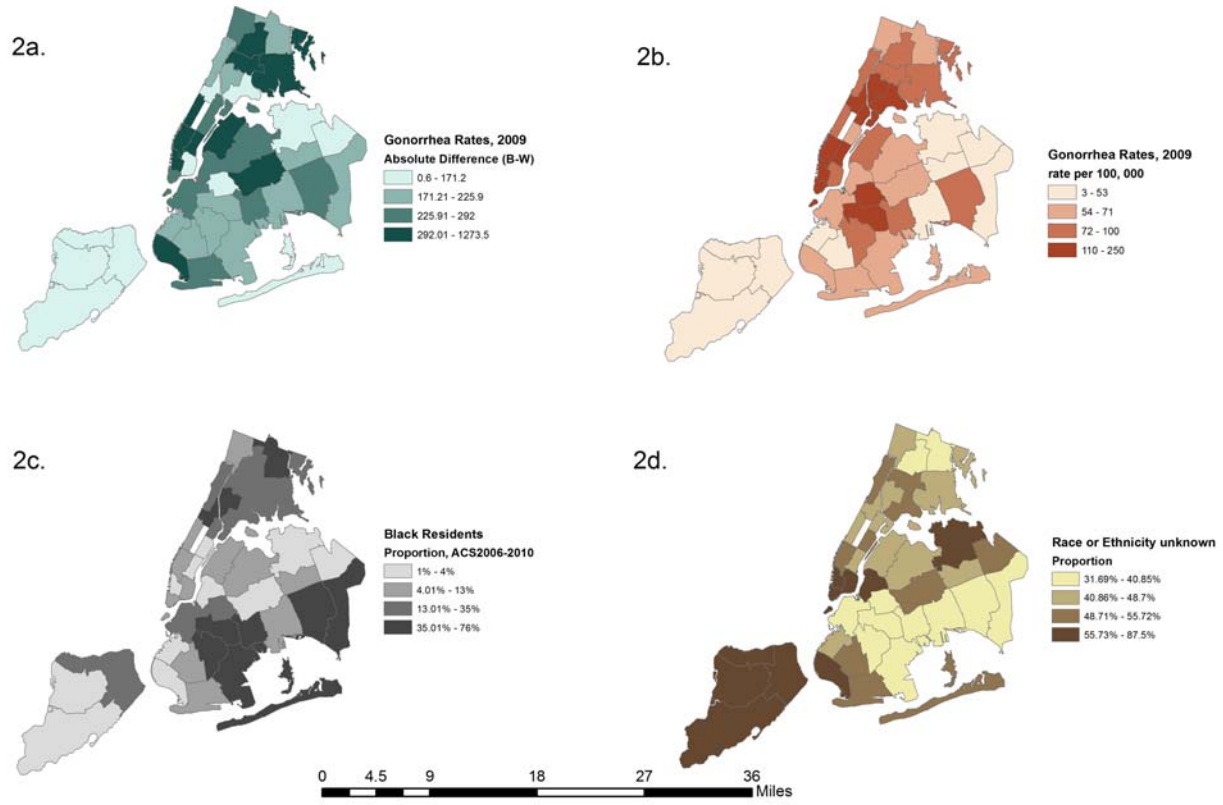


Table 1- Association between race/ethnicity and black-white differences in gonorrhea rates among females in NYC, 2009

	Mean	F, (p-value)
Proportion of unknown race/ethnicity		3.06 (0.04)
Quartile 1	143.56	
Quartile 2	150.45	
Quartile 3	107.43	
Quartile 4	125.45	
Proportion of black residents		10.12 (0.00)
Quartile 1	109.59	
Quartile 2	135.64	
Quartile 3	130.62	
Quartile 4	146.87	

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