Socioeconomic disparities in Sexually Transmitted Infections among young adults in the United States: examining the interaction between income and race/ethnicity

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Socioeconomic disparities in Sexually Transmitted Infections among young adults in the United States: examining the interaction between income and race/ethnicity

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Abstract

Background—There is considerable evidence of racial/ethnic patterning of sexually transmitted infection (STI) risk in the United States (US). There is also evidence that poorer persons are at increased STI risk. Evidence regarding the interaction of race/ethnicity and income is limited, particularly nationally at the individual level.

Methods—We examined the pattern of socioeconomic gradients in STI infection amongst young people in a nationwide US study, and determined how these gradients varied by race/ethnicity. We estimated the cumulative diagnosis prevalence of Chlamydia, Gonorrhoea or Trichomoniasis (via self-report or laboratory confirmation) for young adults (ages 18-26) Hispanics and non-Hispanic Whites, Blacks, and Others across income quintiles in the Add Health dataset. We ran regression models to evaluate these relationships adjusting for individual- and school-level covariates.

Results—STI diagnosis was independently associated with both racial/ethnic identity and with low income, although the racial/ethnic disparities were much larger than income-based ones. A negative gradient of STI risk with increasing income was present within all racial/ethnic categories, but was stronger for non-Whites.

Conclusions—Both economic and racial/ethnic factors should be considered in deciding how to target STI prevention efforts in the US. Particular focus may be warranted for poor, racial/ethnic minority women.

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Keywords

bacterial sexually transmitted infections; income; race/ethnicity; United States

Introduction

It has long been recognized that STI risk in the US is strongly patterned by race/ethnicity, with much the highest rates amongst African-Americans [1-5]. Black men have higher-risk sexual behaviors than White men, however even within strata of sexual and substance-use behavior there remain large differences in STI rates between race/ethnicities, particularly for Black individuals [6].

We expect STI risk to be associated with income, since lower income is associated with less access to preventative information and healthcare, and increased used of sex for economic purposes and as a psychosocial coping mechanism [7]. Past studies of income and STI in the US have found mixed results. Ecological studies have found a positive correlation between STI rates and area-level socioeconomic status (SES) [8-10]. Two nationally representative studies have collected individual-level information on STI infection and income. Among adults in the National Health and Nutrition Examination Survey, Chlamydia was associated with poverty [11]. Among adolescents in the National Longitudinal Study of Adolescent Health (Add Health), higher household income did not predict bacterial STI risk, while by early adulthood, Add Health respondents' childhood experiences of low income were only crudely associated with increased STI risk [12].

Race/ethnicity is an important predictor of income in U.S. society; if race/ethnicity confounds the association between income and STIs, income may be a mediator or moderator of the race/ethnicity-STI relationship [13]. The former would reflect a pathway from racial/ethnic identity through income that acts similarly for all racial/ethnic groups; the latter a pathway that acts differentially by race/ethnicity. To fully explore how income interacts with race/ethnicity with respect to STIs, and in particular how income predicts STI risk within racial/ethnic groups, it is necessary to examine race/ethnicity and income jointly.

Previous analysis has highlighted the interplay of incarceration, social and sexual network segregation and impoverished circumstances that places some racial/ethnic groups, e.g. African-Americans, at far higher risk of infection than the rest of the population [14-16]. Analysis of within-race/ethnicity risk gradients has been less well explored. One study, of Gonorrhoea risk in California by area-level poverty, found that although race/ethnicity was the strongest predictor of risk, gradients existed within all racial/ethnic groups; the gradient was steepest for Whites and shallowest for Hispanics [10]. Another study, of the relationship between education and STI risk in Add Health, found steeper gradients amongst White women for self-reported diagnosis, and steeper gradients amongst Black women for laboratory-confirmed STI [17]. Finally, a study of poverty and STI risk in Add Health found a non-significant trend towards a significant relationship among Black adolescent men [18], but no clear gradient for Whites or Black women.

None of these existing studies provide national evidence regarding income gradients in STI diagnosis within racial/ethnic categories using individual-level data, with the exception of Newbern and colleagues [18], who focus on school-aged respondents. We extend their analysis to cover the period up to young adulthood, to determine how adolescent economic circumstances predict STI risk during individuals' most high-risk years.

Materials and Methods

This analysis used Waves I to III of the Add Health survey, which has followed a nationwide cohort since their adolescence in the mid-1990s [19]; understanding sexual behavior and health was one of its primary design interests. A sample of 80 US high schools (plus 52 of these schools' largest feeder schools) was selected to represent US schools with respect to region of country, urbanicity, school size, school type, and ethnicity. Wave I (1994-95) surveyed a sample of all enrolled students in grades 7 through 12 at home. Wave II (1996) re-surveyed those who had been in grades 7 through 11 at Wave I. Wave III (2001-02; ages 18-26) sought to locate and interview all those surveyed at home in Wave I.

The base study population for this analysis comprised all respondents who were interviewed at Waves I and III, provided information on their age and sex, and were affiliated with one of the 132 core schools. We then excluded respondents whose parents did not provide information on family income or household size. Ethical approval for the Add Health study was obtained from the Institutional Review Board (IRB) at the University of North Carolina, Chapel Hill. This analysis was exempted by the Harvard School of Public Health IRB as a secondary analysis of existing data.

Measures

The primary outcome for this study was a binary measure reflecting whether a respondent had self-reported or laboratory-confirmed *Chlamydia trachomatis*, *Neisseria gonorrhoeae* or *Trichomonas vaginalis* at either Wave II or III. At Wave III, respondents were asked to provide a urine sample testing; detailed descriptions of the testing methods and evidence of their sensitivity and specificity are available elsewhere [20]. Also at Wave III, respondents were asked whether a health professional had, within the past 12 months, told them that they were infected with each of these STIs. At Wave II respondents were asked whether they had been diagnosed since Wave I and at Wave I they were asked if they had ever been diagnosed.

Income was based on parental reports at Wave I of 1994 total pre-tax household income (in $1000 increments, top-coded at $999,000; no income data was collected at Wave II). Household incomes were equivalized by dividing them by the square root of the number of individuals in the household – an approach adopted by the "Luxembourg Income Study" which accounts for economies of scale arising from some household consumption being non-rivalrous in consumption, i.e. use by one member does not diminish the amount available for others [21]. Incomes were categorized into quintiles, using the highest quintile as the reference category, to allow for the detection of non-linearities in STI diagnosis gradients. We classified race/ethnicity into four categories based on respondents' self-report of Hispanic ethnicity and their primary racial identification: White non-Hispanic, Black non-Hispanic, any Hispanic, and Other non-Hispanic (hereafter "White", "Black", "Hispanic" and "Other").

Additional covariates considered as potential confounders of the relationships between race/ethnicity, income and STIs included respondents' age (in years) and sex at Wave I and school urbanicity (urban, suburban or rural), regional location (West, Midwest, South, North-East) and type (public or private).

Analytic approach

We calculated cumulative risk proportions for each combination of race/ethnicity and income quintile, and their adjusted Wilson score 95% approximate binomial confidence intervals (CI). All statistical tests were two-sided at α=0.05 and regression analyses were conducted in SAS version 9.3 (SAS Institute; Cary, NC). Multivariable analysis was conducted using logistic regression models, using survey procedures which allow for clustering at the school level, and sampling weights which adjust for non-response and the unequal probability of selection. We initially established the relationship between racial/ethnic category and STI risk, adjusting for age, sex and school-level covariates. We then added income quintile as a covariate to assess the degree to which income mediated the race/ethnicity-STI relationship, and finally included interactions of race/ethnicity and income quintile to assess effect modification. We also ran models stratified by sex and considering each STI separately.

We conducted three sensitivity analyses: first, given a low likelihood of reverse causation, we included as cases those individuals reporting an STI diagnosis at any age prior to Wave I; second, we restricted our sample to respondents who were interviewed at all three waves; and third, since the impact of family income might be expected to exert its greatest effect while students were in school, we restricted our sample to those interviewed at Waves I and II, and used self-reported STI diagnosis at either wave as our outcome.

Results

10,791 respondents were interviewed at both Waves I and III, were affiliated with a core schools, provided information on age and sex, had parents who reported household size and income, and either answered questions relating to STI history at Waves II and III or provided a valid urine sample for STI testing at Wave III. Age or sex information was missing for 13 Wave III respondents, a further 82 were not from core schools, 3,594 more had no household income information and 423 others lacked sampling weights.

Respondents were almost all aged between 13 and 18 at baseline with an even gender split (Table 1). The sample was more Black and Hispanic than the general US population, and the schools which they attended, reflecting Add Health's intentional oversampling of minorities. Median equivalized per-capita income was $22,660 (95%CI $20,972 - $24,348). Respondents falling in the poorer quintiles of the sample were more likely to be Black or Hispanic and less likely to be White. They were also more likely to come from the South and to attend urban or rural, as opposed to suburban, schools.

Across Waves II and III, prevalence of either a recent diagnosis of, or positive test for, at least one STI was 9.2%. The most common diagnosis was of Chlamydia (6.7%), followed by Trichomoniasis (2.6%) and then Gonorrhoea (1.5%). Diagnosis risk was highest for Blacks (26.1%), followed by Hispanics (10.6%), Others (9.3%) and finally Whites (5.4%). The risk of diagnosis fell as income increased, from 14.7% in the poorest quintile to 5.2% in the richest quintile. This gradient was observed for all four racial/ethnic groups, although the patterns were not strictly monotonic in every instance (Figure 1, values in Supplementary Table 1). Bivariate regression analysis confirmed that Whites were at significantly lower risk of STI diagnosis than all other groups, and all income quintiles at significantly higher risk compared with the richest quintile (Supplementary Table 2).

In multivariable models (Table 2, complete results in Supplementary Table 3), Hispanics and Others had approximately double the odds of STI diagnosis compared with Whites, while Blacks had more than six times the odds. The addition of income reduced the race/ethnicity differentials marginally; however income had an independent association with STIs, with the poorest quintile having 83% increased, and the middle three quintiles having roughly 50% increased, odds compared to the richest quintile. When we interacted race/ethnicity and income, the racial/ethnic differences in the highest income quintile changed little for Blacks and Hispanics. Income gradients were steepest amongst Others, followed by

Hispanics and Blacks and flattest for Whites. As a result, disparities between Whites and Others were most pronounced amongst the poorest (Supplementary Table 4).

When we stratified the analysis by sex, there were no clear gradients in income for White men or women (Table 3; Supplementary Tables 4 and 5 present the same results with direct comparisons within income groups and within racial/ethnic groups respectively). Amongst all other groups, income gradients were steeper for women than for men. The strongest gradient existed for Black women, amongst whom the two poorest quintiles had over 2.5 times the odds of STI diagnosis compared to the richest quintile (OR: 2.68, 95%CI: 1.48-4.85 and OR: 2.70, 95%CI: 1.37-5.30). The average diagnosis ratio between Blacks and all others was wider for women than for men; this reflected White-Black disparities which were larger amongst poor women which than men, but became roughly equal by the highest income quintile.

Analyzing each STI outcome separately, the greatest racial/ethnic disparities existed for Gonorrhoea, reflecting a particularly large gap between Blacks and all other groups. Income gradients were visible for Chlamydia and Gonorrhoea; the gradient for Trichomoniasis was shallow. Within race/ethnicities, significant differences existed between richest and poorest quintiles for all groups for Chlamydia diagnosis; for other infections small numbers of diagnoses led to unstable estimates and gradients, although a gradient was notable by its absence for Trichomoniasis amongst Whites. The three sensitivity analyses had limited impact on the key findings (Supplementary Table 6).

Discussion

This study provides the first analysis of income gradients in STIs within race/ethnicity groups using a national US sample of individuals including young adults. In line with existing studies, including a previous report using this dataset [3], we find large differentials in STI risk across racial/ethnic groups – over a sixfold increase in the odds of either physician or laboratory report for Blacks compared to Whites. This study moves beyond prior analyses in finding that this racial/ethnic disparity continues and perhaps strengthens into young adulthood. We find that these racial/ethnic disparities are only weakly related to income – adding income to a model containing measures of race/ethnicity reduced the point estimates on the latter by between 5 and 15%. Income is nonetheless an independent predictor of STI risk. This is consistent with existing race/ethnicity-adjusted ecological analyses linking area-level poverty and Gonorrhoea rates in California [10]. In contrast, previous studies of STI diagnosis and parental income in Add Health have suggested little relationship using single-wave outcomes[12, 18], although parental and own education was predictive [17, 22]. Pooling diagnoses across waves may have increased our power to detect an association.

When we allow for income and race/ethnicity to interact in our models, we find some evidence for effect-modification, reflected in the better fit of the interaction model as measured by the Akaike Information Criteria (Table 2). Our analyses show that income affected STI diagnosis probability less for Whites than for others, and that racial/ethnic disparities were least pronounced amongst the rich. Moreover, stratification by sex led to income gradients amongst Whites disappearing entirely, suggesting that income is only related to STI diagnosis amongst Whites insofar as it reflects gender differences in income. Our finding of steeper risk gradients amongst Blacks is congruent with existing studies of SES, race/ethnicity and STIs in Add Health: past research has found maternal education and occupation at Wave I, and own education at Wave III, to be associated with STIs amongst Blacks but not Whites [17, 18].

When we further stratify by gender, we find a stronger income gradient for women than for men amongst Blacks and Hispanics. Combined with the finding of greater disparities by income within non-White groups, this result highlights that gender, race/ethnicity and income interact to place poor Black women at increased risk of STIs.

There has been significant research describing how sexual networks, and hence sexual risks, are heavily structured by race/ethnicity, and how this leads to racial/ethnic disparities in STI rates [15, 16]. Whilst being poor, female and African-American are all independent risk factors for STIs [23], our finding of a stronger income gradient for Black women is somewhat surprising. This is because African-Americans have relatively low risk-homophily – i.e. women who are otherwise low-risk tend to have higher-risk partners, due to a range of factors (including racial/ethnic homophily, imbalanced sex ratios – due to higher male mortality rates – and extremely high incarceration rates) limiting their choice of sexual partners [14]. Such disassortative mixing should theoretically lead to less variation in STI risk across the income gradient. A possible explanation is that being "poor" in this study does not have the same meaning for all racial/ethnic groups. Median net worth within the bottom income quintile in the 2000 census was $24,000 for Whites but less than $100 for Blacks [13]. Income quintiles may therefore not reflect the same socioeconomic circumstances for each race/ethnicity, and thus steeper gradients for Blacks may reflect the greater depth of their poverty. (We note that this does not explain why Black women have a steeper income-risk gradient than Black men.)

We find variation in income gradients by race/ethnicity. One potential explanation of this finding relates to spatial concentration. STIs with low population prevalence (i.e. Syphilis, Gonorrhoea) tend to be most concentrated by geography [24], by race/ethnicity [5], and by income [3]. Within a single STI, concentration of rates also appears to be highest amongst African-Americans [10], and to be highest in areas where Blacks experience certain dimensions of geographic and economic segregation [25]. These neighborhoods exhibit high levels both of prevalent STIs and social risk factors (such as drug use rates and high-risk sexual norms) likely to increase risky sexual behavior [26, 27]. Our observed steeper income gradients amongst racial/ethnic minorities might then reflect the higher likelihood of poor minority individuals living in these areas of concentrated high STI risk – compared to poor Whites. Such an argument is congruent with a concentration of STI risk is concentrated amongst poor minority individuals. Given existing evidence that sexual risk behaviors do not explain racial/ethnic disparities in STI rates [6], it might also be of interest to explore whether they explain the income gradients seen in this study.

Our use of the Add Health dataset provides some notable strengths. The prospective, longitudinal nature of the dataset should limit concerns regarding the temporal direction of any associations, especially since attrition is relatively low and does not appear to greatly affect prevalence estimates [28]. Using multiple waves of outcome data additionally raises our power to detect effects. Furthermore, the study's national coverage allows us to draw nationwide conclusions. Additionally, our use of both laboratory testing (avoiding bias arising from variation in healthcare access) and audio-computer-assisted-interview self-report data (ensuring prior but treated cases are captured) strengthens our approach and has the added benefit that social desirability bias in self-reports should be limited by respondents' knowledge that they are also being laboratory-tested.

Nevertheless, there are also a number of potential limitations to our analysis. First, we rely on school (and residential) location at a single time-point, which may have resulted in misclassification of context across waves. Second, although our STI outcomes combine self-reported clinical diagnosis and laboratory testing, there is a five-year gap in respondents' self-report (from Wave II up to one year prior to Wave III) which is troubling if diagnostic patterns (by race/ethnicity or income) differ systematically across respondents' lifetimes. This concern is somewhat allayed by the fact that Add Health effectively comprises six cohorts (since enrolment covered six grades), and thus all ages between 14 and 26 are covered by both self-report and laboratory testing. Consequently, these gradients would need to vary systematically both by age of respondent and by birth cohort in order to generate bias. We have no hypothesis as to why this form of systematic variation might exist; however were it the case then our results would not be generalizable to other birth cohorts.

Third, as is common in survey-based analyses, many individuals do not have income data (24.3%), which may have led to selection bias. Those with missing income data were significantly more likely to be non-White, however they were not more likely to have a positive test result across the whole sample, or within racial/ethnic groups (Supplementary Table 7). Finally, it is important to note the context of this study – US youth in the 1990s and early 2000s – when Chlamydia rates were rising and Gonorrhoea (and perhaps Trichomoniasis) rates were falling [29], when extrapolating results elsewhere.

Our study provides evidence that, while racial/ethnic differentials are significantly larger than income differentials in STI rates nationwide, both factors are independent predictors of increased risk. The Centers for Disease Control and Prevention are committed to integrating consideration of social determinants of health into STI prevention program design [30]. Prevention efforts for STIs in the United States often focus on African-American populations [31, 32], reflecting their very high infection rates at all income levels. Our analysis highlights that there may be added benefit in targeting interventions to assist the poorest within other racial/ethnic groups, particularly other minorities, given their independently higher risk of STIs. This does not imply singling such individuals out for targeted prevention messages, but rather the importance of providing interventions relevant to such individuals, including consideration of structural interventions that lower such individuals' vulnerability to high-risk behaviours, partners and settings [33].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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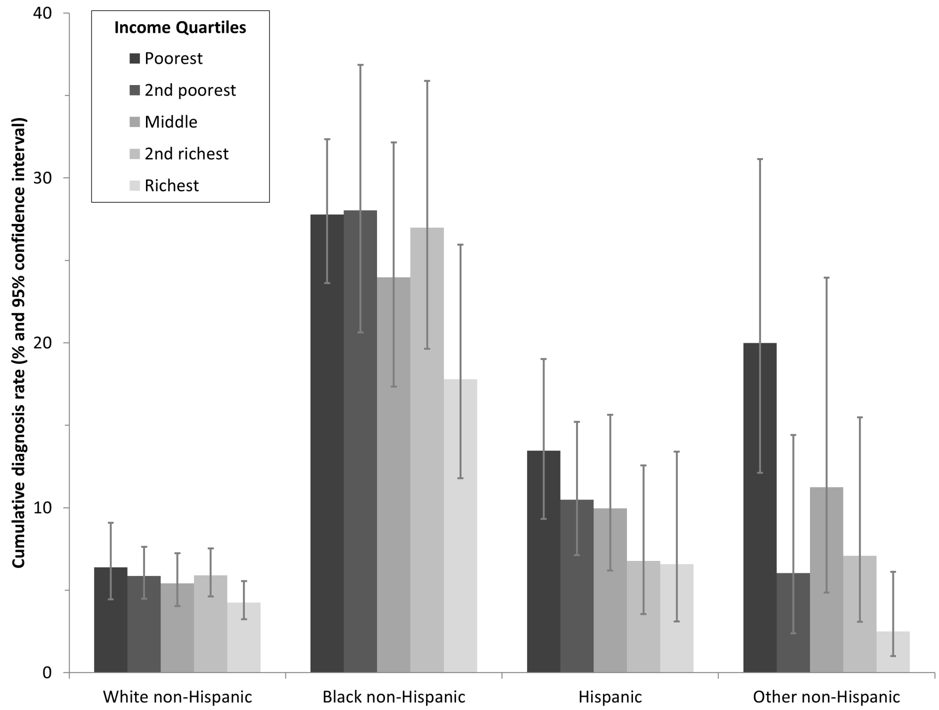

Figure 1.

Cumulative STI diagnosis rates (% and 95% confidence intervals), by race/ethnicity and income quintile, Waves II and III of Add Health

Table 1

Descriptive statistics by income quintile of a sample of respondents from Waves I to III of Add Health

	Poorest	2nd poorest	Middle	2nd richest	Richest	Total
No. of respondents	2,107	2,154	2,195	2,119	2,216	10,791
No. of STI diagnoses	14.7% (1.4%)	10.6% (1.2%)	8.3% (0.9%)	7.4% (0.7%)	5.2% (0.6%)	9.2% (0.6%)
Individual Race/Ethnicity						
White non-Hispanic	45.8% (4.5%)	62.5% (3.7%)	74.4% (3.0%)	82.7% (2.1%)	83.4% (2.0%)	70.0% (2.9%)
Black non-Hispanic	29.1% (4.2%)	18.6% (2.7%)	11.7% (2.0%)	6.5% (1.1%)	6.9% (1.2%)	14.4% (2.1%)
Hispanic	20.5% (3.7%)	13.5% (2.3%)	9.4% (1.4%)	7.2% (1.2%)	5.1% (0.7%)	11.0% (1.7%)
Other non-Hispanic	4.6% (1.1%)	5.4% (1.3%)	4.4% (1.1%)	3.6% (0.8%)	4.6% (1.0%)	4.5% (0.8%)
Sex						
Male	48.6% (1.7%)	49.8% (1.4%)	46.7% (1.3%)	49.4% (1.9%)	49.3% (1.4%)	48.7% (0.7%)
Female	51.4% (1.7%)	50.2% (1.4%)	53.3% (1.3%)	50.6% (1.9%)	50.7% (1.4%)	51.3% (0.7%)
Age at baseline						
<14	18.9% (2.5%)	20.5% (2.4%)	21.6% (2.9%)	21.0% (2.8%)	18.8% (2.7%)	20.1% (2.2%)
14	20.1% (2.4%)	18.0% (1.8%)	15.7% (1.4%)	15.9% (1.6%)	16.1% (1.7%)	17.1% (1.4%)
15	17.5% (1.2%)	17.2% (1.3%)	18.0% (1.3%)	16.7% (1.2%)	17.2% (1.6%)	17.4% (0.9%)
16	15.8% (1.6%)	15.6% (1.4%)	17.0% (1.5%)	17.7% (1.5%)	16.0% (1.4%)	16.4% (1.1%)
17	15.2% (1.7%)	14.4% (1.4%)	15.2% (1.2%)	16.5% (1.5%)	19.6% (1.6%)	16.2% (1.1%)
>17	12.5% (1.7%)	14.4% (1.5%)	12.5% (1.3%)	12.2% (1.1%)	12.3% (1.1%)	12.8% (1.0%)
Urbanicity						
Urban	33.1% (5.6%)	28.3% (4.6%)	23.7% (4.0%)	21.3% (3.7%)	22.6% (4.5%)	25.7% (3.9%)
Suburban	45.6% (5.8%)	53.6% (5.2%)	58.8% (5.5%)	65.2% (5.0%)	67.2% (5.6%)	58.2% (4.8%)
Rural	21.2% (5.3%)	18.0% (4.3%)	17.5% (5.5%)	13.4% (4.3%)	10.2% (4.1%)	16.0% (4.2%)
Region						
West	12.6% (3.5%)	14.1% (3.1%)	15.7% (3.3%)	17.7% (3.6%)	22.1% (4.8%)	16.5% (3.2%)
Midwest	28.9% (5.7%)	31.3% (5.2%)	35.0% (5.9%)	31.5% (5.6%)	33.3% (6.8%)	32.0% (5.1%)
South	47.6% (5.9%)	41.6% (5.0%)	35.4% (4.8%)	34.5% (4.9%)	27.5% (4.7%)	37.1% (4.5%)
Northeast	11.0% (3.2%)	13.0% (3.3%)	13.9% (3.3%)	16.4% (3.8%)	17.1% (4.2%)	14.3% (3.1%)
Type of school						
Public	98.1% (1.0%)	95.0% (1.9%)	93.2% (2.3%)	91.8% (2.9%)	88.4% (3.8%)	93.3% (2.0%)

	Poorest	2nd poorest	Middle	2nd richest	Richest	Total
Private	1.9% (1.0%)	5.0% (1.9%)	6.8% (2.3%)	8.2% (2.9%)	11.6% (3.8%)	6.7% (2.0%)
Per capita family income, equivalized scale $						
Mean (95% confidence interval)	4,972 (4,783-5,160)	12,139 (12,009-12,270)	18,674 (18,543-18,805)	26,425 (26,255-26,595)	49,428 (46,068-52,787)	22,660 (20,972-24,348)

Percentages (and Standard Errors) are based on data weighted for non-random sampling and non-response.

Table 2

Multivariable regressions considering race/ethnicity and income as predictors of STI diagnosis at Waves II or III of Add Health

	Model 1: Race	Model 2: Race & Income	Model 3: Race & Income interaction†
Individual Race/Ethnicity			
White non-Hispanic	1.00	1.00	1.00
Black non-Hispanic	6.48 [5.16 - 8.14]	5.88 [4.68 - 7.37]	5.08 [2.93 - 8.80]
Hispanic	2.28 [1.64 - 3.17]	2.04 [1.47 - 2.83]	1.73 [0.74 - 4.07]
Other non-Hispanic	2.02 [1.28 - 3.19]	1.89 [1.21 - 2.96]	0.66 [0.30 - 1.48]
Per capita family income			
Poorest quintile		1.83 [1.38 - 2.42]	
2nd quintile		1.57 [1.15 - 2.16]	
Middle quintile		1.44 [1.05 - 1.99]	
3rd quintile		1.48 [1.10 - 2.00]	
Richest quintile		1.00	
Per capita family income for White non-Hispanics			
Poorest quintile			1.54 [1.00 - 2.37]
2nd quintile			1.40 [0.93 - 2.10]
Middle quintile			1.30 [0.86 - 1.98]
3rd quintile			1.43 [0.98 - 2.09]
Richest quintile			1.00
Per capita family income for Black non-Hispanics			
Poorest quintile			1.83 [1.10 - 3.05]
2nd quintile			1.86 [0.93 - 3.70]
Middle quintile			1.52 [0.82 - 2.81]
3rd quintile			1.77 [0.97 - 3.22]
Richest quintile			1.00
Per capita family income for non-Hispanics			
Poorest quintile			2.25 [0.97 - 5.22]
2nd quintile			1.69 [0.67 - 4.28]
Middle quintile			1.58 [0.65 - 3.84]
3rd quintile			1.05 [0.38 - 2.89]
Richest quintile			1.00
Per capita family income for Other non-Hispanics			
Poorest quintile			8.97 [3.22 - 24.98]
2nd quintile			2.43 [0.85 - 6.94]
Middle quintile			4.95 [1.46 - 16.79]
3rd quintile			2.77 [0.85 - 9.08]
Richest quintile			1.00
Akaike Information Criteria (AIC)	9,604,887	9,563,401	9,535,430

N is 10,791 individuals from 132 schools for all regressions. Values are odds ratios and [95% confidence intervals].

All models shown are also adjusted for individual age in years and sex, and for school region, urbanicity and public/private school type.

†In Model 3 the top set of odds ratios are comparisons across Race/Ethnicity within the highest income quintile; the lower four sets of odds ratios are comparisons across Income quintiles within racial/ethnic categories.

Table 3

Multivariable logistic regressions for race/ethnicity, income and STI diagnosis in Add Health: sub-group analyses

	Primary analysis	Male	Female	Chlamydia	Gonorrhoea	Trichomoniasis
White non-Hispanic						
Poorest quintile	1.54 [1.00 - 2.37]	0.71 [0.31 - 1.59]	1.08 [0.64 - 1.81]	1.79 [1.11 - 2.88]	2.35 [0.51 - 10.90]	0.99 [0.48 - 2.05]
2nd poorest quintile	1.40 [0.93 - 2.10]	0.96 [0.48 - 1.89]	1.07 [0.66 - 1.72]	1.46 [0.92 - 2.32]	4.33 [1.00 - 18.63]	1.27 [0.60 - 2.72]
Middle quintile	1.30 [0.86 - 1.98]	0.90 [0.49 - 1.66]	0.82 [0.46 - 1.45]	1.31 [0.82 - 2.08]	1.12 [0.25 - 4.97]	0.92 [0.42 - 2.04]
2nd richest quintile	1.43 [0.98 - 2.09]	0.91 [0.51 - 1.62]	1.07 [0.69 - 1.67]	1.42 [0.91 - 2.21]	2.37 [0.59 - 9.56]	0.85 [0.38 - 1.93]
Richest quintile	1.00	1.00	1.00	1.00	1.00	1.00
Black non-Hispanic						
Poorest quintile	9.32 [6.70 - 12.96]	4.86 [2.85 - 8.28]	7.18 [4.75 - 10.84]	8.94 [5.87 - 13.63]	23.35 [7.07 - 77.17]	5.40 [3.20 - 9.09]
2nd poorest quintile	9.45 [5.77 - 15.48]	5.58 [2.53 - 12.31]	7.23 [4.42 - 11.83]	9.07 [5.28 - 15.58]	26.58 [7.08 - 99.78]	5.49 [2.89 - 10.44]
Middle quintile	7.71 [4.66 - 12.75]	5.85 [3.20 - 10.67]	5.35 [2.75 - 10.39]	7.52 [4.34 - 13.01]	21.38 [6.02 - 75.93]	6.94 [3.27 - 14.72]
2nd richest quintile	9.00 [5.71 - 14.21]	6.58 [3.36 - 12.91]	5.76 [2.72 - 12.19]	7.82 [4.55 - 13.44]	28.18 [5.77 - 137.70]	8.30 [3.60 - 19.15]
Richest quintile	5.08 [2.93 - 8.80]	3.17 [1.67 - 6.02]	2.68 [1.37 - 5.24]	4.74 [2.37 - 9.46]	14.57 [3.76 - 56.44]	3.34 [1.50 - 7.42]
Hispanic						
Poorest quintile	3.90 [2.24 - 6.76]	1.88 [0.87 - 4.05]	2.63 [1.26 - 5.47]	4.29 [2.28 - 8.09]	7.06 [1.48 - 33.66]	2.10 [0.99 - 4.48]
2nd poorest quintile	2.93 [1.72 - 5.01]	0.79 [0.27 - 2.32]	2.47 [1.17 - 5.20]	3.49 [1.96 - 6.23]	4.65 [0.98 - 22.00]	1.61 [0.42 - 6.25]
Middle quintile	2.73 [1.57 - 4.76]	3.14 [1.47 - 6.72]	1.55 [0.70 - 3.44]	3.14 [1.64 - 6.01]	1.19 [0.15 - 9.72]	1.30 [0.45 - 3.76]
2nd richest quintile	1.81 [0.85 - 3.87]	1.28 [0.54 - 3.04]	0.64 [0.22 - 1.84]	1.68 [0.64 - 4.37]	2.81 [0.32 - 24.51]	2.00 [0.74 - 5.39]
Richest quintile	1.73 [0.74 - 4.07]	1.06 [0.23 - 4.96]	1.18 [0.39 - 3.60]	1.26 [0.47 - 3.42]	-	2.24 [0.57 - 8.89]
Other non-Hispanic						
Poorest quintile	5.93 [2.90 - 12.14]	11.34 [4.41 - 29.18]	2.13 [0.62 - 7.27]	5.15 [2.02 - 13.10]	17.74 [2.17 - 144.87]	3.36 [1.00 - 11.34]
2nd poorest quintile	1.61 [0.57 - 4.53]	0.24 [0.04 - 1.50]	1.51 [0.58 - 3.91]	1.23 [0.32 - 4.66]	-	1.97 [0.37 - 10.53]
Middle quintile	3.27 [1.22 - 8.77]	1.50 [0.25 - 9.11]	3.08 [0.96 - 9.83]	2.69 [0.76 - 9.53]	11.72 [1.53 - 90.03]	1.63 [0.34 - 7.94]
2nd richest quintile	1.84 [0.72 - 4.71]	0.46 [0.14 - 1.55]	2.63 [0.84 - 8.21]	2.33 [0.87 - 6.26]	-	0.27 [0.04 - 1.89]
Richest quintile	0.66 [0.30 - 1.48]	0.30 [0.07 - 1.28]	0.68 [0.19 - 2.43]	0.62 [0.20 - 1.92]	-	0.61 [0.16 - 2.26]
No. of individuals	10,791	5,156	5,635	10,791	10,791	10,791

Values are odds ratios and [95% confidence intervals]. All models are also adjusted for individual age in years and sex, and for school region, urbanicity and public/private school type.

All odds ratios are for comparisons with White non-Hispanics in the richest income quintile. Cells containing en-dashes represent categories with insufficient numbers of cases to allow estimation.

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