School, Neighborhood, Family, and Individual Determinants of Self-Reported STD Among Adolescents: Findings from the National Longitudinal Study of Adolescent Health

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Abstract

Context: Adolescents have among the highest rates of STD, but until recently it has been difficult to characterize the multiple social and behavioral factors that affect STD risk because of measurement and methodological issues.

Methods: Data from Wave I of the National Longitudinal Study of Adolescent Health (Add Health) are used to estimate effects of school, neighborhood, family, and individual characteristics on acquiring an STD. For sexually active teens, we also estimate the extent to which age at first intercourse affects STD acquisition. Additionally, we investigate the determinants of STD occurrence between Waves I and II of Add Health, and model the effects of prior STD acquisition. Random intercept logistic regression and random intercept piecewise exponential hazard regression are used to account for possible clustering in the Add Health data.

Results: Overall, 7.0 percent of sexually active teens reported ever having an STD as of Wave I, and 6.7 percent reported having an STD between Waves I and II. Among all Wave I teens—uninitiated as well as sexually active—age, gender, race/ethnicity, family background characteristics, neighborhood and school characteristics affect STD acquisition. Among sexually active Wave I teens, those with a younger age at first intercourse are at greater risk of experiencing an STD. Other factors contribute, but to a lesser degree. For example, family structure becomes nonpredictive. For acquisition of an STD between Waves I and II, females, blacks, teens with lower levels of mother's education, and those who had an STD previously are at higher risk.

Conclusions: The findings support our hypothesis that multiple social and behavioral factors influence lifetime history of STD. Also, age at first intercourse and STD history are valid indicators of risk-related behavior.

Introduction

Adolescents have among the highest rates of sexually transmitted diseases (STDs). CDC surveillance data indicate that in 1996 there were more than three million STD cases among teenagers, and that these cases accounted for one-quarter of all reported STD infections.[1] Moreover, based on their review and adjustment of several sources for the year 2000, Weinstock, Berman, and Cates (2004) report that adolescents and young adults accounted for as much as 48 percent of an estimated 18.9 million STD cases in 2000.[a 2] In addition to the known reproductive health sequelae of STDs, their prevalence also suggests substantial economic and psychological costs to young people.[3] Consequently, primary and secondary prevention of STDs, including HIV/AIDS, continues to be a public health priority, especially for adolescents and young adults.[4]

Although adolescents represent an epidemiologically significant subpopulation for STD, until recently it has been difficult to characterize those factors that affect STD for this population beyond a small number of demographic and behavioral variables, because of measurement and methodological issues plaguing previous endeavors. Prior to the release of the National Longitudinal Study of Adolescent Health (Add Health), only the National Survey of Adolescent Males (NSAM), the National Survey of Family Growth (NSFG) (which sampled females of reproductive age, including adolescents), and the Youth Risk Behavior Surveys (YRBS) could be used to provide general population estimates of adolescent reproductive health outcomes. Add Health is unique in this regard because it includes both genders, detailed race/ethnicity measurement, multiple indicators of reproductive health behaviors and outcomes, and contains information on

multiple social contexts. In addition, Add Health has recorded information on multiple episodes of STD acquisition.

This study exploits the richness of the Add Health data to investigate school, neighborhood, family, and individual factors on the risk of STD in a national sample of adolescents. To accomplish this, we address a series of interrelated research questions. First, what are the determinants of ever having had an STD regardless of sexual experience? Second, what are the determinants of age at first intercourse? Third, among sexually active adolescents, what are the effects of age at first intercourse on ever having had an STD? Finally, among sexually active adolescents, what are the determinants of acquiring an STD between the Wave I and Wave II interview dates, and specifically, to what extent do age at first intercourse and STD history contribute to STD risk?[b]

Background and Conceptual Approach

Much of the prior research on STD risk assessment has focused on individual-level determinants,[5] although more recent theoretical and methodological developments cast individual risk within larger social and epidemiological contexts (e.g., reference 6). An emerging model of STD risk incorporates biological, behavioral, and social factors.[7] Specifically, biological processes influence individuals' susceptibility, with the biological factors partially determined by sexual and protective practices. Sexual and protective practices, in turn, are influenced by environmental factors, including social context and epidemiological conditions. Consistent with that emphasis, this study focuses exclusively on adolescents, and examines three social contexts that are especially salient for them—their families, neighborhoods, and schools.

Adolescents are at increased risk of STD because they are more likely to engage in such risk-taking behaviors as unprotected sex, multiple sexual partners, and sexual relationships of short duration,[8] and because of increased physiological susceptibility.[9] Age at first intercourse is correlated with many of these risk-taking behaviors and can be used as a marker for risky sexual behavior.[10] Teens with early onset of sexual activity tend to have more recent partners, more lifetime partners, and are less likely to use condoms than those with later onset.[11] Moreover, early age at first intercourse is independently associated with a positive STD history among sexually active females.[12] In this paper, we conceptualize age at first intercourse as a key risk-related behavior. Thus, we examine the determinants of age at first intercourse to better understand the effects of school, neighborhood, family, and other individual factors on STD history.

Sociodemographic characteristics such as age, gender, race/ethnicity, and nativity of adolescents are associated with STD risk because of group differences in sexual norms, sexual and protective practices, sexual networks, underlying disease prevalence, and biology.[13] Older teens, because they are more likely to be sexually active and have accrued more sexual experience, have higher STD risk than younger teens.[14] Adolescent females are at higher STD risk than males, in part because of their greater biological susceptibility.[15] Although adolescent females tend to have older ages at first sex and fewer sexual partners than adolescent males,[16] these practices do not result in uniformly lower STD risk because of differences in partners' behaviors and sexual networks.[17] Racial and ethnic variability in STD risk reflects differences in the sociocultural contexts within which sexual activity occurs, and these differences translate into differentials in risk-taking behaviors, such as unprotected sex, age at first intercourse, and numbers of

sexual partners, as well as reflect socioeconomic differences.[18] Racial and ethnic variability in risk-taking behaviors do not explain all variability in STD risk, however, because sexual networks and underlying disease prevalence within those networks also have independent effects.[19] For adolescents, surveillance data indicate that blacks, Hispanics, and Native Americans have higher STD rates than whites, and that Asians have lower rates.[20] Furthermore, because surveillance data[21] indicate that gender and race/ethnicity interact to some extent, we explore possible interactions in our Add Health analysis. Lastly, although few previous studies have investigated the effect of nativity status on STD risk, we hypothesize that foreign born teens have lower STD risk than U.S. born teens on the grounds that they are less likely to engage in high-risk behaviors, including early onset of sexual activity.[22]

Families—incontestable social contexts and primary socializing agents for adolescents—provide role models, shape sexual attitudes, set standards for sexual conduct, control and monitor adolescents' behaviors,[23] and constitute the most proximate social and economic environments for adolescent development. Adolescents living with both biological parents have the optimal opportunity for overall well being,[24] and are less likely to engage in sexual risk-taking behaviors such as early sexual initiation.[25] Thus, we expect teens living with both biological parents to be at lower STD risk than those living in other family situations. Family socioeconomic status, partially operationalized as parents' education, is also associated with adolescent reproductive health behaviors. Highly educated parents tend to have higher educational aspirations for their children. These higher aspirations should to some extent discourage sexual activity and encourage contraceptive use (e.g., condom use) among the sexually active,[26] both of which should

reduce the likelihood of experiencing an STD. Family processes, especially parental monitoring and supervision of adolescents' activities, are associated with sexual risk-taking behaviors. Specifically, greater parental monitoring is associated with older ages of sexual initiation, fewer numbers of sexual partners, and more consistent contraceptive use,[27] all of which suggest lower STD risk. The extent to which families exert a direct effect on adolescent STD risk is, however, unknown.[28] Thus, we investigate direct and indirect effects (through age at first intercourse) of family background on STD risk.

Adolescents' neighborhoods of residence also potentially affect STD risk by providing local opportunity structures, institutional resources, normative environments, and epidemiological backdrops that shape the sexual life course of adolescents. Conceptualizations of neighborhoods typically emphasize structural and social dimensions. These include socioeconomic and demographic composition ("structure") and formal and informal networks that shape such social processes as collective monitoring, social control, and norm setting ("social" dimensions). Social processes are thought to mediate the effects of structural characteristics.[29] A growing literature demonstrates that neighborhood conditions influence adolescent sexual risk-taking behavior, including onset of sexual activity.[30] Moreover, STDs are spatially distributed. Studies mapping the sexual networks of high STD risk populations show that neighborhood and sexual network boundaries are correlated.[31] Thus, physical deterioration of neighborhoods is associated with lower socioeconomic status, which in turn is associated with a breakdown in social relations, with fewer effective sanctions and social controls to regulate behavior.[32] In such neighborhoods, high-risk behaviors are more prevalent among residents, and there are increased STD rates.[33] We investigate

whether the Add Health data reveal associations between the socioeconomic conditions of neighborhoods and individuals' reports of STD experience, and the extent to which age at first intercourse mediates neighborhood effects.

We also hypothesize that adolescents' school contexts are associated with STD risk. Because adolescents spend so much time at school and because the social relationships established at school are instrumental to adolescent development, schools can have a profound impact on adolescent well being and development.[34] School structural attributes affect norms and attitudes about dating practices and acceptable sexual behaviors. Studies of the effects of school characteristics on sexual risk-taking behaviors have found that racial composition, school type (public vs. private), and other aspects of school social environment are associated with age at first intercourse and number of sexual partners.[35] Consequently, we incorporate school characteristics into our analyses of both the probability of contracting an STD and age at first intercourse.

Lastly, to more fully characterize STD experiences during adolescence, we also investigate the determinants of STD occurrence between two time periods, namely between the Wave I and Wave II interview dates. In general, we hypothesize that those individual, family, neighborhood, and school factors that are associated with the report of an STD at Wave I will also be associated with the report of an STD occurring between the two waves. We are especially interested in whether age at first intercourse remains a significant determinant of STD acquisition between Waves I and II, and whether a positive STD history at Wave I predicts subsequent acquisition.

Data and Methods

National Longitudinal Study of Adolescent Health

Add Health was designed to assess the general, as well as the sexual and reproductive, health status of adolescents in the United States.[36] It represents a major effort to measure the ways in which multiple social contexts influence adolescent health and risk-taking behaviors, and this makes it well-suited for the current investigation.

Sample design and selection. The details of the Add Health study design are described in detail elsewhere (http://www.cpc.unc.edu/projects/addhealth/design, accessed March 22, 2004); here we provide relevant design aspects. The Wave I sampling frame consisted of all U.S. high schools stratified by region, size and type of place, school type, ethnic mix of school, and size of school. Eighty eligible high schools were selected with probability proportional to size. Feeder schools for each high school, defined as schools that included a seventh grade and sent graduates to that high school, were identified and selected for participation. In the realized sample, 132 schools were grouped into 80 "school communities" (feeder school(s) plus the sampled high school). Each participating school provided a student roster that became the student-level sampling frame. From that listing, a sample was drawn consisting of a core sample and oversamples for specific ethnic groups, disabled adolescents, and biologically related adolescents. The core sample is a probability sample of 12,105 respondents and is nationally representative of adolescents enrolled in grades 7-12 during the 1994-1995 academic year. The total Wave I sample has 20,745 respondents. Wave II was conducted during the 1995-1996 academic year. It includes all adolescents interviewed at Wave I, except for the deletion of twelfth graders at Wave I who were not part of the genetic sample, the deletion of the Wave I disability sample, and the addition of a small

number of teens from the genetic sample who were not previously interviewed. The Wave II sample has 14,738 respondents.

To obtain population-based estimates, respondents not assigned Wave I sample weights were dropped from our analytic sample. Also, because the observations in the sample are nearly but not completely nested (adolescents within households, within neighborhoods (i.e., census tracts), within school "communities") our analytic data set includes only those observations for which we could establish perfect hierarchical nesting. In addition, we randomly selected one teen in households with multiple respondents.[c] Further drops for consistently poor data, missing STD information, or incomplete data on parental presence, resulted in a final analytic sample of 16,494 adolescents. For the age at first intercourse analysis, we also drop cases for which we do not have complete dates of first intercourse. Sample size for that analysis is 15,633. Some of our analysis is based on adolescents who were sexually active by the time of the Wave I interview, which reduces the sample to 6,321. Lastly, to investigate STD risk between Waves I and II, the sample consists of sexually active teens interviewed at both waves (N=3,396).

Variable Description and Measurement

STD outcome variables. We created two binary STD outcome variables based on self-reports (elicited by audio-CASI techniques) from a series of questions about sexual behavior, contraception, and STDs. The first STD variable is measured as ever having had any STD as of the Wave I interview date ("STD at Wave I"). Respondents were asked, "Have you ever been told by a doctor or nurse that you had …" for each of the following STDs: chlamydia; syphilis; gonorrhea; HIV or AIDS; genital herpes; genital

warts; trichomoniasis; hepatitis B; bacterial vaginosis (for female respondents); and non-gonoccocal vaginitis (for female respondents). This battery of questions was limited to the subsample of respondents who responded affirmatively to a question about heterosexual vaginal intercourse (described below).[d] This STD variable is coded $Y_1 = 1$ if an adolescent responded affirmatively to any of the listed STDs (except HIV/AIDS), and coded $Y_1 = 0$ otherwise.[e] The second STD variable is measured as having acquired any STD between the Wave I and Wave II interview dates ("STD between Waves I and II"). The construction of this measure was based on the same criteria and set of questions listed above, except that respondents were explicitly asked whether they had acquired a new STD since their last interview. This STD variable is coded $Y_2 = 1$ if an adolescent responded affirmatively to any of the listed STDs (except HIV/AIDS), and is coded $Y_2 = 0$ otherwise.

Age at first intercourse. In order to examine the extent to which age at first intercourse mediates the covariate effects on the STD outcome, we treat age at first intercourse as an outcome in its own right. The construction of this variable is based on two questions about sexual activity. Using audio-CASI, all respondents were asked, "Have you ever had sexual intercourse? When we say intercourse, we mean when a male inserts his penis into a female's vagina." If the response was affirmative, the next question was, "In what month and year did you have sexual intercourse for the very first time?" We code age at first intercourse in months since exact age 11, with an indicator for censoring at the Wave I interview date.[f] Age at first intercourse is modeled as a piecewise exponential hazard regression with six-month hazard segments, with a random intercept at the school community level. Age at first intercourse is also used as a

covariate in some of the STD regressions. For this purpose we use dummies for ages 11-13; 14-16; and 17 and older. In the regressions, the youngest age group is the reference.[g]

Individual characteristics. The included sociodemographic attributes of adolescents are age, gender, race/ethnicity, and nativity status. Age is measured in years and included as a linear term in the STD regressions but not in the age at first sex regression. For race/ethnicity we give priority to any mention of being Hispanic, with groups defined as non-Hispanic white; non-Hispanic black; non-Hispanic Asian; non-Hispanic Native American; and non-Hispanic Other. To test for possible country of origin differences among Hispanics, we further categorize this group as Cuban; Puerto Rican; Mexican American; and all other Hispanics. (We were also interested in Asian-American subgroups, but there are too few STD cases in the data to sustain that level of detail.) Non-Hispanic white is the reference. Additionally, we include a gender by race/ethnicity interaction term found to be statistically significant in our preliminary work—white males. Nativity status is binary—whether an adolescent was born in the United States (reference category is U.S. born). In the analysis of STD risk between Waves I and II, we also include STD status at Wave I.

Family background characteristics. We used the information in the Add Health household roster at Wave I to construct a detailed family structure variable categorized as two biological parents; biological mother with stepfather; biological father with stepmother; biological mother with cohabiting partner; biological father with cohabiting partner; biological mother only; biological father only; and all other situations (e.g., living with relatives other than parents). The two biological parents category is the reference. Mother's and father's education are separately coded as years of schooling

completed. For a resident parent whose education was not reported, the missing value was imputed using conditional mean imputation.[37] [h] (Household income was included in our early models, but its coefficient was never statistically significant, and the variable was dropped from our final specification.) Add Health elicited parents' occupations in 16 categories. We coded professional, managerial, and technical occupations as "high status," and coded sales, office work, crafts, mechanical, factory, military, and farm work as "low status." If a respondent's father was not working at the time of the interview, no occupation was reported in the data. We coded occupational status in this case as "none." In the regressions, occupational status consists of three dummies, with high status treated as the reference. (We also examined mother's occupational status, but it was not statistically significant in any of the regressions.) Our measure of parental monitoring is based on how often each resident parent is home in the morning, and is coded as a five-point Likert scale that ranges from "never" to "always."[i]

Neighborhood structural characteristics. We treat census tract boundaries as plausible demarcations of neighborhoods, and retain two of the many 1990 Census tract variables appended to the Add Health data set.[38] These are residential stability—the proportion of individuals five years and older who have lived in the same household since 1985, and unemployment composition—the proportion of adults who are unemployed.[j] For exploratory purposes the tract variables were coded into quintiles using a tract-level data set. This coding is retained in the regressions reported here.[k]

School structural characteristics. Two aspects of school structure are included in the final model. We categorize school *status* as public, private (non-Catholic), and Catholic, with public school as the reference. School *type* is categorized as high school,

junior high, and "combination" (for schools that consist of grades 7-12), with junior high school as the reference.[l]

Analytic Strategy

We first present descriptive statistics for the variables included in our analysis, separately for the three groups we consider: 1) all adolescents, regardless of their sexual experience; 2) adolescents who were sexually active as of the Wave I interview date; and 3) adolescents who were sexually active as of the Wave I interview date who were also re-interviewed at Wave II and had valid STD information at Wave II. Next, we regress Y_1 (STD at Wave I) on individual, family, neighborhood, and school characteristics in the full sample. Because age at first intercourse may mediate the effects of individual, family, school, and neighborhood characteristics on the STD outcome, we present a piecewise-exponential hazard model of time to first sex. We then restrict the sample to adolescents who were sexually active as of the Wave I interview date and re-estimate Y_1, controlling for age at first intercourse. Lastly, we further restrict the sample to sexually active adolescents who were also re-interviewed at Wave II to estimate the effects of individual, family, neighborhood, and school factors on Y_2 (STD between Waves I and II). All regressions are estimates of random intercept models that account for potential clustering effects at the school community level.[m] Computations were performed using Stata 8.2.[39 n]

Results

Table 1 provides the weighted distributions of the variables used in the Add Health analysis for each of the three samples we consider. Here, we focus on the Wave I full sample (column one). The average age of teens at Wave I is 15.4 and there are equal

proportions of males and females. The sample is two-thirds white, followed by black (15.7 percent), Mexican American (6.8 percent), Other Hispanic and Asian Americans (3.4 and 3.3 percent, respectively), Puerto Rican (1.3 percent); the remaining groups each consist of one percent or less of the sample. Slightly over five percent of teens are foreign born. Over half (54.1 percent) of teens live with both biological parents, followed by living with biological mother only (20.6 percent), 10.4 percent live in stepfamilies, 5.6 percent live with one biological parent and their cohabiting partner, 3.0 percent live with their biological father only, and 6.3 percent live in other family situations (most often with other family members such as grandparents or aunts and uncles; not shown). The average years of schooling completed for both mother and father is slightly over 13 years. Two thirds of resident fathers are employed in low status occupations. Two thirds of resident mothers are always present in the morning and three quarters are present "most of the time" or more. One third of resident fathers are always present in the morning and about one-half are present "most of the time" or more. The average level of neighborhood residential stability (the proportion over age five who have lived in the census tract for five or more years) is .551; the average proportion unemployed is .075. The majority of teens (93.6 percent) attend public school; close to half attend high school (49.3 percent), 29.7 percent attend junior high school, and 21.0 percent attend schools that combine grades 7-12. In the full sample 2.7 percent reported an STD at Wave I.

Table 1 here

Among the sexually active at Wave I sample (column two), 23.6 percent report an age at first intercourse under age 14, 54.7 between ages 14 and 16, and 13.8 percent over

age 16. In all, 7.0 percent of sexually active teens reported having an STD as of the Wave I interview date. Column three presents the distributions of the variables for the subset of sexually active teens who were also reinterviewed at Wave II.[o] The distributions of age at first intercourse are similar across the two samples, although at Wave II the distribution is "younger." Lastly, 6.4 percent of the Wave II sample reported having an STD at Wave I and 6.7 percent reported an STD between Waves I and II.

Table 2 presents the random intercept logistic regression of Y_1 for the full sample. The likelihood of ever having had an STD significantly increases with age. Males are significantly less likely to have experienced an STD, and the gender difference is greatest for whites. Compared to whites, blacks are significantly more likely to experience an STD; there are no differences between whites, Cubans, Puerto Ricans, and Other Hispanics. However, Mexican Americans are significantly less likely than whites to have an STD as of Wave I. (Sparse data preclude elaboration of results for Asians, Native Americans, and other ethnicities.) Nativity status has no effect on ever having had an STD. Overall, the effects of family background characteristics are modest. Compared to adolescents living with two biological parents, only those living in a stepfamily (with a biological mother and stepfather) are significantly more likely to have a positive STD history. Although both have coefficients in the expected direction, only mother's education, not father's, is inversely related to risk. Father's occupational status, mother's presence in the morning, and father's presence in the morning are not significant.

Table 2 here

Turning next to neighborhood effects, as residential stability increases, STD risk at Wave I significantly decreases.[p] And, as the proportion unemployed increases, STD

risk significantly increases. Compared to public schools, adolescents who attend private schools have significantly lower STD risk; there is no difference between public and Catholic schools. In addition, compared to youth in junior high, those in high school have significantly higher STD risk; there is no difference between youth in junior high and combination (grades 7-12) schools. Lastly, the intraclass correlation is nearly zero and not significant, which indicates that there is little homogeneity in STD outcomes within school communities once the covariates are taken into account.[q]

The regression presented in Table 2 does not exclude teens who were not sexually active. That is defensible inasmuch as one of our goals is to estimate sociodemographic risk differentials regardless of sexual initiation status. Equally useful would be estimates of such differentials for sexually active teens. For this group, in a regression of an "ever had" measure of STD it is helpful to control not only for all of the dimensions used thus far, but also for age at first intercourse. All other things equal, the earlier the initiation of sexual activity, the greater the STD risk. As a measure of risky behavior, age at first sex may mediate the effects of the sociodemographic characteristics we have introduced. If so, age at first intercourse should depend on these characteristics. As a check, we present the hazard regression for that outcome. With one exception—the omission of school "type"—the covariates in the age at first sexual intercourse regression are identical to those for Y_1 (STD at Wave I) in Table 2.[r 40] Table 3 and Figure 1 present the regression. Figure 1, which plots the log baseline hazard, shows that the hazard of first sexual intercourse increases monotonically up to about age 17, and is essentially flat thereafter.[s]

Table 3 and Figure 1 here

As Table 3 shows, age at first intercourse depends in part on sociodemographic factors at the individual and family levels; it depends on parental presence; and it depends on neighborhood and school characteristics. At any age, males are more likely than females to be sexually active. The gender difference, however, reverses for whites. Compared to whites, blacks are more likely to be sexually active, and Mexican Americans, Other Hispanics, and Asian Americans are less likely. There are no significant differences between whites and Cubans, Puerto Ricans, Native Americans, or "Other" ethnicities. Compared to teens born in the United States, foreign born teens are less likely to be sexually active.

Compared to teens living with both biological parents, those living in stepfamilies (especially the biological mother with stepfather combination) are more likely to be sexually active. Father's occupational status is not associated with onset of sexual activity. The higher mother's and father's education, the lower the risk of sexual activity. Also, increased morning presence of either parent significantly reduces the risk of first sexual intercourse.

Only one of the neighborhood measures is associated with risk of first sexual intercourse. As the proportion unemployed increases, so does risk. Compared to teens in public schools, those in private schools are at lower risk. There is no difference between public and Catholic schools. Lastly, the between-group variance component is small but significant, suggesting that teens in the same school community are somewhat more like one another in age at first sexual intercourse than teens from different school communities, even controlling for important individual and familial characteristics.

Having shown that age at first intercourse is associated with determinants of STD acquisition at the individual, family, neighborhood, and school levels, we turn next to the analysis of STD acquisition among sexually active teens. Table 4 displays several regressions for this group. In the first regression, the risk of acquiring an STD as of Wave I is re-estimated with age at first sexual intercourse as a covariate. Current age is positively and significantly associated with STD risk at Wave I. Age at first intercourse has a strong effect on STD outcome at Wave I, even controlling for current age. Compared to teens who began sexual activity at age 13 or younger, those who began at age 14 or older are significantly less likely to have had an STD. Males continue to be less likely than females to have had an STD. However, the coefficient for the white male interaction is no longer significant, which suggests that the lower risk observed in the STD regression that is not conditioned on sexual activity (the regression in Table 2) is due to the later onset of sexual activity for white males relative to white females. A similar explanation holds for Mexican Americans relative to whites. Puerto Ricans now emerge as significantly more likely than whites to have had an STD at Wave I (although not due to differences in age at first intercourse). Nativity status is not significantly associated with STD risk.

Table 4 here

The effects of family background characteristics, already minimal, are further reduced. Teens living in stepfamilies are no longer more likely to have had an STD. The increased likelihood seen earlier can be explained by their higher risk of becoming sexually active. The effect of mother's education remains—as mother's education increases, STD risk at Wave I declines. The effect of neighborhood residential stability

remains significant and in the expected direction. Neighborhood unemployment becomes insignificant. Lastly, the effect of school status on STD shown in Table 2 can be explained by differences in age at first intercourse. That is, reduced STD risk among teens attending private schools can be explained by their delay in first sex.

The next three columns in Table 4 pertain to the analysis of our second STD variable, Y_2 (STD between Waves I and II). Teens not reinterviewed at Wave II differed to some degree from those who were reinterviewed. Because differences between the two groups might influence the results for Y_2, we begin by replicating the model in column one (Y_1) for sexually active teens who were reinterviewed at Wave II. These results are presented in column two. Overall, the results for the two samples are similar, but there are some differences: the white-Puerto Rican contrast is no longer significant and the white-Mexican American contrast becomes significant. Mother's education is no longer significant. The junior high-high school contrast becomes significant. As noted earlier (endnote o), there was design selectivity in the definition of eligible Wave II respondents. In addition, Wave II respondents are incidentally selected on STD risk. In these data, female teens and those with earliest sexual initiation, both most likely to have experienced an STD, were more likely than males and those with later sexual initiation to attrite. Finally, and perhaps most importantly, the Wave II sample size used in the regressions is about half that of the Wave I sample size. However these factors combine, the Wave I sexually active sample is clearly the most representative for assessment of STD experience as of Wave I. Thus, we emphasize that among sexually active teens, there remain socially important STD risk differentials, including age, age at first

intercourse, race/ethnicity, mother's education, and neighborhood (as reflected in residential stability).

We next consider regressions 2 and 3 in Table 4. These pertain to STD experience as of Wave I and STD experience between Waves I and II. The covariates for the two regressions are identical, and the respondents are the same in each regression. The response variables differ only with respect to time reference. Thus, the two regressions should have similar coefficients, and in the main they do. For the two separate elicitations of STD experience, age and age at first intercourse differentiate, as do gender and race/ethnicity. There are, however, some differences. Tract residential stability and the high school contrast are no longer significant for this selected subsample of Wave II respondents. Also at Wave II, the family structure residual category ("other situations") is significant, as is mother's education. The "other" family contrast with two-biological-parent families cannot be understood without considering the other parent-related covariates in the regression. This contrast will be evaluated in Table 5.

The most important reason for analyzing self-reported STD experience between Waves I and II is that doing so enables examination of the extent to which previous STD experience affects subsequent STD experience. Regression 4 of Table 4 extends the covariate list of regression 3 to include a dummy variable for STD at Wave I. The coefficient for report of an STD at Wave I is highly statistically significant and positive: Teens who report a prior STD are much more likely to report an STD between Waves I and II, controlling for individual, family background, neighborhood, and school characteristics. Moreover, once STD at Wave I is included in the regression, the effects of age and age at first intercourse become insignificant. Apart from the effect of STD at

Wave I, the remaining significant coefficients are for the gender and white-black contrasts, and the family structure effect, which we next consider.

Post-estimation computation is required to accurately evaluate the family structure contrasts. The model coefficients cannot be interpreted without taking the other parental measures in the model into consideration. Table 5 presents the results of the post-estimation calculations for regressions 3 and 4 (STD between Waves I and II). These calculations can be interpreted as regression standardizations in which the family structure categories are evaluated at the mean of parental education, the sample proportions for father's occupational status, and the mean of the parental presence variables. As Table 5 shows, compared to teens living with both biological parents, those living in "other" family situations are at higher risk of STD between Waves I and II when the other parental variables are set at the "centers" of their distributions.

We also ran a regression excluding the parental variables. In this instance, the family structure contrasts are directly interpretable. When STD at Wave I is excluded from the regression, the coefficient for "other" family situations is significant and positive; when STD at Wave I is included, the coefficient for "other" family situations is not significant (results not shown). We would expect teens not living under the umbrella of parental protection to be at greater risk of STD acquisition, and this is what we found at the mean.[t]

Discussion

For sexually active teens, using the Add Health data, we find that 7.0 percent reported ever having an STD, with females much more likely than males to have a positive history (11.3 percent for females and 2.8 percent for males, data not shown). In

addition, we find that 6.7 percent of sexually active teens (who were reinterviewed) reported having an STD between the two interview dates. Ellen et al. (1998), using the 1992 Youth Risk Behavior Survey (YRBS), found that 9.7 percent of sexually active females and 4.3 percent of sexually active males ages 14-21 reported ever having an STD.[41] Results from adult surveys conducted in the early to mid-1990s provide additional context. In an analysis using the 1995 NSFG, 6.0 percent of sexually active women ages 15-44 reported ever having a bacterial STD.[42] Including both bacterial and viral STDs, in data from the National Survey of Women, 15.8 percent of sexually active women ages 20-37 reported ever having had an STD. In the National Survey of Men, 10.2 percent of sexually active men ages 20-39 reported ever having had an STD.[43] In the National Health and Social Life Survey, 19.4 percent of sexually active females and 12.0 percent of sexually active males ages 18-29 reported ever having an STD.[44] Thus, although the mean age of our sexually active subsample of the Add Health data set is only 16, our estimates of STD prevalence are plausibly within range of those found by other researchers for adolescents and young adults. Furthermore, our results are some of the first to provide a longitudinal assessment of STD risk using a national sample of adolescents, and the levels we have found underscore the significance of STD as a reproductive health priority for the teenage population.

Behavioral covariates. Age at onset of sexual activity marks the beginning of a key behavior necessary for the contraction of a sexually transmitted disease. Among the sexually active, the earlier the onset the more likely an individual is to report a positive STD history at Wave I. Age at onset largely, but not entirely, mediates covariate effects observed when regression estimation is based on both the sexually experienced and

uninitiated. Additionally, a positive history of STD is strongly associated with an increased risk of subsequent STD, and prior STD mediates the effects of age and age at first intercourse on the risk of STD between Waves I and II. Although other sexual and protective practices are also relevant, these findings highlight the importance of age at first intercourse as a marker of STD risk[45] and are consistent with the results of several earlier studies showing that STD history is strongly predictive of subsequent STD.[46]

Further discussion of findings. We find that among those who are sexually active, older teens have higher STD risk, net of age at onset. This suggests that older teens are accruing sexual experience and accumulating sexual partners.[47] However, we also find that STD at Wave I mediates the effect of age on STD risk between Waves I and II. At any given age, although males have higher risk of onset of sexual activity than females, they have lower STD risk, even controlling for prior STD. Other studies show that males tend to have more partners than females do, and that men are more likely to engage in other high-risk sexual behaviors.[48] There is some evidence that adolescent females are less likely than males to report that condoms have been used during intercourse[49]. Explanations of increased STD risk for females often center on biological differences, including gender differences in efficiency of transmission and greater cervical ectopy among adolescent females compared to older females.[50] Additionally, adolescent females tend to have sexual partners older than themselves, and STD rates are higher among males in their twenties than they are for teens.[51] The increased STD risk among females is also the result of differences in the sexual behaviors of the partners (e.g., males are more likely than females to have multiple partners[52]). Gender differences

in STD risk among adolescents are clearly the result of a complex of behavioral, biological, and social factors requiring further study.

Compared to whites, blacks have higher risk of sexual onset, and their increased STD risk at Wave I is maintained among the sexually active, even controlling for age at first sexual intercourse. The persistent higher STD risk among blacks reflects group differences in individual risk-taking behaviors. In addition, sexual networks among blacks tend to be more homogeneous and "closed".[53] Because of the racial and ethnic diversity of the Add Health data, we were able to distinguish national origin differences in STD risk among Hispanic teens, using the full sample at Wave I. The reduced STD risk at Wave I among Mexican Americans is entirely explained by their lower risk of becoming sexually active at any age. Among sexually active teens, Mexican Americans are no more likely than whites to contract an STD. For the full sample at Wave I, Cubans and Puerto Ricans are no more likely than whites to contract an STD. Furthermore, at any age, Cubans and Puerto Ricans are no more likely than whites to initiate sexual activity. The small sample sizes for Cubans and Puerto Ricans suggest caution when attempting to document STD differentials among sexually active teens. It remains to be seen whether the national origin differences we were able to document for Hispanic teens using the full sample at Wave I will be replicated with larger samples. Future studies of ethnic differentials will be most helpful to the extent that they collect information about sexual relationship characteristics and dynamics, and structure investigations of patterns of sexual networking. Although foreign born adolescents have lower risk of sexual onset than U.S. born adolescents, nativity status does not affect STD risk among the sexually

active. A possible explanation may be that foreign born teens and young adults are less likely to engage in protective behaviors, such as condom use.[54]

Overall, family characteristics have modest effects on STD risk. Our Wave I results for the full sample suggest that the increased STD risk among teens in stepfamilies, specifically with a biological mother and stepfather, is explained by their higher risk of sexual onset relative to teens in two biological parent families. For the sexually active respondents who were re-interviewed at Wave II, our post-estimation calculations suggest that teens living in "other" family situations (most commonly with relatives other than parents) are at increased risk of STD between interviews for much, if not all, of the socioeconomic range. The protective effect of two biological parent families on age at first intercourse has been consistently demonstrated in the literature (e.g., reference 55). Although increases in parental presence are associated with lower risk of sexual onset, there is no continuing effect of parental presence on STD risk at Wave I among the sexually active. Mother's education continues to matter even after controlling for sexual activity and age at first intercourse, and is inversely associated with both STD measures. Clearly, mothers communicate education-related knowledge and values that affect what their sons and daughters do, given that their children are sexually active. These findings are a further articulation of the family's role as a socializing agent of youth.

In the full sample, higher levels of neighborhood residential stability decrease the risk of STD at Wave I and higher levels of neighborhood unemployment increase risk. Among the sexually active, residential stability continues to have an effect at Wave I, and neither neighborhood characteristic affects STD risk between Waves I and II. Other

studies have found that living in lower socioeconomic status neighborhoods is associated with higher risk of sexual onset (e.g., reference 56), as we have demonstrated here using neighborhood unemployment rate. Our findings suggest, however, that neighborhood socioeconomic status does not have an independent effect on risk of STD at Wave I, controlling for age at first intercourse. Neighborhood residential stability is a plausible proxy for the extent of effective social monitoring of adolescents' behaviors. Higher levels of household turnover almost certainly hinder the establishment of stable social ties, and operate against the enforcement of norms through collective monitoring and social control of adolescent behaviors.[u] These neighborhood measures do not have enduring effects on STD risk between Wave I and II.

We also find that age at first intercourse mediates the effects on STD risk of the school characteristics we considered. School environment shapes adolescent sexual behavior through school norms about appropriate sexual conduct, as well as through expectations about academic achievement and future orientation. More fundamentally, schools are also the major source of sexual partners.[57] Future work will need to investigate how school sexual networks influence STD risk.

In sum, our findings support the hypothesis that multiple social contexts and behavioral factors are associated with the risk of STD acquisition. We also find that age at first intercourse and STD history predict subsequent acquisition of STD, and in doing so, mediate the effects of several sociodemographic and contextual characteristics. Moreover, STD history mediates the effects of age at first intercourse on risk of STD between Waves I and II.

Limitations. Although our research provides new information on STD risk in a nationally representative sample of adolescents, it has several limitations. First, self-reports of STD, which could just as well be called *indirect* reports of STD, are often disparaged for their presumed measurement error. The belief is that those who know they have a positive STD history tend to deny it. To the extent that this occurs, the estimated probability of ever having had a diagnosed STD should be depressed relative to the true probability, and the absolute values of the regression coefficients should be reduced relative to their true values. Although we are unable to assess the extent of underreporting bias, we would not be surprised by its existence. Nonetheless, it is clear that by no means are all of the regression coefficients in our analysis zero, and that effects are in the hypothesized direction. Thus, we have found that self-reports evince nontrivial reporting accuracy. Moreover, audio-CASI techniques have been shown to improve underreporting of sensitive behaviors.[58] Other subjective indicators based on self-reports have also been found to be useful for their intended purpose.[59] Biomarker tests of the general population are the gold standard for the presence of contemporaneous, largely asymptomatic STDs.[60] There is also evidence that a positive STD history predicts subsequent infection.[61] Clearly there is value in some type of effort to record the STD experiences of respondents in sample survey settings.

A second limitation is that the Add Health STD data are clearly incomplete. The STD report at Wave I is an "ever" or lifetime measure of STD and the Wave II measure refers to the time period between interview dates (which varies across respondents and is, on average, about 15 months). It would be useful to have a more comprehensive history of STD, especially with a more meaningful time referent. For example, in the recently

released Wave III, Add Health respondents were asked about STD diagnoses in the past 12 months.

A third limitation is that, because the Add Health sample is drawn from the population of school-going adolescents, the number of cases for each STD type is small relative to study designs based on individuals attending STD clinics. This precludes pathogen-specific multivariate analysis. In addition, the Waves I and II Add Health data are based on reports of *diagnosed* cases of STD, which—if unadjusted—lead to underestimation of true prevalence. Asymptomatic infection is common, especially for females, and significantly contributes to the maintenance of disease in the population.[62]

Lastly, the Add Health data do not provide clinical information such as the type, duration, and severity of symptoms. Many of the limitations discussed can be addressed using the more comprehensive STD information available in Wave III of Add Health. In particular, Wave III provides a unique opportunity to assess STD biomarker outcomes, time referent STD self-report histories, and clinically relevant symptomology, for the now primarily young adult panel of respondents.

Endnotes

a. Weinstock et al. (2004) do not separate estimates for adolescents and teenagers from those for young adults (source: reference 2).

b. The Add Health project has thus far collected three waves of data. Wave III was conducted in 2003. By then, most members of the Add Health sample were young adults. Because our interest is in the acquisition of STDs during adolescence, in this paper we focus on the STD self-report information available in Waves I and II. In related work in progress, we use Wave III to investigate the social and behavioral epidemiology of STD acquisition in young adults, as well as the connection between self-reports and the results of biomarker tests for several STD pathogens.

c. Some twins were opportunistically sampled in the original design.

d. This definition of sexual activity is a data-imposed limitation. It hinders our ability to assess STD risk among adolescents who engage in other types of sexual activity (e.g., anal intercourse) exclusively (or primarily).

e. Cases of HIV/AIDS are excluded from both measures. Because the epidemiological profile for HIV/AIDS differs from that of other STDs (it is more common among males in this age group), we eliminated HIV/AIDS from consideration in our analysis of the Add Health data. This resulted in a loss of five cases.

f. Individuals reporting an age at first intercourse younger than 11 are dropped from the analysis on the ground that such early onset is unlikely to be driven by the respondent's individual choice.

g. To retain cases with known sexual experience, but who are missing on date of first intercourse, a dummy for missing date is included in the final regression model of STD risk.

h. Nonresident parents were coded zero on education and parental presence. Any constant would be valid; zero is convenient. Interpretation of contrasts between family types without a defined parent and family types with both parents requires post-estimation calculation.

i. Add Health includes a battery of items on parental presence. Our use of just the morning presence indicators is the result of extensive exploratory analysis.

j. The selection of these variables was based on theoretical considerations and exploratory analysis. We investigated several tract variables with overlapping content, including median household income, a measure of racial heterogeneity, a measure of "youth idleness," proportion black, proportion Hispanic, proportion of households with intact families, and a composite measure of "concentrated disadvantage." None of these variables had statistically significant coefficients in the regressions.

k. The scores are 0, 1, 2, 3, 4, and chosen so that 0 is a meaningful score in the baseline hazard for age at first sexual intercourse.

l. Again, the selection of these variables was based on theoretical considerations and exploratory analysis. We also investigated the effects of proportion white and school size, neither of which had statistically significant coefficients in the regressions and are excluded from the final model.

m. We also estimated models that allow for clustering at the tract level; the results did not change.

n. We do not use regression weights. In exploratory analyses, we included the design variables that were used in the construction of the weights to better understand their substantive relevance. The coefficients of the design variables turned out not to be statistically significant. For this reason, we have excluded the design variables from the final models.

o. We used logistic regression to model Wave II attrition for teens who were sexually active at Wave I. As might be expected from the study design, older teens were significantly less likely to be reinterviewed. Males were significantly more likely to remain in the panel. Compared to teens living with both biological parents, those living with biological mother and stepfather were more likely to be reinterviewed. Compared to teens whose father's occupational status is high, those whose father did not have an occupation or whose occupational status was low were more likely to be reinterviewed. Compared to teens who attended a junior high school at Wave I, those who attended a high school or a combination school were more likely to be reinterviewed. Lastly, compared to teens with an age at first intercourse under age 14, those reporting an age between 14 and 16 were more likely to be reinterviewed. None of the other covariates are associated with attrition.

p. For ease of expression, henceforth we refer to "STD risk" instead of "the probability that an individual with particular characteristics will experience a detected STD."

q. In the null model, the intraclass correlation is larger and statistically significant. The observed covariates appear to account for similarity among observations due to clustering.

r. There are obvious structural zeros in the age by junior high-combination school-high school classification (e.g., there are no 16-year olds in junior high school). To ignore these structural zeros as well as the age selectivity inherent in a classification defined by grade would be to invite spurious comparisons (source: reference 40).

s. More precisely, the graph plots an estimated log baseline hazard against midpoints of the six-month intervals of the piecewise exponential. The plotted values refer to U.S. born white females living with both biological parents; both parents have a high school education and are never home when adolescents leave for school in the morning; respondents are living in neighborhoods in the lowest quintile of residential stability and in the lowest quintile of the unemployment rate; respondents attend a public school.

t. We have not carried out calculations for other standardizing parental values, but it is clear that the tipping point is below the mean of mother's education (which is the only relevant statistically significant covariate).

u. In work not presented here, we attempted to operationalize neighborhood social processes using adolescents' responses to a variety of questions about their experiences in their neighborhoods, and to examine the effects of these processes on sexual onset. Ultimately, however, we concluded that measures based on adolescents' responses are endogenous.

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Acknowledgments

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Table 1. Weighted means of individual, family, neighborhood, and school characteristics for the full and sexually active samples, Add Health

	Wave I sample		Wave II sample
	All	Sexually active	Sexually active
Individual characteristics			
Age at Wave I	15.415	16.436	15.976
Gender			
Male	0.510	0.507	0.493
Female	0.490	0.493	0.507
Race/ethnicity			
White	0.668	0.631	0.632
Black	0.157	0.216	0.212
Cuban	0.007	0.005	0.004
Puerto Rican	0.013	0.017	0.020
Mexican American	0.068	0.063	0.065
Other Hispanic	0.034	0.032	0.034
Asian American	0.033	0.019	0.017
Native American	0.008	0.008	0.009
Other	0.011	0.010	0.008
Nativity status			
US born	0.947	0.963	0.969
Foreign born	0.053	0.037	0.031
Family background characteristics			
Family structure			
Both biological parents	0.541	0.425	0.415
Biological mother, stepfather	0.085	0.097	0.103
Biological father, stepmother	0.019	0.022	0.018
Biological mother, cohabiting partner	0.048	0.064	0.069
Biological father, cohabiting partner	0.008	0.008	0.007
One parent – biological mother	0.206	0.239	0.263
One parent – biological father	0.030	0.036	0.036
Other situations	0.063	0.109	0.089
Parental education			
Mother's education	13.100	12.801	12.713
Father's education	13.357	12.943	12.835
Father's occupational status			
High status	0.313	0.266	0.235
Low status	0.648	0.685	0.710
None	0.039	0.049	0.055

Table 1. con't.

	Wave I sample		Wave II sample
	All	Sexually active	Sexually active
Mother's presence in the morning			
Never	0.091	0.117	0.107
Almost never	0.054	0.064	0.060
Some of the time	0.080	0.082	0.079
Most of the time	0.130	0.120	0.123
Always	0.644	0.616	0.631
Father's presence in the morning			
Never	0.248	0.290	0.299
Almost never	0.107	0.103	0.107
Some of the time	0.152	0.150	0.154
Most of the time	0.137	0.116	0.109
Always	0.355	0.341	0.331
Neighborhood (census tract) characteristics			
Tract residential stability	0.551	0.553	0.558
Tract proportion unemployed	0.075	0.081	0.083
School characteristics			
School status			
Public	0.936	0.951	0.963
Catholic	0.032	0.028	0.023
Private	0.032	0.021	0.014
School type			
Junior high school	0.297	0.125	0.148
High school	0.493	0.688	0.682
Combination school (grades 7-12)	0.210	0.187	0.170
Age at first sexual intercourse			
Less than 14 years old	—	0.236	0.259
14-16 years old	—	0.547	0.595
More than 16 years old	—	0.138	0.079
Bad data on age at first sex	—	0.079	0.068
STD outcomes			
As of Wave I	0.027	0.070	0.064
Between Wave I and II	—	—	0.067

Notes: Means (proportions) for polytomies may not sum to 1.0 due to rounding. *N*=16,494 for the full sample, *N*=6,321 for the sexually active Wave I sample, and *N*=3,396 for the sexually active Wave II sample, except for maternal and paternal education, paternal occupational status, and maternal and paternal presence, for which the *N*s are appropriately reduced for adolescents in families lacking a mother or father.

Table 2. Logistic regression of STD at Wave I on individual, family, neighborhood, and school characteristics, with random intercept at school community level—full Wave I sample, Add Health

Covariates	Y_1 **Coefficients**
Individual Characteristics	
Age at Wave I	0.4052***
White male	– 0.5837*
Male	– 1.0438***
Race/ethnicity (white reference)	
Black	0.8065***
Cuban	– 0.6412
Puerto Rican	0.4771
Mexican American	– 0.6753**
Other Hispanic	– 0.2766
Asian American	– 0.9176*
Native American	– 0.1292
Other	– 0.0830
Nativity status (US born reference)	– 0.3619
Family Background Characteristics	
Family structure (two biological parents reference)	
Biological mother, stepfather	0.6742***
Biological father, stepmother	0.3081
Biological mother, cohabiting partner	0.5870
Biological father, cohabiting partner	– 0.2202
One parent – biological mother	0.3993
One parent – biological father	0.2184
Other situations	– 0.1595
Mother's education	– 0.0625*
Father's education	– 0.0317
Father's occupation (high status reference)	
Low status	0.3769
None	0.3745
Mother's presence in the morning	– 0.0764
Father's presence in the morning	– 0.0161
Neighborhood (census tract) characteristics	
Tract residential stability	– 0.1071**
Tract proportion unemployed	0.1187**
School characteristics	
School status (public reference)	
Catholic	– 0.0596
Private	– 1.4651*
School type (junior high reference)	
High school	0.6696**
Combination school (grades 7-12)	0.2563

Table 2. con't.

Constant	– 9.5238***
Wald chi-square (31 df)	543.65***
Intraclass correlation	0.0144

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

Note: N = 16,494.

Table 3. Piecewise exponential hazard regression of time to first intercourse on individual, family, neighborhood, and school characteristics, with random intercept at school community level, Add Health

Covariates	Coefficients
Individual Characteristics	
White male	– 0.4422***
Male	0.2298***
Race/ethnicity (white reference)	
Black	0.1310**
Cuban	– 0.1889
Puerto Rican	– 0.0094
Mexican American	– 0.2512***
Other Hispanic	– 0.1817*
Asian American	– 0.6343***
Native American	– 0.1828
Other	– 0.1667
Nativity status (US born reference)	– 0.6094***
Family Background Characteristics	
Family structure (two biological parents reference)	
Biological mother, stepfather	0.4224***
Biological father, stepmother	0.1842*
Biological mother, cohabiting partner	0.2186
Biological father, cohabiting partner	– 0.0702
One parent – biological mother	– 0.0205
One parent – biological father	– 0.0905
Other situations	– 0.2578
Mother's education	– 0.0169*
Father's education	– 0.0207*
Father's occupation (high status reference)	
Low status	0.0390
None	0.0364
Mother's presence in the morning	– 0.0638***
Father's presence in the morning	– 0.0397***
Neighborhood (census tract) characteristics	
Tract residential stability	0.0108
Tract proportion unemployed	0.0452***
School characteristics	
School status (public reference)	
Catholic	– 0.1097
Private	– 0.5726***

Table 3. con't

Constant	– 6.3072***
Likelihood ratio chi-square (42 df)	5913.21***
Between-group variance component	0.0851***

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

Note: N = 15,633.

Table 4. Logistic regressions of STD acquisition on individual, family, neighborhood, and school characteristics, with random intercept at school community level, among sexually active adolescents, Add Health

Covariates	Wave I STD		Wave II STD	
	Y_1 [1]	Y_1 [2]	Y_2 [3]	Y_2 [4]
Individual Characteristics				
Age at Wave I	0.2968***	0.2695***	0.1622*	0.0974
White male	– 0.1049	0.1802	-0.0629	-0.1056
Male	– 1.4741***	-1.5688***	-1.2687***	-1.0341***
Race/ethnicity (white reference)				
Black	0.8238***	0.5340**	0.4602*	0.4174*
Cuban	– 0.7322	-1.2651	0.3518	0.6699
Puerto Rican	0.5895*	0.4140	0.4399	0.3809
Mexican American	– 0.3561	-0.8343*	0.1904	0.2604
Other Hispanic	– 0.1257	-0.1719	0.2297	0.2667
Asian American	– 0.4982	-0.1457	0.2593	0.3251
Native American	0.1543	0.6218	0.4625	0.4345
Other	0.1563	-0.3037	-0.2071	-0.0647
Nativity status (US born reference)	0.2901	0.2832	-0.6033	-0.6896
Age at first intercourse (Ages $\leq$13 reference)				
Ages 14-16	– 0.5265***	-0.7028***	-0.3895*	-0.2562
Ages $\geq$17	– 0.9981***	-0.9536**	-0.4615	-0.1684
Family Background Characteristics				
Family structure (two biological parents reference)				
Biological mother, stepfather	0.2948	0.0175	0.3075	0.2723
Biological father, stepmother	0.1154	0.3216	-0.4434	-0.4960
Biological mother, cohabiting partner	0.6192	0.6915	-0.6920	-0.9158
Biological father, cohabiting partner	– 0.3090	0.7435	-0.7206	-0.9065
One parent – biological mother	0.6195	0.3279	-0.4160	-0.5765
One parent – biological father	0.2058	0.3666	-1.0165	-1.1111
Other situations	0.1247	-0.1742	-1.6880*	-1.7378*

Table 4. con't.

Covariates	Wave I STD		Wave II STD	
	Y_1 [1]	Y_1 [2]	Y_2 [3]	Y_2 [4]
Mother's education	– 0.0587*	-0.0500	-0.1231***	-0.1184**
Father's education	– 0.0021	-0.0074	-0.0086	-0.0121
Father's occupation (high status reference)				
Low status	0.3836	0.3734	-0.1279	-0.2025
None	0.4110	0.4041	0.4457	0.3710
Mother's presence in the morning	– 0.0278	-0.0227	-0.0520	-0.0395
Father's presence in the morning	0.0045	-0.0664	-0.0667	-0.0545
Neighborhood (census tract) characteristics				
Tract residential stability	– 0.1026**	-0.1735**	-0.0543	-0.0318
Tract proportion unemployed	0.0783	0.0908	0.0515	0.0264
School characteristics				
School status (public reference)				
Catholic	0.0265	-0.1827	0.2029	0.1927
Private	– 1.0984	-0.7309	-0.2524	-0.1892
School type (junior high reference)				
High school	0.3248	0.8889*	0.0716	-0.1053
Combination school (grades 7-12)	0.1058	0.4758	0.3687	0.3018
STD as of Wave I				1.6932***
Constant	– 6.7175***	-6.2904***	-2.7077*	-1.8971
Log likelihood	-1397.189	-702.118	-793.596	-757.094
Wald chi-square	325.51***	155.42***	111.01***	198.91***
df	34	34	34	35
Intraclass correlation	< 0.0001	0.0250	0.0172	< 0.0001
N	6,321	3,396	3,396	3,396

* $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$

[1] STD as of Wave I among sexually active Wave I sample.

[2] STD as of Wave I among sexually active Wave I sample reinterviewed at Wave II.
[3] STD between Waves I and II among sexually active Wave I sample reinterviewed at Wave II.
[4] STD between Waves I and II among sexually active Wave I sample reinterviewed at Wave II, controlling for prior STD.

Table 5. Family structure contrasts: Computations using mean parental education, sample proportions for father's occupational status, and mean parental presence

Family Structure	Regression 3	Regression 4
Both biological parents	0	0
Biological mother, stepfather	0.307	0.272
Biological father, stepmother	-0.443	-0.496
Biological mother, cohabiting partner	-0.246	-0.388
Biological father, cohabiting partner	1.077	0.780
Biological mother only	0.030	-0.048
Biological father only	0.781	0.575
Other	0.556	0.477

Notes: Computations based on results from Table 4, columns three and four.

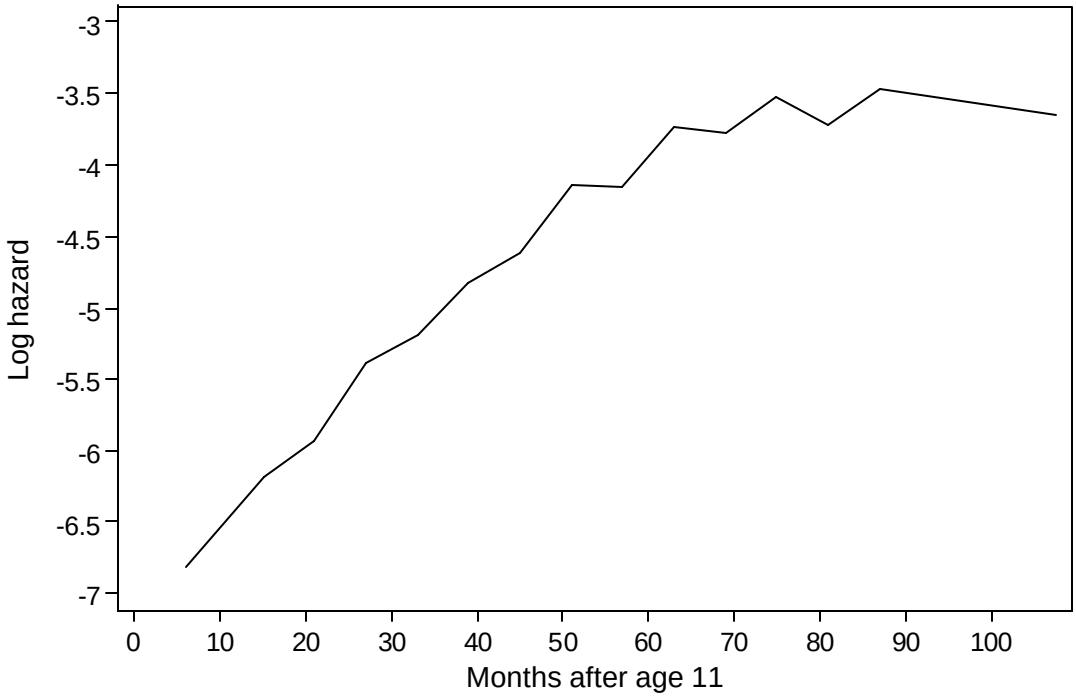

Figure 1. Baseline hazard of age at first sexual intercourse, Add Health