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## Sexual Partner Characteristics and Sexually Transmitted Diseases Among Adolescents and Young Adults

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### Abstract

**Background**—Among adolescents and young adults, the extent that partner characteristics account for sexually transmitted diseases (STDs) in context of individual sexual activities and demographic characteristics is unclear.

**Methods**—Sexual partner characteristics, individual sexual activities, and STD diagnosis were assessed among 15 to 24-year-old STD clinic attendees from 1999 to 2002 (n = 412). We used exact logistic regression to calculate odds ratios (OR) for several sexual partner characteristics (age discordance, incarceration, STD diagnosis, other partners, alcohol problem, marijuana problem, and a calculated composite variable) adjusting for demographics and individual sexual activities, including condom use.

**Results**—Sexual partner characteristics associated with STD diagnosis were 5 years age discordance [OR = 2.6 (95% confidence interval (CI) = 1.6, 4.5)] and STD in the past year [OR = 3.4 (95% CI = 2.0, 5.7)]. Even when considering individual sexual activities, composite partner risk was associated with STD diagnosis [intermediate to low OR = 2.1 (95% CI = 1.0, 4.2) and high to low OR = 3.4 (95% CI = 1.6, 7.0)]. Composite individual sexual activities was associated with STD diagnosis when considering demographics [intermediate to low OR = 1.8 (95% CI = 1.0, 3.2), high to low OR = 2.3 (95% CI = 1.2, 4.5)], but not when also considering partner characteristics [intermediate to low OR = 1.6 (95% CI = 0.9, 2.8), high to low OR = 1.8 (95% CI = 0.8, 3.9)].

**Conclusions**—Among this sample of 15 to 24-year-olds, sexual partner characteristics identified individuals at increased risk of prevalent STDs and were more predictive of STDs than an individual's sexual activities.

In the United States, 9 million cases of sexually transmitted diseases (STDs) occurred among 15 to 24-year-olds in 2000.<sup>1</sup> Because individuals cannot acquire STDs through sex with an uninfected partner, having sex with a partner who has a STD is an important risk factor for STD acquisition.<sup>2</sup> Several characteristics of partners are associated with STD risk including: (1) age difference between partners (age discordance)<sup>3–5</sup>; (2) partner has other partners during the same period in time<sup>6,7</sup>; (3) partner intoxicated during sex<sup>8</sup>; or (4) partner was previously in jail.<sup>9,10</sup> The importance of each partner characteristic has been shown, but

studies have not considered the cumulative effect of partners' risk characteristics on an individual's likelihood of having a STD.

The relative importance of partner characteristics and individual sexual activities (e.g., age at first intercourse, number of sex partners, and condom use) in STD diagnosis is unclear. The association between sexual partner characteristics and STDs persists when considering the individual's number of sexual partners.<sup>5,11</sup> But the influence of other important individual sexual activities, including condom use, has not been considered in assessments of partner characteristics.

Among urban STD clinic attendees ages 15 to 24 years, we pursued 2 objectives to improve understanding of the influence of partner characteristics on STD risk. First, we assessed the association between STD diagnosis and a composite measure of partner characteristics incorporating age discordance, incarceration, STD diagnosis, other partners, alcohol problem, and marijuana problem. Second, we compared the association between STDs and partner characteristics to the association between STDs and individual sexual activities.

## MATERIALS AND METHODS

### Design and Sample

Data were from The Relationship of Alcohol, Youth, and STD Project, described previously.<sup>12</sup> This study was conducted among men and women aged 15 to 24 years (n = 448) attending an urban STD clinic in Pittsburgh. STDs were assessed clinically and an interviewer administered a questionnaire about demographic variables, alcohol use, sexual activities, and sexual partner characteristics. The present analysis includes the 412 black and white participants who reported having heterosexual sex. Institutional Review Board approval was obtained for the study procedures from the University of Pittsburgh and for this analysis from the University of Florida.

### Sexual Partner Characteristics

Based on the literature about partners and sexual risk,<sup>3-5,9,12-14</sup> we selected 6 measures of partner characteristics: (1) 5 years age discordance, (2) previously incarcerated, (3) STD diagnosis in the past year, (4) other partners in the past year, (5) alcohol problem, and (6) marijuana problem. Participants reported each characteristic for both their main partner and their most recent, not main partner. Responses for each partner were considered equally. The partner was defined as having a perceived alcohol problem if the participant reported that the partner "needs to cut down his or her drinking," "has been annoyed by people criticizing his or her drinking," "has felt bad or guilty about his or her drinking," or "has had to take a drink first thing in the morning to steady his or her nerves or get rid of a hangover." The partner was defined as having a perceived marijuana problem if the participant reported that the partner smokes marijuana daily.

Using a predetermined method, we created a simple composite partner characteristic variable that could be incorporated into clinical practice and maximized the existing data. For each of the 6 partner characteristics described above, we assigned a value of 0 to the referent category and 1 to the risk category. For each participant, we calculated the proportion of the responses in the risk category. This yielded a score ranging from 0 to 1 for each participant; 0 indicated all characteristics were in the referent category and 1 indicated all characteristics in the high risk category. We divided this score into 3 broad groups: low (< 0.33), intermediate (>0.33 and < 0.66), and high (>0.66). For sensitivity analysis, we also created the composite without the measure of partner had a STD.

### Individual Sexual Activities

Based on the literature of individual sexual risk factors,<sup>9,12,15-19</sup> we selected 9 measures of individual sexual activities: (1) age at first intercourse, (2) number of lifetime sexual partners, (3) number of past year sexual partners, (4) concurrent sex partners, (5) new sexual partner in the past month, (6) casual sex in the past 12 months, (7) sex under the influence of alcohol, (8) condom use during last sex, and (9) frequency of condom use in past 12 months. Age at first intercourse, number of lifetime sex partners, and number of sex partners in the past year were collected as continuous variables and categorized by the overall median response for analysis.

We also created a composite of individual sexual activities. Because we detected moderate correlation (Pearson correlation coefficient between 0.3 and 0.5) between casual partner and 4 of the other measures, we did not include casual partner in the composite variable. We created the individual sexual activities composite variable with the 8 other individual sexual activities measures using the same methodology as we used to create the partner characteristic composite. In brief, we created a score from 0 to 1 by calculating the proportion of responses of increased risk among the individual sexual activities variables. Then, we divided this score into 3 categories; low (< 0.33), intermediate (>0.33, and < 0.66), and high (>0.66).

### Sexually Transmitted Diseases

Women's cervical samples and men's urethral samples were tested for chlamydia and gonorrhea. Syphilis was tested among serum samples for both sexes. Women's vaginal samples were cultured for trichomonas. Viral culture of genital herpes was performed for suspicious lesions and genital warts were diagnosed by clinical observation. Similar to our previous analysis from this study,<sup>12</sup> an individual diagnosed with any of the above diseases was defined as having a confirmed STD.

### Demographic Covariates

Based on the STD literature, we selected 5 covariates: race, sex, age, marital status, and type of medical insurance.<sup>16,20</sup> Marital status was analyzed as single versus other (married, divorced, living with partner in marriage-type relationship, and widowed). Type of medical insurance was analyzed as any insurance (Medicaid or private insurance) versus no insurance.

### Statistical Methods

We used SAS software, version 9.0 (SAS Institute, Inc., Cary, NC) for frequencies, and LogXact software, version 8.0 (Cytel Software Corporation, Cambridge, MA) for exact logistic regression. For each variable, we used both race-adjusted and multivariate (covariates included race, sex, age, and type of medical insurance) exact logistic regression to estimate the association between partner characteristics and STD diagnosis. Marital status was not included in the multivariate model because there was little variability in this measure: 83% of participants were single. Common to models with several covariates,<sup>21,22</sup> we found that the exact permutation distribution for the sufficient statistic was computationally infeasible to calculate for our multivariate models; therefore, for multivariate models we used the LogXact network-based Monte Carlo sampling approach for conditional logistic regression to estimate unbiased exact confidence intervals.<sup>21,22</sup>

## RESULTS

### Participant Characteristics

The mean age of the 412 study participants was 20.4 years (2.2 standard deviation), ranging from 15 to 24 years. There was substantial representation by sex (48% men), race (41% white), and health insurance (40% did not have health insurance). Most of the participants were single (83%) and lived in the city of Pittsburgh (76%).

All of the participants were sexually experienced. The median number of lifetime sex partners was 10 (range: 1–200) and the median number of partners in the past year was 3 (range: 1–50). Most participants reported that they had a casual partner in the past year (70%), used a condom less than nearly always (67%), and believed that at least one of their sexual partners had other sexual partners in the past year (71%). Approximately, 25% reported 5 years age discordance with one of their partners; partners ranged from 6 years younger to 34 years older than the participant.

We found differences between women and men on reporting of partner characteristics and individual sexual activities (Table 1). Women were more likely than men to report partners with risk characteristics including discordant ages, previously in jail, and had alcohol, or marijuana problems. Men were more likely than women to report individual sexual activities with increased risk, except for condom use and sex under the influence of alcohol that were reported equally by men and women.

### Sexually Transmitted Diseases

STDs were diagnosed among 27% (113/412) of the adolescents and young adults; 15.9% (65/409) had chlamydia, 12.4% (50/402) had gonorrhea, 1.5% (6/412—lesions were tested for 29 adolescents) had newly diagnosed genital herpes, 3.4% (14/412) had genital warts, and 8.0% (17/212) of women had trichomonas. Women (30%) and men (26%) were equally likely to have an STD (Table 1). For most of the STDs examined, a similar percent of men and women were infected, but genital warts were more common among men than women (Table 1).

### Sexual Partner Characteristics

Adolescents reporting that their partner had a STD in the past year were 3 times as likely to have a STD as adolescents who did not report a partner with a STD (Table 2). Compared with individuals with age concordant partners, individuals with age discordant partners were approximately 3 times as likely to have a STD. We were unable to assess whether there was a differential association with older and younger partners because few participants reported partners 5 years younger ( $n = 8$ ). Results were similar for other analyses considered: adjusting for race only, analyzing blacks and whites separately, and analyzing the 4 race-sex groups separately.

### Individual Sexual Activities

Adolescents reporting condom use during their last sexual encounter were half as likely to have a STD compared with adolescents reporting no condom use (Table 2). A similar association was found between condom use and STD diagnosis when considering the frequency of condom use in the past year. Additionally, individuals reporting casual partners in the past year or 10 lifetime sexual partners were more likely to be diagnosed with a STD. The associations between individual sexual activities and STD diagnosis were weaker than associations found between partner characteristics and STD diagnosis (Table 2).

## Composite Markers

Each category of the composite variables separated the sexual activity markers well. For example, we found a significant linear trend by category of partner composite risk (low, intermediate, high) in median age discordance with the most discordant sex partner (2, 3, 5 years of age difference) and median number of sex partners of the not-main partner (2, 3, 4 partners). Across categories of the individual sexual activities composite (low, intermediate, high), we found significant linear trends by the median reported number of lifetime sex partners (4, 10, 23 partners) and the median age at first intercourse (16, 15, 14-years-old).

With each increased category of partner characteristic composite, the percent of individuals diagnosed with a STD increased ( $P < 0.001$ ). When adjusting for demographic characteristics, the partner characteristic composite was significantly associated with STD diagnosis (Table 3). When also adjusting for the individual sexual activities composite, the association between partner characteristic and STD diagnosis remained significant, and partner characteristics contributed to the explanation of STDs (Likelihood ratio test:  $P < 0.001$ ). When we created the composite without the measure of whether the partner had a STD in the past year, the association between partner characteristics and STD diagnosis was slightly reduced [intermediate to low OR = 1.9 (95% CI = 1.0, 3.5) and high to low OR = 2.3 (95% CI = 1.1, 4.6)].

With each increased category of individual sexual activity composite, the percent of individuals diagnosed with a STD increased ( $P = 0.01$ ). When adjusting for demographic characteristics, individual sexual activity was significantly associated with STD diagnosis (Table 3). When also adjusting for the partner characteristics composite, however, we did not find a significant association between individual sexual activity and STD diagnosis and individual sexual activity did not contribute significantly to the explanation of STDs (Likelihood ratio test:  $P = 0.16$ ). Similar to the analyses for each measure, the association between composite individual sexual activity and STD diagnosis was weaker than the association between composite partner risk and STD diagnosis (Table 3).

Partner characteristics and individual sexual activities identified different individuals (Fig. 1). Within each category of individual sexual activity, we found adolescents and young adults classified as high partner risk. For example, among adolescents with low individual sexual activity, 47% reported partner characteristics of intermediate (40%) or high risk (7%).

## Racial Disparity

Black individuals were 4 times as likely as white individuals to have a STD [OR = 4.5 (95% CI = 2.6–8.1)]. When adjusting for demographic covariates, partner characteristics, and individual sexual activities, blacks individuals remained 4 times more likely than whites to have a STD (Table 4). We found the largest change in the OR by race when controlling for whether the partner had a STD in the past year (OR = 3.0), but this estimate was not statistically different from the crude OR estimate. Partner characteristics did not explain the racial disparity in STD diagnosis.

## DISCUSSION

Even when controlling for individual sexual activities, including condom use, partner characteristics identified adolescents and young adults at high risk of STDs. Incorporation of a composite measure of partner characteristics into routine assessment of STD risk would be beneficial because partner characteristics identified different individuals than individual sexual activities and partner characteristics may be more predictive of STD risk than

individual sexual activities. Despite the importance of partner characteristics in STD risk assessment, partner characteristics did not explain the racial disparity in STD diagnosis.

The stronger association we found between partner characteristics and STD diagnosis than between individual sexual activities and STD diagnosis supports and expands previous findings from black 14 to 19-year-old girls to both black and white men and women ages 15 to 24 years.<sup>5</sup> Additionally, our study expands previous findings by showing a persistent association between partner characteristics and STD diagnosis when considering condom use and other individual sexual activities. One reason partner selection may be more important for STD acquisition than individual sexual activities is that sexual activities with an uninfected partner present no risk of STD acquisition.

Our finding of a 50% reduction in STDs among condom users is among the stronger associations detected for protectiveness of condoms for prevalent STDs and adds to the evidence of condom effectiveness preventing transmission of STDs other than HIV.<sup>19,23,24</sup> The detected association is likely an underestimate of the protectiveness of condoms because we were unable to assess infection status of the partner, incident infections, or correctness of condom use (i.e., condom problems or not using condoms from beginning to end of sexual intercourse).<sup>23,25</sup> Additionally, our estimate of condom effectiveness is a combination of the protectiveness of condoms for the STDs examined.<sup>23,26–28</sup>

Individuals may have come to the STD clinic because their partner was diagnosed with a STD; therefore, the adolescents and young adults in our study may be more likely than the general population to have a partner who had a STD in the past year. This potential selection bias may have resulted in a stronger association between partner characteristics and STDs in our study than would be found in the general population. The persistence of an association between composite partner characteristics and STD diagnosis when disregarding whether the partner had a STD suggests that even if selection bias was present it would not account for the association between partner characteristics and STD prevalence.

Previous studies suggest that the participant's report would likely agree with the partner's report for partner's age and whether the partner was previously in jail, but agreement may be low regarding the existence and number of other sexual partners.<sup>29,30</sup> Despite the potential for low agreement on some measures of sexual partner characteristics, we were able to use the participant's report of several characteristics of their partners to separate individuals into 3 categories (high, intermediate, and low) that showed a clear association with STD diagnosis.

The 4-fold racial difference in STD diagnosis was not explained when controlling for partner characteristics. It is possible that some of the racial disparity in STDs is explained by partner characteristics other than those measured in our study (e.g., partner's race).<sup>4,31</sup> Additionally, racial differences in STD diagnosis may be due to biologic differences in vaginal bacteria; for example, 1 study found increased STD incidence among black women with bacterial vaginosis infections compared with all white women and black women without bacterial vaginosis infections.<sup>32</sup>

This study had limitations. First, we performed secondary analysis of The Relationship of Alcohol, Youth, and STD Project; therefore, we were limited to the data collected and could not assess potentially important partner characteristics including partner's race or intoxication during sex.<sup>4,8,31</sup> Second, because sexual partners were not interviewed, our analyses relied on the individual's knowledge of their partner; agreement between the partners may be low for some measures, especially the existence and number of other sexual partners.<sup>29,30</sup> Third, our study population was not representative of all youth ages 15 to 24-

years-old; the study population was recruited from an STD clinic and may have higher risk partners than the general population.

This study had several strengths. First, STDs among adolescents were diagnosed clinically as opposed to relying on self-report that may underestimate STDs because of social desirability bias in reporting and undiagnosed infections.<sup>33</sup> Second, we had multiple measures of sexual partners. Third, our measure of age discordance included both older and younger partners for both men and women, incorporating the multidimensions of age discordance that are rarely considered.<sup>34</sup> Finally, the creation of a composite partner characteristic provided a comprehensive view of overall sexual risk and may have provided a more realistic representation of partner risk than considering each measure alone.

Incorporating an assessment of the composite partner characteristic measure described in this study may aid clinicians in identifying individuals at increased risk of STDs. First, over half of individuals with high-risk partners had a STD. Second, among the measures assessed, STDs were most strongly associated with composite partner characteristics. Third, the strong association between STDs and the partner characteristic composite persisted when considering individual sexual activities, including condom use.

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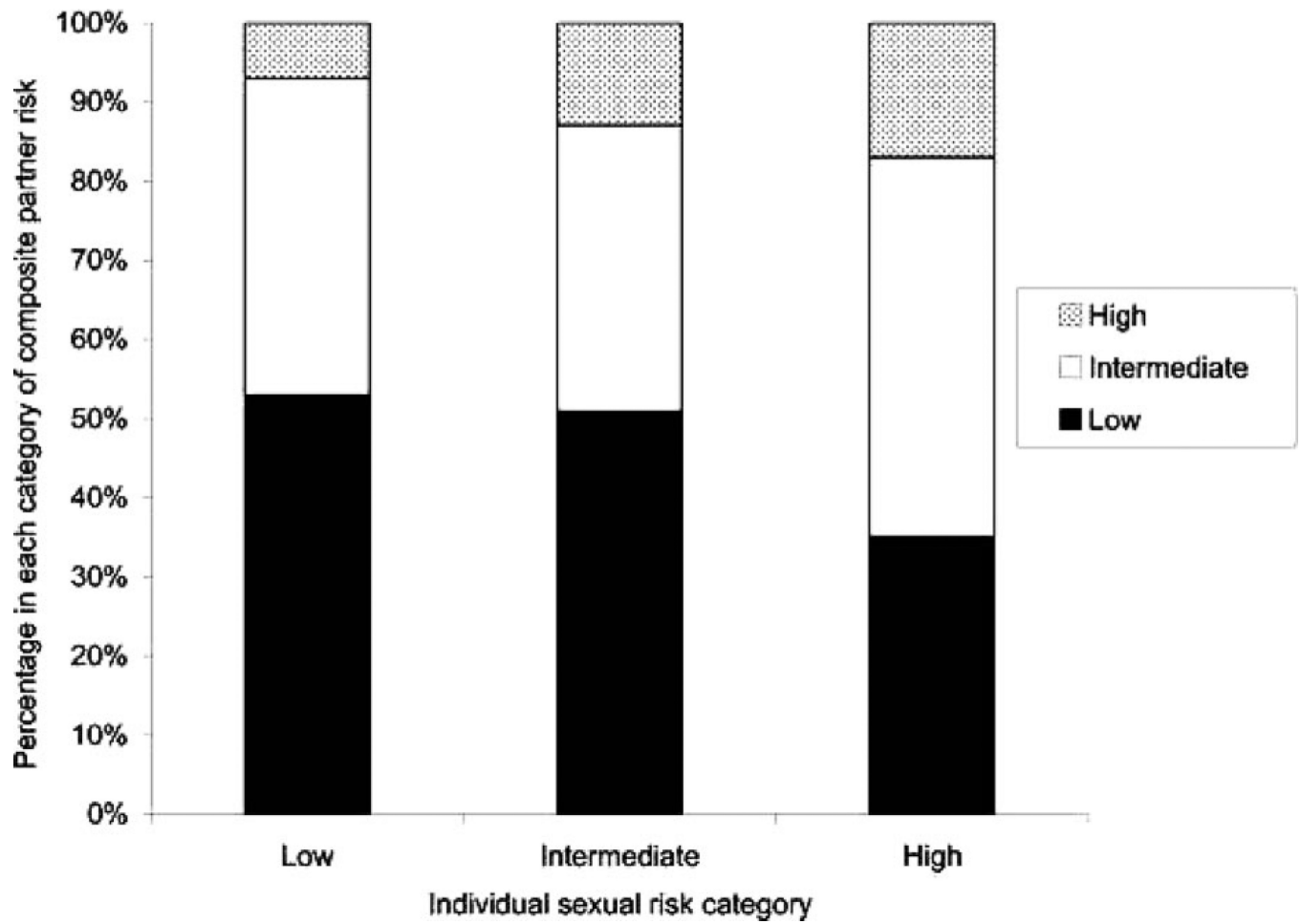
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**Figure 1.** Proportion of adolescents in each individual sexual risk category by composite partner characteristics.

TABLE 1

Characteristics of the 412 Participants From the Relationship of Alcohol, Youth, and Sexually Transmitted Disease Project, by Sex

	Women (n = 212) % (n)	Men (n = 200) % (n)	Women Compared With Men Odds Ratio	
			OR	95% CI
Sexually transmitted disease	28.4% (61)	26.4% (52)	1.1	0.7, 1.7
Chlamydia	16.0% (34)	15.8% (31)	1.0	0.6, 1.8
Gonorrhea	12.5% (26)	12.2% (24)	1.0	0.5, 1.9
Newly diagnosed genital herpes	1.9% (4)	1.0% (2)	1.8	0.3, 20.6
Genital warts	1.4% (3)	5.6% (11)	0.2	0.0, 0.9
Trichomonas	8.0% (17)	—	—	—
Partner characteristics				
STD in past yr	37.2% (61)	36.5% (58)	1.0	0.6, 1.7
5 yr age difference	34.0% (69)	15.2% (29)	2.9	1.7, 4.9
Previously in jail	50.3% (97)	16.0% (26)	5.3	3.1, 9.2
Had other partners in past yr	73.8% (121)	68.9% (113)	1.3	0.8, 2.1
Alcohol problem	53.9% (111)	42.8% (83)	1.5	1.0, 2.3
Marijuana problem	43.7% (90)	27.3% (53)	2.0	1.3, 3.1
Individual sexual activities				
Did not use a condom during last sexual experience	57.8% (122)	57.4% (112)	1.0	0.7, 1.6
Use a condom less than nearly always during sexual activities*	66.8% (139)	66.7% (195)	1.0	0.7, 1.6
Casual partner in the past yr	60.5% (130)	80.5% (157)	0.4	0.2, 0.6
10 sexual partners in lifetime	40.9% (88)	67.7% (130)	0.3	0.2, 0.5
Sexual activities under the influence of alcohol	34.9% (75)	42.1% (83)	0.7	0.5, 1.1
Concurrent partners in the past yr <sup>†</sup>	40.9% (88)	55.2% (107)	0.6	0.4, 0.9
3 sexual partners in the past yr	37.3% (79)	67.7% (132)	0.3	0.2, 0.4
New partner in the past mo	29.3% (63)	44.2% (87)	0.5	0.3, 0.8
Age at first intercourse 15 yr	53.5% (115)	65.0% (128)	0.6	0.4, 0.9

The odds ratios in this table compare women with men by each characteristic. For example, an odds ratio of 2.9 means that women are 2.9 times more likely than men to report the given characteristic.

% = percent with STD with given characteristic, n = total number of adolescents in each group, OR = odds ratio, CI = confidence interval.

\* Analyses compared 2 categories of condom use: always and nearly always versus more than half the time, half of the time, less than half of the time, and never.

<sup>†</sup> Participants were defined as having concurrent partners in the past 12 mo if they reported >1 partner for "the largest number of people you have been in a sexual relationship with at the same time."

TABLE 2

Associations between Sexually Transmitted Disease Diagnosis and Both Sexual Partner Characteristics and Individual Sexual Activities

	Diagnosis of Sexually Transmitted Disease		
	In Those With Characteristic % (n)	In Those Without Characteristic % (n)	<u>With to Without Characteristic Adjusted* Odds Ratio 95% CI OR</u>
Partner characteristics			
STD in past yr	46.2% (119)	19.1% (204)	3.4 2.0, 5.7
5 yr age difference	44.9% (98)	23.3% (296)	2.6 1.6, 4.5
Previously in jail	35.8% (123)	23.2% (233)	1.6 0.9, 2.5
Had other partners in past yr	26.9% (234)	22.3% (94)	1.2 0.8, 2.6
Alcohol problem	29.4% (194)	26.7% (206)	1.2 0.8, 1.9
Marijuana problem	31.5% (143)	26.1% (257)	1.0 0.7, 1.7
Individual sexual activities			
Did not use a condom during last sexual experience	34.2% (234)	19.2% (172)	2.1 1.3, 3.4
Use a condom less than nearly always during sexual activities <sup>†</sup>	32.3% (269)	19.4% (134)	1.8 1.1, 3.1
Casual partner in the past yr <sup>‡</sup>	29.3% (287)	22.8% (123)	1.7 1.0, 3.0
10 sexual partners in lifetime	31.7% (218)	22.2% (189)	1.6 1.0, 2.6
Sexual activities under the influence of alcohol	27.9% (158)	27.2% (254)	1.5 0.9, 2.5
Concurrent partners in the past yr <sup>§</sup>	30.3% (195)	23.8% (214)	1.3 0.8, 2.1
3 sexual partners in the past yr	27.5% (211)	27.6% (196)	1.1 0.7, 1.8
New partner in the past mo	28.0% (150)	27.1% (262)	1.1 0.7, 1.7
Age at first intercourse 15 yr	30.0% (243)	23.7% (169)	1.0 0.6, 1.6

\* Adjusted for race, age, sex, and medical insurance.

<sup>†</sup> Analyses compared 2 categories of condom use: always and nearly always versus more than half the time, half of the time, less than half of the time, and never.

<sup>‡</sup> Variable not included in the composite variable.

<sup>§</sup> Participants were defined as having concurrent partners in the past 12 mo if they reported >1 partner for “the largest number of people you have been in a sexual relationship with at the same time.”

% indicates percent with STD with given characteristic; n, total no. adolescents in each group; OR, odds ratio; CI, confidence interval.

**TABLE 3**  
 Association between Diagnosis with a Sexually Transmitted Disease and Composite Risk Variables

	Diagnosis of Sexually Transmitted Disease						
	In Those Categorized Low Risk % (n)	In Those Categorized Intermediate Risk % (n)	In Those Categorized High Risk % (n)	Intermediate to Low Adjusted Odds Ratio		High to Low Adjusted Odds Ratio	
				OR	95% CI	OR	95% CI
Partner characteristic composite	20.1% (189)	29.4% (160)	52.9% (51)				
Adjusted for demographics*				2.2	1.3, 4.4	3.9	1.9, 8.0
Adjusted for demographics and individual sexual activities composite				2.1	1.0, 4.2	3.4	1.6, 7.0
Individual sexual activities composite	20.8% (96)	24.9% (205)	37.8% (111)				
Adjusted for demographics				1.8	1.0, 3.2	2.3	1.2, 4.5
Adjusted for demographics and partner characteristic composite				1.6	0.9, 2.8	1.8	0.8, 3.9

\* Demographics include race, age, sex, and medical insurance.  
 % = percent with STD with given characteristic, n = total number of adolescents in each group, OR = odds ratio, CI = confidence interval.

**TABLE 4**

## Association between Sexually Transmitted Disease Diagnosis and Race

	Black to White Adjusted* Odds Ratio	
	OR	95% CI
Crude	4.3	2.5, 7.4
Partner characteristics		
Partner had a STD in past yr	3.0	1.6, 5.5
5 yr age difference between partners	3.9	2.2, 6.8
Partner previously in jail	4.3	2.3, 7.9
Partner had other partners in past yr	3.9	2.1, 7.0
Partner abuses alcohol	4.5	2.6, 7.5
Partner abuses marijuana	4.3	2.5, 7.4
Partner characteristic composite	4.0	2.3, 6.8
Partner characteristic composite and individual sexual activities composite	3.8	2.1, 6.8

\* Adjusted for sex, medical insurance, and age.

CI indicates confidence interval, OR = odds ratio.