

Depression, Sexually Transmitted Infection, and Sexual Risk Behavior Among Young Adults in the United States

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Objective: To measure associations among depression, sexual risk behaviors, and sexually transmitted infection (STI) among white and black youth in the United States.

Design: Analysis of prospective cohort study data. Wave I of the National Longitudinal Study of Adolescent Health occurred in 1995 when participants were in grades 7 through 12. Six years later, all Wave I participants who could be located were invited to participate in Wave III and to provide a urine specimen for STI testing.

Setting: In-home interviews in the continental United States, Alaska, and Hawaii.

Participants: Population-based sample. A total of 10 783 Wave I (adolescence) and Wave III (adulthood) white and black respondents with sample weight variables.

Main Exposures: Chronic depression (detected at Waves I and III) and recent depression (detected at Wave III only) vs no adult depression (not detected at Wave III).

Outcome Measures: Multiple sexual partners and inconsistent condom use in the past year and a current positive test result for *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, or *Trichomonas vaginalis* (adulthood).

Results: Recent or chronic depression in adulthood was more common for blacks (women, 19.3%; men, 11.9%) than for whites (women, 13.0%; men, 8.1%). Among all groups (white men and women, and black men and women), adult depression was associated with multiple partners but not with condom use. Among black men, depression was strongly associated with STI (recent: adjusted prevalence ratio, 2.36; 95% confidence interval, 1.26-4.43; chronic: adjusted prevalence ratio, 3.05; 95% confidence interval, 1.48-6.28); having multiple partners did not mediate associations between depression and STI.

Conclusions: Integration of mental health and STI programs for youth is warranted. Further research is needed to elucidate how depression may influence the prevalence of STI among black men.

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APPROXIMATELY 19 MILLION new sexually transmitted infections (STIs) occur in the United States each year,¹ with nearly half occurring in adolescents and young adults aged 15 to 24 years.² Improved understanding of factors that contribute to STI in adolescents and young adults is needed to assist prevention efforts.

Depression is a modifiable factor associated with high-risk sexual behaviors and STI among youth in the United States.³⁻¹⁰ While sexual risk behaviors and STI are risk factors for depression,^{6,9,10} depression also may increase susceptibility to risk behaviors and infection.¹¹ Depression may impair cognitive function and memory¹²⁻¹⁵, decrease impulse control^{16,17}; contribute to psychosocial impairment,¹³ including emotional reactivity in peer relationships¹⁸; re-

duce motivation¹³; and increase fatalism.¹⁹ These depression-related effects may inhibit clear perception of STI risk and the ability to prevent risk behavior. Depression also is associated with substance use,^{13,20-35} a consistent correlate of STI and related behaviors.^{29,30,36-49} While depression and substance use may influence STI risk by promoting high-risk sexual behaviors, adolescents affected by 1 or both of these disorders also may be more likely to have high-risk peers and sexual networks characterized by high levels of STI; this may increase the risk of sex with an infected partner⁵⁰⁻⁵² and STI acquisition. Diagnosis and treatment of adolescent depression, important in themselves, also may constitute a component of adolescent STI prevention.

To our knowledge, only 1 study has assessed the longitudinal relationship

between depression and STI among adolescents, using data from Wave I (adolescence) and Wave II (1 year later) of the National Longitudinal Study of Adolescent Health (Add Health).⁶ In adjusted analyses, the presence of major depression predicted STI among boys but not among girls. An important limitation was that measurement of STI was based on self-report. Add Health Wave III is available and provides data on depression in adolescence and adulthood and on biologically confirmed STI in young adulthood. Given the limited research into depression and STI from adolescence into adulthood, further study of depression and STI in the Add Health sample was warranted.

The purpose of this study was to measure the association between depression in adolescence and adulthood and sexual risk behaviors and biologically confirmed STI in adulthood using Waves I and III of Add Health. We investigated whether the associations between depression and outcomes differed for men vs women and for whites vs blacks, to obtain population-specific information needed to maximize intervention resources.

METHODS

Add Health is a prospective cohort study designed to investigate factors of health from adolescence into adulthood.⁵³ The original study population was a stratified, random, school-based sample representative of US middle and high school students. During Add Health Wave I (1995), more than 20 000 adolescents completed a baseline interview assessing characteristics that included sexual behavior and depression. Parents were also interviewed. During Wave III (2001-2002), Wave I participants were reinterviewed and urine specimens were collected for determination of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infection with use of ligase chain reaction (Abbott LCx Probe System; Abbott Laboratories, Abbott Park, Illinois) and of *Trichomonas vaginalis* infection with use of polymerase chain reaction (Amplicor CT/NG Urine Specimen Prep Kit; Roche Diagnostic Systems, Indianapolis, Indiana). The study design has been described in detail elsewhere.⁵⁴⁻⁵⁹

We used measures from Waves I and III for this analysis of depression and STI. Ethical approval for this research was obtained from The University of North Carolina at Chapel Hill School of Public Health Institutional Review Board.

MEASURES

Exposure: Depression

Depression was assessed using a modified version of the Center for Epidemiologic Studies Depression Scale (CES-D).⁶⁰ The original CES-D is composed of 20 items, each of which assesses the frequency of experiencing depressive symptoms in the past week (responses are rated as 0, never or rarely; 1, sometimes; 2, a lot of the time; or 3, most of the time/all of the time). Four items assess positive symptoms (eg, frequency of happiness, whether one enjoys life) and are reversed before the score is computed. The composite score (based on the 20-item CES-D) ranges from 0 to 60, with higher scores indicating increased severity of depression. The scores of 24 for females and 22 for males have been determined to be sensitive and specific indicators of major depressive disorder among adolescents.⁶¹

We used a modified version of the CES-D composed of a subset of 9 items common to both Waves I and III (eSupplement; <http://www.archpediatrics.com>) to calculate each par-

ticipant's depression score at Wave I and at Wave III (possible score range, 0-27).

Following the methods of Shrier et al.^{5,6} we identified sex-specific cut points for major depressive disorder based on a modified CES-D that were proportional to the cut points for major depressive disorder based on the complete 20-item CES-D.⁶¹ With our 9-item CES-D, scores of 9.9 among males and 10.4 among females indicated major depressive disorder. For convenience, we identified male or female respondents with a score of 10 or greater as having a high likelihood of major depressive disorder. We subsequently refer to this high likelihood of major depressive disorder as "depression."

Based on our categorizations of depression at Waves I and III, we defined a 3-level depression exposure variable. We coded respondents with depression in adulthood (Wave III) who also had depression in adolescence (Wave I) as having *chronic depression*, respondents with depression in adulthood (Wave III) who did not have depression in adolescence (Wave I) as having *recent depression*, and respondents who were not depressed in adulthood (Wave III) as having *no adult depression*.

Outcomes: Sexual Risk Behaviors and STI (Wave III)

We measured associations between recent and chronic depression and the following sexual risk behaviors in the year before Wave III: 2 or more sexual partners, 6 or more sexual partners, 10 or more sexual partners, 0% condom use, and less than 100% condom use (yes vs no). We also examined the association between depression and biologically confirmed STI at Wave III (a positive test result for *C trachomatis*, *N gonorrhoeae*, or *T vaginalis* on Wave III urine specimen vs a negative result for all 3 tests).

POTENTIAL CONFOUNDING VARIABLES

We considered each of the following covariates as a potential confounding variable based on its a priori causal relationship with the exposure and outcome: age; marital history; maternal education measured by Wave I self-report if the mother was interviewed, otherwise by adolescent's report; Wave III low functional income status in the past year; age at first vaginal intercourse; self-reported STI at Wave I (self-report of diagnosis with chlamydial infection, gonorrhea, trichomoniasis, syphilis, genital herpes, or human immunodeficiency virus vs no self-reported STI diagnosis); Wave I frequent alcohol consumption in the past year, defined as drinking at least 3 days per week; Wave I lifetime marijuana use; and Wave I lifetime crack or cocaine use.

DATA ANALYSIS

For all analyses, we used survey commands in Stata Version 9.1 (StataCorp, College Station, Texas) to account for stratification, clustering, and unequal selection probabilities, yielding nationally representative estimates.

We used bivariable analyses to calculate weighted prevalences and 95% confidence intervals (CIs) of Wave III STI by demographic, socioeconomic, mental health, and behavioral variables. We also investigated whether depression and mental health care differed between whites and blacks.

We estimated unadjusted prevalence ratios (PRs) and 95% CIs for associations between depression and outcomes (multiple partner indicators, condom use indicators, and STI) by sex and race (white vs black) using a Poisson model without an offset, specifying a log link and probability weights.^{62,63} Adjusted models included demographic, socioeconomic, depression, and adolescent STI risk and substance use variables.

Among populations in which we observed an association between depression and sexual risk behaviors (indicators of multiple sexual partners or inconsistent condom use) as well as STI, we explored whether the behavioral variables predicted by depression were mediators of the depression-STI relationship. We compared associations between depression and STI adjusted for original confounding variables with associations further adjusted for the intermediate sexual behavior determinants. If the associations between depression and STI were attenuated on further adjustment for the behavioral intermediates, we assumed these variables mediated the association between depression and STI.

RESULTS

Of the 18 924 participants in the weighted Wave I sample, 14 322 (75.7%) were located and reinterviewed during Wave III and had no missing values for sample weight variables.

The STI testing procedures, participation, and results have been described in detail previously.^{58,64,65} Of the 14 322 Wave III participants, 1130 (7.9%) refused to provide a urine specimen, 226 (1.6%) were unable to provide a urine specimen, 421 (2.9%) provided urine specimens that could not be processed due to shipping or laboratory problems, and 951 (6.6%) did not have results for all 3 STI tests. The prevalence of missing or incomplete STI data was not significantly different by race/ethnicity.

We conducted analyses among the 10 783 respondents with complete sample weight variables. Of these, the 8794 Wave III participants (81.6%) with a result for all 3 tests (*C trachomatis*, *N gonorrhoeae*, and *T vaginalis*) were included in the analyses of depression and STI.

WAVE III STI PREVALENCE BY RESPONDENT CHARACTERISTICS

Of the respondents in the analytic sample, 50.4% were men and 49.6% were women; their mean age was 21.8 years; and 80.9% were white and 19.1% were black (**Table 1**).

The overall weighted prevalence of infection at Wave III with *C trachomatis*, *N gonorrhoeae*, or *T vaginalis* was 6.1% (95% CI, 5.0%-7.2%) (Table 1). The prevalence of STI was higher in women than in men (unadjusted odds ratio, 1.61; 95% CI, 1.32-1.96) and markedly higher in blacks than in whites (odds ratio, 6.99; 95% CI, 5.38-9.09).

DEPRESSION AND MENTAL HEALTH CARE

Of the total Wave III sample, 11.5% had depression in adulthood: 7.2% had recent depression and 4.3% had chronic depression. Prevalence of recent or chronic depression was highest among black women (19.3%), followed by white women (13.0%), black men (11.9%), and white men (8.1%) (Table 1). Among those who were categorized as having recent or chronic depression at Wave III, blacks were much less likely than whites to report having received psychological or emotional counseling (blacks: 10.1%, whites: 20.9%) or prescription medication for depression or stress (blacks: 5.4%, whites: 17.0%) in the year before the survey.

DEPRESSION AND MULTIPLE PARTNERS IN THE PAST YEAR

White Men

Among white men, neither recent nor chronic depression vs no adult depression was associated with having 2 or more partners in the past year in bivariable analyses and analyses adjusting for demographic, socioeconomic, and adolescent STI risk and substance use variables (recent: adjusted PR, 1.23; 95% CI, 0.96-1.56; chronic: adjusted PR, 1.14; 95% CI, 0.79-1.62) (**Table 2**).

While recent depression was not associated with having 6 or more partners in the past year (adjusted PR, 1.15; 95% CI, 0.46-2.87), chronic depression appeared to be associated with this outcome (adjusted PR, 2.15; 95% CI, 0.90-5.15). This estimate was imprecise due to the low number of chronically depressed white men available for the analysis.

Recent and chronic depressions were not associated with having 10 or more partners in the past year (recent: adjusted PR, 0.56; 95% CI, 0.12-2.61; chronic: adjusted PR, 1.66; 95% CI, 0.23-12.0).

White Women

Among white women, recent depression was moderately associated with having 2 or more partners in the past year (adjusted PR, 1.45; 95% CI, 1.19-1.77) (Table 2). Chronic depression was weakly and insignificantly associated with this outcome (adjusted PR, 1.24; 95% CI, 0.90-1.70).

In this group, recent and chronic depressions were strongly associated with having 6 or more partners in the past year (recent: adjusted PR, 2.13; 95% CI, 1.06-4.25; chronic: adjusted PR, 2.40; 95% CI, 0.98-5.90) and 10 or more partners in the past year (recent: adjusted PR, 6.87; 95% CI, 2.53-18.6; chronic: adjusted PR, 8.42; 95% CI, 3.23-22.0).

Black Men

Among black men, recent depression was not associated with having 2 or more partners in the past year (adjusted PR, 0.88; 95% CI, 0.67-1.16) (Table 2). Chronic depression was not associated with having 2 or more partners in the past year in unadjusted analyses (unadjusted PR, 1.10; 95% CI, 0.73-1.67) but was weakly associated with this outcome in adjusted analyses (adjusted PR, 1.37; 95% CI, 0.96-1.95).

In this group, recent depression was not associated with having 6 or more partners in the past year (adjusted PR, 1.06; 95% CI, 0.53-2.11). While chronic depression was not associated with having 6 or more partners in the past year in bivariable analyses (unadjusted PR, 1.74; 95% CI, 0.66-4.54), it was strongly associated with the outcome in adjusted analyses (adjusted PR, 2.48; 95% CI, 1.05-5.82).

Among black men, recent and chronic depressions were not associated with having 10 or more partners in the past year (recent: adjusted PR, 0.51; 95% CI, 0.12-2.11; chronic: adjusted PR, 2.23; 95% CI, 0.77-6.47).

Black Women

Black women with recent or chronic depression did not appear to have a higher prevalence of 2 or more partners

Table 1. Respondent Characteristics and Sexually Transmitted Infection (STI) in Wave III Among 10 783 White and Black US Adults Aged 18 to 25 Years^a

	No. ^b	Weighted, % ^c	Weighted, % With STI ^c	Unadjusted Odds Ratio (95% Confidence Interval)
Sociodemographic Characteristics				
Sex				
Women	5799	49.6	7.4	1.61 (1.32-1.96)
Men	4984	50.4	4.8	1 [Reference]
Age, y				
18-20	2682	28.7	5.6	1 [Reference]
21	1867	17.0	7.3	1.32 (0.86-2.00)
22	1981	16.4	6.9	1.24 (0.83-1.85)
23	1995	15.6	6.0	1.08 (0.67-1.74)
24-28	2258	22.4	5.3	0.94 (0.56-1.57)
Race/ethnicity				
White	7741	80.9	3.2	1 [Reference]
Black	3042	19.1	18.6	6.99 (5.38-9.09)
Ever married				
No	8767	81.8	6.6	1 [Reference]
Yes	2003	18.2	4.0	1.70 (1.23-2.35)
Socioeconomic Background				
Mother's education (Wave I)				
<High school graduate	1183	11.9	11.9	2.70 (2.03-3.60)
High school graduate	3422	35.1	6.1	1.29 (1.01-1.66)
≥College	5952	53.0	4.8	1 [Reference]
Respondent/household could not afford housing/utilities in past year (Wave III)				
No	9098	85.9	5.7	1 [Reference]
Yes	1554	14.1	8.5	1.54 (1.17-2.04)
Mental Health				
Adult depression status ^d				
No depression (not detected at Wave III)	9450	88.5	5.8	1 [Reference]
Recent depression (detected at Wave III only)	827	7.2	8.3	1.48 (1.05-2.09)
Chronic depression (detected at Waves I and III)	472	4.3	8.6	1.53 (1.03-2.29)
Received psychological or emotional counseling in the past year, among those with recent or chronic depression ^e				
No	9965	92.2	6.2	1 [Reference]
Yes	812	7.8	4.5	0.72 (0.44-1.15)
Received prescription medication for depression or stress in the past year, among those with recent or chronic depression ^e				
No	10 188	94.2	6.3	1 [Reference]
Yes	585	5.8	2.7	0.42 (0.23-0.74)
Adolescent STI Risk				
Age at first vaginal sex, y				
≤15	3183	30.6	9.1	2.99 (1.83-4.91)
16	1854	17.4	6.3	2.01 (1.20-3.39)
17-18	2926	26.7	4.6	1.44 (0.87-2.38)
19-25	1383	12.8	4.5	1.41 (0.78-2.54)
Never had sex	1293	12.5	3.2	1 [Reference]
Self-reported STI in adolescence (Wave I)				
No	10 147	96.3	5.7	1 [Reference]
Yes	444	3.7	16.4	3.27 (2.24-4.77)
Substance Use in Adolescence (Wave I)				
Drank ≥3 d/wk in past year in adolescence (Wave I)				
No	10 427	96.6	6.0	1 [Reference]
Yes	337	3.4	9.0	1.55 (0.90-2.69)
Ever used marijuana in adolescence (Wave I)				
No	7785	72.6	5.9	1 [Reference]
Yes	2891	27.4	6.5	1.10 (0.84-1.45)
Ever used crack or cocaine in adolescence (Wave I)				
No	10 360	96.7	6.0	1 [Reference]
Yes	306	3.3	9.7	1.69 (0.95-3.00)

^aOverall, 6.1% of the analytic sample was confirmed to have a positive test result with *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, or *Trichomonas vaginalis*.

^bTotals may not sum to 10 783 due to missing values.

^cUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates of white and black young adults.

^dDepression at Wave I and/or Wave III was based on having a Center for Epidemiologic Studies Depression Scale score of 10 or greater of a total of 27. Prevalence of recent or chronic adult depression was highest among black women (19.3%), followed by white women (13.0%), black men (11.9%), and white men (8.1%).

^eAmong those who were categorized as having recent or chronic depression at Wave III, blacks were much less likely than whites to report having received psychological or emotional counseling (blacks, 10.1%; whites, 20.9%) or prescription medication for depression or stress (blacks, 5.4%; whites, 17.0%) in the year before the survey.

Table 2. Prevalence Ratios (PRs) and 95% Confidence Intervals (CIs) for the Associations Between Recent and Chronic Depression and Multiple Partners in the Year Before Wave III Among White and Black US Adults Aged 18 to 25 Years

No. of Sexual Partners and Depression Status ^a	Men				Women			
	No.	Weighted % With Multiple Partners ^b	Unadjusted PR (95% CI)	Adjusted PR (95% CI) ^c	No.	Weighted % With Multiple Partners ^b	Unadjusted PR (95% CI)	Adjusted PR (95% CI) ^c
White Adults								
≥2 Sexual partners in past year								
No depression (not detected at Wave III)	2856	35.8	1 [Reference]	1 [Reference]	3090	24.9	1 [Reference]	1 [Reference]
Recent depression (detected at Wave III only)	173	43.3	1.21 (0.96-1.52)	1.23 (0.96-1.56)	277	36.1	1.45 (1.19-1.77)	1.45 (1.19-1.76)
Chronic depression (detected at Waves I and III)	68	40.9	1.14 (0.80-1.63)	1.14 (0.79-1.62)	185	31.3	1.25 (0.94-1.67)	1.24 (0.90-1.70)
≥6 Sexual partners in past year								
No depression (not detected at Wave III)	2856	4.9	1 [Reference]	1 [Reference]	3090	2.0	1 [Reference]	1 [Reference]
Recent depression (detected at Wave III only)	173	4.8	0.98 (0.39-2.48)	1.15 (0.46-2.87)	277	4.9	2.43 (1.23-4.79)	2.13 (1.06-4.25)
Chronic depression (detected at Waves I and III)	68	11.6	2.37 (0.90-6.22)	2.15 (0.90-5.15)	185	5.4	2.68 (1.10-6.50)	2.40 (0.98-5.90)
≥10 Sexual partners in past year								
No depression (not detected at Wave III)	2856	1.7	1 [Reference]	1 [Reference]	3090	0.5	1 [Reference]	1 [Reference]
Recent depression (detected at Wave III only)	173	1.0	0.54 (0.13-2.37)	0.56 (0.12-2.61)	277	3.2	6.95 (2.45-19.8)	6.87 (2.53-18.6)
Chronic depression (detected at Waves I and III)	68	4.1	2.37 (0.33-17.2)	1.66 (0.23-12.0)	185	3.8	8.32 (2.59-26.7)	8.42 (3.23-22.0)
Black Adults								
≥2 Sexual partners in past year								
No depression (not detected at Wave III)	994	49.4	1 [Reference]	1 [Reference]	1230	33.3	1 [Reference]	1 [Reference]
Recent depression (detected at Wave III only)	98	47.0	0.95 (0.73-1.24)	0.88 (0.67-1.16)	151	42.2	1.27 (0.97-1.66)	1.12 (0.87-1.45)
Chronic depression (detected at Waves I and III)	40	54.4	1.10 (0.73-1.67)	1.37 (0.96-1.95)	120	28.6	0.86 (0.61-1.21)	0.87 (0.64-1.18)
≥6 Sexual partners in past year								
No depression (not detected at Wave III)	994	10.2	1 [Reference]	1 [Reference]	1230	2.7	1 [Reference]	1 [Reference] ^d
Recent depression (detected at Wave III only)	98	14.6	1.44 (0.76-2.73)	1.06 (0.53-2.11)	151	7.1	2.60 (1.01-6.65)	2.58 (1.08-6.17)
Chronic depression (detected at Waves I and III)	40	17.7	1.74 (0.66-4.54)	2.48 (1.05-5.82)	120	0.3	0.12 (0.02-0.60)	0.10 (0.01-0.76)
≥10 Sexual partners in past year								
No depression (not detected at Wave III)	994	4.8	1 [Reference]	1 [Reference]	1230	0.6	1 [Reference] ^e	1 [Reference] ^e
Recent depression (detected at Wave III only)	98	2.6	0.54 (0.15-1.96)	0.51 (0.12-2.11)	151	2.6		
Chronic depression (detected at Waves I and III)	40	7.9	1.65 (0.42-6.41)	2.23 (0.77-6.47)	120	0.1		

^aDepression at Wave I and/or Wave III was based on having a Center for Epidemiologic Studies Depression Scale score of 10 or greater of a total of 27.

^bUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates of white and black young adults.

^cAdjusted for age (18-20, 21, 22, 23, or 24-28 y), marital history (ever married vs never married), mother's educational level (<high school graduate, high school graduate, or ≥college graduate), respondent's functional income at Wave III (respondent or respondent's household did not have enough money to pay rent/mortgage payment or utilities in the past year vs no problems paying housing and utilities), age at first vaginal intercourse (≤15, 16, 17-18, or 19-25 y or never had sex), Wave I self-reported sexually transmitted infection (respondent reported diagnosis with chlamydia, gonorrhea, trichomoniasis, syphilis, genital herpes, or human immunodeficiency virus vs no self-reported sexually transmitted infection diagnosis), ever use of marijuana in adolescence (Wave I), ever use of crack or cocaine in adolescence (Wave I), and consumption of alcohol at least 3 d/wk in the past 12 mo in adolescence (Wave I).

^dAll black women with 6 or more partners in the past year had used crack or cocaine by Wave I and had consumed alcohol at least 3 d/wk in the past 12 mo before the Wave I interview. Hence, these substance use variables were omitted from the multivariable model use that estimated the association between depression and having 6 or more partners.

^eStratum-specific sample size was too small to yield reliable estimates.

in the past year than black women with no depression (recent: adjusted PR, 1.12; 95% CI, 0.87-1.45; chronic: adjusted PR, 0.87; 95% CI, 0.64-1.18) (Table 2).

Among black women, recent depression was strongly associated with having 6 or more partners in the past year (adjusted PR, 2.58; 95% CI, 1.08-6.17). Black women with chronic depression were much less likely to have had 6 or more partners in the past year than black women with no depression (adjusted PR, 0.10; 95% CI, 0.01-0.76).

In this group, small stratum-specific sample size prevented estimation of the associations between depression and having 10 or more partners in the past year.

DEPRESSION AND CONDOM USE IN THE PAST YEAR

In all subgroups, recent and chronic depressions were not associated with inconsistent condom use (<100% condom use or 0% condom use) (Table 3).

DEPRESSION AND STI

White Men

Among white men, STI was not associated with recent depression (adjusted PR, 0.47; 95% CI, 0.15-1.51) or chronic depression (adjusted PR, 0.77; 95% CI, 0.16-3.72) (Table 4).

White Women

Among white women, STI was not associated with recent depression (adjusted PR, 1.23; 95% CI, 0.54-2.77) (Table 4). White women with chronic depression had lower levels of STI than those with no depression in adulthood (adjusted PR, 0.20; 95% CI, 0.05-0.81).

Black Men

Among black men, STI was strongly associated with recent and chronic depressions in unadjusted analyses

Table 3. Prevalence Ratios (PRs) and 95% Confidence Intervals (CIs) for the Associations Between Recent and Chronic Depression and Inconsistent Condom Use in the Year Before Wave III Among White and Black US Adults Aged 18 to 25 Years

Condom Use and Depression Status ^a	Men						Women		
	No.	Weighted % With No Condom Use ^b	Unadjusted PR (95% CI)	Adjusted PR (95% CI) ^c	No.	Weighted % With No Condom Use ^b	Unadjusted PR (95% CI)	Adjusted PR (95% CI) ^c	
White Adults									
<100% Condom use									
No depression (not detected at Wave III)	2562	76.4	1 [Reference]	1 [Reference]	2855	83.3	1 [Reference]	1 [Reference]	
Recent depression (detected at Wave III only)	154	82.5	1.08 (0.98-1.19)	1.09 (0.98-1.21)	258	83.9	1.01 (0.93-1.10)	0.99 (0.90-1.08)	
Chronic depression (detected at Waves I and III)	54	86.9	1.14 (0.98-1.32)	1.06 (0.90-1.26)	174	87.9	1.05 (0.98-1.14)	0.99 (0.91-1.09)	
0% Condom use									
No depression (not detected at Wave III)	2562	29.0	1 [Reference]	1 [Reference]	2855	35.9	1 [Reference]	1 [Reference]	
Recent depression (detected at Wave III only)	154	31.4	1.08 (0.80-1.47)	1.14 (0.82-1.60)	258	37.1	1.03 (0.88-1.22)	1.03 (0.86-1.23)	
Chronic depression (detected at Waves I and III)	54	32.5	1.12 (0.69-1.82)	0.85 (0.51-1.41)	174	43.7	1.22 (1.00-1.48)	1.09 (0.87-1.36)	
Black Adults									
<100% Condom use									
No depression (not detected at Wave III)	924	66.5	1 [Reference]	1 [Reference]	1128	73.7	1 [Reference]	1 [Reference]	
Recent depression (detected at Wave III only)	91	65.4	0.98 (0.76-1.27)	1.11 (0.90-1.38)	134	84.1	1.14 (1.03-1.26)	1.13 (1.01-1.26)	
Chronic depression (detected at Waves I and III)	39	80.7	1.21 (0.99-1.50)	1.17 (0.94-1.47)	109	78.8	1.07 (0.96-1.19)	1.05 (0.94-1.18)	
0% Condom use									
No depression (not detected at Wave III)	924	17.0	1 [Reference]	1 [Reference]	1128	22.5	1 [Reference]	1 [Reference]	
Recent depression (detected at Wave III only)	91	19.0	1.12 (0.60-2.08)	1.26 (0.62-2.56)	134	23.2	1.03 (0.62-1.74)	1.06 (0.70-1.61)	
Chronic depression (detected at Waves I and III)	39	32.3	1.90 (0.99-3.64)	1.50 (0.60-3.70)	109	26.9	1.20 (0.84-1.71)	1.04 (0.70-1.53)	

^aDepression at Wave I and/or Wave III was based on having a Center for Epidemiologic Studies Depression Scale score of 10 or greater of a total of 27.

^bUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates of white and black young adults.

^cAdjusted for age (18-20, 21, 22, 23, or 24-28 y), marital history (ever married vs never married), mother's educational level (<high school graduate, high school graduate, or ≥college graduate), respondent's functional income at Wave III (respondent or respondent's household did not have enough money to pay rent/mortgage payment or utilities in the past year vs no problems paying housing and utilities), age at first vaginal intercourse (≤15, 16, 17-18, or 19-25 y or never had sex), Wave I self-reported sexually transmitted infection (respondent reported diagnosis with chlamydia, gonorrhea, trichomoniasis, syphilis, genital herpes, or human immunodeficiency virus vs no self-reported sexually transmitted infection diagnosis), ever use of marijuana in adolescence (Wave I), ever use of crack or cocaine in adolescence (Wave I), and consumption of alcohol at least 3 d/wk in the past 12 mo in adolescence (Wave I).

(recent: unadjusted PR, 1.93; 95% CI, 0.94-3.95; chronic: unadjusted PR, 2.07; 95% CI, 1.04-4.10) (Table 4). In analyses adjusting for confounding factors, these estimates strengthened (recent: adjusted PR, 2.36; 95% CI, 1.26-4.43; chronic: adjusted PR, 3.05; 95% CI, 1.48-6.28).

Black Women

Among black women, in unadjusted and adjusted analyses, STI was not associated with recent depression (adjusted PR, 1.01; 95% CI, 0.63-1.61) or chronic depression (adjusted PR, 1.08; 95% CI, 0.66-1.76) (Table 4).

INVESTIGATION OF SEXUAL RISK BEHAVIORS THAT MEDIATE THE ASSOCIATION BETWEEN DEPRESSION AND STI AMONG BLACK MEN

Does engagement in multiple partnerships mediate the depression-STI relationship among black men? Among black men, chronic depression was associated with multiple sexual partners and STI. We sought to identify whether multiple partners mediated the relationship between chronic depression and STI. In analyses adjusted for original confounding factors and for variables hypothesized to mediate the depression-STI association (indicators of having 2, 6, or ≥10 partners in the past year), the association was not attenuated. In fact, the association between chronic depression and STI somewhat strengthened (adjusted PR, 3.44; 95% CI, 1.89-6.24). Having 6 or more partners in the past year did not mediate the association between chronic depression and STI.

Although recent depression was associated with STI among black men, it was not associated with multiple partners or condom use. Other sexual behaviors or non-behavioral factors not measured in this study appeared to account for the strong association between recent depression and STI.

COMMENT

Among this nationally representative sample, white and black young adults with recent or chronic depression were much more likely to have multiple sexual partners, an important determinant of STI, than were those identified as having no depression in adulthood. In black men, depression was associated with 2 to 3 times the prevalence of STI. In all groups, associations between depression and STI-related behaviors and infection remained when adjusted for demographic, socioeconomic, and adolescent STI risk and substance use variables, suggesting that depression may influence STI risk independent of these factors. Because our analysis included components of a longitudinal study, including measurement of depression from adolescence and control of baseline STI risk, we interpret these findings to suggest that depression through adolescence likely contributed to STI risk among young adults. Our observations support earlier findings that depression appears to predict STI and related behaviors among adolescents and young adults.^{6,9} Given the strong associations between depression and STI risk, these findings highlight a need for improved inte-

Table 4. Prevalence Ratios (PRs) and 95% Confidence Intervals (CIs) for the Associations Between Recent and Chronic Depression and Sexually Transmitted Infection (STI) Among White and Black US Adults Aged 18-25 Years

STI and Depression Status ^a	Men				Women			
	No.	Weighted % With STI ^b	Unadjusted PR (95% CI)	Adjusted PR (95% CI) ^c	No.	Weighted % With STI ^b	Unadjusted PR (95% CI)	Adjusted PR (95% CI) ^c
White Adults								
No depression (not detected at Wave III)	2718	0.4	1 [Reference]	1 [Reference]	2924	3.8	1 [Reference]	1 [Reference]
Recent depression (detected at Wave III only)	170	1.0	0.38 (0.11-1.24)	0.47 (0.15-1.51)	251	4.7	1.25 (0.60-2.63)	1.23 (0.54-2.77)
Chronic depression (detected at Waves I and III)	70	2.2	0.82 (0.18-3.68)	0.77 (0.16-3.72)	172	1.5	0.38 (0.12-1.24)	0.20 (0.05-0.81)
Black Adults								
No depression (not detected at Wave III)	943	12.6	1 [Reference]	1 [Reference]	1142	22.3	1 [Reference]	1 [Reference]
Recent depression (detected at Wave III only)	97	24.2	1.93 (0.94-3.95)	2.36 (1.26-4.43)	137	24.6	1.10 (0.71-1.71)	1.01 (0.63-1.61)
Chronic depression (detected at Waves I and III)	37	25.9	2.07 (1.04-4.10)	3.05 (1.48-6.28)	112	25.4	1.14 (0.73-1.77)	1.08 (0.66-1.76)

^aDepression at Wave I and/or Wave III was based on having a Center for Epidemiologic Studies Depression Scale score of 10 or greater of a total of 27. Participants with a positive test result with *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, or *Trichomonas vaginalis* were coded as having an STI.

^bUse of survey commands to account for stratification, clustering, and unequal selection probabilities yielded nationally representative estimates of white and black young adults.

^cAdjusted for age (18-20, 21, 22, 23, or 24-28 y), marital history (ever married vs never married), mother's educational level (<high school graduate, high school graduate, or ≥college graduate), respondent's functional income at Wave III (respondent or respondent's household did not have enough money to pay rent/mortgage payment or utilities in the past year vs no problems paying housing and utilities), age at first vaginal intercourse (≤15, 16, 17-18, or 19-25 y or never had sex), Wave I self-reported STI (respondent reported diagnosis with chlamydia, gonorrhea, trichomoniasis, syphilis, genital herpes, or human immunodeficiency virus vs no self-reported STI diagnosis), ever use of marijuana, ever use of crack or cocaine, and consumption of alcohol at least 3 d/wk in the past 12 mo.

gration of mental health and STI screening and prevention programs for adolescents and young adults in white and black communities.

For black men, although chronic depression was associated with having multiple sexual partners, this behavior did not appear to mediate the association between depression and STI. Other factors underlie the association between depression and STI in black men. It is possible that chronic depression contributed to other sexual risk-taking behaviors that we did not measure. In addition, chronically depressed black men may have high-risk social and sexual networks and, hence, experience greater risk of coming into contact with an infected sexual partner than do black men who are not depressed. This may be the case, in part, because depression is strongly associated with substance use,^{13,20-35} and substance users have networks with high levels of STI.⁵⁰⁻⁵² This study has pointed to a robust association between depression and STI risk in black men. Because this study has not elucidated the mechanisms through which depression may increase the prevalence of STI in this group, it highlights the need for further research into the effects of depression on STI risk for black men and their sexual partners.

For all groups (white men and women, and black men and women), depression-related increases in multiple partners did not appear to translate into higher infection levels. For whites, this finding was not surprising given the low prevalence of infection in white sexual networks. However, if infection were introduced into sexual networks of recently and chronically depressed whites, depression-associated increases in multiple partners may facilitate STI transmission.

For blacks, although depression was associated with having multiple partners, the prevalence of STI was alarmingly high among blacks with both high and low levels of

depression and multiple partners. These findings validate an earlier Add Health study that found STI prevalence is disproportionately high in blacks compared with that in whites, even in blacks with relatively low levels of risk behaviors.⁶⁶ The study concluded that factors other than individual-level risk behaviors likely drive high infection rates in blacks. Sexual mixing between high- and low-risk groups is much more common for blacks than for whites and likely contributes to disproportionate STI transmission in black populations.⁶⁶ It is possible that structural and contextual factors play a more important role than individual-level behaviors in driving STI transmission in blacks, by contributing to sexual mixing patterns and the concentration of infection in black communities.

The prevalence of depression was higher for blacks than for whites, and we observed a race differential in levels of counseling and treatment for depression. These differences support existing evidence of a race disparity in mental health care⁶⁷⁻⁶⁹ and further indicate that undiagnosed, untreated depression constitutes an important public health concern for blacks. These results documented the high prevalence of depression and inadequate diagnosis of and care for mental health needs in blacks, as well as strong associations between depression and STI risk in this group, highlighting the importance of improving mental health care in black communities.

The most important limitation of this research was our inability to conduct a fully longitudinal study, because we sought to examine chronic depression from adolescence into adulthood and STI in adulthood. In particular, the long time between data collection in adolescence (Wave I) and young adulthood (Wave III) limited our ability to definitively assess the causal role of depression in sexual risk behavior and STI. To establish whether adolescent depression is causally associated with acquisition of STI in adulthood among blacks, a longitudinal

study should be conducted to accurately measure depression, STI, and important covariates such as substance use at frequent intervals to disentangle the specific effects of each variable of interest on STI.

This research was also potentially limited by our use of the CES-D. Our 9-item modified CES-D was not validated against a clinical diagnosis of depression, which may have resulted in misclassification of depression. Furthermore, we assumed that the CES-D functioned similarly in white and black groups. While some research has shown that the CES-D measures differing underlying phenomena for different racial/ethnic adolescent groups,⁷⁰ other studies have suggested that the scale functions comparably in both white and African American populations⁷¹ and has good sensitivity and moderate specificity to detect depression in black populations.⁷²

This study provided further evidence that US youth at high risk for STI also experience a disproportionate risk of depression, highlighting the need for improved integration of mental health and STI diagnosis, treatment, and prevention. Because levels of depression and STI were higher and the associations between these variables were stronger for blacks than for whites, black youth should be a priority when allocating resources to improve mental health care. Improved diagnosis and care for depression are needed not only because depression constitutes an important public health concern in itself but also because addressing depression may lead to improved physical health, including lower risk for STI.

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