Association of Depressive Symptoms and Substance Use With Risky Sexual Behavior and Sexually Transmitted Infections Among African American Female Adolescents Seeking Sexual Health Care

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Objectives. We examined how depression and substance use interacted to predict risky sexual behavior and sexually transmitted infections (STIs) among African American female adolescents.

Methods. We measured depressive symptoms, substance use, sexual behavior, and STIs in 701 African American female adolescents, aged 14 to 20 years, at baseline and at 6-month intervals for 36 months in Atlanta, Georgia (2005–2007). We used generalized estimating equation models to examine effects over the 36-month follow-up period.

Results. At baseline, more than 40% of adolescents reported significant depressive symptoms; 64% also reported substance use in the 90 days before assessment. Depression was associated with recently incarcerated partner involvement, sexual sensation seeking, unprotected sex, and prevalent STIs (all $P < .001$). In addition, adolescents with depressive symptoms who reported any substance use (i.e., marijuana, alcohol, Ecstasy) were more likely to report incarcerated partner involvement, sexual sensation seeking, unprotected sex, and have an incident STI over the 36-month follow-up (all $P < .05$).

Conclusions. African American female adolescents who reported depressive symptoms and substance use were more likely to engage in risky behavior and acquire incident STIs. This population might benefit from future prevention efforts targeting the intersection of depression and substance use. (*Am J Public Health.* 2015;105:2137–2142. doi:10.2105/AJPH.2014.302493)

Although self-exploration and identity seeking are healthy aspects of adolescence, certain adverse behaviors, such as substance use and risky sexual behavior, have also been associated with adolescence. HIV, other sexually transmitted infections (STIs), and adolescent pregnancy are significant contributors to female adolescents' morbidity and mortality in the United States.[1] Adolescents aged 15 to 24 years account for approximately 50% of new STI cases each year,[2] and it is estimated that 24.1% of adolescent girls aged 14 to 19 years have 1 of 5 commonly reported STIs (herpes simplex virus, trichomonaisis, chlamydia, gonorrhea, and human papilloma virus).[3] Minority adolescents are disproportionately at higher risk for HIV and other STIs relative to their White counterparts.[4] For example, African American adolescents account for 65% of HIV diagnoses among individuals aged 13 to 24 years.[5] Among African American female adolescents aged 14 to 19 years, a national study found that 44% had at least 1 STI.[3] Because African American female adolescents are at heightened risk for engaging in risky sexual behavior and STI acquisition, it is important to gain a better understanding of factors that may be associated with these risks. Two such factors are depressive symptoms and substance use or abuse.[6–15]

In a national survey, 4.3% of youths, aged 12 to 17 years, reported current depression, and girls, regardless of age, were more likely to report depression than boys (6.7% vs 4.0%).[16] In addition, 1 study found that among adolescents in mental health treatment, girls were more likely to use condoms inconsistently and were more than 9 times likely to contract an STI than were boys.[17] The National Longitudinal Study of Adolescent Health found that 19.7% of African American female adolescents reported recent and chronic depressive symptoms compared with 13% among White female adolescents.[18] Other studies found rates of depressive symptoms ranging from 40% to 55% among African American female adolescents.[6,7,19] Previous research among African American female adolescents reported that depressive symptoms were associated with inconsistent condom use,[6,10,12] multiple sexual partners,[7,9,10] risky male sexual partners,[6] sexual contact while high on alcohol or drugs,[6,7,9,11] low frequency of sexual communication,[6,7] fear of communication about condoms,[6,7] self-reported previous or current STI,[7,8,10] and biologically confirmed STIs.[6]

With regards to substance use, a national survey revealed that among African American female 9th to 12th graders, 31.3% reported current alcohol use (vs 35.7% for White and 39.7% for Hispanic), 11.5% reported 5 or more drinks in a sitting (vs 21.1% for White and 22.6% for Hispanic), 27.1% reported current marijuana use (vs 18% for White and 27.4% for Hispanic), and 2.1% reported ever using Ecstasy (vs 4.6% for White and 10.1% for Hispanic).[20] Another study found that approximately 27% of African American female adolescents reported having 3 or more drinks in a sitting.[13] Substance use often co-occurred with sexual risk behaviors,[20] placing adolescents at increased risk for less condom use. Among young African American women, substance use was associated with inconsistent condom use,[13,15] sexual sensation seeking,[13] multiple sexual partners,[13,15] risky sexual partners,[15] having sexual intercourse while high on alcohol or drugs,[13] and STIs.[13–15]

Previous studies established the relationship between depression, substance use, and risky sexual behavior, and although limited, some studies examined the longitudinal effects of depressive symptoms and substance use on sexual risk-taking among African American female adolescents.[7,11–13,15] However, to our knowledge, there is scant research available on the interaction of depressive symptoms and substance use to longitudinally predict sexual risk-taking and STIs among this population. A previous study found that substance use mediated the relationship between depression and substance use, but this effect was only significant for male adolescents and not for female adolescents.[8] In addition, this previous study sample included adolescents from multiple ethnicities; thus, the findings might not be applicable to African American adolescents.

Because of the impact of these 2 factors on sexual risk-taking, combined with increased HIV/STI vulnerability among African American female adolescents, we aimed to expand upon the existing literature on depression, substance use, and risky sexual behavior in African American female adolescents. To advance the current knowledge and inform HIV/STI prevention efforts among this group, we examined the longitudinal effects of depression and substance use on risky sexual behavior and STI contraction, as well as the interaction between these 2 factors among a clinic-based sample of African American female adolescents over an extended period (36-month follow-up).

METHODS

From June 2005 to June 2007, an African American female staff member recruited African American female adolescents ranging from 14 to 20 years old from 3 clinics that provided sexual health services to predominantly minority adolescents in metropolitan Atlanta, Georgia. After approaching adolescents in clinic waiting areas, the study recruiter described the study, solicited participation, and assessed adolescents' eligibility. Eligibility criteria included the following: self-identifying as African American, aged 14 to 20 years at enrollment, heterosexual, and reporting at least 1 episode of unprotected vaginal sex in the past 6 months. If adolescents reported being married, pregnant, or attempting to become pregnant, then they were excluded from involvement in this study. Informed consent or assent was obtained from all adolescents, with parental consent waived for those younger than 18 years because of the confidential nature of the clinic services. Of the eligible adolescents, 94% (n = 701) enrolled and completed baseline assessments.

Data Collection and Intervention Methods

We derived our data from the National Institutes of Health funded AFIYA (AFIYA means "health" in Swahili) study; details on the study protocol were described elsewhere.[21] We conducted data collection at baseline (before randomization) and again at 6, 12, 18, 24, 30, and 36 months. At baseline and at each 6-month assessment interval, participants completed assessments on their sociodemographic characteristics, mental health, substance use, and STI/HIV risk behaviors via audio computer-assisted self-administered interviews and also provided self-collected vaginal swab specimens assayed for prevalent STIs. A total of 429 participants participated at the 36-month follow-up (61.2% retention rate).

The primary intervention in the AFIYA study was based on a Centers for Disease Control and Prevention evidence-based intervention, HORIZONS, which is a group-based STI/HIV intervention designed to be culturally- and gender-congruent for African American female adolescents. The primary goals of the intervention are to enhance STI/HIV preventive attitudes and behaviors, sexual negotiation and refusal skills, and promote safer sex norms. Two African American female health educators implemented the intervention, and the efficacy of this intervention was described previously.[22] In the AFIYA study, the active intervention arm included HORIZONS plus a phone counseling prevention maintenance intervention, which consisted of regular, brief (10-minute) phone counseling contacts initiated by an African American female health educator and tailored to the STI/HIV risk profile of each participant.[23]

Measures

Depressive symptoms. At each assessment, we examined participants' depressive symptoms using the brief 8-item Center for Epidemiological Studies Depression (CES-D) scale.[13,15,24] Each participant was asked to report on depressive symptoms during the last 7 days, and rank each symptom on a Likert scale from 1 (less than 1 day) to 4 (5–7days). We totaled the scores; higher scores indicated higher depressive symptomology. In this analysis, scores ranged from 8 to 32 ($\alpha = 0.91$), with scores 15 and greater indicating clinically significant depression symptom levels.

Substance use. We assessed marijuana, alcohol, and Ecstasy use at each time point. Each participant was asked, "In the past 90 days, how many days have you used _____?" Participants' reports of substance use were dichotomized in this study (yes/no), with any substance use on 1 or more day coded as "yes."

Sexual risk behavior. We assessed recently incarcerated partner involvement by asking study participants whether they had engaged in vaginal intercourse in the past 90 days with a male partner who was recently released from a detention center, jail, or prison. We assessed participants' responses at each time point throughout the 36-month follow-up period, and coded the answers as binary (yes/no) responses. We assessed sexual sensation seeking using the Sexual Sensation-Seeking Scale for Adolescents.[25,26] This 10-item scale assesses sexual impulsivity among African American female adolescents. Items were summed, with scores ranging from 10 to 40 ($\alpha = 0.78$). For this study, scale scores were dichotomized using a median split (median = 19). We assessed unprotected sex with the following question: "The last time you had sex with your partner, did he use a condom?" Binary responses were coded as yes/no.

Sexually transmitted infections. To assess STI incidence, we trained participants on how to self-collect vaginal swab specimens,[27] which were assayed for 3 prevalent STIs: *Chlamydia trachomatis*, *Neisseria gonorrheae*, and *Trichomonas vaginalis*.[28] Participants with positive STI tests were promptly notified of their status, provided appropriate treatment as per Centers for Disease Control and Prevention guidelines, and were encouraged to refer sex partners for treatment. We also notified county health departments of STI incidence.

Data Analysis Plan

Initially, we assessed baseline differences among those randomly assigned to the

intervention and control groups using the 2-sample t test and χ^2 test for continuous and dichotomous variables, respectively. We assessed differences in the following variables at baseline: age, depression, substance use variables (marijuana use, alcohol use, and Ecstasy use), and STIs (biologically confirmed positive STI test for gonorrhea, chlamydia, or trichomonas). We constructed separate generalized estimating equation (GEE) models for each outcome and used an unstructured correlational matrix to longitudinally examine the interaction effects of depression and substance to predict risky sexual behavior and STIs. GEE models accounted for the correlated nature of repeated observations and missing data in response variables, which are both characteristics of longitudinal data.[29] Binary variables were easily accommodated in GEE by using the logit link function, and we derived odds ratios (ORs) to assess associations.[30] We interpreted coefficients (ORs) that resulted from the GEE models as population-averaged effects over the 36-month follow-up period. All analyses were performed using SAS version 9.3 software (SAS Institute, Cary, NC).[31] All covariates in the analysis were dichotomous, including depression (high = score of ≥15 vs low) and sexual sensation seeking (high = greater than media score vs low). We adjusted initial GEE analyses for clinic site, which yielded no differences in results compared with multivariable models that did not include clinical symptoms as a covariate. Therefore, we removed clinical symptoms from the GEE models. Those who dropped out of this study did not differ significantly on any variables of interest. Also, there was no statistically significant difference for attrition between intervention and control groups.

RESULTS

At baseline, 41.2% of African American female adolescents reported depressive symptoms above the clinical cutoff (≥15). Among those with high depression symptoms scores, the mean CES-D was 21.3 (SD = 5.2), compared with an average score of 10.4 (SD = 2.0) for those below the clinical cutoff. Sixty-four percent of participants reported substance use (marijuana, alcohol, or Ecstasy) in the 90 days before the baseline assessment, with more than one half (51.6%) reporting recent alcohol use and 39.1% reporting recent marijuana use. In addition, 39.8% tested positive for at least 1 STI (gonorrhea, chlamydia, or trichomonas). There was no statistically significant difference in age, depression, substance use, or STI positivity at baseline between the intervention and control groups (Table 1).

Table 2 includes results from GEE models that assessed the association between depression and sexual risk behaviors over time, as well as the interaction of depression and substance use to predict risky sexual behavior and STIs over a 36-month follow-up period. Overall, higher levels of depressive symptoms were associated with recently incarcerated partner involvement (OR = 3.74; 95% CI = 2.88, 4.87; $P<.001$), sexual sensation seeking (OR = 3.32; 95% CI = 2.85, 3.88; $P<.001$), unprotected sex (OR = 3.81; 95% CI = 3.25, 4.45; $P<.001$), and laboratory-confirmed STI acquisition (OR = 2.01; 95% CI = 1.67, 2.41; $P<.001$). Marijuana use, alcohol use, and Ecstasy use were also all longitudinally associated with each of the sexual risk behaviors and STI acquisition over the 36-month follow-up period ($P<.001$). Most notably, marijuana users were 7.23 times more likely to report recently incarcerated partner involvement (95% CI = 4.78, 10.94) and 4.25 times more likely to acquire an incident STI (95% CI = 3.2, 5.65) relative to nonusers. Participants reporting alcohol use were 6.01 times more likely to report sexual sensation seeking behavior (95% CI = 4.84, 7.45) compared with nonusers, and participants reporting Ecstasy use were 3.31 times more likely to report unprotected sex (95% CI = 1.9, 5.76) relative to nonusers.

Significant interaction effects between depression and substance on sexual risk behaviors and STI acquisition were observed over the 36-month follow-up. High levels of depressive symptoms and marijuana use were significantly associated with recently incarcerated partner involvement (OR = 3.12; 95% CI = 1.91, 5.1). In addition, high levels of depressive symptoms and alcohol use were significantly associated with sexual sensation seeking (OR = 3.16; 95% CI = 2.41, 4.14) and STI acquisition (OR = 3.35; 95% CI = 2.31, 4.86). Finally, high levels of depressive symptoms and Ecstasy use were significantly associated with unprotected sex (OR = 3.31; 95% CI = 1.9, 5.76).

TABLE 1—Baseline Age, Depression, Substance Use, and Sexually Transmitted Infection Prevalence Among African American Female Adolescents (n = 701): Atlanta, GA, 2005–2007

Variable	Total Sample, Mean ±SD or No. (%)	Intervention Group, Mean ±SD or No. (%)	Control Group, Mean ±SD or No. (%)	P
Age, y	17.6 ±1.6	17.6 ±1.6	17.7 ±1.7	.15
Depression score[a]	14.9 ±6.5	14.6 ±6.3	15.2 ±6.7	.22
Marijuana use[b]	274 (39.1)	130 (18.5)	144 (20.5)	.57
Alcohol use[b]	362 (51.6)	179 (25.5)	183 (26.1)	.72
Ecstasy use[b]	52 (7.4)	24 (3.4)	28 (4.0)	.69
STI	279 (39.8)	137 (19.5)	142 (20.3)	.89

Note. STI = sexually transmitted infection.
[a]Measured by the 8-item Center for Epidemiological Studies Depression scale. Scores ≥15 are above the clinical cutoff.
[b]Substance use within 90 days before baseline assessment. Sixty-four percent of the sample reported using at least 1 substance within 90 days before baseline.

DISCUSSION

Our study was among the first to longitudinally examine the interactive effects of depression and substance use among African American female adolescents seeking sexual health care. Our findings corroborated and extended previous research. We confirmed associations between depression, substance use, and risky sexual behavior among African American female adolescents.[7,19] In addition, the baseline prevalence of STI positivity was 39.8%, which was significantly more than the 24.1% seen nationally among adolescent girls

aged 14 to 19 years, and slightly less than the 44% reported among African American female adolescents aged 14 to 19 years.[3]

Our study was unique because of its exclusive focus on African American female adolescents, as well as its lengthy follow-up period and findings related to the interaction of depression and substance use on risky sexual behaviors. The influence of depression and substance use on risky sexual behaviors was examined previously in African American female adolescents in follow-up periods of up to 24 months,[32,33] but the main contribution of our study was evidence of a significant interaction between depression and substance use on risky sexual behaviors and STIs across a 36-month follow-up period. In summary, participants with high levels of depressive symptoms who also reported using marijuana, alcohol, or Ecstasy were more likely to report risky sexual behaviors and acquire incident laboratory-confirmed STIs compared with those who reported lower levels of depressive symptoms and no substance use.

Limitations

Despite the robust findings, there were limitations to this study. The data on depressive symptoms, alcohol, and sexual behavior relied on retrospective self-report data. It was possible that participants had difficulty recalling important information or that they provided a socially desirable response to sensitive questions. However, it was noteworthy that STI acquisition was biologically confirmed. The CES-D is a self-report screening tool that serves as an indicator of depressive symptomatology; it is not a substitute for a clinical diagnostic assessment of depression. Also, assessment of substance use was general, because we only examined use in the past 90 days before the assessments. For example, frequency and quantity of substance use, frequency of alcohol use, and event-specific associations related to HIV or STI-risk behavior and STI acquisition were not examined. A final limitation might be the homogeneity of the sample, which consisted of African American female adolescents from the southeastern part of the United States who were seeking sexual health care. Thus, the results might limit generalizability; replication with diverse ethnic and geographic populations would be needed.

Conclusions

The findings in our study, coupled with a relatively high rate of depressive symptoms across the sample, highlighted the need to further address both mental health and substance use needs among African American female populations. There are many mechanisms by which depressive symptoms may be linked to poor sexual decision-making and risky sexual practices. Jessor developed a conceptual framework noting that biology or genetics, social environment, perceived environment, personality, and behavior played a role in influencing risk behavior.[34] According to cognitive theory,[35–37] negative thoughts, often associated with depression,[38] influence not only how one feels about themself, but also influences one's behavior. This can often lead to unhealthy decision-making in several situations, including sexual situations.[35,36,39]

However, the often intertwined, co-occurring nature of depressive symptoms with substance use and its impact on risky sexual behavior highlighted the opportunity for more integrated behavioral health approaches with African American female adolescents.[19] For clinicians providing services to female adolescents, depression and substance use screening might be warranted for those who are sexually active, being treated for an STI, or for those facing the reality of being pregnant. Beyond identifying the presence of depressive symptomatology, clinicians who identify a young woman engaging in sexual risk-taking behavior and substance use, as well as endorsing depressive symptoms, might consider interventions that include simply alleviating the depression through pharmacological and psychotherapeutic treatments. In addition, provider interventions might also include preventive education, risk reduction counseling, or specially designed treatments that address coexisting conditions, such as substance use. In addition to these traditional and adolescent-focused provider-delivered interventions, clinicians working with adolescents might consider developing a referral resource. These higher risk adolescents could then be referred to existing community-based mental health and substance abuse programs.

TABLE 2—Longitudinal General Estimated Equations (36 Months) Associations Between Depression and Substance Use on Sexual Risk Behaviors and Sexually Transmitted Infections Among African American Female Adolescents: Atlanta, GA, 2005–2007

	Recently Incarcerated Partner Involvement		Sexual Sensation Seeking		Unprotected Sex		Any STI	
Variable	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*	OR (95% CI)	*P*
Depression	3.74 (2.88, 4.87)	< .001	3.32 (2.85, 3.88)	< .001	3.81 (3.25, 4.45)	< .001	2.01 (1.67, 2.41)	< .001
Marijuana use	7.23 (4.78, 10.94)	< .001	4.35 (3.34, 5.68)	< .001	3.26 (2.56, 4.14)	< .001	4.25 (3.20, 5.65)	< .001
Depression × marijuana use	3.12 (1.91, 5.10)	< .001	2.64 (1.93, 3.62)	< .001	2.35 (1.71, 3.23)	< .001	2.38 (1.63, 3.46)	< .001
Alcohol use	4.66 (3.07, 7.06)	< .001	6.01 (4.84, 7.45)	< .001	4.42 (3.53, 5.52)	< .001	3.47 (2.62, 4.59)	< .001
Depression × alcohol use	2.87 (1.74, 4.73)	< .001	3.16 (2.41, 4.14)	< .001	3.90 (2.90, 5.24)	< .001	3.35 (2.31, 4.86)	< .001
Ecstasy use	5.36 (2.93, 9.78)	< .001	5.71 (3.52, 9.26)	< .001	5.81 (3.73, 9.03)	< .001	3.63 (2.16, 6.11)	< .001
Depression × Ecstasy use	2.23 (1.08, 4.57)	.03	2.16 (1.25, 3.73)	.006	3.31 (1.90, 5.76)	< .001	3.23 (1.67, 6.23)	.005

Note. CI = confidence interval; OR = odds ratio; STI = sexually transmitted infection. Recently incarcerated partner involvement, unprotected sex, and any STI are coded as dichotomous (yes/no) response variables. We used the median value of sexual sensation seeking to convert from continuous to binary (high or low) values.

Our findings also had implications for the development of HIV or STI risk-reduction programs. Although many HIV or STI risk reduction programs address the health risks associated with substance use, fewer address the health risk of depression, and fewer still address the co-occurring nature of these conditions and their adverse impact on HIV-associated sexual behavior and STI acquisition. Because of the association between STIs and subsequent HIV infection,[40] our findings suggested a need to intensify and target risk reduction efforts at this high risk group.

Based on our findings, we recommend that researchers and clinicians consider multidisciplinary, multifaceted, and multidimensional interventions that address medical, psychological, and social issues related to depression and sexual behavior and also attend to other areas that likely affect sexual decision-making (e.g., substance use). An example of such an approach would be to have young women participate in a group-based intervention focused on sexual risk-taking and the intersection of mental health, substance use, and risk-taking, followed up with occasional individual sessions with health educators or mental health professionals to "check-in" on each participant's mental and behavioral status. By coordinating medical care with mental health services, including substance use services, early detection of potential problems would be facilitated. Ultimately, this approach would likely improve the current services provided to young female African Americans who use clinics for their physical and mental health care needs. ■

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This article was accepted November 25, 2014.

Contributors

J. M. Jackson contributed to every aspect of the article, including study concept, data analysis, article preparation, and editing of the article. P. Seth contributed significantly to article preparation and editing of the article. R. J. DiClemente was the principal investigator of the parent study from which the data were derived, and contributed significantly to article preparation and editing of the article. A. Lin contributed to article preparation and editing of the article.

Acknowledgments

This study was supported by P30 AI050409 (Emory University Center for AIDS Research, Office of Behavioral and Social Science Research, National Institutes of Health). J. M. Jackson was also supported by K12 GM000680 (National Institute of General Medical Sciences).

Human Participant Protection

The Emory University institutional review board approved all study protocols for this study.

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