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Associations between psychosocial factors and incidence of sexually transmitted disease among South African adolescents

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Abstract

Background—Adolescents living in South Africa are at high risk for HIV and other sexually transmitted disease (STD). The present study sought to identify correlates of curable STD incidence among a cohort of adolescents in Eastern Cape Province, South Africa.

Methods—Data were collected in conjunction with an HIV/STD prevention intervention randomized controlled trial¹. At 54 months post-intervention, curable STD incidence (gonorrhea, chlamydial infection and trichomoniasis) was assayed and self-report measures of potential correlates of STD incidence were collected.

Results—Participants were adolescents reporting at least one sexual partner in the past 3 months (N = 659). As expected, univariate analyses revealed that girls were more likely than boys to have

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an STD. In addition, intimate partner violence, unprotected sex, and having older partners were associated with incident STD. In Poisson multiple regression analyses, gender (risk ratio [RR] = 4.00, 95% confidence interval [CI]: 2.51–6.39), intimate partner violence (RR = 1.23, 95% CI: 1.12–1.35), unprotected sex (RR = 1.42, 95% CI: 1.09–2.01), and multiple partners (RR = 1.70, 95% CI: 1.11–2.61), but not partner's age (RR = 1.00, 95% CI: 0.94–1.07) were associated with incident STD, adjusting for 42-month STD prevalence. Binge drinking, forced sex, and age were unrelated to STD incidence in both analyses. Interactions between gender and the hypothesized correlates were non-significant, suggesting that gender did not modify these relationships.

Conclusions—Interventions to reduce HIV/STD incidence among adolescents in South Africa should address the risk associated with gender, unprotected sex, intimate partner violence, and multiple partnerships.

Keywords

HIV; STD incidence; interpersonal violence; adolescents; South Africa

Introduction

Sexually transmitted disease (STD) represents a significant health problem for South African adolescents. The World Health Organization has estimated that of a population of 384.4 million, 92.6 million curable STIs occurred in the African Region in 2008². While correlates of STD have been identified for a variety of populations, few such studies have been conducted among adolescents in sub-Saharan Africa^{3–5}. In one study⁴, a sexual risk reduction intervention produced a significant reduction in incidence of HSV-2. Studies on other populations, however, have revealed some general correlates. One of these is gender, with females more susceptible to STD due to biological, economic, and social factors⁶. Another is having a much older sexual partner, which is common among women in sub-Saharan Africa⁷ and puts women, especially, at risk for STD^{8–10}, including HIV. It should be noted, however, that although very few studies have examined effects of age disparity on boys' STD risk, there is some evidence to suggest that boys are more likely to be infected with HIV when their most recent female partner was older¹¹.

Binge drinking has also been shown to be predictive of STD incidence^{12–13}. A study by Boden and colleagues¹², which was conducted among men and women aged 15–30 in New Zealand, showed an alcohol dose effect with higher levels of alcohol consumption, and more symptoms of dependence, related to more STD. In South Africa, shabeens—casual houses where beer is sold and consumed—are ubiquitous. It is understood that if a man buys a girl a beer, she is expected to have sex with him.

Intimate partner violence has been found to be correlated with STD among U.S. women and male perpetrators of violence^{14–15} and with HIV infection in South Africa¹⁶. South Africa has high rates of rape¹⁷, and forced sex has been shown to be associated with STD both in the U.S.^{18–19} and in South Africa²⁰.

Self-reported sexual behavior has been an inconsistent correlate of STD. Having multiple sex partners has been shown to predict STD²¹ and HIV²² in some studies, but not others²³.

Condom use has also been examined as an STD predictor. In an early study²⁴, condom use was found to be unrelated to STD incidence, probably because contracting a STD requires that the person be exposed to an infected partner. Thus, people who have unprotected sex with partners who do not have an STD will not contract an STD, diminishing the relation between self-reported behavior and STD²⁵.

The present study was designed to identify correlates of curable STD at 54 months post-intervention in the "Let Us Protect Our Future" trial^{26,1}. No STD assessment was done at baseline, but as only 3% of participants were sexually active at that time, it can be assumed that the overwhelming preponderance of infections happened after the 8-day intervention. At 42 months, all identified STD was treated, so that curable STD at 54 months can be taken as an incidence measure.

We hypothesized that curable STD incidence would be predicted by older age, female gender, risk reduction intervention arm, binge drinking, having experienced intimate partner violence, having been raped, having had condom-unprotected sex, multiple partners, and having older partners. We examined these relationships in bivariate analyses as well as in Poisson multiple regression.

Methods

The Institutional Review Board (IRB) #8 at the University of Pennsylvania, which was the designated IRB under the federalwide assurances of the University of Pennsylvania and the University of Fort Hare, approved the study. The laboratory testing was additionally approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, South Africa. We conducted the study in Mdantsane, an urban township, and Berlin, a neighboring rural settlement, in Eastern Cape Province, South Africa, where isiXhosa is the first language of 95.1% of the population.

The participants were adolescents who enrolled in a school-based cluster-randomized controlled trial of an HIV/STD risk-reduction intervention. Schools that taught sixth-grade learners and served the general population were eligible. All 35 eligible schools (26 in Mdantsane, 9 in Berlin) agreed to participate. From 17 matched pairs of schools similar in numbers of sixth-grade learners, numbers of classrooms, and whose classrooms had electricity, we randomly selected nine and randomized within pairs one school to the HIV/STD risk-reduction intervention and one to the health-promotion-control intervention. Methods for the intervention study are described in detail elsewhere²⁶. We enrolled 18 schools over 13 months beginning in October 2004. The initial informed-consent process covered activities through the 12-month follow-up. Accordingly, we located the original participants who were now dispersed to over 100 secondary schools and gave them parent/guardian consent forms and cover letters explaining the continuation of the trial and inviting their parents or guardians to a meeting where they could receive additional information and ask questions about the follow-up study. This article is based on the 54-month follow-up data. The 42-month follow-up data were collected beginning in April 2008, and the 54-month data collection was completed by June 2010.

Measures

Incident STD—At the 42 and 54 month follow-up assessments, participants provided a urine specimen after completing the self-report questionnaire. First-pass urine specimens were delivered to the Centre for HIV and STIs at the National Institute for Communicable Diseases, Johannesburg, South Africa and assayed for *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoeae* (NG) using the Gen-Probe APTIMA Combo 2 Assay (Gen-Probe, Inc., San Diego, CA, USA) and for *Trichomonas vaginalis* (TV) using the APTIMA *Trichomonas vaginalis* assay (Gen-Probe, Inc., San Diego, CA, USA). All participants with a positive curable STD (CT, NG, or TV) test received directly observable single-dose antimicrobial treatment and risk-reduction counseling per CDC recommendations. The outcome variable in the present analysis is the incidence of any of these STDs at 54 months. Participants received a binary code based on whether they had any STD or not.

The predictor variables included age, gender, study arm, binge drinking, intimate partner violence, history of forced sex, any unprotected sex, multiple partners, and participants' report of age of sexual partner assessed at 54-month follow-up.

Unprotected vaginal intercourse—Participants were coded as having unprotected vaginal intercourse if they reported having vaginal intercourse without using a condom in the previous 3 months.

Multiple partners—Participants reporting 2 or more sexual partners in the previous three months were coded as having multiple partners.

Forced sex—History of forced sex was assessed with a single item: "Have you ever been forced to have vaginal intercourse against your will?"

Intervention condition—Intervention condition was a dichotomous variable indicating whether the participant had been in the sexual risk reduction intervention or the health promotion control intervention.

Binge drinking—Respondents were asked how many times in the past month they had had 5 or more drinks of alcohol. Participants were coded as having had a binge drinking episode if they reported having 5 or more drinks of alcohol on a single occasion in the past month.

Intimate partner violence—This was assessed with the physical abuse subscale of the Conflict in Adolescent Dating Relationships Inventory²⁷. We averaged four items to create a scale. The items assessed estimates of the number of times each event had occurred during the preceding year, with responses ranging from "0" to "6 or more." The item stem was "In the last year, how many times did..." The items were: "a sexual partner throw something at you?"; "a sexual partner kick, hit, or punch you?"; "a sexual partner slap you or pull your hair;" and "a sexual partner push, shove, or shake you?"

Partner's age—Participants were asked the ages of their last 3 sexual partners and partner's age was operationalized as the oldest partner's age.

Statistical analysis

We performed Poisson regression analyses with robust standard errors to identify potential predictors of presence of a curable STD (CT, GC, or TV) at 54 months post-intervention. The potential predictors were unprotected vaginal sex in the past 3 months, gender, history of forced sex, age, intimate partner violence, intervention condition, multiple partners in the past 3 months partner age, and binge drinking. Two models were tested, one unadjusted for 42-month STD prevalence and the other adjusted for 42-month STD prevalence. Because partner age was one of the predictor variables, the sample was restricted to those who had a partner during the preceding 3 months at the 54-month follow-up (N = 659). To test whether the predictors differed for males versus females we added the gender X predictor interactions to the models. We report risk ratios and their corresponding 95% confidence intervals.

Results

Over 90% of 1,057 participants returned for each data-collection session. Retention was 93% in each arm at the 54-month follow-up time point. Attending a follow-up session was unrelated to gender, father's presence in the household, residing in Berlin, or sexual behavior.

The sample for the present study consists of all sexually active participants who reported having a sex partner during the preceding 3 months at the 54-month follow-up; N = 659. The analytic sample for the present paper is described in Table 1, separately for girls, boys, and the combined sample. Significant differences based on gender were observed for several factors. Boys were more likely to have binged on alcohol (45% v. 24%) and to have had multiple partners (36% vs 8%). Girls were significantly more likely to have each STD, as well as any STD, compared with boys. Thirty-one percent of girls, but only 8.8 percent of boys, were found to be infected at the 54-month time point..

Correlates of STD

As expected, univariate analyses, presented in Table 2, revealed that girls were significantly more likely than boys to be diagnosed with an STD. In addition, intimate partner violence, having had unprotected sex, and having an older partner were significantly associated with incident STD.

Results for the Poisson multiple logistic regression analyses are presented in Table 3, unadjusted and adjusted for 42-month STD prevalence. As expected, in the unadjusted analysis, being female was highly associated with becoming infected with STD. Intimate partner violence, having unprotected sex in the past 3 months, and, marginally, ever having been forced to have sex and having multiple sexual partners in the past 3 months were associated with STD. In contrast, current age, partner age, binge drinking, and being in the intervention arm were not associated with STD. Table 3 also shows that similar results were obtained in the analysis adjusting for 42-month STD prevalence, the main difference being that having multiple partners was associated with increased risk of incident STD. None of the gender by correlates interactions approached significance, with p-values ranging from p

= .27 to $p = .87$. However, it should be noted that the study had insufficient power to identify significant interactions with these small interaction effect sizes.

Discussion

As has been shown previously²⁸, girls were substantially more likely than boys to become infected with STD. However, the present study is ambiguous as to the role of older partners in STD incidence. While the univariate relationship was significant, the effect was non-significant in the multiple regression models. Additional analyses using the difference between the participant's age and partner's age as the predictor revealed similar results (analyses not shown). In order to better understand the lack of an association between partner's age and STD incidence, we ran a model with only gender and partner's age as predictors. Both were significant. Only when intimate partner violence or unprotected sex were included in the model did the effect of partner age become non-significant. In univariate analyses by gender, older partner age was significantly associated with STD in boys; this was not the case for girls, although the difference between correlations was non-significant. Thus, it could be that the significant effect of partner age is mediated by increased intimate partner violence or unprotected sex, adjusting for the adolescent's gender. The finding of a significant relationship between older partner age and STD among boys but not girls is surprising; however, most of the published literature has looked only at females.

Self-reported sexual behavior—unprotected sex--was—in contrast to results from some other studies—predictive of STD incidence. Our results are consistent with the well-controlled study reported by Warner and colleagues²⁵. Binge drinking was not significantly predictive of STD incidence, and this result is at odds with those of other studies^{12, 13}.

The intervention significantly reduced STD prevalence at 42 months post-intervention, but not STD incidence at 54 months post-intervention, as reported more comprehensively elsewhere¹. Behavioral interventions have been shown to have significant effects on STD incidence at 12 months post-intervention^{29–31}. The fact that the intervention did not show such an effect 54 months (i.e., 4.5 years) afterward is not terribly surprising given that the effects of behavioral interventions tend to dissipate over time, and given the probabilistic nature of exposure to pathogens²⁵.

Notable predictors of STD incidence were intimate partner violence and (near-significantly) history of forced sex. These relationships have been observed in prior studies^{14,15,16,17,18,19,20}. That intimate partner violence is common even among teenagers suggests the need for intervention early in children's dating lives. Addressing intimate partner violence might have the effect of reducing the burden of STD in this population as well as limiting physical harm. Forced sex could have occurred at any time in the past (although only 3% of participants reported having had any sex at baseline, when they were 12–13 years of age). Early sexual abuse has been found in numerous studies, in numerous populations, to predict sexual risk behavior and even HIV infection³². Efforts to prevent child sexual abuse remain of paramount importance in South Africa as elsewhere. Among boys, avoidance of older female partners may be an important STD prevention message.

Limitations of the present study include the essentially cross-sectional design, as self-reports and STD were assessed at the same time point. However, the self-reports were retrospective, and the longitudinal design, in which all curable STD identified at 42 months was treated, permit the STD to be taken as incident.

That South African teens are experiencing intimate partner violence and rape, and that these are associated with STD incidence, mandates that early intervention be deployed to end these. Rachel Jewkes³³ has argued that gender-based violence against women and inequity are central issues that must be addressed if the HIV/STD epidemics are to be effectively controlled. Both boys and girls appeared to exhibit IPV as a predictor of STD. Indeed, there were no differential predictors of STD incidence, as indicated by the non-significant interactions between the predictors and gender. Working with both boys and girls around issues of violence, including sexual violence, remains an important task.

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Short summary

We examined psychosocial and demographic correlates of incident curable sexually transmitted diseases among South African adolescents. Significant correlates included female sex, intimate partner violence victimization, unprotected sex, and having an older partner. In Poisson multiple regression analyses, gender, intimate partner violence, unprotected sex, and multiple partners were significant correlates.

Table 1

Characteristics of Learners Reporting At Least One Sexual Partner in the Past 3 Months, by Intervention Condition, Mdantsane and Berlin, South Africa

Characteristic	All learners	Boys	Girls
N	659	330	329
No. (%) Rural resident	50 (7.59)	26 (7.93)	24 (7.32)
Mean (SD) Age, years	16.91 (1.21)	17.20 (1.26)	16.62 (1.08)***
Mean (SD) Partner's age, years	18.08 (2.55)	16.8 (1.93)	19.3 (2.49)***
No. (%) Ever forced sex to have	127 (19.27)	91 (27.74)	36 (10.98)***
Mean (SD) Intimate partner violence	0.44 (0.87)	0.31 (0.60)	0.57 (1.06)***
No. (%) Unprotected intercourse	242 (36.89)	126 (38.53)	115 (35.17)
No. (%) Multiple sexual partners	139 (21.55)	114 (35.29)	25 (7.79)***
No. (%) Binge drinking	222 (34.31)	142 (44.38)	80 (24.54)***
No. (%) HIV/STD intervention	362 (54.93)	183 (55.79)	177 (53.96)
No. (%) Any STD	131 (19.88)	29 (8.84)	102 (31.10)***
No. (%) Chlamydia	103 (15.53)	27 (8.23)	76 (23.17)***
No. (%) Gonorrhea	41 (6.22)	6 (1.83)	35 (10.67)***
No. (%) Trichomoniasis	19 (2.88)	0 (0.00)	19 (5.79)***

Note. Unprotected intercourse and multiple sexual partners were reported over the past 3 months. Binge drinking was reported over the past month. Intimate partner violence is mean of four items regarding the frequency (0 to 6 or more times) of such victimization in the past year.

 $p < .001$.

Table 2

Correlations (p-values) among STD incidence and its potential predictors at the 54-month post intervention follow-up assessment among learners reporting at least one sexual partner in the past 3 months.

Variable	1	2	3	4	5	6	7	8	9
1. Female	1.00								
2. Age	-.24 (<.001)	1.00							
3. Partner's age	.49 (<.001)	.19 (<.001)	1.00						
4. Ever forced to have sex	-.23 (<.001)	.12 (.002)	-.04 (.321)	1.00					
5. Intimate partner violence	.15 (<.001)	.07 (.059)	.21 (<.001)	.03 (.406)	1.00				
6. Unprotected intercourse	-.04 (.258)	.04 (.305)	.13 (<.001)	.10 (.013)	.07 (.090)	1.00			
7. Multiple sexual partners	-.34 (<.001)	.11 (.004)	.02 (.612)	.12 (.002)	.04 (.355)	.28 (<.001)	1.00		
8. Binge drinking	-.22 (<.001)	.14 (<.001)	.01 (.724)	.08 (.034)	.10 (.014)	.17 (<.001)	.24 (<.001)	1.00	
9. HIV/STD intervention	-.01 (.787)	-.03 (.433)	-.01 (.784)	-.04 (.345)	-.01 (.768)	-.06 (.111)	.01 (.774)	.02 (.636)	1.00
10. STD incidence	.28 (<.001)	-.04 (.356)	.21 (<.001)	.02 (<.001)	.19 (<.001)	.11 (.004)	-.02 (.667)	.00 (.935)	.01 (.839)

Note. Unprotected intercourse and multiple sexual partners were reported over the past 3 months. Binge drinking was reported over the past month. Intimate partner violence is mean of four items regarding the frequency (0 to 6 or more times) of such victimization in the past year.

Table 3

Risk ratios (RR), 95% confidence intervals (CIs), and significance probabilities (p values) for associations between potential predictor variables and incident STD (*Chlamydia trachomatis*, *Neisseria gonorrhoeae* and/or *Trichomonas vaginalis*), at the 54-month follow-up assessment among learners reporting at least one sexual partner in the past 3 months, unadjusted and adjusted for 42-month STD prevalence.

Potential predictors	Unadjusted for 42-month STD prevalence		Adjusted for 42-month STD prevalence	
	RR (95% CI)	P value	RR (95% CI)	P value
Female	3.98 (2.51, 6.30)	<.0001	4.00 (2.51, 6.39)	<.0001
Age	1.03 (0.91, 1.16)	.6727	1.01 (0.90, 1.14)	.8503
Partner's age	1.02 (0.96, 1.08)	.5437	1.00 (0.94, 1.07)	.9110
Ever forced to have sex	1.39 (0.98, 1.97)	.0622	1.25 (0.87, 1.80)	.2244
Intimate partner violence	1.21 (1.10, 1.33)	<.0001	1.23 (1.12, 1.35)	<.0001
Unprotected intercourse	1.48 (0.81, 1.13)	.0118	1.42 (1.09, 2.01)	.0277
Multiple partners	1.50 (0.98, 2.30)	.0632	1.70 (1.11, 2.61)	.0152
Binge drinking	1.04 (0.74, 1.45)	.8171	1.03 (0.73, 1.45)	.8611
HIV/STD intervention	1.11 (0.82, 1.50)	.4904	1.11 (0.81, 1.51)	.5145