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The impact of community-based STI screening results on sexual risk behaviors of African-American Adolescents

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Abstract

Purpose—To examine the effect of a community-based sexually transmitted infection (STI) screening program on sexual risk behavior among African-American adolescents. We hypothesized that adolescents testing positive for an STI and receiving post-test counseling would reduce risky sexual practices, whereas STI-negative adolescents would show little or no change in protective sexual behavior after screening.

Methods—From August 2006 to January 2008, we recruited 636 sexually active African American adolescents (ages 14–17) from community-based organizations in two mid-sized U.S. cities with high STI prevalence. Participants were screened for three STIs (gonorrhea, chlamydia, and trichomoniasis) and completed an audio computer-assisted self-interview. Youth who tested positive for an STI (6.6%) received treatment and counseling. Youth testing negative received no further intervention. Approximately 85% of participants completed 3- and 6 month follow-up assessments. Generalized estimating equations determined the effects of STI screening on adolescents' number of sexual partners and occurrence of unprotected sex.

Results—Adolescents who tested positive for an STI reduced their number of vaginal and oral sex partners and the probability of unprotected sex. STI-negative adolescents demonstrated no change in numbers of partners or in unprotected sex.

Conclusions—Community-based STI screening can help to reduce sexual risk behavior in youth who test positive for STIs. Alternative approaches will be needed to reduce risk behavior in youth who test negative but who are nevertheless at risk for acquiring an STI.

Keywords

community-based STI screening; STI/HIV prevention; African-American adolescents

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INTRODUCTION

Compared to other groups of youth in United States, African-American youth have a markedly higher incidence of HIV [1] and other sexually transmitted infections (STIs) [2] increasing their vulnerability to infertility, poor pregnancy outcomes, and cervical cancer. These disparities cannot be explained by individual risk factors alone as structural determinants [3] (e.g. limited access to adequate treatment and preventive healthcare [4,5] and distrust of healthcare providers [4,6–8]) also influence health disparities.

Community-based STI screening may be a promising strategy for combating the intersecting STI/HIV epidemic among low-income urban youth [9,10]. Screening can enhance detection and treatment of STIs among asymptomatic individuals who may otherwise not seek services [11]. STI screening and counseling, coupled with treatment for those who test positive, may also help to promote safer sexual practices in those at highest risk of subsequent transmission or infection. Furthermore, screening sponsored by culturally-sensitive community organizations and providers may increase access to STI treatment services.

In the near future, community-based STI screening will become increasingly feasible with the advent of rapid and reliable point-of-care STI testing technology [12]. These developments will create opportunities for intervention at both the individual and community level. However, more research on adolescents' responses to testing will be needed to make informed decisions and recommendations regarding community-based STI screening. Hitherto, research has commonly relied upon clinical samples [13–15] and brief follow-up periods [13–16] to assess effects. Some of these studies have found adoption of protective behavior as a result of positive STI diagnosis and counseling [13,15,17].

Evidence of STI screening effects in clinical samples may, however, not be applicable to community-based samples due to differences in sexual experience and reasons for testing. Yet, there are almost no studies that have examined the effects of community-based STI screening. In one exception, Cohen and colleagues [11] examined the effects of repeated school-based STI screening on subsequent STI rates over a 3 year period; however, they did not examine changes in sexual behavior. Thus, the effects of STI screening on sexual behavior in community-based adolescent samples have yet to be investigated.

Little attention has also been given to effects of STI screening on adolescents who test negative. One exception is Crosby et al. [14] who examined effects on receiving either a negative or positive HSV-2 diagnosis in a clinical sample. All participants, regardless of diagnosis, came back for a brief session with a clinician after screening. The study found a slight increase in condom use in both infected and uninfected participants, indicating that change in sexual behavior was not related to whether participants received a positive HSV-2 diagnosis, but rather the experience of testing and/or meeting with a health care provider.

Community-based screening is likely to involve more STI-negative adolescents than are typically encountered in clinical settings, and there is usually no post-diagnosis intervention for this group. Furthermore, behavioral disinhibition [18], which is particularly relevant to receiving a negative STI diagnosis, has been noted in the literature as a potential unintended consequence of STI/HIV testing. Without further counseling, STI-negative adolescents may incorrectly conclude that they are not at-risk for disease acquisition, which may in turn increase their willingness to practice risky sex. Given increasing interest in employing “test and treat” programs to identify STI/HIV positive persons [9,10,19,20], obtaining more information about such unintended screening effects is important.

The objective of the present study was to assess the impact of community-based STI screening on African-American adolescents at risk for STI/HIV. Using data from 3- and 6-month follow-up assessments, we examined changes in unprotected sex and number of sexual partners among adolescents who tested STI-positive versus negative. We hypothesized that receipt of a positive test result and associated treatment and counseling would reduce risky sexual behavior. However, effects on those testing negative were expected to be weaker and potentially produce behavioral disinhibition.

METHODS

Study Design

Data analyzed in this study are part of project iMPPACS^a, a multisite intervention that combined two levels of HIV/STI prevention programming targeted to African American adolescents: face-to-face small group counseling sessions and a community-wide mass media campaign. As part of the assessment plan, all participants were also tested for three STIs at the baseline of the study and at 6 month follow-up.

Interventions were delivered in two matched northeast and southeast U.S. cities, with one city in each region randomly assigned to receive the media intervention. Because the media campaign ran throughout the study's recruitment period and produced effects on sexual behavior before the screening occurred [21], data for this analysis are derived from the two non-media cities (Providence, RI and Columbia, SC). Additionally, prior to receiving test results, participants were randomly assigned to either a small-group HIV-prevention intervention or a time-equivalent general health promotion intervention. Analysis of these interventions showed that the participants in the HIV-prevention component increased their HIV-knowledge, but that this did not translate into any attitudinal or behavioral changes (unpublished observations). Although we control for the small group interventions in the current analysis, we focus on the effects of testing STI-positive versus negative on subsequent sexual behavior.

Detailed information about recruitment has been reported elsewhere [21]. Briefly, the project recruited 829 adolescents (ages 14–17) between August 2006 and January 2008 in the two non-media cities (Providence n=304, Columbia n=332). Adolescents were recruited from community-based organizations (CBOs) providing services to African American youth, as well as through street outreach, and youth and adult referral. Because this paper focuses on changes in sexual behavior, we only include youth who reported lifetime sexual experience (vaginal, oral, or anal) before or during the trial (636 adolescents). Less than a third of these participants (31%) reported previous STI-testing experience, and of these only 11% reported a previous positive diagnosis.

Following informed youth assent and parental consent, participants completed baseline assessment using an audio, computer-assisted self-interview (ACASI), designed to reduce barriers of reading comprehension and to promote confidentiality [22,23]. Participants provided urine specimens at baseline and 6-month follow-up to assess the presence of three STIs. Chlamydia and gonorrhea were tested using Strand Displacement Amplification [24], whereas trichomoniasis was tested using a real-time PCR assay [25]. Specimens were appropriately stored and shipped overnight to the Emory University Microbiology Laboratory.

^aiMPPACS is the acronym developed for the multi-site project “in Macon, Providence, Philadelphia, Atlanta, Columbia, and Syracuse.”

Participants testing negative received no further intervention related to their test result. STI-positive participants were referred to a health care provider (one per site) chosen by the research teams based on experience treating STI-positive African American adolescents and based on clients' acceptance and respect for their working practices. The providers administered a single oral dose of antimicrobial therapy and counseling according to Centers for Disease Control and Prevention (CDC) guidelines [26]. These guidelines encourage providers to promote abstinence, mutually monogamous relationships with an uninfected partner, and correct and consistent condom use.

Of the 636 participants interviewed at baseline, 568 (90%) completed the 3-month, and 542 (85%) completed the 6-month-follow ups. Forty-six participants (7.2%) did not complete either follow-up assessment. Multivariate logistic regression analysis indicated that dropout (at one or both follow-ups) was not associated with age, gender, or STI test result (all $ps > .05$). Attrition bias was examined further by fitting each analytic model with and without respondents lost at follow-up. The two versions did not substantially affect any conclusions. For this study, we used Generalized Estimation Equations (GEE), which are robust to missing data [27]; therefore, we report on models that include respondents missing at one but not both follow-ups ($N=590$).

Youth received \$30 for completing each assessment. The study was approved by the IRBs of the participating universities.

Primary Outcomes

Number of sex partners was measured by separately assessing respondents' number of vaginal and oral sex partners in the last three months, a recall period found reliable in previous studies [28,29]. There were too few cases of anal sex partners to allow analyses on this outcome. For respondents with lifetime sexual experience but who had not had sex in the last three months, number of partners was coded as 0. Responses ranged from 0–20 (2 extreme outliers were excluded from analysis).

Unprotected sexual contacts were measured by summing two items that asked youth how many times they had vaginal or anal sex without a condom in the last three months. Because this count was extremely skewed, we conducted the analysis with a more stringent outcome: 0= no unprotected sex and 1= one or more unprotected sex contacts. Only respondents who reported having at least one sexual partner at any assessment were included in the models predicting this outcome ($N=446$), and respondents reporting no sexual partner at any assessment were coded as 0.

Predictors

Demographics—All models included respondents' age (in months) at baseline, gender, and city.

STI Screening—To examine effects of screening, STI test results at baseline (0=STI-negative and 1=STI-positive) and assessment time point (0=baseline, 3=3 months post baseline, 6=6 months post baseline) were included in all models. We also examined interactions between these factors and demographics.

Small group intervention—We controlled for small group intervention by examining the simple effect of the intervention (0=general health promotion and 1= HIV risk reduction) and its interaction with assessment point and STI test result.

Data Analysis

Unadjusted logistic regressions were used to identify baseline differences between STI-positive versus STI-negative adolescents. To examine change in the number of sex partners and unprotected sex over time, we used negative binomial and logistic GEE regression, which calculates unbiased estimates for correlated data. Models were estimated using an unstructured working correlation matrix which is recommended when there are many clusters, each with few observations [27]. The analyses were conducted sequentially, starting with all simple effects (gender, age, STI test result, assessment point, small group intervention and city) and the interaction between assessment point and STI result. We then included higher-order interactions to assess whether STI testing effects differed by age, gender, city and small group intervention. Because no significant effects were found for these interactions, they were excluded from the final models.

Our design is based on detecting changes in sexual behavior from baseline to 3- and 6-month follow-ups. Our primary hypothesis focused on differences between STI-positive and negative participants. However, we also tested whether a potential increase in sexual risk behavior among STI-negative adolescents was due to behavioral disinhibition or maturation (i.e., typical increase in sexual risk trajectory as youth age) [30]. We tested for behavioral disinhibition in a two step analysis. In the first step, we examined whether STI-negative adolescents increased their risk behavior over the follow-up period. Only if the coefficient for assessment point was significant did we proceed to the second step. Here we examined whether the increase was larger than we would expect based on three and six months of maturation. To determine this, we tested a model in which coefficients for age at baseline and assessment point were jointly estimated. If the increase over time was larger than what we would expect based on three months increase in age, it would indicate that STI-negative adolescents exhibited change beyond maturation, which would provide evidence for behavioral disinhibition. All analyses were conducted using Stata 10 [31].

RESULTS

Participants' ages ranged from 14 to 17 ($M = 15.6$, $SD = 1.16$; 52% female). At baseline, 42 (6.6%) tested positive for at least one STI. Table 1 shows that females were more likely than males to test STI-positive and that the entire sample exhibited ample risk behavior: 20% of the adolescents reported multiple vaginal sex partners and 25% reported unprotected vaginal and/or anal sex in the last three months. Those testing STI-positive were more likely ($p < .01$) to report multiple vaginal sex partners and unprotected sex.

STI screening effects

Table 2 shows the final models for effects on risk behavior during the follow-up period. The interaction between STI test result and assessment point was significant (**model 1**; $p < .001$), indicating that the slopes for STI-positive and negative adolescents were different. A model containing a contrast for just STI-positive adolescents indicated that the decline was significant on its own ($p < .001$), confirming that there was a reduction in the number of vaginal sex partners for STI-positive youth. Indeed, Figure 1 shows a 44% reduction at the 6-month follow-up (from an average of 1.49 to 0.83 partners). A similar pattern was observed for oral sex partners (model not shown, $p < .001$).

Figure 1 also shows that STI-negative adolescents increased their number of vaginal sex partners by 32% during the 6-month follow-up period (from an average of 0.60 to 0.79 partners). A separate analysis within the STI-negative group entering age, assessment point and gender as predictors showed, however, that this increase was not significant (assessment point, $p = .078$) and therefore unlikely to represent change beyond maturation.

Model 2 (Table 2) shows that in predicting unprotected sex, the STI test result X assessment point interaction was significant ($p<.005$), indicating that the slopes for STI-positive and negative adolescents were different. Furthermore, a model with a contrast for just the STI positive youth confirmed that the reduction in this group was significant ($\text{AOR}=1.69$, $p=.002$). Figure 2 shows that receipt of a positive STI test was associated with a subsequent 28% decrease in the probability of reporting unprotected vaginal or anal sex over the following 6 months (from 0.61 to 0.44).

Figure 2 also shows that STI-negative adolescents increased in the probability of unprotected sex by 29% over the 6-month follow-up (from an average of 0.31 to 0.40). A separate analysis on the STI-negative group confirmed that this increase was significant and that each 3 month follow up period was associated with a 9% increase in the odds of having engaged in unprotected sex ($p<.001$). However, this increase was no larger than what we would expect based on the age coefficient, which indicated that a three-month increase in age was associated with a 9% increase in the odds of having engaged in unprotected sex ($p<.001$). Thus, the analysis shows that the increase in the probability of unprotected sex was unlikely to be attributed to behavioral disinhibition.

STI testing at six-month follow-up revealed a 19% (8 out of 42) re-infection rate. Furthermore, an additional 4.3% of those who were STI-negative at baseline tested positive at 6 months. Infection at 6-month follow-up was associated with the following characteristics at baseline: being female ($\text{AOR}=4.151$, $p=.006$), having multiple partners ($\text{AOR}=4.633$, $p=.006$) and being STI-positive ($\text{AOR}=2.832$, $p=.042$).

DISCUSSION

The STI/HIV epidemic affects African-American adolescents disproportionately and requires intervention efforts at the community and individual level. Community-based STI screening and counseling has the potential to address structural barriers that African Americans confront and might also serve to detect and avert the spread of asymptomatic STIs [13]. From an individual's perspective, an STI-positive diagnosis with subsequent medical care and counseling has the potential to be a powerful intervention reinforcing the need for protective behavior while also treating infection.

This study found strong evidence that adolescents who tested positive for an STI in a community-based STI-screening program and received CDC-compliant treatment and counseling decreased their number of sex partners. We also found a decrease in unprotected sex among STI-positive adolescents.

Our results also showed that a positive STI test result was associated with partner reduction at 3 and 6 months, whereas a reduction in unprotected sex was evident only at the 6 month assessment. One interpretation of this difference is that while STI-positive participants may well have reduced the number of partners soon after learning of their infection (either by dissolving these relationships or discontinuing sex with those partners), they continued to engage in unprotected sex with the partners they retained. However, by the 6-month assessment, they may have acquired new partners with whom they were likely to use condoms at the same rate as STI-negative youth. Thus, the reduction in unprotected sex that was observed at 6 months may be a delayed effect that took longer to appear than the more immediate effect on number of partners. We do not have direct evidence to support this hypothesis; however, it is consistent with what we know about the short course of sexual relationships in adolescents [32] and condom use behaviors with new partners [33]. This finding also underscores the need for further research on the effects of community-based STI screening on condom use with new and ongoing partners.

Despite decreased sexual risk behavior, 8 of 42 adolescents who tested positive at baseline (19%) were re-infected at 6-month follow-up. Similar re-infection rates have been found in other studies [34]. In addition to inadequate reduction in risk behavior and treatment failure, re-infection may reflect inadequate treatment and counseling of partners. Indeed, re-infection is common due to continued sexual contact with untreated partners [35,36]. Although patient-initiated partner notification is central to most STI control efforts [26], prior research suggests that fewer than 40% of partners of STI-positive adolescents are reached [37]. Although our data do not allow for analysis of the effect of STI screening at the partner level, the 19% re-infection rate suggests that partner notification warrants more effective strategies and research attention.

An alternative explanation for the decrease in risky sexual behavior in STI-positive adolescents is that it reflects regression to the mean [38]. According to this explanation, a positive test result at baseline was a marker for an extreme event. However, regression to the mean would lead this group to regress at the 3-month assessment, but not at 6 months as observed. Furthermore, the infection rate at 6 months was higher in the group that tested positive at baseline than those who tested negative (19 vs. 4.3%), indicating that an STI test result at baseline was not a chance event.

Although demonstrating beneficial effects for STI-positive adolescents, we observed no reduction in number of sex partners or unprotected sex for STI-negative adolescents. Indeed, after receiving a negative test result, adolescents exhibited increases in risk behavior but these were typical of maturation. Although these results suggest that receiving a negative STI test does not cause adverse effects, they underscore the need for counseling of STI-negative youth to reduce the normal age trajectory of risky sexual behavior.

The small group HIV-prevention intervention implemented in this study did not reduce sexual risk behaviors. However, previously reported analyses using data from the current cities as well as data from two other cities receiving an STI/HIV prevention media campaign [21] indicate that the media campaign led to improved self-efficacy and safe sex attitudes and expectancies among STI negative and positive adolescents. The media also reduced unprotected sex but not number of partners. These results, combined with the results from the current study, suggest that a media campaign coupled with community-based STI screening might be particularly successful as it has the potential to reduce sexual risk behavior in both STI-positive and STI-negative youth, something that STI screening alone does not achieve.

Limitations and directions for future studies

Several limitations need to be acknowledged. First, we included only a 6 month follow-up period; although this is longer than previous research, future studies might examine effects over longer time periods. Second, we do not have detailed information about the quality of counseling provided to STI-positive youth. We did, however, select health care providers who were experienced and well-respected in the community for treating STIs in African American adolescents. We also contacted the two health care providers after they completed the baseline and 6 month STI treatments and verified that counseling had been delivered according to CDC guidelines. Indeed, we found strong effects of receiving an STI test suggesting that, even in an uncontrolled setting in which counseling was not monitored, it was efficacious. In addition, our findings were robust across regions. However, quality of service delivery should be confirmed in future research. Third, we did not examine the effects of testing and counseling separately; this is difficult to do given the ethical and clinical mandates associated with public health practice.

A fourth limitation is that we were unable to disentangle the effects of screening and participation in the small group interventions. Although no differences in sexual risk behavior were observed between participants in the HIV and general health group interventions, it is possible that the effects of the positive STI test result are partly attributable to receiving a small group intervention. Future studies should examine the potential effects of additional counseling that goes beyond standard care for positive STI test results. Fifth, because of the absence of a 6-month incidence rate among youth who were not screened, we could not identify screening effects on overall STI incidence in our sample. This would be challenging, however, because a design with a control arm in which persons are not tested at baseline does not allow for a true test of reduction in STI incidence, that is, it only permits a comparison between an incidence rate (screening arm) and a prevalence rate (control arm). Sixth, the use of self-report introduces the possibility of memory or motivational biases; however, our use of ACASI helped to minimize such biases [22,23]. Finally, it should also be noted that STI screening is expensive and would require new funding mechanisms, especially if administered by most CBOs.

CONCLUSIONS

Testing positive for an STI through community-based screening and receiving standard of care treatment and counseling can lead to a reduction in number of sex partners and reduction in unprotected sex. Screening is, however, less likely to benefit STI-negative adolescents. This is problematic because receiving a negative test result is not an indication of reduced risk for infection. Indeed, STI-negative adolescents in this study reported substantial unprotected sex and multiple partners at baseline. Furthermore, STI testing at the 6 months follow-up showed that 4.3% of previously STI-negative adolescents tested positive at this time point. Thus, it appears that the success of community-based STI screening programs hinges on successful additional intervention to promote risk reduction for STI-negative youth and/or repeated testing to identify youth who later contract infections.

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Figure 1. unadjusted mean number of vaginal sexual partners by STI diagnosis at baseline and assessment point

Figure 2. unadjusted probability of unprotected vaginal or anal sex by STI diagnosis at baseline and assessment point

Table 1

Number (%) with STI-positive screening result by gender, age, and sexual risk behavior

	STI positive (n=42)	Total (n=636)	P value ^a
	n (%)	n	
Gender			
Male	7 (2.3)	306	
Female	35 (10.6)	330	<0.001
Age			
14–15	20 (5.5)	362	
16–17	22 (8.0)	274	0.210
Number of vaginal sex partners in the last 3 months			
0 ^b	7 (2.2)	319	
1	15 (8.0)	187	0.004
2+	20 (15.4)	130	<0.001
Unprotected vaginal or anal sex in the last 3 months			
No	18 (3.9)	476	
Yes	24 (15.0)	160	<0.001

^aP values are from unadjusted logistic regressions predicting STI diagnosis;^bDenotes referent category.

Table 2
Effects of STI screening on Number of Vaginal Sex Partners and Unprotected Vaginal and Anal Sex

Determinants	Model 1 ^a : number of vaginal sex partners, N=590			Model 2 ^b : unprotected anal and vaginal sex, N=446		
	Coef.	95% CI	P value	OR	95% CI	P value
Female	-0.426	-0.13, -0.340	<0.001	0.934	0.695, 1.263	0.668
Age	0.007	0.004, 0.010	<0.001	1.032	1.021, 1.043	<0.001
Assessment point	0.008	-0.006, 0.022	0.261	1.075	1.010, 1.144	0.022
STI positive	0.487	0.407, 0.567	<0.001	3.938	1.960, 7.913	<0.001
STI positive × assessment	-0.094	-0.132, -0.057	<0.001	0.805	0.692, 0.938	0.005
Small group intervention	0.010	-0.064, 0.083	0.794	1.136	0.768, 1.679	0.523
Small group intervention × assessment	0.002	-0.016, 0.020	0.802	1.033	0.949, 1.125	0.455
City	0.018	-0.097, 0.062	0.666	1.169	0.869, 1.572	0.301

Abbreviations: CI, confidence interval; Coef, Coefficient; OR, Odds Ratio.

^aNumber of vaginal sexual partners is a continuous variable and was estimated using Generalized Estimation Equation with a negative binomial link function.

^bUnprotected anal and vaginal sex is a bivariate variable and was estimated using Generalized Estimation Equation with a logit link function.