



Published in final edited form as:

*Womens Health Issues*. 2012 May ; 22(3): e303–e310. doi:10.1016/j.whi.2012.03.001.

## College Graduation Reduces Vulnerability to STIs / HIV among African-American Young Adult Women

**Julia E. Painter, PhD, MPH[Post-Doctoral Research Fellow],**

Emory University School of Medicine and Rollins School of Public Health 1518 Clifton Road, Room 426 Atlanta, GA 30322 Phone: 404-520-0824 Fax: 404-727-1369 jellenb@emory.edu

**Gina M. Wingood, ScD, MPH[Professor],**

Emory University, Rollins School of Public Health 1518 Clifton Road, Room 556 Atlanta, GA 30322 Phone: (404) 727-0241 Fax: 404-727-1369 gwingoo@emory.edu

**Ralph J. DiClemente, PhD[Candler Professor and Associate Director],**

Center for AIDS Research Emory University, Rollins School of Public Health Rollins School of Public Health 1518 Clifton Road, Room 554 Atlanta, GA 30322 Phone: (404) 727-0237 Fax: 404-727-1369 rdiclem@sph.emory.edu

**Lara M. DePadilla, PhD[Research Assistant Professor], and**

Emory University, Rollins School of Public Health 1518 Clifton Road, Room 726 Atlanta, GA 30322 Phone: (404) 727-0241 Fax: 404-727-1369 ldepadi@emory.edu

**LaShun Simpson-Robinson, PhD[Project Director]**

Emory University, Rollins School of Public Health 1518 Clifton Road, Room 556 Atlanta, GA 30322 Phone: (404) 727-0241 Fax: 404-727-1369 lsimps2@emory.edu

### Abstract

African-American women are disproportionately affected by STIs including HIV. The Theory of Gender and Power (TGP) posits that economic exposures, including educational attainment, place women at increased risk for STIs/HIV. This study examined the association between educational attainment and vulnerability to STIs/HIV, as well as potential TGP-driven mediators of this association, among African-American women. Baseline data were assessed from an STI/HIV prevention intervention for African-American women (N=848) aged 18–29 recruited from three Kaiser Permanente Centers in Atlanta, GA. Data collection included 1) a survey of demographic, psychosocial, and behavioral measures and 2) self-collected, laboratory-confirmed vaginal swabs for STIs (trichomoniasis, chlamydia, gonorrhea, and human papillomavirus). Multiple regression analyses and multivariate mediation analyses were used to examine the association between educational attainment with a laboratory-confirmed STI and potential TGP mediators. Controlling for age and receipt of public assistance, the odds of an STI diagnosis were 73% lower among participants with a college degree or greater compared to participants who had not completed high school. There were also significant associations between educational attainment and multiple TGP mediators from the Sexual Division of Power and the Structure of Cathexis. TGP constructs did not mediate the association between educational attainment and laboratory-confirmed STI. The

---

© 2012 Jacobs Institute of Women's Health. Published by Elsevier Inc. All rights reserved.

Corresponding Author / Requests for reprints should be sent to: Julia E. Painter, PhD, MPH, Post-Doctoral Research Fellow, Emory University School of Medicine and Rollins School of Public Health 1518 Clifton Road, Room 426 Atlanta, GA 30322 Phone: 404-520-0824 Fax: 404-727-1369 jellenb@emory.edu.

**Publisher's Disclaimer:** This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

current study suggests that graduating from college may lead to a beneficial reduction in vulnerability to STIs/HIV among African-American women. Findings from this study support expanding structural level interventions, emphasizing both high-school and college graduation, as a means of reducing vulnerability to STIs/HIV among African-American women.

---

## Introduction

Young African-American women experience a disproportionate burden of HIV and other sexually transmitted infections (STIs) such as chlamydia, trichomoniasis, gonorrhea, and human papillomavirus (HPV) (Centers for Disease Control and Prevention, 2009, 2010, November 2009; Weinstock, Berman, & Cates Jr, 2004). The disproportionate rates of STIs among African-American women aged 15-24 could potentially lead to devastating consequences. First, gonorrhea and chlamydia are common causes of pelvic inflammatory disease, which can lead to abdominal pain, infertility, and increased risk for ectopic pregnancy (Centers for Disease Control and Prevention, 2007a, 2007b). HPV infection can lead to numerous sequelae, including: almost all cervical cancers, other anal and genital cancers, and related precursors; anal and genital warts; and recurrent respiratory papillomatosis (Markowitz et al., 2007). Furthermore, the presence of STIs can increase the risk of contracting HIV, and cause HIV-infected people to transmit HIV more easily to others (Centers for Disease Control and Prevention, 2007a, 2007b; Risser et al., 2005).

Due to the burden of STIs and their sequelae, it is imperative to hone our understanding of risk and protective factors among young African-American women. The Theory of Gender and Power (TGP) provides a framework for understanding the socioeconomic, interpersonal, and individual exposures that place women at increased risk for acquiring HIV and other STIs (Wingood & DiClemente, 2002). The TGP posits that the three main structures impacting women's HIV risk are the Sexual Division of Labor, the Sexual Division of Power, and the Structure of Cathexis (social norms and affective attachments) (Wingood & DiClemente, 2002). The Sexual Division of Labor includes socioeconomic exposures, such as poverty level, employment status, and educational attainment (Wingood & DiClemente, 2002). Research has shown that several socioeconomic exposures, including living in poverty (Centers for Disease Control and Prevention, 2009), being unemployed or underemployed (Wingood & DiClemente, 1998), having limited or no health insurance (Diaz, Chu, & Buehler, 1994), working in a high-demand / low-control environment (such as sex-work) (Shannon et al., 2009), and being an ethnic minority (Centers for Disease Control and Prevention, 2009), may lead to increased STI/HIV risk. Another noteworthy socioeconomic exposure is having less than a high-school level education (Anderson, Brackbill, & Mosher, 1996; Upchurch et al., 1992).

There are several mechanisms through which educational attainment, particularly college completion, may impact vulnerability to STIs/HIV. First, it is possible that educational attainment, as a structural determinant in the Sexual Division of Labor, impacts more proximal determinants within the Sexual Division of Power, such as condom communication skills, lower self-efficacy to avoid STIs/HIV, and limited perceived control over condom use (Wingood & DiClemente, 2002). Previous research among African-American adolescent females has shown that economic risk (comprising receipt of public assistance, employment, and educational attainment) was a distal predictor of condom communication (DePadilla, Windle, Wingood, Cooper, & DiClemente, 2011). Furthermore, people with increased levels of education report a greater sense of control over their lives and health (Freudenberg & Ruglis, 2007; Ross & Wu, 1995). This may provide a sense of empowerment for women, allowing them to feel more comfortable negotiating condom use

and STI testing with their partners, as well as increased relationship control (Crosby et al., 2007; Wingood & DiClemente, 2002).

Educational attainment may also impact more proximal determinants within the Structure of Cathexis, such as limited knowledge of HIV prevention, having sex with older partners, and having sex with multiple partners (Wingood & DiClemente, 2002). Research has shown that increased education provides increased financial earnings and improved access to health information and the tools to acquire health-related resources, which may increase STI-related knowledge (Freudenberg & Ruglis, 2007; Ross & Wu, 1995). Women with increased educational attainment may also have more tools to avoid partner-related risks, such as having older partners and multiple sex partners, that may be associated with STI infection (DiClemente et al., 2002; Seth et al., 2011; Seth, Wingood, Robinson, & DiClemente, 2009).

In the United States, research has shown that adolescents who are not enrolled in high school are more likely to initiate sexual activity earlier (Mauldon & Luker, 1996), engage in unprotected vaginal and anal sex (Crosby et al., 2007), and become pregnant (Manlove, 1998). Several studies have examined the association between educational attainment and HIV risk in developing countries (Birdthistle et al., 2009; Hargreaves et al., 2008; Hargreaves & Howe, 2010; Kayeyi, Sandoy, & Fylkesnes, 2009; Pettifor et al., 2008), and a few studies have examined the association between educational attainment and HIV risk among certain high-risk sub-populations in the United States, including injection drug users (Hasnain, Levy, Mensah, & Sinacore, 2007), and incarcerated women (Paasche-Orlow, Clarke, Hebert, Ray, & Stein, 2005). Together, these studies have provided mixed evidence for the effects of educational attainment on HIV risk. Some studies have demonstrated a protective association between educational attainment and HIV risk (Birdthistle et al., 2009; Pettifor et al., 2008), although some studies have reported higher levels of educational attainment may place women at increased risk for HIV (Hargreaves et al., 2008).

A recent study from the Centers for Disease Control and Prevention demonstrated increased HIV prevalence among heterosexual men and women aged 18-50 in urban areas with less than a high school education compared with high school graduates and people with more than a high school education (Centers for Disease Control and Prevention, 2011). However, beyond the high school level, little is known about the magnitude and mechanisms of the association between educational attainment and vulnerability to STIs/HIV among young adult African-American women.

This study examined the association between educational attainment and vulnerability to STIs/HIV and potential mediating mechanisms of this association, among a sample of young African-American women. Specifically, this study examined the association between educational attainment (from the TGP's Sexual Division of Labor) and laboratory-confirmed STI, as well as the association between educational attainment and theoretical mediators of HIV risk from the TGP's Sexual Division of Power and the Structure of Cathexis. Additionally, potential mediation mechanisms of the association between educational attainment and laboratory-confirmed STI were tested using the TGP framework.

## Methods

### Study Participants

The current study used baseline data from an STI/HIV prevention intervention for African-American women aged 18–29 (N=848). All data were collected prior to intervention implementation. Participants were recruited from three Kaiser Permanente (KP) Centers in Atlanta, GA. In order to receive services at KP, all participants had to be insured with KP, either through their employers or their families. The 4,488 African-American women

receiving services from the three KP centers were sent invitation letters to participate in the study and were screened for eligibility via telephone. Eligibility criteria included: 1) being African-American, 2) female, 3) aged 18–29, 4) unmarried, 5) sexually active in the past six months, and 6) providing written informed consent. Participants received \$50.00 as compensation for their time. Overall, 3,509 women were ineligible for the study because they did not meet eligibility criteria (55.9%), were not available to participate (13.2%), or were not interested in participating (9.1%). All 979 (21.8%) women remaining were invited to participate in the study, and 848 (86.6%) enrolled. This study was approved by the Institutional Review Board at the researchers' university.

### Data collection

Data collection included both a survey and laboratory-confirmed STI diagnosis. For the survey, participants completed a 40-minute Audio Computer-Assisted Survey Interview (ACASI) to assess demographic, psychosocial, and behavioral characteristics. The psychosocial and behavioral measures were selected to represent different constructs within the Theory of Gender and Power. All psychosocial and behavioral measures were derived from previous HIV prevention interventions created by DiClemente and Wingood (DiClemente & Wingood, 1995; DiClemente et al., 2004; DiClemente et al., 2009). Details about the items in each measure are presented in Table 1. For the laboratory-confirmed STI diagnosis, participants provided self-collected vaginal swabs. Swabs were tested for gonorrhea (*Neisseria gonorrhoeae*), chlamydia, (*Chlamydia trachomatis*), trichomoniasis, (*Trichomonas vaginalis*) and human papillomavirus (HPV).

### Measures

**Main outcome variable: Laboratory-Confirmed STI**—The main outcome variable (dichotomous) was assessed by the presence of at least one clinically diagnosed STI (gonorrhea, chlamydia, trichomoniasis, or HPV).

### TGP - Sexual Division of Labor

**Main predictor variable: Educational attainment**—The main exposure variable, educational attainment, was assessed by asking, “What is the last grade that you completed in school?” Responses were grouped into 4 categories: < high school, high school graduation, some college, and college education.

### Demographic control variables: Age and receipt of public assistance

Demographic control variables included age (continuous) and any receipt of public assistance (dichotomous). Receipt of public assistance included receipt of Welfare, food stamps, WIC, or Section 8 housing in the past 12 months. This measure was used as a proxy measure for poverty.

### TGP - Sexual Division of Power: Theoretical Mediators

Constructs included: 1) *Condom negotiation barriers*, (3 item scale,  $\alpha = .865$ ), sample item: “If I asked my partner to use a condom, he would think I don’t trust him.” Answers were reported on 5-point Likert scales, ranging from 1 (Strongly disagree) to 5 (Strongly agree). Answers were coded such that higher scores on the scale indicated higher condom negotiation barriers; 2) *Self-efficacy to ask partner for an STI test*: (4 item scale,  $\alpha = .901$ ), “If I ask my partner to get tested for STDs he may think that I gave him a STD.” Answers were reported on 5-point Likert scales, ranging from 1 (Strongly disagree) to 5 (Strongly agree). Answers were coded such that higher scores indicated increased self-efficacy for STI test negotiation; 3) *Relationship control*, (5 item scale,  $\alpha = .751$ ), sample item: “How much control do you have over whether or not your main partner uses a condom during

vaginal sex?” Answers were reported on 4-point Likert scales, ranging from 1 (No control) to 4 (Total control). Higher scores indicated more relationship control; 4) *Risky partners* was characterized by at least one of the following: recently released from jail, had an STI, used injection drugs, or had a concurrent sex partner.

### TGP - Structure of Cathexis: Theoretical Mediators

Constructs included 1) *STI Knowledge*: (10 item index,  $\alpha=.420$ ), sample item: “Having an STD can increase the risk of getting HIV.” Incorrect answers were assigned a value of 0, correct answers were assigned a value of 1. The number of correct answers was summed to form the knowledge index; 2) *Generally having older male sex partners* (Likert scale with 5 categories to choose from ranging from much younger (more than 5 years) to much older (more than 5 years)). Responses were dichotomized into 2 categories: much younger: 5 years, younger: 2-4 years, or same age vs. older: 2-4 years or much older: 5 years); and 3) *Multiple partners*<sup>1</sup> meaning participants had more than one sex partner in the past 12 months ( 1 vs. >1); 3) Had a risky partner in the past 6 months (y/n). Both measures were dichotomous variables.

### Data Analysis

All data analyses were conducted using IBM SPSS Statistics version 19.0. Descriptive statistics were used to assess the distributions of demographic, exposure, mediation, and outcome variables among survey respondents. Questions assessing psychosocial TGP constructs were combined into scales, and Cronbach’s alphas were calculated for each scale to assess internal consistency. Scale information is presented in Table 1.

Chi-square tests were used to compare dichotomous variables (STI diagnosis and dichotomous TGP constructs) and ANOVA tests were used to compare mean scores for continuous variables (TGP scale and index constructs) across participants by level of educational attainment.

Two demographic characteristics, age and receipt of public assistance, were identified as variables which may have potential confounding effects on the association between educational level and each of the outcome variables. The purpose of this analysis was to investigate the impact of educational attainment on laboratory-confirmed STI and TGP mediators of HIV risk, parceling out the effects of age and poverty. Thus, age and receipt of public assistance (a proxy for poverty) were entered as covariates in multivariable regression analyses. Logistic regression analyses were used to examine the association between educational attainment and dichotomous variables (STI diagnosis and dichotomous TGP constructs), controlling for age and receipt of public assistance. Linear regression analyses were used to examine the association between educational attainment and continuous TGP constructs (condom negotiation barriers, self-efficacy for asking a partner to get and STI test, relationship control, and STI knowledge), controlling for age and receipt of public assistance.

Finally, repeated logistic regression analyses were used to test for mediation of the effect of educational attainment on laboratory-confirmed STI through TGP constructs from the Sexual Division of Power and the Structure of Cathexis. Procedures for mediation analyses were performed in keeping with methods delineated by Barron and Kenny (Baron & Kenny, 1986). First, educational attainment was tested as a predictor of the outcome (laboratory-

<sup>1</sup>Although *multiple partners* was not a construct included in the original Theory of Gender and Power applied to HIV / AIDS, the authors recognize that theory is dynamic, and may change over time. They have determined that this construct is important to consider, and have categorized it as a social exposure within the Structure of Cathexis.



confirmed STI) and the TGP construct mediators, controlling for age and receipt of public assistance (Table 3). Next, the TGP mediators that were significantly associated with educational attainment were tested as predictors of laboratory-confirmed STI. Those TGP mediators that were significantly associated with both educational attainment and laboratory-confirmed STI were then tested as predictors in multivariate mediation models that included educational attainment, controlling for age and receipt of public assistance. If the effect of educational attainment on acquiring a laboratory-confirmed STI was no longer statistically significant when the TGP mediators were added into the equation, then the effect of educational attainment would be concluded as indirectly impacting the acquisition of a laboratory-confirmed STI through the mediating variable.

## Results

The mean age among participants was 22.0 (SD = 3.6). The majority of participants did not receive any public assistance in the past 12 months (n = 691, 81.5%). In terms of educational attainment, 11.1% (n=94) did not complete high school, 25.6% (n=217) graduated high school, 42.1% (n=357) completed some college, 17.3% (n=147) graduated college, and 3.9% (n=33) completed some graduate school. Participants who graduated from college and completed some graduate school were combined for analyses, totaling 21.2% (n=180).

### Unadjusted Bivariate Analyses

Results from bivariate analyses are presented in Table 2. Unadjusted analyses revealed significant differences in several variables across levels of educational attainment, including having a laboratory confirmed STI, self-efficacy to ask sexual partners for an STI test, STI knowledge, and having multiple sexual partners.

### Adjusted Regression Analyses

Results from multivariate regression analyses examining the impact of educational attainment on laboratory confirmed STI and potentially mediating TGP constructs are presented in Table 3. All analyses were controlled for age and receipt of public assistance.

**Laboratory-confirmed STI outcome**—Analyses revealed that, controlling for age and receipt of public assistance, the odds of an STI diagnosis were 73% lower among participants with a college degree or greater compared to the odds among participants who had not completed high school (p=.003). Compared to participants who had not completed high school, the odds of an STI diagnosis were also 15% lower among participants who had completed high school and 45% lower among participants who had completed some college, although these results were not statistically significant. Stated another way, increased educational attainment demonstrated a protective effect against STI acquisition.

**TGP constructs as outcomes – Sexual Division of Power**—Compared to participants who had not completed high school, participants who had completed high school, some college, and college or greater all demonstrated significantly higher self-efficacy for asking a partner to get an STI test and significantly lower condom negotiation barriers. Participants with a college degree or greater also demonstrated significantly increased relationship control compared to participants who had not completed high school. Finally, all participants with higher educational attainment demonstrated a reduction in the odds of having sex with a risky partner in the past 6 months compared to those who had not completed high school, with significant reductions among participants who had completed some college (39%) and college or greater (45%).

**TGP constructs as outcomes – Structure of Cathexis**—Participants who had completed some college and college or greater demonstrated higher mean scores on the STI knowledge scale, compared to participants who had not completed high school. Results indicated a significant reduction in the odds of having multiple sex partners in the past year among women with a college degree or greater (70%) compared to participants who had not completed high school. Participants who completed high school and some college also experienced reductions in the odds of having multiple sex partners in the past year compared to participants who had not completed high school (41% and 45% respectively), although these results were not statistically significant. There was no significant reduction in the odds of having sex with older partners across levels of educational attainment.

### Mediation analyses

**TGP constructs as mediators - Sexual Division of Power**—Repeated logistic regression analyses were used to test for mediation of the effect of educational attainment on laboratory-confirmed STI through three TGP constructs from the Sexual Division of Power: condom negotiation barriers, self-efficacy to ask sexual partners to get an STI test, and having risky partners. In controlled multivariable mediation analyses, increased condom negotiation barriers and having a risky partner were significantly associated with having a laboratory-confirmed STI, while higher self-efficacy for condom negotiation led to a reduction in the odds of having a laboratory-confirmed STI (Table 4). However, none of these constructs reduced the magnitude of the association between educational attainment and having a laboratory-confirmed STI and were therefore not indicative of mediation.

**TGP constructs as mediators – Structure of Cathexis**—Only one potential mediator from the Structure of Cathexis, having more than one sex partner in the past 12 months, qualified to be tested as a potential mediator of the relationship between educational attainment and having a laboratory-confirmed STI. In controlled multivariable mediation analyses, there was a significant increase in the odds of having an STI diagnosis among participants with multiple sex partners in the past 12 months. However, this construct did not mediate the relationship between educational attainment and having a laboratory-confirmed STI.

### Discussion

This study demonstrated a significant association between level of educational attainment and vulnerability to STIs/HIV among African-American young adult women, aged 18-29, controlling for demographic and theoretical mediation variables. Findings from this study suggest that increased educational attainment, particularly having a college degree or greater, is protective against multiple indicators of vulnerability to STIs/HIV. Findings from this study, in conjunction with extant research, support the TGP's assertion that structural level factors specified by the Sexual Division of Labor, including educational attainment, impact women's STI/HIV risk (Wingood & DiClemente, 2002). Furthermore, findings from this study suggest that constructs from each of the three main structures in the TGP (Sexual Division of Labor, Sexual Division of Power, and the Structure of Cathexis), may have significant, independent effects on women's STI/HIV risk. Despite myriad interventions successful in reducing individual and behavioral level STI/HIV risk factors among African-American women (Crepaz et al., 2009), African-American females continue to be disproportionately affected by STIs/HIV (Centers for Disease Control and Prevention, 2008, 2009, 2010). This could be attributed in part to structural factors from the Sexual Division of Labor, such as disparities in educational attainment. Accordingly, there has been a growing appreciation for the critical influence of structural level factors in HIV infection, and their compounding effects on biological and behavioral risk (Karim, Sibeko, & Baxter, 2010).

The importance of structural factors in impacting STI/HIV risk, particularly educational attainment, is further highlighted through the mediation testing in this study. In analyses controlled for known behavioral risk factors, including condom negotiation barriers, self-efficacy for asking sexual partners for an STI test, having risky partners (from the Sexual Division of Power) and having multiple partners (from the Structure of Cathexis), having a college degree or greater remained a significant independent predictor of having a laboratory-confirmed STI. This finding underscores the importance of addressing socioeconomic factors that impact HIV risk (such as educational attainment), rather than solely addressing proximal psychosocial and behavioral factors, which are often the focus of HIV prevention interventions. Recent studies have called for emphasizing high school completion as a method of increasing our nation's health (Freudenberg & Ruglis, 2007), and indeed, the US Department of Health & Human Services has proposed "Increase the educational attainment of adolescents and young adults" as a new objective for *Healthy People 2020* (US Department of Health & Human Services, 2009). Findings from this study support the emphasis on high school completion as a means to reduce HIV risk among African-American women, corroborating findings from studies demonstrating the protective value of educational attainment among injection drug users and incarcerated women (Hasnain et al., 2007; Paasche-Orlow et al., 2005), and the protective value of school enrollment among adolescent females in the United States (Crosby et al., 2007; Manlove, 1998) and abroad (Hargreaves & Howe, 2010; Kayeyi et al., 2009; Pettifor et al., 2008). Furthermore, findings from this study suggest that graduating from college, over and above graduating from high school, may lead to a beneficial reduction in vulnerability to STIs/HIV among African-American young adult women. This study suggests that behavioral interventions may be necessary, but not sufficient to prevent STI/HIV risk unless 1) behavioral interventions are combined with structural interventions, or 2) behavioral interventions are tailored to account for the different needs created by structural (eg. educational) disparities.

It is unclear why having a college degree or greater maintained a significant protective effect against an STI diagnosis, even when controlling for age, receipt of public assistance, and potential TGP mediators STI/HIV risk. Perhaps the background risk created by educational disparities explains this association. Research has demonstrated that risky sexual networks and high rates of STI infection in an available pool of sex partners are associated with individual-level risk of having an STI (Adimora, Schoenbach, & Floris-Moore, 2009; Jennings et al., 2010), and that African-Americans endure disparities in "social context" (including demographic, socioeconomic, marcoeconomic, sociopolitical, and environmental factors) that impact sexual networks and in turn, HIV risk (Adimora & Schoenbach, 2002, 2005). Perhaps participants with a college education were exposed to sexual networks with a lower burden of STIs. Alternatively, there could be underlying personal characteristics, such as future orientation, sensation seeking, or worry about sexual outcomes, simultaneously impacting both educational attainment and TGP mediators of STI/HIV risk (Robbins & Bryan, 2004; Sales et al., 2009). Finally, research has shown that increased education leads to increased financial earnings, which enable people to afford better housing, healthier food, better medical care, and health insurance (Freudenberg & Ruglis, 2007; Ross & Wu, 1995). Perhaps these factors impacted the effect of educational attainment on STI/HIV risk.

## Limitations

First, this is a cross-sectional study. Thus, a causal link between educational attainment and STI/HIV risk outcomes could not be established. Second, the study population comprises African-American women aged 18-29 with health insurance in a Southeastern state. Thus, the results of this study may not be generalizable to other populations. Third, the study was unable to account for income variations beyond receipt of public assistance, which may



impact the association between educational attainment and health-related outcomes. Furthermore, there could be other confounding variables, such as household structure and sexual orientation, which may have impacted our results. Fourth, the STI knowledge scale had a low alpha, which is not ideal for data analysis. Finally, one of the behavioral outcomes assessed by this study was generally having older male partners. Although having older partners is a known risk factor for African-American adolescent females (DiClemente et al., 2002), having older partners may not pose as much of a risk for young adult women.

## Conclusions

The current study suggests that graduating from college, over and above graduating from high school, may lead to a beneficial reduction in vulnerability to STIs/HIV among African-American young adult women. Findings from this study support expanding structural level interventions, emphasizing both high school and college graduation, as a means of reducing vulnerability to STIs/HIV in this population. Study findings also support taking educational attainment into account when designing behavioral interventions. Future research is needed to fully understand the impact of attaining a college degree and STI/HIV risk reduction among African-American young adult women, as well as to assess the association between educational attainment and vulnerability to STIs/HIV among other populations. Future research should also examine other potential mediators of the association between educational attainment and STI/HIV risk.

## Acknowledgments

The study that provided the data for this project was funded by two grants from the National Institutes of Health [NIH Grant # 5R01MH62717] and Centers for AIDS Research [CFAR Grant # P30-AI50409]. Manuscript preparation was also supported by a grant from the National Institute of Allergy and Infectious Diseases [Award Number T32AI074492]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the Centers for AIDS Research National Institute of Allergy and Infectious Diseases, or the National Institutes of Health.

**Sources of Support:** Sources of support for this grant included: two grants from the National Institutes of Health – One from the National Institute of Mental Health, [NIH Grant # 5R01MH62717] and one from the National Institute of Allergy and Infectious Diseases, [NIH Grant # T32AI074492], as well as a grant from the Center for AIDS Research [CFAR Grant # P30-AI50409].

## REFERENCES

- Adimora AA, Schoenbach VJ. Contextual factors and the black-white disparity in heterosexual HIV transmission. [Review]. *Epidemiology*. 2002; 13(6):707–712. doi: 10.1097/01.EDE.0000024139.60291.08. [PubMed: 12410013]
- Adimora AA, Schoenbach VJ. Social context, sexual networks, and racial disparities in rates of sexually transmitted infections. [Research Support, U.S. Gov't, P.H.S. Review]. *J Infect Dis*. 2005; 191(Suppl 1):S115–122. doi: 10.1086/425280. [PubMed: 15627221]
- Adimora AA, Schoenbach VJ, Floris-Moore MA. Ending the epidemic of heterosexual HIV transmission among African Americans. [Research Support, N.I.H., Extramural]. *Am J Prev Med*. 2009; 37(5):468–471. doi: 10.1016/j.amepre.2009.06.020. [PubMed: 19840704]
- Anderson J, Brackbill R, Mosher W. Condom use for disease prevention among unmarried US women. *Family Planning Perspectives*. 1996; 28:25–28. [PubMed: 8822412]
- Baron R, Kenny D. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*. 1986; 51:1173–1182. [PubMed: 3806354]
- Birdthistle I, Floyd S, Nyagadza A, Mudziwapasi N, Gregson S, Glynn JR. Is education the link between orphanhood and HIV/HSV-2 risk among female adolescents in urban Zimbabwe? *Soc Sci Med*. 2009; 68(10):1810–1818. doi: S0277-9536(09)00118-X [pii] 10.1016/j.socscimed.2009.02.035. [PubMed: 19303688]

- Centers for Disease Control and Prevention. [Retrieved May 28, 2010] CDC Fact Sheet: Chlamydia. 2007a. from <http://www.cdc.gov/std/Chlamydia/Chlamydia-Fact-Sheet.pdf>
- Centers for Disease Control and Prevention. [Retrieved May 28, 2010] CDC Fact Sheet: Gonorrhea. 2007b. from <http://www.cdc.gov/std/Gonorrhea/gonorrhea-fact-sheet.pdf>
- Centers for Disease Control and Prevention. [Retrieved July 1, 2010] Cases of HIV Infection and AIDS in the United States and Dependent Areas, 2006. HIV/AIDS Surveillance Report Vol. 18. 2008. from <http://www.cdc.gov/hiv/topics/surveillance/resources/reports/2006report>
- Centers for Disease Control and Prevention. [Retrieved May 28, 2010] HIV/AIDS Surveillance Reports, 2007. 2009.
- Centers for Disease Control and Prevention. [Retrieved May 28, 2010] Nationally Notifiable Infectious Conditions. 2010. from <http://www.cdc.gov/ncphi/diss/nndss/phs/infdis2010.htm>
- Centers for Disease Control and Prevention. Characteristics associated with HIV infection among heterosexuals in urban areas with high AIDS prevalence --- 24 cities, United States, 2006-2007. *MMWR Morb Mortal Wkly Rep.* 2011; 60(31):1045-1049. [PubMed: 21832975]
- Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance, 2008. U.S. Department of Health and Human Services; Atlanta, GA: Nov. 2009
- Crepaz N, Marshall KJ, Aupont LW, Jacobs ED, Mizuno Y, Kay LS, O'Leary A. The efficacy of HIV/STI behavioral interventions for African American females in the United States: a meta-analysis. *Am J Public Health.* 2009; 99(11):2069-2078. doi: AJP.2008.139519 [pii] 10.2105/AJPH.2008.139519. [PubMed: 19762676]
- Crosby RA, DiClemente RJ, Wingood GM, Salazar LF, Rose E, Sales JM. The protective value of school enrolment against sexually transmitted disease: a study of high-risk African American adolescent females. *Sex Transm Infect.* 2007; 83(3):223-227. doi: 83/3/223 [pii] 10.1136/sti.2006.022590. [PubMed: 17569721]
- DePadilla L, Windle M, Wingood G, Cooper H, DiClemente R. Condom use among young women: modeling the theory of gender and power. [Research Support, N.I.H., Extramural]. *Health Psychol.* 2011; 30(3):310-319. doi: 10.1037/a0022871. [PubMed: 21553975]
- Diaz T, Chu S, Buehler J. Socioeconomic differences among people with AIDS: results from a multistate surveillance project. *American Journal of Preventive Medicine.* 1994; 10:217-222. [PubMed: 7803064]
- DiClemente R, Wingood G. A randomized controlled trial of an HIV sexual risk-reduction intervention for young African-American women. [Clinical Trial Randomized Controlled Trial Research Support, Non-U.S. Gov't]. *JAMA.* 1995; 274(16):1271-1276. [PubMed: 7563531]
- DiClemente R, Wingood G, Crosby R, Sionean C, Cobb B, Harrington K, Oh M. Sexual risk behaviors associated with having older sex partners: a study of black adolescent females. *Sex Transm Dis.* 2002; 29(1):20-24. doi: 00007435-200201000-00004 [pii]. [PubMed: 11773874]
- DiClemente R, Wingood G, Harrington K, Lang D, Davies S, Hook E 3rd, Robillard A. Efficacy of an HIV prevention intervention for African American adolescent girls: a randomized controlled trial. [Clinical Trial Randomized Controlled Trial Research Support, U.S. Gov't, P.H.S.]. *JAMA.* 2004; 292(2):171-179. doi: 10.1001/jama.292.2.171. [PubMed: 15249566]
- DiClemente R, Wingood G, Rose E, Sales J, Lang D, Caliendo A, Crosby R. Efficacy of sexually transmitted disease/human immunodeficiency virus sexual risk-reduction intervention for african american adolescent females seeking sexual health services: a randomized controlled trial. [Randomized Controlled Trial Research Support, N.I.H., Extramural]. *Arch Pediatr Adolesc Med.* 2009; 163(12):1112-1121. doi: 10.1001/archpediatrics.2009.205. [PubMed: 19996048]
- Freudenberg N, Ruglis J. Reframing school dropout as a public health issue. *Prev Chronic Dis.* 2007; 4(4) [http://www.cdc.gov/pcd/issues/2007/oct/2007\\_0063.htm](http://www.cdc.gov/pcd/issues/2007/oct/2007_0063.htm).
- Hargreaves JR, Bonell CP, Boler T, Boccia D, Birdthistle I, Fletcher A, Glynn JR. Systematic review exploring time trends in the association between educational attainment and risk of HIV infection in sub-Saharan Africa. *AIDS.* 2008; 22(3):403-414. doi: 10.1097/QAD.0b013e3282f2aac300002030-200801300-00010 [pii]. [PubMed: 18195567]
- Hargreaves JR, Howe LD. Changes in HIV prevalence among differently educated groups in Tanzania between 2003 and 2007. *AIDS.* 2010; 24(5):755-761. doi: 10.1097/QAD.0b013e328336672e. [PubMed: 20051806]

- Hasnain M, Levy JA, Mensah EK, Sinacore JM. Association of educational attainment with HIV risk in African American active injection drug users. *AIDS Care*. 2007; 19(1):87–91. doi: J1W2034G661UWX54 [pii] 10.1080/09540120600872075. [PubMed: 17129862]
- Jennings JM, Taylor R, Iannacchione VG, Rogers SM, Chung SE, Huettner S, Ellen JM. The available pool of sex partners and risk for a current bacterial sexually transmitted infection. *Ann Epidemiol*. 2010; 20(7):532–538. doi: S1047-2797(10)00073-6 [pii] 10.1016/j.annepidem.2010.03.016. [PubMed: 20538196]
- Karim Q, Sibeko S, Baxter C. Preventing HIV Infection in Women: A Global Health Imperative. *Clinical Infectious Diseases*. 2010; 50(S3):S122–S129. [PubMed: 20397940]
- Kayeyi N, Sandoy IF, Fylkesnes K. Effects of neighbourhood-level educational attainment on HIV prevalence among young women in Zambia. *BMC Public Health*. 2009; 9:310. doi: 1471-2458-9-310 [pii] 10.1186/1471-2458-9-310. [PubMed: 19706189]
- Manlove J. The influence of high school dropout and school disengagement on the risk of school-age pregnancy. *Journal of Research on Adolescence*. 1998; 8:187–220. [PubMed: 12294323]
- Markowitz LE, Dunne EF, Saraiya M, Lawson HW, Chesson H, Unger ER. Quadrivalent Human Papillomavirus Vaccine: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2007; 56(RR-2):1–24. doi: rr5602a1 [pii]. [PubMed: 17380109]
- Mauldon J, Luker K. The effects of contraceptive education on method use at first intercourse. *Family Planning Perspectives*. 1996; 28:19–24. [PubMed: 8822411]
- Paasche-Orlow MK, Clarke JG, Hebert MR, Ray MK, Stein MD. Educational attainment but not literacy is associated with HIV risk behavior among incarcerated women. *J Womens Health (Larchmt)*. 2005; 14(9):852–859. doi: 10.1089/jwh.2005.14.852. [PubMed: 16313213]
- Pettifor AE, Levandowski BA, MacPhail C, Padian NS, Cohen MS, Rees HV. Keep them in school: the importance of education as a protective factor against HIV infection among young South African women. *Int J Epidemiol*. 2008; 37(6):1266–1273. doi: dyn131 [pii] 10.1093/ije/dyn131. [PubMed: 18614609]
- Risser WL, Bortot AT, Benjamins LJ, Feldmann JM, Barratt MS, Eissa MA, Risser JM. The epidemiology of sexually transmitted infections in adolescents. *Semin Pediatr Infect Dis*. 2005; 16(3):160–167. doi: S1045187005000397 [pii]. [PubMed: 16044389]
- Robbins RN, Bryan A. Relationships Between Future Orientation, Impulsive Sensation Seeking, and Risk Behavior Among Adjudicated Adolescents. *J Adolesc Res*. 2004; 19(4):428–445. doi: 10.1177/0743558403258860. [PubMed: 16429605]
- Ross C, Wu C. The links between education and health. *Am Sociol Rev*. 1995; 60(5):719–745.
- Sales JM, Spitalnick J, Milhausen RR, Wingood GM, DiClemente RJ, Salazar LF, Crosby RA. Validation of the worry about sexual outcomes scale for use in STI/HIV prevention interventions for adolescent females. *Health Educ Res*. 2009; 24(1):140–152. doi: cyn006 [pii] 10.1093/her/cyn006. [PubMed: 18353760]
- Seth P, Wingood GM, Diclemente RJ, Crosby RA, Salazar LF, Rose ES, Sales JM. Differences between African-American adolescent females with and without human papillomavirus infection. [Letter Research Support, N.I.H., Extramural]. *Sex Health*. 2011; 8(1):125–127. doi: 10.1071/SH10107. [PubMed: 21371396]
- Seth P, Wingood GM, Robinson LS, Diclemente RJ. Exposure to high-risk genital human papillomavirus and its association with risky sexual practices and laboratory-confirmed chlamydia among African-American women. *Womens Health Issues*. 2009; 19(5):344–351. doi: S1049-3867(09)00064-4 [pii] 10.1016/j.whi.2009.06.001. [PubMed: 19679492]
- Shannon K, Strathdee SA, Shoveller J, Rusch M, Kerr T, Tyndall MW. Structural and environmental barriers to condom use negotiation with clients among female sex workers: implications for HIV-prevention strategies and policy. *Am J Public Health*. 2009; 99(4):659–665. doi: AJPH.2007.129858 [pii] 10.2105/AJPH.2007.129858. [PubMed: 19197086]
- Upchurch DM, Ray P, Reichart C, Celentano DD, Quinn T, Hook EW 3rd. Prevalence and patterns of condom use among patients attending a sexually transmitted disease clinic. *Sex Transm Dis*. 1992; 19(3):175–180. [PubMed: 1523535]

- US Department of Health & Human Services. [Retrieved June 29, 2010] Proposed Healthy People 2020 Objectives—List for Public Comment. 2009. from <http://www.healthypeople.gov/hp2020/Objectives/TopicArea.aspx?id=11&TopicArea=Adolescent+Health>
- Weinstock H, Berman S, Cates W Jr. Sexually transmitted diseases among American youth: incidence and prevalence estimates, 2000. *Perspect Sex Reprod Health*. 2004; 36:6–10. [PubMed: 14982671]
- Wingood G, DiClemente R. Partner influences and gender-related factors associated with noncondom use among young adult African American women. *Am J Community Psychol*. 1998; 26(1):29–51. [PubMed: 9574497]
- Wingood, G.; DiClemente, R. The Theory of Gender and Power: A Social Structural Theory For Guiding Public Health Interventions. In: DiClemente, R.; Crosby, RK., editors. *Emerging Theories in Health Promotion Practice and Research*. Jossey-Bass; San Francisco, CA: 2002.

**Table 1**

## Items comprising TGP measures

Scale	Measure type	Alpha	Items
<b>Sexual Division of Power</b>			
Condom negotiation barriers	Scale	.865	If I asked my partner to use a condom, he would think I don't trust him  If I asked my partner to use a condom, he might get angry.  If I asked my partner to use a condom, he might think I'm putting him down or insulting him
SE to ask partner to get STI test	Scale	.901	If I ask my partner to get tested for STDs he may think that I gave him a STD.  If I ask my partner to get tested for STDs he may think that I cheated on him.  If I ask my partner to get tested for STDs he may think that I believe that he gave me an STD.  If I ask my partner to get tested for STDs he may think that I believe that I am too "dirty" to be intimate with
Relationship control	Scale	.751	How much control do you have over whether or not your main partner uses a condom during vaginal sex?  How much control do you have over giving your main partner a blow job?  How much control do you have over whether or not your main partner uses a condom when you give him a blow job?  How much control do you have over giving your main partner a hand job?  How much control do you have over telling your main partner that a condom must be used when you have sex?
Risky partner	Dichotomous	-	Yes to at least one of the following:  In the past 6 months, have you had vaginal sex with a guy who you know has just been released from a jail, prison, or a detention center?  In the past 6 months, have you had sex with someone you thought or suspected had an STD?  In the past 6 months, have you had sex with someone you thought or suspected injected drugs?  In the past 6 months, has your main partner had sex with other women?
<b>Structure of Cathexis</b>			
STI knowledge	Index	.420	African-American women, 18-25 living in the south rarely get STDs  If your partner has an STD and you have sex with him, it is very likely that you will get the STD.  Most of the time when a women has an STD she can tell.  Having an STD can increase the risk of getting HIV  Only uneducated black women are at risk of getting an STD.  One type of STD, genital warts, can increase a women's risk of cervical cancer.  STDs can cause infertility, spontaneous abortions and still births.  If a man pulls out before cumming, condoms don't need to be used to protect a woman from STDs.  You can always tell when your male partner has an STD.  Douching increases a woman's chance of getting an STD.
Have sex with older partners, generally	Dichotomous	-	In general how old are the people you have sex with?



Scale	Measure type	Alpha	Items
More than one sex partner	Dichotomous	-	In the past year (12 months), how many guys have you had vaginal sex with?

**Table 2**  
Bivariate Associations between educational attainment, Diagnosed STI, and TGP mediators

Outcome	< than HS (n = 94) n (%) or Mean (SD)	HS (n = 217) n (%) or Mean (SD)	Some college (n = 357) n (%) or Mean (SD)	College and above (n = 180) n (%) or Mean (SD)	Chi Square or ANOVA	P-value
<b>Laboratory-confirmed STI</b>	26 (27.7)	50 (23.0)	56 (15.7)	12 (6.7)	27.26	< .001***
<b>Sexual Division of Power</b>						
Condom negotiation barriers	5.69 (2.82)	5.04 (2.81)	5.24 (2.00)	5.62 (3.08)	1.85	.137
SE to ask partner to get STI test	13.10 (4.38)	14.91 (4.58)	14.82 (4.55)	15.04 (4.25)	4.62	.003**
Relationship control	18.79 (2.32)	18.91 (2.03)	18.94 (1.89)	19.09(1.78)	.477	.698
Risky partner <sup>1</sup>	42 (44.7)	83 (38.2)	119 (54.8)	57 (31.7)	6.08	.108
<b>Structure of Cathexis</b>						
STI Knowledge	7.80 (1.42)	7.65 (1.44)	8.08 (1.28)	8.19 (1.14)	7.34	< .001***
Have sex with older partners, generally	48 (51.1)	118 (54.4)	197 (55.2)	95 (52.8)	0.65	.885
More than one sex partner <sup>2</sup>	66 (70.2)	131 (60.4)	217 (60.8)	94 (52.2)	8.72	.033*

\* P-value <.05

\*\* P-value <.01

\*\*\* P-value <.001

<sup>1</sup> Past 6 months

<sup>2</sup> Past 12 months

**Table 3**

Multivariate associations between educational attainment, Diagnosed STI, and TGP mediators among African American young adult females, Adjusted for Age and Receipt of Public Assistance (Reference group is Less than High School)

Outcome	High School AOR (95% CI) or B (95% CI)	P-value	Some college AOR (95% CI) or B (95% CI)	P-value	College and above AOR (95% CI) or B (95% CI)	P-value
<b>Laboratory-confirmed STI</b>	0.85 (0.49, 1.50)	.576	0.57 (0.33, 1.00)	.052	0.27 (0.12, 0.64)	.003**
<b>Sexual Division of Power</b>						
Condom negotiation barriers	-0.90 (-1.62, -0.19)	.014*	-0.875 (-1.57, -0.19)	.013*	-0.99 (-1.85, -0.14)	.023*
SE to ask partner to get STI test	1.92 (0.83, 3.02)	.001**	1.88 (0.82, 2.94)	.001**	2.25 (0.94, 3.56)	.001**
Relationship control	0.22 (-0.31, 0.75)	.407	0.37 (-0.14, 0.87)	.159	0.77 (0.15, 1.38)	.015*
Sex with risky partner <sup>1</sup>	0.76 (0.46, 1.25)	.283	0.61 (0.38, 0.99)	.043*	0.55 (0.30, 1.00)	.050*
<b>Structure of Cathexis</b>						
STI Knowledge	-0.12 (-0.45, 0.20)	.455	0.33 (0.18, 0.64)	.038*	0.50 (0.13, 0.88)	.011*
Have sex with older partners, Generally	1.07 (0.65, 1.75)	.795	1.07 (0.67, 1.71)	.791	0.870 (0.48, 1.57)	.644
More than one sex partner <sup>2</sup>	0.59 (0.35, 0.99)	.048*	0.55 (0.33, 0.92)	.022*	0.30 (0.16, 0.57)	<.001***

\* P-value < .05  
 \*\* P-value < .01  
 \*\*\* P-value < .001  
<sup>1</sup> Past 6 months  
<sup>2</sup> Past 12 months

**Table 4**

Multivariate mediation analyses testing TGP mediators of the relationship between educational attainment and laboratory-confirmed STI among African American young adult females, adjusted for age and receipt of public assistance (Reference group is less than high school)

	Adjusted Mediation Analyses OR (95% CI)	P-value
<b>Sexual Division of Power:</b>		
Educational Attainment		
High School	0.91 (0.52, 1.61)	.750
Some College	0.61 (0.35, 1.08)	.088
College and above	0.29 (0.13, 0.69)	.005**
Condom negotiation barriers	1.08 (1.01, 1.14)	.015*
Educational Attainment		
High School	0.93 (.057, 1.64)	.798
Some College	0.62 (0.35, 1.09)	.098
College and above	0.32 (0.13, 0.71)	.006**
Self-efficacy to ask partner for an STI test	0.95 (0.92, 0.99)	.020*
Educational Attainment		
High School	-	
Some College	-	
College and above	-	
Relationship Control	-	
Educational Attainment		
High School	0.89 (0.51, 1.57)	.691
Some College	0.61 (0.35, 1.08)	.092
College and above	0.30 (0.13, 0.70)	.005**
Sex with risky partner <sup>1</sup>	1.90 (1.31, 2.75)	.001**
<b>Structure of Cathexis</b>		
Educational Attainment		
High School	-	
Some College	-	
College and above	-	
STI knowledge	-	
Educational Attainment		
High School	0.91 (0.52, 1.61)	.755
Some College	0.62 (0.35, 1.09)	.094
College and above	0.32 (0.14, 0.75)	.009**
More than one sex partner <sup>2</sup>	1.97 (1.31, 2.95)	.001**

\* P-value <.05

\*\* P-value <.01

\*\*\*  
P-value <.001

<sup>1</sup>Past 6 months

<sup>2</sup>Past 12 months