Differential effects of education by gender and age cohort on engagement in risky and protective sexual behaviors in 7 sub-Saharan African Countries.

Abstract

HIV infection has been a significant health problem around the world, particularly in SSA. Past studies have shown that educational attainment has historically been related to increased risk of HIV infection, with education's wealth effect increasing risky sexual behavior. HIV campaigns and interventions have focused on increasing HIV knowledge and changing attitudes in hopes of changing sexual behavior. Our study examines whether education has shifted away from a wealth effect to an information effect by examining whether the accumulation of facts and attitudes moderates the effect of education on an individual's sexual behavior using the Demographic Health Surveys from 7 SSA countries. Our study finds that education is not solely working through an information effect, but has an independent effect on sexual behavior. Educational attainment is significantly related to changing behavior above the accumulation of facts and attitudes for younger cohorts, but not among older cohorts.

Introduction

The spread of mass schooling around the world has been identified as a significant preventative force in many public health problems associated with higher morbidity and greater mortality (Backlund, et al, 1999; Furnée et al., 2008; Kitagawa & Hauser, 1973; Adams, 2002; Adler & Newman, 2002; Feinstein, 2006). However, the relationship between education and HIV and AIDS in sub-Saharan Africa (SSA) has not followed this historical preventive model as seen in other areas of public health (Hargreaves & Glynn, 2002; Hargreaves et al, 2007; 2008). This makes the HIV and AIDS pandemic in SSA a compelling public health problem to examine the effect of education on HIV for four reasons. First, epidemiological studies from early in the pandemic (pre 1996) in SSA reported that educated individuals were more likely to become infected (Ainsworth & Semali, 1998; Cogneau & Grimm, 2006; Smith et. al., 1999), while recent demographic research on various SSA nations studies indicate that among younger cohorts who became sexually active in the 1990s, education has shifted back to the traditional association with the more educated individuals being more likely to not be infected (Baker et al, 2008; DeWalque et al, 2005; Hargreaves et al., 2008; Michelo et al. 2006). Second, before information

was readily available to the African public (circa 1995) the cultural practice of transactional sex, and the persistence of multiple sexual partners that reflected an individual's social status and wealth, led to a spurious positive education association with HIV infection (Mishra et al., Rushing, 1995; Swindler & Watkins, 2007). Thirdly, even as accurate medical information became available worldwide, heterosexual sex, the main vehicle for infection in SSA, was not identified as a potential mode of transmission until the late 1980s, with misinformation about modes of transmission abounding until the mid 1990s (Rushing, 1995). Lastly, as accurate information has become available to the general population in the SSA region, new HIV infections have shifted away from the more educated to their lower educated peers (Baker et al, 2008; DeWalque et al, 2005; Michelo et al. 2006).

There are also important policy implications of this shift in the role of education in the pandemic in SSA. As accurate information became available about the modes of transmission of HIV, governments and non-governmental organizations (NGOs) in the region developed mass information campaigns and quasi-educational HIV interventions for adults and school-aged youth to transmit this information to both in-school and out-of school adolescent and adult populations (Hargreaves & Boler, 2006). These interventions have followed a three-tiered model that targets: a) increasing individuals' factual knowledge about the modes of transmission and means of preventing the spread of HIV; b) positive attitudes and beliefs about the rights, caring for, and interacting with people living with HIV and AIDS; and c) changing sexual behaviors by reducing risky sexual behavior and increasing protective sexual behavior. The health intervention literature has documented how accurate information and attitudes and beliefs are directly related to behavior and must be targeted in any behavior change intervention (Ross & Rosser, 1989). This paper will examine the relationships between education and engagement in

both risky and protective sexual behavior, while examining how information about HIV and attitudes and beliefs moderate this relationship. Given the history of education and HIV in SSA, the central question addressed here is: what are the causal mechanisms by which educational attainment prevents HIV infection in SSA?

Hypotheses

Early studies assumed that education was highly correlated with HIV infection as a result of education's wealth effect. More mobile and wealthy educated individuals engaged in higher risky sexual activity such as having multiple partners and engaging in transactional sex. James Hargreaves et al. (2008) noted that after 1996 studies started to see a shift in the relationship between education and HIV infection away from the more educated to their less educated peers. Baker et al. (2008) reported a shift in education from a risk factor for HIV infection in older adult populations to a protective factor in younger adults. Education is believed to impact an individual's ability to assess and process information. Education has also been posited to increase an individual's access to information. In this study we test two hypotheses about widely assumed, yet rarely tested, propositions about the causal mechanisms behind education as a social vaccine that encourages use of preventative behavior and discourages risky sexual behavior among adults living in the midst of the HIV and AIDS pandemic in SSA. Also tested is a counter hypothesis about education's causal mechanisms by examining whether educational attainment or facts and attitudes are driving the shift in the relationship between education and HIV infection via risky and/or protective sexual behavior.

One of the driving mechanisms of education in promoting health is believed to be the ability to disseminate information to a large segment of the population in a cost-effective manner (Mirosky & Ross, 2003). One of our guiding research questions is whether education has now

shifted away from a wealth effect to an information effect, where more educated individuals have greater access to information and whether access to information is changing the observed relationship between education and HIV. The causal path behind this proposition is that through formal education people learn facts about health and disease that then lead to healthier behavior, and hence the first two-part hypothesis is:

H1a: More educational attainment leads to knowledge of the facts about the transmission of HIV.

H1b. Knowing accurate facts about HIV leads to more protective, and less risky, sexual behavior.

Similar to the our first hypothesis, HIV curricula and interventions focus extensively on changing individual's attitudes about the disease and people living with the disease. Interventions have been guided by the assumption that changing an individual's attitudes will lead to behavior change. This second common proposition about formal education is that it introduces and increases positive, realistic attitudes about health, and hence our second two-part hypothesis is:

H2a: More educational attainment leads to more positive and realistic attitudes about HIV and people who are infected.

H2b: Holding positive and realistic attitudes about HIV leads to more protective, and less risky, sexual behavior.

Conversely there has been some speculation that the causal mechanism of education is more than a simple process of information transfer and improved attitudes (Mirowsky & Ross, 2003). For example, both of these propositions leave out a broader conception of learning and thinking that past cross-cultural psychological research has identified as important in

determining behavior (Cole, 1996). This suggests that neither facts nor attitudes are sufficient explanations of the causal mechanisms of education, and hence, within the limitations of the data used here, a third two-part hypothesis is examined:

H3a: More educational attainment leads to knowledge and positive attitudes about the transmission of HIV.

H3b: Educational attainment leads to more protective, and less risky, sexual behavior, even after controlling for the effects of knowledge and attitudes.

This study examines the relationship between education and sexual behaviors that have been seen as reducing or increasing an individual's risk to HIV. To account for differences found by Baker et al. (2008) in age cohorts, this study examines each hypothesis by age cohort to see how education, facts, and attitudes relate to both risky and protective sexual behavior for different age cohorts.

Data

For the analysis, we use 7 Demographic Health Surveys (DHS) conducted between 2003 and 2005 for 7 sub-Saharan African countries. Because of the relative slower growth in mass education in SSA, the DHS provides representative samples of adults with a wide range of educational attainment including significant proportions with small amounts or no formal education. These samples maximize the education effect and thus more thoroughly identify causal mechanisms. The DHS surveys, funded by the United States Agency for International Development (USAID), have been administered by Macro International since 1984 and are available by request from www.measuredhs.com. Over 200 DHS surveys have been conducted in over 75 countries since 1984. The surveys are based on nationally representative household samples ranging between 5,000 and 6,000 households using representative probability sampling

techniques. Countries are geographically divided into enumeration areas that consist of approximately 500 households identified from national census data or previous nationally representative surveys conducted in the country. The survey respondents are selected using a two-stage stratified sampling technique where all households are first identified in randomly selected enumeration areas, and then households within each enumeration area are randomly selected with each household having an equal probability of selection. All women between the age of 15 and 49 and males between the age of 15-59 of the selected household are eligible to be included in the surveys (Macro International, 1996; Rutstein & Rojas, 2006). The DHS surveys collect national, population-based HIV prevalence data on internationally-recognized facts, attitudes, and sexual behavior that consist of questions designed to measure respondent's knowledge of HIV/AIDS and HIV/AIDS prevention methods, attitudes towards those with HIV/AIDS, and HIV/AIDS related behaviors such as higher-risk sex and HIV testing (Rutstein & Rojas, 2006). The surveys include questions that assess respondent's fertility, family planning, maternal and child health, as well as child survival, malaria, and nutrition in addition to HIV and AIDS. The DHS surveys typically conducted every five years, with recent surveys involving HIV testing biomarker data and three distinct questionnaires, one for the household, one for women, and one for men.

The countries included in the analysis and the corresponding years of the DHS survey are: Cameroon, 2004; Ghana, 2003; Guinea, 2005; Kenya, 2003; Malawi, 2004; Rwanda, 2005; and Senegal, 2005.The data was first cleaned and then multivariate models based on theories influenced by the literature were tested. In our analysis, survey respondents were sorted into three age cohorts: 15-24 year olds, 25-34 year olds, and 35 and older. The 25 to 34 year old cohort is used as the reference category in the analysis presented here. Analysis was first

conducted on the pooled sample, and then separate analyses were conducted for male and female respondents separately.

Methodology

Structural Equation Modeling (SEM) was used to address our hypotheses. SEM is a flexible approach used to model the covariation among observed variables through a system of equations allowing dependent variables to also act as predictors in other equations in the system (Duncan, 1975; Bollen, 1989; Kline, 1998). Each of the direct and indirect (mediating) effects corresponding to our hypotheses can be tested within the context of these models.

Our primary model consists of both structural and measurement models (see Figure 1). A measurement model consists of relationships among observed variables that reflect latent traits. In our model, we have four latent constructs: our two mediator variables are Facts and Attitudes; and Risky and Protective Sexual Behavior are our dependent variables.

For our mediator variables, *Facts* is a latent construct that is composed by five discrete observed variables where a respondent replied whether: a person could get AIDS from a mosquito bite; a person could get AIDS from witchcraft; a person could get AIDS by sharing food with an infected person; a healthy looking person could be infected with AIDS; and AIDS could be transmitted from mother to her child. *Attitude* is a latent construct that is composed of four discrete observed variables where the respondent indicated whether they : were willing to care for relatives infected with AIDS; believed a person infected with AIDS should be allowed to continue teaching; believe children should be taught about condoms; and would buy vegetables from a vendor infected with AIDS. The correlation between Facts and Attitudes is .32 for the pooled sample, .33 for the female sample, and .25 for the male sample. All are significant at the .05 level.

In the case of the dependent variables, *Protective Sexual Behavior* is a latent construct composed of two variables: whether a person had multiple sexual partners within the last 12 months and whether they had used a condom during their last sexual intercourse. *Risky Sexual Behavior* is a latent construct also composed of two variables: whether a respondent reported having an sexually transmitted infection (STI) or symptoms of STI in the last 12 months and if the respondent had multiple sexual partners in the last 12 months and did not use a condom during their last sexual intercourse. The correlation between risky sexual behavior and protective sexual behavior was .03 for the total sample, .08 for the female sample, and -.06 for the male sample.

The structural portion of the model consists of the direct and indirect effects between educational attainment (measured as years of schooling) with facts about HIV, attitudes toward AIDS, and protective and risky sexual behavior. In addition, several covariates or controls are included in the model: gender (pooled sample), age's cohort, marital status (married), socioeconomic status (SES), and place of residence (urban).

The *structural equations* or *causal models* used in this paper are:

$\eta_1 = \alpha_0 + \alpha_1 W + \alpha_2 X + \varepsilon_1$ *Facts about HIV*

$\eta_2 = \beta_0 + \beta_1 W + \beta_2 X + \varepsilon_2$ *Attitudes toward AIDS*

$\eta_3 = \gamma_0 + \gamma_1 \eta_1 + \gamma_2 \eta_2 + \gamma_3 W + \gamma_4 X + \varepsilon_3$ *Risky/Protective Sexual Behavior*

$\text{cov}(\varepsilon_1, \varepsilon_2) \neq 0$, all the other covariances among errors are considered to equal 0.

where:

η_1	: Facts about HIV – Latent Variable with five indicators.
η_2	: Attitudes toward AIDS – Latent Variable with four indicators.
η_3	: Protective/Risky Sexual Behavior – Latent Variable with 2 indicators.
X	: Control variables (gender, place of residence, socioeconomic status, and age's cohort).
W	: Schooling level (years of schooling).
α, β, and γ	: Structural parameters.
ε	: Random errors.

And the *measurement models* for the latent variables are:

Facts about HIV

$a_1 = \lambda_{y1}\eta_1 + \mu_{a1}$

…

$a_5 = \lambda_{y5}\eta_1 + \mu_{a5}$

Attitudes toward AIDS

$b_1 = \lambda_{z1}\eta_2 + \mu_{b1}$

…

$b_4 = \lambda_{z4}\eta_2 + \mu_{b4}$

Risky/Protective Sexual Behavior

$c_1 = \lambda_{c1}\eta_3 + \mu_{c1}$

$c_2 = \lambda_{c2}\eta_3 + \mu_{c2}$

where:

a_i	: Observed indicators for Facts about HIV.
b_i	: Observed indicators for Attitudes toward AIDs.
c_i	: Observed indicators for Protective/Risky Secual Behavior.
λ_{ai}, λ_{bi}, and λ_{ci}	: Factor loadings (correlation between the variable and the latent variable).
μ_{ai}, $\mu_{bi,}$ and μ_{ci}	: Measurement errors

Thus, in the first stage we estimated the measurement models for each mediator and dependent variable with the objective to estimate the latent construct behind the observed variables. Once the first stage was finalized, we used this latent construct in the second stage of our analysis to estimate the structural relationships (indirect and direct effects) among education, mediators (facts and attitudes) and dependent variables (protective/ risky sexual behavior). To estimate these relationships, we used Lisrel 8.8 software.

Results

HIV facts and attitudes. Education has a significant effect on respondent's ability to spontaneously provide accurate facts about the modes of HIV transmission (see figure 1). For every increase in 1 standard deviation (SD) of educational attainment, facts about HIV increase significantly by .64 SD in the pooled (i.e. both genders) sample. This same pattern is seen when the analysis is analyzed by gender. An increase in female educational attainment significantly increases survey respondents facts about HIV score by .65 SD and male respondents see an

increase in facts about HIV significantly increase by .64 SD. Education is significantly positively related to more positive attitudes towards people living with HIV and less stigma about HIV. For every increase in 1 SD of educational attainment, attitudes towards HIV increase significantly by .49 SD in the pooled sample. This same pattern is also seen when the analysis is analyzed by gender. An increase in female educational attainment significantly increases survey respondent's attitudes towards people living with HIV score and reduces attitudes related to stigma by .50 SD and male respondents see an increase in positive attitudes significantly increase by .42 SD. These findings support hypotheses 1a and 2a and indicate that education does increase access and understanding of HIV facts.

However our findings do not support hypothesis 1b and only partial support for hypothesis 2b. Facts and attitudes have no significant relationship with protective behavior in the pooled sample and this relationship does not change once the sample is dived by gender. Although there is no statistically significant relationships identified between facts, attitudes and protective behavior, attitudes slightly increases protective behaviors by .01 SD in the female sample, while decreasing protective sexual behavior by .01 SD for males. Facts only increase male protective behavior by .02 SD for males with no relationship being seen for the female sample. In terms of risky sexual behavior, facts have no significant effect on engagement in risky sexual behavior for the pooled sample even though facts reduce risky behavior by .02 SD. When gender is considered, facts do not increase risky sexual behavior for women, while significantly decreasing male risky sexual behavior by .17 SD. Attitudes do significantly reduce risky sexual behavior by .08 SD in the pooled sample and remains significant when the sample is divided by gender. Attitudes reduce female engagement in risky sexual behavior by .07 SD and .10 SD for males.

Protective sexual behavior. As predicted in our hypothesis 3a, for the entire sample, education has a direct effect that is significantly related to engagement in protective sexual behaviors, where every additional year of education increases engagement in protective sexual behavior by .13 SD (see Figure 1). Neither the introduction of facts about HIV nor attitudes appear to be related to engagement in protective sexual behavior, even though each additional year of education increases facts about HIV by .64 SD and better attitudes about HIV by .49 SD. Both facts about HIV and attitudes have no relationship with protective sexual behavior. When the sample is analyzed by gender, the effect of education on protective sexual behavior is not significantly different for males and females. For the female sample, each additional year of schooling increases engagement in protective sexual behavior by .13 SD, when facts about HIV and attitudes are introduced into the model educations effect on protective sexual behavior increases by .005 SD. Attitudes are the driving mechanism in the increased effect of education on protective sexual behavior although this effect is not statistically significant. As reported for females, each additional year of schooling increases better attitudes around HIV by .5 SD and increases a person's ability to correctly identify facts about the modes of HIV transmission by .65 SD. An increase of 1 point in attitude score only increases protective behavior by.01 SD while increasing facts about HIV have no effect on protective sexual behavior. For the male sample, each additional year of schooling also increases engagement in protective sexual behavior by .13 SD, when facts about HIV and attitudes are introduced into the model educations effect on protective sexual behavior increases non-significantly by .0086 SD. For males facts about HIV are the driving mechanism in the increased effect of education rather than attitudes as seen in the female sample. As reported for males, each additional year of schooling increases a person's ability to correctly identify facts about the modes of HIV transmission by .64 SD and

increases better attitudes around HIV by .42 SD. Facts about HIV non-significantly increase engagement in protective sexual behavior by .02 SD with attitudes decreasing it by -.01 SD. When the interaction between education and age cohort is added into the model (see Table 1), gender differences also remain in the relationship between education and protective sexual behavior. Education significantly increases protective sexual behavior by .19 SD for the 15-24 age male cohort in comparison to the 25 to 34 age male cohort and significantly reduces protective sexual behavior by .13 SD in the 35 and older male cohort. Similarly, education increases protective sexual behavior for the 15 to 24 age female cohort by .22 SD in comparison to the 25 to 34 age cohort, and significantly decreases protective sexual behavior by .07 SD among the 35 and older female cohort. When the introduction of HIV facts and attitudes are introduced into the interaction between education and age cohorts we see the introduction of HIV facts and attitudes has no effect on the relationship between education and protective sexual behavior, with the only change in coefficient being seen in reducing educations effect from .15 SD to .14 SD for the 15-24 male cohort but does not significantly change the relationship between education and protective sexual behavior for the two older male cohorts or any of the female cohorts.

Risky sexual behavior. For the pooled sample, education has a direct effect that is significantly related to engagement with risky sexual behavior, where every additional year of education increases engagement in risky sexual behavior by .13 SD (see Figure 2). Once facts about HIV and attitudes are introduced into the model, education's effect on risky behavior is reduced by .0456 SD for the pooled sample, as each additional year of education increases facts about HIV by .64 SD and better attitudes about HIV by .49 SD. Attitudes have a stronger effect on reducing risky behavior than facts as a 1 point increase in attitude score reduces risky sexual behavior by

.08 SD whereas increasing facts about HIV only decreases risky behavior by .01 SD. When the pooled sample is divided by gender, we see that the effect of education on risky behavior is different for males and females. For the female sample, each additional year of schooling increases engagement in risky sexual behavior by .11 SD, when facts about HIV and attitudes are introduced into the model educations effect on risky sexual behavior decreases by .022 SD. Attitudes are the driving mechanism in the reduced effect of education on risky sexual behavior. For females, each additional year of schooling increases better attitudes around HIV by .50 SD and increases a person's ability to correctly identify facts about the modes of HIV transmission by .65 SD and. An increase of 1 point in attitude score reduces risky sexual behavior by .07 SD while facts about HIV non-significantly increase engagement in risky sexual behavior by .02 SD. For the male sample, each additional year of schooling increases engagement in risky sexual behavior by .20 SD, when facts about HIV and attitudes are introduced into the model educations effect on risky sexual behavior decreases by .151 SD. For males facts about HIV are the driving mechanism in the reduced effect of education rather than attitudes as seen in the female sample. For males, each additional year of schooling increases a person's ability to correctly identify facts about the modes of HIV transmission by .64 SD and increases better attitudes around HIV by .42. Facts about HIV reduce engagement in risky behavior by .17 SD in contrast to increases risky sexual behavior by .02 SD for the female sample. For males attitudes reduce risky sexual behavior by .1 SD similar to the reduction of .07 in the female sample.

When the interaction between education and age cohort is added into the model (see Table 1), gender differences remain in the relationship between education and risky sexual behavior as predicted by part b of our third hypothesis. Education shifts from increasing risky behavior by .05 SD to decreasing risky behavior by .17 SD for males between the age of 15 and

24, but does not significantly change the relationship for either of the older male cohorts over the age of 25. In contrast, education increases risky behavior for the 15 to 24 age female cohort by .12 SD in comparison to the 25 to 34 age cohort, and significantly decreases risky behavior by .02 SD among the 35 and older female cohort. When the introduction of HIV facts and attitudes are introduced into the interaction between education and age cohorts we see that facts and attitudes mediate the protective effect of education and reduces educations effect on risky sexual behavior from -.17 SD to -.13 SD for the 15-24 male cohort but does not significantly change the relationship between education and risky sexual behavior for the two older male cohorts. In contrast, for the female sample, there is no statistical difference between education and risky sexual behavior for any age cohort once HIV facts and attitudes are introduced into the model.

Discussion and Implications

The results lead to three main conclusions, first, the role of facts and attitudes in driving behavior are consistently less important in relating to changes in behavior than educational attainment, second the effect of gender remains a strong mediating factor in how education relates to risky and protective sexual behavior, and third, age remains a strong mediator in the relationship between education and sexual behavior.

HIV and AIDS curricula have a core focus of transmitting information about sexual modes of transmission and instilling attitudes and beliefs that reduce stigma and promote more open discussions of the implications of HIV infection on the individual, family, community and nation. However, our results indicate that knowing facts about the mode of transmission does not increase protective sexual behavior. The effect of education on protective sexual behavior remains unchanged once facts and attitudes are introduced into the model. This finding is surprising since particularly adult HIV curricula emphasize reducing sexual partners and using

condoms, and yet these messages although understood do not reduce the effect of education on engagement of protective behaviors and do not significantly impact protective behaviors for any group within the sample. In contrast attitudes and behavior do influence risky sexual behavior, more for males than female, but even controlling for these facts and attitudes, education remains the strongest predictor of engagement in risky behavior. The non-significant influence of facts on risky sexual behavior observed among the female sample is troubling as it identifies that current HIV curricula may not be targeting the right information to create behavior change among women. Facts about HIV do reduce risky sexual behavior by males and do reduce the effect of education by .04 SD among the youngest cohort, but the effect of facts remains significantly smaller than the effect of education on risky behavior for the younger male cohort. In the older male cohort the effect of facts and attitudes follows the same pattern seen in all age cohorts of the female sample and do not significantly affect risky sexual behavior. Similar to other studies (Ross & Rosser, 1989), we find that attitudes are significantly more effective in creating behavior change than facts, however we only see this in the female sample, with facts being more important for younger males than attitudes. That being said, attitudes about HIV significantly reduce engagement for risky sexual behavior in both our male and female samples. However the effect of education on risky behavior is not significantly changed for any group within our sample except for 15-24 year old males once facts and attitudes are included in the analysis. Even among young males the inclusion of facts and attitudes suppresses the education effect by .04 points, but education remains the strongest predictor of influencing behavior change in the model. The consistent and enduing effect of education on both protective and risky behavior above and beyond facts and attitudes reinforces the significance of education in the spread and fight against the HIV pandemic in these countries. In addition, the lack of effect that

facts and attitudes have on changing sexual behaviors in this study calls into question the core foundations of most HIV curricula. Are mere facts or the continual focus on facts about sexual modes of transmission and condoms enough to change people's behaviors? Somehow the interaction between education and these facts and attitudes are changing behaviors for young males but not females. Do we need more gender based curricula that focus on the different needs of males and females?

Second, the interaction between age and education remains to be a significant variable in our model. Age remains to be a significant predictor in moderating the effect of education on both risky and protective sexual behavior. Similar to other studies (Ainsworth & Semali, 1998; Cogneau & Grimm, 2006; Smith et. al., 1999) we find that education increases risky sexual behavior and reduces protective sexual behavior for older male cohorts, however education has shifted towards a social vaccine for the 15-24 age male cohort twofold by reducing risky sexual behavior and increasing protective sexual behavior. Unlike the male cohort the effect of education remains a risk factor for 15-24 year old women while being a protective factor for the 35 and older female cohort that presents an interesting paradox. The issue that older male educated cohorts are involved in more risky and less protective sexual behavior, could be an artifact that they had already engaged in sexual activity before information about HIV became available, similar to studies on other risky behaviors (Ennett et al. 1994), we see that once individuals have already engaged in an activity it is more difficult to change their behaviors than those that have not engaged in the behavior. However, this line of reasoning does not hold for the female sample. The inclusion of facts and attitudes appear to also have little to no effect on the older age cohorts. The continual effect of education on increasing risky behavior and reducing protective behaviors among older males is troubling particularly as males in this age group are

increasingly having sexual relationships with younger females and in SSA, males have been identified as having greater control and influence in sexual relationships. The effect of gender becomes more prominent in this analysis and requires a more in-depth discussion.

After education, gender is the most influential predictor in our model. Males and females have very different patterns when it comes to engagement in risky and protective sexual behavior as well as how facts and attitudes influence these behaviors. When we examine protective sexual behavior we see that both males and females follow similar patterns, with education increasing protective behavior for the younger age cohort and reducing protective behavior for the older cohort. Even though both males and females show similar effects of education on protective behavior, education has a stronger affect for males than females in either increasing or reducing protective behaviors. In contrast, gender interacts with education so that we see inverse relationships among males and females in how education affects risky sexual behavior. For younger age cohorts education has become a social vaccine reducing risky behavior, however education remains a risk factor for 15-24 year old women. This relationship changes among the older cohort where education reduces risky sexual behavior for women over the age of 35 and increases risky sexual behavior for males over the age of 35. This presents an interesting effect that was not expected when we began our analysis. Although not measured in this study, it is hypothesized that this may be a result of young female's lack of access to financial resources and the pervasive trend of transactional sex engaged in by adolescent females with older males to pay for school fees (Bajaj, 2008; Collins, 2008; Erulker, 2006; Human Rights Watch, 2001; 2002; Kaufman & Stavrou, 2004; Varga, 1997). Therefore it is not unreasonable that we see that more educated older men who are targeting females in the youngest cohort for transactional relationships both show education as a continued risk factor, whereas education has enabled

some sexual independence in older women. There is a burgeoning literature that has addressed the effect of cultural gender norms around sexuality in SSA. Researchers have documented that gender norms and cultural practices such as transactional sex reduce female bargaining power and ability to negotiate less risky sexual behavior (Ajuwon et al., 2001; Balmer et al. 1997; Jejeebhoy & Bott, 2003; Jewkes, et al, 2001; Kaufman & Stavrou, 2004; Swidler & Watkins, 2007; Varga 1997; Wood and Jewkes 1997). In this case, additional studies need to be conducted to see whether we are seeing the effect of education increasing female risky behavior or whether the need for additional resources required for schooling has exposed adolescent and young females to become dependent on older males.

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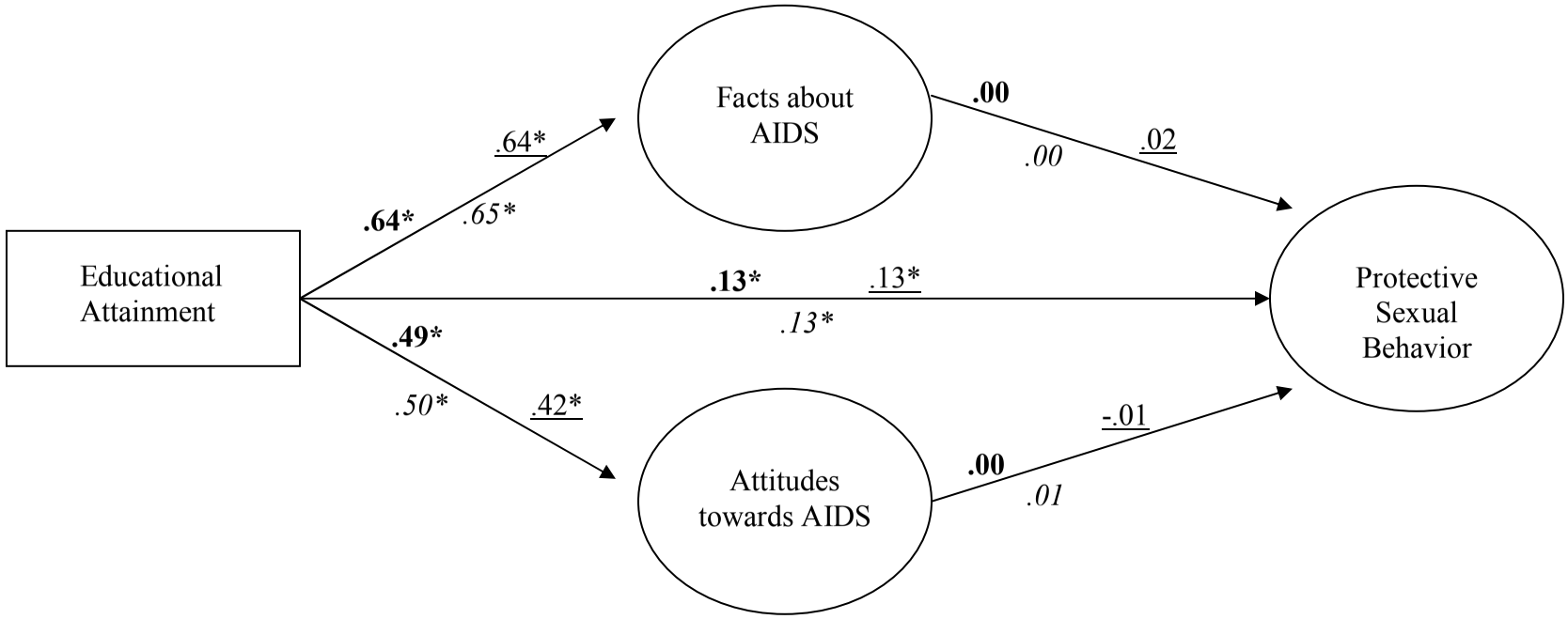
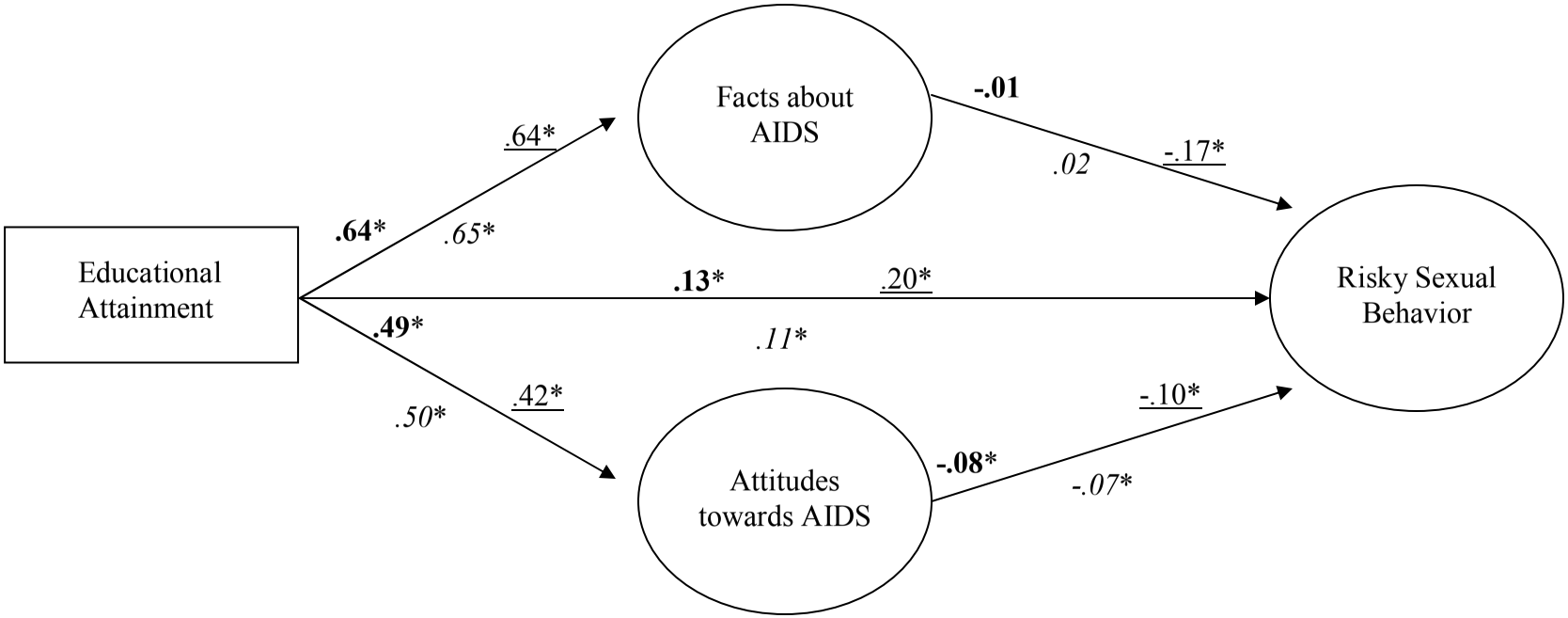
Figure 1. Relationship between Education and Protective Sexual Behavior moderated through Facts and Attitudes towards HIV



Note: **Bold** indicates Pooled Sample coefficients, *Italics* indicate Female Sample coefficients and are presented below the line, and Underline indicates Male Sample coefficients

Figure 2. Relationship between Education and Risky Sexual Behavior moderated through Facts and Attitudes towards HIV



Note: **Bold** indicates Pooled Sample coefficients, *Italics* indicate Female Sample coefficients and are presented below the line, and Underline indicates Male Sample coefficients

Table 1. The effect of educational attainment, facts, and attitudes on sexual behavior by age cohort and gender.

		Educational Attainment			Education*Younger Age Cohort			Education*Older Age Cohort		
		Pooled	Male	Female	Pooled	Male	Female	Pooled	Male	Female
Protective Sexual Behavior	Without controlling for Facts and Attitude	.13*	.14*	.13*	.19*	.15*	.22*	-.11*	-.13*	-.07*
	Controlling for Facts and Attitude	.13*	.13*	.13*	.19*	.14*	.22*	-.11*	-.13*	-.07*
Risky Sexual Behavior	Without controlling for Facts and Attitude	.08*	.05*	.09*	.06*	-.17*	.12*	-.02*	0.03	-.02*
	Controlling for Facts and Attitude	.13*	.20*	.11*	.06*	-.13*	.12*	-.03*	0.02	-.03*

*The p-value is significant at the .05 level, 25-34 year age cohort is the reference group