

Age is Nothing but a Number (or So They Say): Age-Discordant Heterosexual Relationships and
Their Influence on HIV Transmission in Ghana

By

Romanadvoratreunder L. G. Fetherolf

Bachelor of Science
The Ohio State University
2010

Thesis Committee Chair: Samuel M. Jenness, PhD MPH

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2017

Abstract

Age is Nothing but a Number (or So They Say): Age-Discordant Heterosexual Relationships and Their Influence on HIV Transmission in Ghana

By Romanadvoratrelunder L. G. Fetherolf

In Sub-Saharan Africa (SSA), age-discordant relationships in which the male partner is older than the female have been suggested to increase the risk of human immunodeficiency virus (HIV) infection for women. We investigated these patterns of sex-asymmetric age mixing and its relationship with prevalent HIV infection in Ghana. Using a sample of 590 participants from a cross-sectional study Accra, Ghana, we asked about demographic information and sexual history with the three most recent partners within the previous 12 months. Bivariate and multivariate linear regression was performed to estimate the relationship between reported partner age as a function of participant age and sex. We then used logistic regression to quantify the association between male-relative age within partnerships and prevalent HIV status, and history of diagnosis with a sexually transmitted infection. Men were on average 4.8 years older than female partners. Factors associated with greater male-relative age difference were entering the relationship for money, gifts, or assistance and having a partner who was wealthy. There does not appear to be a strong relationship between male-relative age with HIV status; however, there does appear to be a relationship between female participants receiving money, gifts, or assistance and HIV status. Many studies performed in this field have shown a relationship between age-discordance and HIV status across SSA. By performing more research on factors that may lead to age-discordant relationships as well as providing women more options for HIV prevention methods, the transmission of HIV may begin to decrease.

Keywords: HIV, age-discordance, Sub-Saharan Africa, Ghana, age mixing, heterosexual, partnerships

Age is Nothing but a Number (or So They Say): Age-Discordant Heterosexual
Relationships and its Influence on HIV Transmission in Ghana

By

Romanadvoratreunder L. G. Fetherolf

Bachelor of Science
The Ohio State University
2010

Thesis Committee Chair: Samuel M. Jenness, PhD MPH

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2017

Table of Contents

Introduction.....	1
Methods.....	3
Study Population	3
Sample and Study Design	3
Measurement Methods	4
Statistical Analysis	5
Results.....	6
Discussion.....	9
Appendix.....	i
Table 1: Demographics of Study Participants.....	i
Table 2: Summary of Participants' Partners	iii
Table 3: Linear Regression for Age Difference Between Partnerships and Predictors ..	v
Table 4.1: Logistic Regression for HIV Status and Predictors	vii
Table 4.2: Logistic Regression for Ever Having a STD and Predictors	vii
Figure 1. Age Differentials by Sex.....	viii
Figure 2. Prediction of Partner's Age by Participant Gender	ix
References.....	x

Introduction

In 2015, 36.7 million people worldwide were living with the Human Immunodeficiency Virus (HIV). Since the beginning of the HIV epidemic in 1981, 78 million people have become infected (1). Most persons with HIV/AIDS reside in low- to middle-income countries, largely in Sub-Saharan Africa (SSA) (2): 25.6 million people in 2016 (3). In western and central Africa, the number of HIV-infected people in 2015 was 6.5 million, with approximately 60% of those infections among women. The concentration of HIV among women in SSA raises critical public health concerns, as this group has had less access to effective prevention tools, including engaging their sexual partners in safer sex practices (4). Understanding the drivers of new infections among women in SSA may help to target these new interventions (5).

Western Africa has experienced lower HIV rates than eastern and southern SSA, yet HIV is highly concentrated in urban environments there. The overall prevalence of HIV in Ghana, for example, was approximately 1.6% 2015 (6), yet in Agbogbloshie, an urban slum area in the capital Accra, prevalence may be almost four times as high (5.5%). One recent study in Ghana found that the HIV prevalence among women was 7.2%, compared to 2.8% in men (9), a ratio that is comparable to other countries within western Africa. In Cameroon, the HIV prevalence for women was 5.6% for women and 2.9% among men in 2011(10).

Ongoing HIV transmission across SSA has been driven by many political, social, and ethical issues that exist across the region. These include the high burden of other infectious diseases, poverty, low literacy levels, and low health care access for many (11). Because of economic issues, women may participate in transactional or commercial

sex to meet their basic needs (11). Mobility and migration may also contribute to HIV incidence across the region (7), (8). Migrants may establish new partnerships in the residential area or engage in sex with commercial sex workers there (7). Risk behaviors that contribute to the transmission of HIV include unprotected sex, use of alcohol, and multiple partnerships (12), (13).

Age discordance, which is our focus in this paper, occurs when there is an age difference between partners. The main focus for this paper will be on the asymmetry in age mixing where men are older than women within partnerships. This practice is more common in countries most affected by HIV (12). Age mixing occurs for a variety of reasons, including older men economically providing for younger women. In this scenario, men have been referred to as “sugar daddies” (15). Because of this asymmetrical age discordance, younger women have an increased risk of HIV given the potential power differentials in the relationship and unsafe sexual practices associated with transactional sex (13). A study in Kenya found that the age and economic status differences in partnerships led to a decrease in condom use (16). Transactional sex among age-discordant couples may also be associated with higher rates of anal sex (15). Women who enter partnerships with older men are at a higher risk of contracting HIV than if she was to engage in a relationship with a man her own age (16). In addition to the power differentials, women can contract HIV from older men because they are less likely to always use condoms, less likely to use condom during last sexual encounter, and their partners are more likely to engage in concurrent partnerships (14).

Our study addresses how sex-asymmetrical age discordance in heterosexual partnerships could impact HIV incidence and shape prevention opportunities for younger

women in SSA. First, we investigated the prevalence and predictors of sex-asymmetrical age discordance within heterosexual partnerships. Second, we estimated whether this discordance was associated with prevalence of infection with HIV and related sexually transmitted diseases. The goal of this study is to examine the association between the age difference between males and females and how it affects HIV transmission.

Methods

Study Population

For our analysis, we used data from the Migration & HIV in Ghana (MHG) study, a cross-sectional study of individuals who live in Agbogbloshie, an urban slum area located within the city of Accra. Individuals were eligible for MHG if they were adults between the ages of 18 and 49, residents of the randomly selected households in Agbogbloshie, and had reported a lifetime history of consensual sexual intercourse (9).

Sample and Study Design

Study participants were sampled using a three-stage cluster randomized sampling scheme. Within Agbogbloshie, a census was used to define and then sample households. After households were selected, adults within the households were randomly selected. Participants were then asked if they had a cohabiting partner or were married. If so, participants were asked to refer their partners to be part of the study. In total, 590 individuals were recruited to take part in the study (this includes 484 people who were recruited through the random household samples and 106 who were referred by household members).

As part of the MHG study, participants completed a survey that asked about demographics, travel and migration, and sexual history. The sexual history module

included questions on participant marital status, socioeconomic status, history of travel events, and partnership-level sexual behavior over the previous year. Information gathered about the partners included an age comparison within the partnerships, the average age of partners, how well the participant knew his or her partner, and the partner's economic status. In addition to the survey, participants were asked to take a diagnostic HIV test. Participants who took the HIV test were asked to return after one week to receive test results. Those who tested positive for HIV were referred to medical care (9).

Measurement Methods

For this analysis, participants reported up to three of their last three partnerships within the year prior to this study. Primary disease outcomes were HIV status measured by the study test, and lifetime history of sexually transmitted disease diagnosis.

Male relative-age was the independent variable of interest in the analysis of HIV status and lifetime history of sexually transmitted disease diagnosis. The male-relative age variable was created by taking the age difference between participants and their partners with focus on the age of males. For example, if the participant's gender was male, then the male-relative age variable was the age of the partner subtracted from the participant's age.

The primary exposure variable was the gender of the study participant. We also controlled for the age of the participant, how well the participant knew his or her partner (categories were: "well," "somewhat," "not at all," and "very well"), whether the participant expected to have sexual intercourse with the partner again, the type of relationship ("engaged," "dating," "casual partner," "commercial sex," "one-time only",

and “spouse”), the partner’s economic status (“wealthy”, “middle class/average”, and “poor”), the main reason for starting the relationship (specifically, “money/gifts/assistance” versus all other reasons), the frequency of unprotected sexual acts per month, and the number of the partner’s concurrent partnerships.

Statistical Analysis

The primary outcome for the linear regression performed was the age of the partner, with gender and age of the participant as the independent variables. Because of clustering of reported partnerships per study participant, generalized estimating equations (GEE) were used for the regression analyses. Two types of regression models were performed. We used linear regression to perform a bivariate analysis and multivariate analysis to investigate the factors associated with sex-asymmetric age mixing within partnerships. An interaction term between participant age and sex was included in the model. The dependent variable is the age of the male partner.

Second, we built logistic regression models with male-relative age difference as the primary exposure variable, with HIV status the outcome in the first model and lifetime STD diagnosis the outcome in the second. For both the primary and secondary analyses, the variables that were being controlled were the same: age of participant, main reason for starting the relationship (“money/gifts/assistance” versus all other reasons), and the frequency of unprotected sexual acts per month. These were the hypothesized confounders potentially associated with both male-relative age difference the disease outcomes.

These analyses were performed using SAS 9.4 (SAS Institute, Cary NC) and R 3.3.2 (17), (18).

Results

Demographic information about the participants are reported in Table 1. Detailed information about the partnerships are provided in Table 2. The descriptive analysis indicated there were a total of 590 participants with 56.7% female and 43.2% male. The average age for females was 30.3 years old and 32.2 for males. All participants reported having ever had sexual intercourse. The average age of sexual debut for males was 19 years old and the average age for females was 18 years old. There were 41.8% participants who reported having 4 or more lifetime sexual partners, with 60.0% of male respondents having 4 or more partners and 28.3% have females having 4 or more partners. Of the males, 10.6% reported 1 lifetime sexual partner and 16.4% of females had the same amount. Within the previous year, 67.8% of participants reported having 1 partner – 54.5% of male respondents reported 1 partner and 77.9% of female respondents reported the same. There were 68.3% participants who had an average number of 1 unprotected partners within the last year. Of the 254 males who responded to the unprotected partner question, 59.8% of males reported 1 unprotected partner in the last year and 74.6% of the 335 females reported the same (Table 1).

Table 2 presents the descriptive analysis at the partnership level. After observations with missing values were excluded, there were 273 female participants and 328 male partners were reported; all reported partnerships were heterosexual even though participants could have reported same-sex partners. For female participants, 91.1% of their reported partnerships were with older men. The average age of those male partners was 29.4 years old. For male participants, only 11.2% of their reported partnerships were with older women, while 81.0% of partnerships were with younger women. The average

age of female partners was 22.8 years old.

The average male-relative age was 4.8 years and the median was 5 years. There was a positive linear association between participant age and partner age (Figure 1). Male participants reported partner age typically below the equality line (i.e., partners of equal ages), and the female participants reported partner age typically above the equality line. In a smoothed linear regression prediction model, males were predicted to have younger partners over their lifetime, and women are predicted to have older partners over their lifetime (Figure 2).

Using a linear regression bivariate analysis to determine the relationship between the gender of the participant and age of the participant with the age of the partner. There appears to be a relationship between the two variables – female participants had a partner who was 6.54 years older (95% CI: 5.36, 7.71). Another significant relationship within the linear regression bivariate analysis is whether or not the participant believed he or she will have sexual intercourse with the partner again and the male-relative age difference. Based on age, there was a 0.34-year increase in partner's age for females (95% CI: 0.26, 0.42). Participants who entered the relationship for money, gifts, or assistance had a partner who was 3.85 years older (95% CI: 1.00, 6.70). People who had a partner who was considered wealthy had a partner who was 3.79 years older (95% CI: 0.17, 7.40), and participants who had a partner who was in the middle class had a partner who was 1.40 years older (95% CI: 0.03, 2.77). The remaining variables in the bivariate analysis, when regressed with the partner age, were not found to be significant (Table 3).

A multivariate analysis was performed using a linear regression with the partner age as the dependent variable and the age and gender of the participant was again the

primary predictors of interest. Females had a partner who was 2.88 years older (95% CI: -1.22, 6.98), and based on participant age, the partner was 0.32 years older (95% CI: 0.12, 0.51). The drop in the main gender coefficient in the multivariate model indicates that the other variables included in the model helped to explain the association between age and gender of the participant and age of the partner. The interaction between age and gender, there is a 0.16 increase in age of the partner (95% CI: 0.03, 0.29). Participants who entered into the relationship for money, gifts, or assistance had a partner who was 1.67 years older (95% CI: -0.58, 3.92), and participants who had a wealthy partner had a partner who was 3.63 years older (95% CI: 0.74, 6.51). Participants whose partner was considered middle class had a partner who was 0.68 years older (95% CI: -0.40, 1.75).

In logistic regression analyses to determine the relationship of male-relative age difference with both HIV status, we estimated the odds ratio for the association at 0.97, with 95% confidence intervals of 0.82 to 1.16. In the multivariate regression of male-relative age difference and HIV status including all hypothesized confounders, the independent variable had a null odds ratio and a 95% confidence interval of 0.93 to 1.08. The relationship between the age of the participant was also not associated with HIV status, controlling of for the age difference (OR = 1.00, 95% CI: 0.92, 1.08). In the relationship between the gender of the participant and HIV status, women were 11% more likely to be HIV-infected than men. The relationship between money, gifts, or assistance as the reason for starting the relationship was strongly associated with HIV status, but with wide uncertainty (OR = 3.33; 95% CI: 0.64, 17.29). There was no association between the frequency of unprotected sex and HIV status (OR: 0.94; 95% CI: 0.81, 1.10).

In the second logistic regression model with lifetime STD diagnosis as the outcome, greater male-relative age discordance was positively associated with the outcome (OR: 1.04; 95% CI: 1.00, 1.08). Age, controlling for male relative age difference, had a similar association. The odds ratio for the relationship between female gender and having ever had a STD diagnosis was 0.16, with a confidence interval of 0.05 to 0.58. Starting the relationship for money, gifts, and assistance was strong associated with ever being diagnosed with a STD (OR: 4.40; 95% CI: 1.05 to 18.44). The relationship between the frequency of unprotected sex was not strongly associated with ever having a STD diagnosis (OR: 0.97; 95% CI: 0.92, 1.03).

Discussion

Our study investigated the relationship between gender and age with HIV status as well as lifetime history of STD diagnoses. We also looked at the relationship between the participant age and gender with the age of their partner. We found a positive association in the linear regression between the gender and age of the participant and the age of the partner. We did not find a significant relationship between male-relative age and HIV status; however, we found a relationship between participants receiving money, gifts, or assistance from their partner when the outcome was both HIV status and STD diagnoses.

Several prior studies have suggested a link between age discordance and HIV status. In South Africa, direct and indirect evidence supported the hypothesis that age disparity was a risk factor for STDs in young women (19). The study found the average age difference between men and their partners could affect transmission of HIV, since those in age disparate relationships were more likely to have symptoms of STDs than

those not in an age disparate relationship (19). Younger women in that study who entered a relationship with older men were more likely to have a partner who is already HIV infected – one study suggested the probability that a woman has a partner who is HIV positive is 24% (20). Also, the couple was less likely to use condoms during intercourse and exhibit concurrent partnerships (20). While many studies have focused on women in relationships with older men, a smaller literature has found evidence of younger men in relationships with older women, with men could be at an increased risk of having HIV or STDs (21), (22).

Similar to the findings in our analysis, several studies have failed to establish a relationship between age discordance and HIV incidence or prevalence. Analyses in one study indicated there was not a significant relationship between gender and age with STD incidence when intimate partner violence and unprotected sex; however, in a bivariate analysis of gender and age with STD incidence, researchers found a significant relationship (22). While many studies have found an association between age-discordance and HIV status, there are also studies that have found no association between the two. HIV status was associated more with the factors that are characteristics of age-discordance relationships as opposed to the age-discordance itself (14). These include casual partnerships and having a partner with concurrent partnerships, and more frequent partnerships (14). Also, having a history of age-discordance relationships is linked to increased HIV risk in women (14).

Our current study has several limitations. Because the survey measures were self-reported, participants may not have reported their own age, their partners' ages, or lifetime STD diagnoses accurately due to recall or sensitivity biases. Another limitation

may be the location of the study. Because participants were sampled from one neighborhood with Accra, Ghana the results may not be generalizable to the broader city, country, or region.

In conclusion, since the prevalence of HIV among women in Sub-Saharan Africa remains high, it is recommended that studies continue in the region. Because there has not been as much research conducted on the relationship between younger men and older women and how that may influence HIV and STD status, it is recommended that more studies are performed on those partnership dynamics. Because of the development of new HIV prevention methods for women, our study suggests that educating women and making available these prevention options available for younger women in age-discordant relationships may have significant prevention benefits. Biomedical prevention methods such as pre-exposure prophylaxis, treatment as prevention, and microbicides are examples of newly developed methods that could be effective for women in SSA. In addition, age-appropriate sexual education can be an effective form of HIV prevention. Intravaginal rings such as the dapivirine ring are another HIV prevention method that has been found to be effective (23). Conducting more research in the reasons for and characteristics of age-discordant relationships for males and females as well as providing females more options for HIV prevention methods are important steps towards reducing HIV incidence in SSA.

Appendix

Table 1: Demographics of Study Participants

Characteristics	Male (n=255)	Female (n=335)	Overall (n=590)
	N(%) or Mean (SD)	N(%) or Mean (SD)	N or Mean
Ever had sexual intercourse			590
Yes	255 (43.2%)	335 (56.8%)	590 (100%)
Age (years)	32.2 (SD 8.3)	30.3 (SD 7.8)	31.1 (SD 8.1)
Marital Status			590
Never Married	91 (35.7%)	117 (34.9%)	208 (35.3%)
Living together/cohabiting	46 (18.0%)	68 (20.3%)	114 (19.3%)
Married monogamous	96 (37.6%)	106 (31.6%)	202 (34.2%)
Married polygamous	4 (1.6%)	3 (0.9%)	7 (1.2%)
Divorced	10 (3.9%)	29 (8.7%)	39 (6.6%)
Separated	7 (2.7%)	4 (1.2%)	11 (1.9%)
Widowed	1 (0.4%)	8 (2.4%)	9 (1.5%)
Number of Children	1.9 (SD 1.8)	2.0 (SD 1.7)	2.0 (SD 1.7)
Ever Attended School			590
Yes	228 (89.1%)	274 (81.8%)	502 (85.1%)
Highest Level of School Completed			589
Primary	43 (16.9%)	85 (25.5%)	128 (21.7%)
Middle/JSS/JHS	126 (49.4%)	156 (46.7%)	282 (47.9%)
Secondary	52 (20.4%)	29 (8.7%)	81 (13.8%)
Higher	7 (2.8%)	3 (0.9%)	10 (1.7%)
None	27 (10.6%)	61 (18.3%)	88 (14.9%)
Religion			590
Catholic	35 (13.7%)	14 (4.2%)	49 (8.3%)
Anglican	3 (1.2%)	5 (1.5%)	8 (1.4%)
Methodist	4 (1.6%)	10 (3.0%)	14 (2.4%)
Presbyterian	18 (7.1%)	36 (10.8%)	54 (9.2%)
Pentecostal/Charismatic	95 (37.3%)	189 (56.4%)	284 (48.1%)
Other Christian	24 (9.4%)	31 (9.3%)	55 (9.3%)
Muslim	33 (12.9%)	34 (10.2%)	67 (11.4%)
Traditional/Spiritualist	2 (0.8%)	0 (0.0%)	2 (0.3%)
None	41 (16.1%)	16 (4.8%)	57 (9.66%)
Ethnic Group			590
Akan	119 (46.7%)	184 (54.9%)	303 (51.4%)
Ga/Dangme	28 (11.0%)	29 (8.7%)	57 (9.7%)
Ewe	40 (15.7%)	52 (15.5%)	92 (15.6%)
Guan	2 (0.8%)	0 (0%)	2 (0.3%)
Mole-Dagbani	37 (14.5%)	37 (11.0%)	74 (12.5%)

Grussi	16 (6.3%)	5 (1.5%)	21 (3.6%)
Mande	0 (0%)	1 (0.3%)	1 (0.2%)
Other	13 (5.1%)	27 (8.1%)	40 (6.8%)
Tested for HIV			590
Yes	90 (35.3%)	175 (52.2%)	265 (44.9%)
Region of Birth			590
Western	11 (4.3%)	16 (4.8%)	27 (4.6%)
Central	21 (8.2%)	56 (16.7%)	77 (13.1%)
Greater Accra	74 (29.0%)	74 (22.1%)	148 (25.1%)
Volta	22 (8.6%)	30 (9.0%)	52 (8.8%)
Eastern	48 (18.8%)	65 (19.4%)	113 (19.2%)
Ashanti	32 (12.6%)	48 (14.3%)	80 (13.6%)
Brong Ahafo	8 (3.1%)	5 (1.5%)	13 (2.2%)
Northern	6 (2.4%)	15 (4.5%)	21 (3.6%)
Upper East	29 (11.4%)	20 (6.0%)	49 (8.3%)
Upper West	0 (0%)	2 (0.6%)	2 (0.3%)
Burkina Faso	0 (0%)	1 (0.3%)	1 (0.2%)
Ivory Coast	0 (0%)	2 (0.6%)	2 (0.3%)
Nigeria	3 (1.2%)	1 (0.3%)	4 (0.7%)
Togo	1 (0.4%)	0 (0%)	1 (0.2%)
Number Lifetime Sexual Partners¹			
1	26 (10.6%)	54 (16.4%)	80 (13.9%)
2	32 (13.1%)	94 (28.6%)	126 (22.0%)
3	40 (16.3%)	88 (26.8%)	128 (22.3%)
4+	147 (60.0%)	93 (28.3%)	240 (41.8%)
Age at First Sexual Intercourse (years)²	19.0 (SD 3.9)	17.8 (SD 2.8)	18.3 (SD 3.4)
Number of Partners in the Last Year			
0	23 (9.0%)	45 (13.4%)	68 (11.5%)
1	139 (54.5%)	261 (77.9%)	400 (67.8%)
2	55 (21.6%)	20 (6.0%)	75 (12.7%)
3	13 (5.1%)	5 (1.5%)	18 (3.1%)
4+	25 (9.8%)	4 (1.2%)	29 (4.9%)
Avg Number of Unprotected Partners in the Last Year³			
0	37 (14.6%)	58 (17.3%)	95 (16.1%)
1	152 (59.8%)	250 (74.6%)	402 (68.3%)
2	41 (16.1%)	20 (6.0%)	61 (10.4%)
3	9 (3.5%)	3 (0.9%)	12 (2.0%)
4+	15 (5.9%)	4 (1.2%)	19 (3.2%)

¹ Average number of sexual partners – males n=245; females n=329

² Average age at first sexual intercourse – males n=250; females n=325

³ Average number of unprotected sexual partners – males n=254

Table 2: Summary of Participants' Partners

Characteristics	Male	Female	Overall (n=688)
	N(%) or Mean (SD)	N(%) or Mean (SD)	N or Mean
Gender of Sexual Partner			
Female	360	0	360 (52.3%)
Male	0	328	328 (47.7%)
Age Comparison Between Sexual Partner and Participant ¹			
Older	40 (11.2%)	298 (91.1%)	338 (49.4%)
Same	28 (7.8%)	19 (5.8%)	47 (6.9%)
Younger	289 (81.0%)	10 (3.1%)	299 (43.7%)
Avg Age of Partners (Years) ²	22.8 (5.8)	29.4 (7.2)	25.8 (7.3)
How Well Participant Knew Partner			
Very Well	111 (30.8%)	86 (26.2%)	197 (28.6%)
Well	108 (30.0%)	105 (32.0%)	213 (31.0%)
Somewhat	97 (26.9%)	86 (26.2%)	183 (26.6%)
Not at All	44 (12.2%)	51 (15.5%)	95 (13.8%)
Expect to Have Sexual Intercourse with Partner Again ³			
Yes	203 (71.5%)	232 (85.0%)	435 (78.1%)
No	81 (28.5%)	40 (14.7%)	121 (21.7%)
Type of Relationship with Partner ³			
Spouse/Living as Married	72 (25.4%)	98 (36.0%)	170 (30.6%)
Fiancé/Promised to Marry	63 (22.2%)	89 (32.7%)	152 (27.3%)
Dating	86 (30.3%)	69 (25.4%)	155 (27.9%)
Casual Partner	49 (17.3%)	9 (3.3%)	58 (10.4%)
Commercial Sex Worker/Client	2 (0.7%)	0 (0%)	2 (0.4%)
One-time Only	12 (4.2%)	7 (2.6%)	19 (3.4%)
Partner's Economic Status ⁴			
Wealthy	7 (2.5%)	15 (5.6%)	22 (4.0%)
Middle Class/Average	124 (45.1%)	185 (68.5%)	309 (56.7%)
Poor	144 (52.4%)	70 (25.9%)	214 (39.3%)
Main Reason for Starting Relationship ⁵			
Want to Marry	51 (18.0%)	69 (25.3%)	120 (21.5%)
Social Pressure	4 (1.4%)	4 (1.5%)	8 (1.4%)
Wanted Partnership/Relationship	24 (8.5%)	29 (10.6%)	53 (9.5%)
Sex	38 (13.4%)	2 (0.7%)	40 (7.2%)
Physically Attracted to Him/Her	32 (11.3%)	5 (1.8%)	37 (6.6%)
Liked His/Her Personality	47 (16.5%)	41 (15.0%)	88 (15.8%)
In Love	48 (16.9%)	63 (23.1%)	111 (19.9%)
Money/Gifts/Assistance	3 (1.1%)	31 (11.4%)	34 (6.1%)

¹ Number of male participants = 357; Number of female participants = 327

² Number of male participants = 261; Number of female participants = 217

³ Number of male participants = 284; Number of female participants = 272

⁴ Number of male participants = 257; Number of female participants = 270

⁵ Number of male participants = 283; Number of female participants = 270

Convenience	1 (0.4%)	6 (2.2%)	7 (1.3%)
Adventure/Curiosity/Experimental/Fun	2 (0.7%)	0 (0%)	2 (0.4%)
Arranged	2 (0.7%)	2 (0.7%)	4 (0.7%)
Other	31 (10.9%)	18 (6.6%)	49 (8.8%)
Average Number of Sexual Intercourse Encounters ⁶	4.2 (4.4)	3.9 (3.7)	4.1 (4.1)
Average Number of Unprotected Sexual Intercourse Encounters ⁷	3.2 (4.6)	3.7 (3.7)	3.5 (4.2)
Number of Concurrent Partners ⁸	1.4 (5.4)	2.3 (9.1)	1.8 (7.5)

⁶ Number of male participants = 281; Number of female participants = 267

⁷ Number of male participants = 281; Number of female participants = 266

⁸ Number of male participants = 284; Number of female participants = 273

Table 3: Linear Regression for Age Difference Between Partnerships and Predictors

Variable	Bivariate Analysis		Multivariate Analysis	
	Coefficient	95% Confidence Interval	Coefficient	95% Confidence Interval
Female Gender	6.54	5.36, 7.71	2.88	-1.22, 6.98
Age (Years)	0.34	0.26, 0.42	0.32	0.12, 0.51
Gender*Age	0.07	-0.06, 0.21	0.16	0.03, 0.29
Well Known Partner?				
Very Well	0	--	0	--
Well	0.89	-0.82, 2.60	-0.39	-1.71, 0.94
Somewhat	0.92	-0.81, 2.65	0.53	-0.79, 1.86
Not at All	1.32	-0.89, 3.54	0.65	-1.09, 2.39
Expect Sexual Intercourse Again?				
No	0	--	0	--
Yes	0.59	-1.04, 2.21	0.01	-1.47, 1.50
Type of Relationship				
Spouse	0	--	0	--
Engaged	0.07	-1.65, 1.78	3.88	2.48, 5.29
Dating	-0.39	-2.13, 1.34	5.09	3.58, 6.61
Casual Partner	-0.17	-2.48, 2.15	4.57	2.56, 6.58
Commercial Sex	-6.40	-16.61, 3.82	4.20	-6.70, 15.10
One-time Only	1.32	-2.70, 5.33	4.85	1.50, 8.19
Partner's Economic Status				
Wealthy	3.79	0.17, 7.40	3.63	0.74, 6.51
Middle Class/Average	1.40	0.03, 2.77	0.68	-0.40, 1.75
Poor	0	--	0	--
Main Reason for Starting Relationship				
Non-Money Reasons	0	--	0	--
Money/Gifts/Assistance	3.85	1.00, 6.70	1.67	-0.58, 3.92

Frequency of Unprotected Sex ¹	-0.03	-0.19, 0.12	0.02	-0.10, 0.15
Number of Concurrent Partners	0.04	-0.12, 0.19	-0.06	-0.18, 0.06

¹ Number of times per month

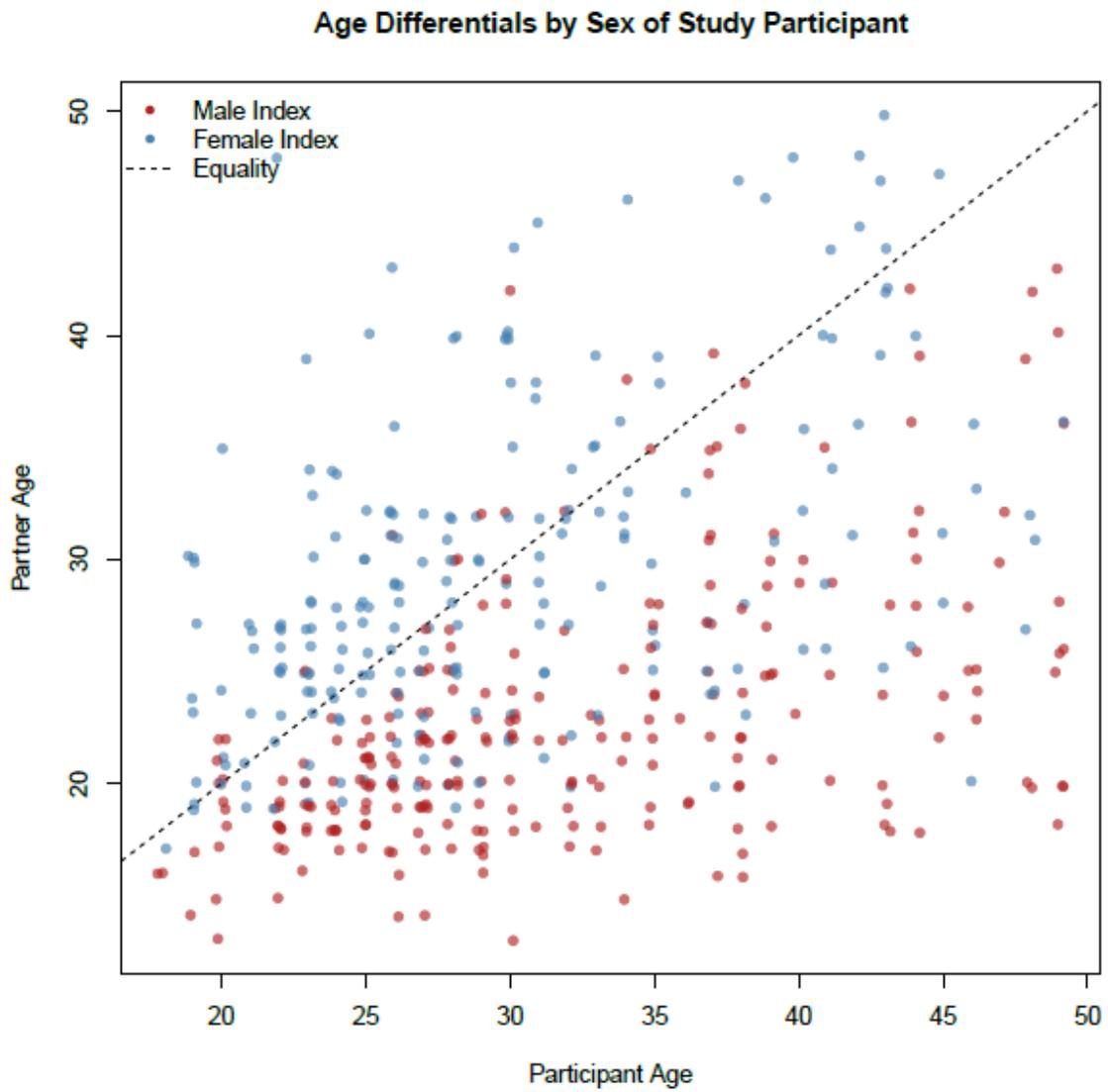
Table 4.1: Logistic Regression for HIV Status and Predictors

Variable	Odds Ratio	95% Confidence Interval
Male-Relative Age	1.00	0.93, 1.08
Age	1.00	0.92, 1.08
Gender of Participant	1.11	0.28, 4.30
Main Reason for Starting Relationship		
Non-Money Related Reasons	1.00	--
Money/Gifts/Assistance	3.33	0.64, 17.29
Frequency of Unprotected Sex	0.94	0.81, 1.10

Table 4.2: Logistic Regression for Ever Having a STD and Predictors

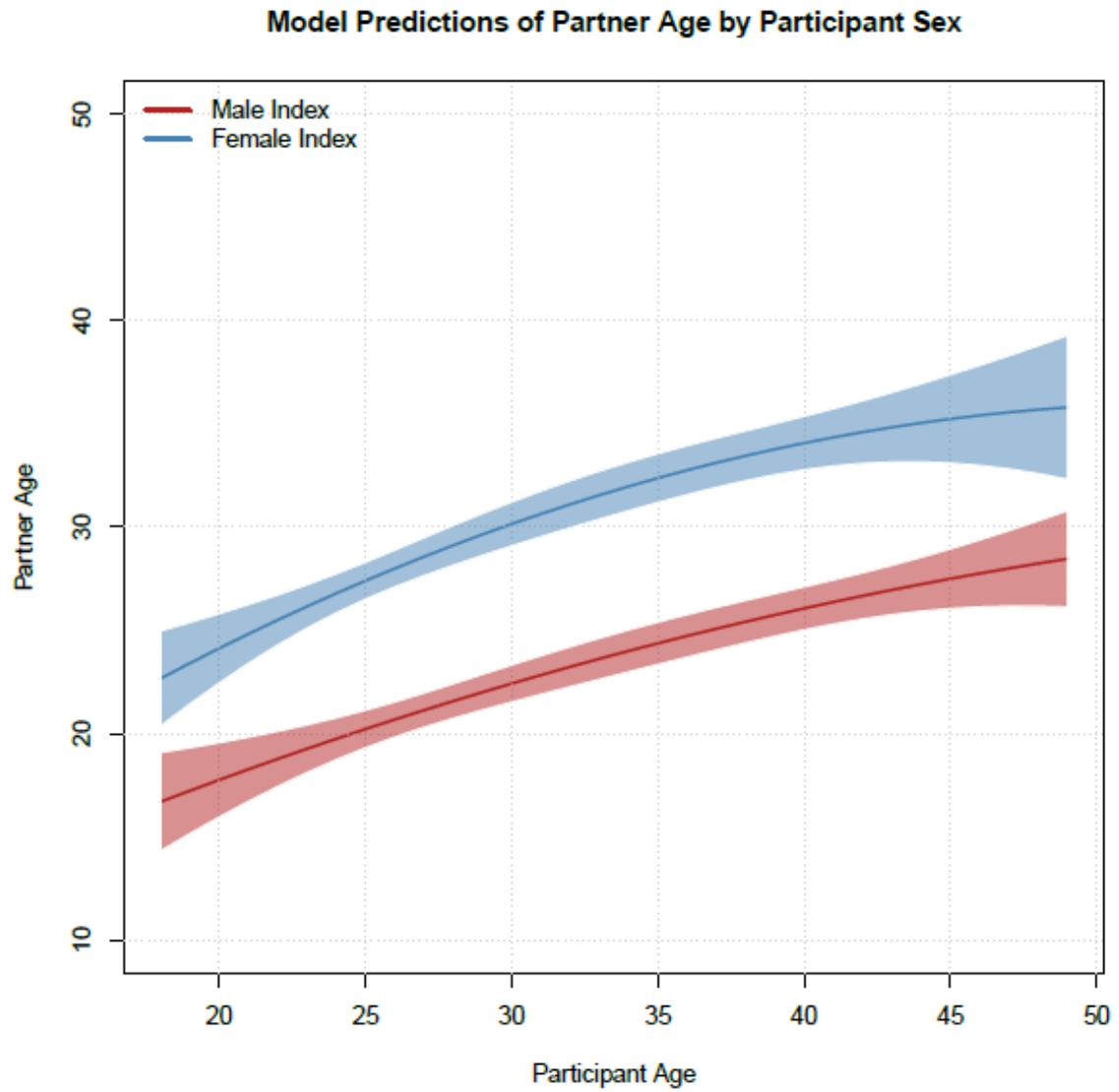
Variable	Odds Ratio	95% Confidence Interval
Male-Relative Age	1.04	1.00, 1.08
Age	1.04	1.00, 1.08
Gender of Participant	0.16	0.05, 0.58
Main Reason for Starting Relationship		
Non-Money Related Reasons	1.00	--
Money/Gifts/Assistance	4.40	1.05, 18.44
Frequency of Unprotected Sex	0.97	0.92, 1.03

Figure 1. Age Differentials by Sex



Most of the males lie below the equality line, indicating they have younger partners. Most of the females lie above the equality line, which indicates they have older partners.

Figure 2. Prediction of Partner's Age by Participant Gender



Women of all ages tend to have older partners than men of the same age.

References

- 1 Joint United Nations Programme on HIV/AIDS (UNAIDS), *Fact Sheet 2016*, 2016
http://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf
- 2 United States Federal Government – AIDS.gov, *HIV/AIDS 101: Global Statistics*, 2016. <https://www.aids.gov/hiv-aids-basics/hiv-aids-101/global-statistics/>
- 3 World Health Organization (WHO), *HIV/AIDS Fact Sheet*, 2016
<http://www.who.int/mediacentre/factsheets/fs360/en/>
- 4 Tsai AC, Subramanian SV. Proximate context of gender-unequal norms and women's HIV risk in sub-Saharan Africa, *AIDS*, 2012, vol. 26 3(pg. 381-386)
- 5 Kharsany ABM, Karim QA. HIV infection and AIDS in Sub-Saharan Africa: current status, challenges and opportunities, *Open AIDS J*, 2016, vol. 10(pg. 34-48)
- 6 The World Bank, *Ghana*, 2016
<http://data.worldbank.org/indicator/SH.DYN.AIDS.ZS?locations=GH>
- 7 Lagard E, Schim van der Loff, Enel C, Holmgren B, Dray-Spira R, Pison G, Piau JP, Delaunay V, M'Bou S, Ndoye I, Coeuret-Pellicer M, Whittle H, Aaby P. *Int J Epidemiol*, 2003, vol 32 5(pg. 744-752)
- 8 Deane KD, Parkhurst JO, Johnston D. Linking migration, mobility and HIV, *Trop Med Int Health*, 2010, vol 15 12(pg. 1458-1463)
- 9 Cassels S, Jenness S, Biney AAE, Ampofo WK, Dodoo FNA. Migration, sexual networks, and HIV in Agbogbloshie, Ghana, *Demographic Research*, 2014, vol. 31 28(pg. 861-888)
- 10 Sia D, Onadja Y, Hajizadeh M, Heymann SJ, Brewer TF, Nandi A. What explains gender inequalities in HIV/AIDS prevalence in sub-Saharan Africa? Evidence from the demographic and health surveys, *BMC Public Health*, 2016, vol. 16 1136
- 11 Dhai A. HIV and AIDS in Africa: social, political, and economic realities, *Theor Med Bioeth*, 2008, vol. 29 5(pg. 293-296)
- 12 Maughan-Brown B, Evans M, George G. Sexual behavior of men and women within age-disparate partnerships in South Africa: implications for young women's HIV risk, *PLoS One*, 2016, vol 11 8(online)
- 13 Genberg BL, Kulich M, Kawichai S, Modiba P, Chingono A, Kilonzo GP, Richter L, Pettifor L, Sweat M, Celentano DD. HIV risk behaviors in sub-Saharan Africa and

- Northern Thailand: baseline behavioral data from Project Accept, *J Acquir Immune Defic Syndr*, 2008, vol 49 3(pg. 309-319)
- 14 Ritchwood TD, Hughes JP, Jennings L, MacPhail C, Williamson B, Selin A, Kahn K, Gomez-Olive FX, Pettifor A. Characteristics of age-discordant partnerships associated with HIV risk among young South African women, *J Acquir Immune Defic Syndr*, 2016
 - 15 Toska E, Cluver LD, Boyes M, Pantelic M, Kuo C. From ‘sugar daddies’ to ‘sugar babies’: exploring a pathway between age-disparate sexual relationships, condom use, and adolescent pregnancy in South Africa, *Sex Health*, 2015, vol. 12 1(pg. 59-66)
 - 16 Luke N. Confronting the ‘sugar daddy’ stereotype: age and economic asymmetries and risky sexual behavior in urban Kenya, *Int Fam Plan Perspect*, 2005, vol. 31 1(pg. 6-14)
 - 17 R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>
 - 18 Vincent J Carey. Ported to R by Thomas Lumley and Brian Ripley. (2015). gee: Generalized Estimation Equation Solver. R package version 4.13-19. <https://CRAN.R-project.org/package=gee>
 - 19 Beauclair R, Kassanje R, Temmerman M, Welte A, Delva W. Age-disparate relationships and implications for STI transmission among young adults in Cape Town, South Africa, *Eur J Contracept Reprod Health Care*, 2012, vol. 17 1(pg. 30-39)
 - 20 Gregson S, Nyamukapa CA, Garnett GP, Mason PR, Zhuwau T, Chandiwana SK, Anderson RM. Sexual mixing patterns and sex-differentials in teenage exposure to HIV infection in rural Zimbabwe, *The Lancet*, 2002, vol. 359 9321 (pg. 1896-1903)
 - 21 Beauclair R, Helleringer S, Hens N, Delva W. Age differences between sexual partners, behavioural and demographic correlates, and HIV infection on Likoma Island, Malawi, *Sci Rep*, 2016, vol. 6 36121
 - 22 O’Leary A, Jemmott III JB, Sweet Jemmott L, Teitelman A, Heeren GA, Ngwane Z, Icard L, Lewis DA. Associations between psychosocial factors and incidence of sexually transmitted disease in South African adolescents, *Sex Transm Dis*, 2015, vol. 42 3(pg. 135-139)
 - 23 Harrison A. HIV prevention and research considerations for women in Sub-Saharan Africa: moving toward biobehavioral prevention strategies, *Afr J Reprod Health*, 2014, vol. 18 3(pg. 17-24)