The Early Antecedents of Sexual and Reproductive Health Knowledge in Late Adolescence and Early Adulthood: Evidence from a Longitudinal Survey in Ethiopia

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Abstract

We use data from four rounds of a longitudinal survey of adolescents and their families collected in southwestern Ethiopia to identify the impact of experiences during early adolescence on knowledge of HIV preventive methods, access to condoms, and contraception in late adolescence and early adulthood. The Jimma Longitudinal Family Survey of Youth conducted by investigators from Brown and Jimma Universities follows a sample of adolescents ages 13-17 at baseline for seven years. Results from multivariate analyses indicate that school engagement in early adolescence, participation in youth clubs, and early exposure to reproductive health services are all associated with better sexual and reproductive health knowledge at older ages when youth have entered or about to enter romantic relationships and sexual activity. The positive impact of early program interventions on knowledge at older ages provides support for family planning and safe sex interventions that target youth before they become sexually active.

Introduction

Sexual and reproductive health program interventions that target youth begin with the premise that knowledge is a necessary precondition for risk avoidance and preventive behaviors (Bandura 2004). Youth who possess incomplete or incorrect sexual and reproductive health knowledge are at a greater risk of sexual transmitted infections, HIV, and unwanted pregnancies. Many knowledge based interventions focus on youth in early adolescence and at even younger ages before they have begun sexual activity. Before and after participation program evaluation studies have demonstrated the effectiveness of many youth interventions, especially peer-to-peer based programs, in increasing knowledge of HIV preventive methods (Kirby 2007). However, little is known about the longer term effects of early program participation on knowledge, and the impact of early contact with other reproductive health services and outreach programs on knowledge at older ages when youth are sexually active or on the verge of transitioning into sexual activity. In this study we use multiple rounds of survey data from a longitudinal survey of Ethiopian youth to identify the early antecedents of sexual and reproductive health knowledge in late adolescence and early adulthood. In particular, we focus on the role of school engagement, participation in youth clubs, and contact with formal health services on knowledge of HIV preventive methods, access to condoms among men and women, and knowledge of modern contraceptive methods among women. Out results provide evidence of long-term effects of early educational experiences on sexual and reproductive health knowledge, and they point to key ages in the early life course where program interventions may be most effective.

Theory

Social cognitive theory provides the theoretical rationale for many youth centered sexual health programs (DiIorio, et al. 2001). It is concerned with the process of knowledge acquisition or

learning, which the theory posits occurs through the observation and modeling of what others do whether in the context of social interactions, experiences or media consumption. Because learning occurs primarily through observing, the environment within which one grows up has a big impact on development. The environment provides the models for learning and imitation, and it influences the range of expected outcomes the follow from different behaviors. In addition to social behavior and the environment, social cognitive theory emphasizes the importance of cognition on learning and individual development. Cognition refers to the gathering and processing of information, the application of information to problems and tasks, and the anticipation of how current actions affect future outcomes. It is the role of formal education to develop cognition in youth. Closely interconnected with cognition is self-efficacy. People with high self-efficacy set high goals for themselves and expect to experience positive outcomes. People with low self-efficacy do not believe their actions will make a difference and hence set low goals and aspirations for themselves, and they have no incentives to behave proactively. Self-efficacy is important for knowledge acquisition and developing cognitive competencies because resiliency and self-belief is necessary for sustained efforts.

We adapt to social cognitive theory to understand the potential influences of early life course experiences and social environments on sexual and reproductive health knowledge in late adolescence and early adulthood. We identify five determinants of knowledge that are derived from social cognitive theory: these include cognition, self-efficacy, planfulness, environment, and peer behavior and knowledge. Cognition is critical for recognizing the value of information, searching-out for it, making sense of it, and retaining it for application to future challenges. Early school engagement is critical to developing cognition. Youth who are fully engaged in school are

more likely to develop literacy, and analytical and information processing skills that facilitate the acquisition and retention of sexual and reproductive health knowledge. Self-efficacy influences the motivation to gather and process information. Youth who have a strong sense of influence over their future will make extra efforts to learn about preventive methods to avoid HIV and unwanted pregnancies. Closely related to self-efficacy is planfulness. Youth who make concrete plans for the future will develop strategies for realizing their plans, which includes becoming knowledgeable about methods of risk avoidance. The environment provides the social context within which learning occurs. Family, youth programs, and health outreach services are important social conduits for the transmission of sexual and reproductive health information to youth. Peer behavior and knowledge is the other principal source of information about sex and sex related matters for youth.

Data and Analysis

The data for this paper come from the Jimma Longitudinal Family Survey of Youth (JLFSY) conducted by investigators from Brown University and Jimma University. The JLFSY began in 2005-06 with a baseline household survey of approximately 3,700 households, and an adolescent survey of 2,100 youth ages 13-17. Subsequent follow-up surveys of the youth were conducted in 2006-07 and 2009-10, and of households in 2008-09. The study area includes the city of Jimma Town, population 120,000; three outlying market towns with populations of approximately 5,000 or less; and the rural areas immediately surrounding the market towns. Jimma Zone, which encompasses the study area, is in southwestern Ethiopia, and has a semi-tropical climate with rich agricultural soils and reliable rain fall. The city of Jimma Town and the outlying towns in the study area are connected by paved highways to the capital city of Addis Ababa, which is a six hour drive to the northeast. The rural population is ethnically Oromo and Moslem, and the

urban populations are ethnically and religiously diverse with a large presence of Orthodox and Protestant Christians. The rural economy is dominated by small landholding households with a mixture of staple crops for household consumption and cash crops. The primary cash crops are coffee and chat, a mildly narcotic leaf that is chewed as a stimulant and is popular in East Africa. The primary economic activities in the towns are petty commerce and services, and agricultural trade. The city of Jimma Town is the zonal center for health and administrative services, a major regional market center, and the location of a regional university with a resident student population of approximately 20,000-25,000.

A multi-stage stratified sample design was used in Jimma Town. The city is divided into three administrative units, and then further subdivided into a total of 21 kebeles which are the equivalent of neighborhoods. In the first stage, two neighborhoods were randomly selected from each of the three large administrative units with selection probabilities proportionate to size. In each of the selected neighborhoods, sampling frames were constructed by conducting a street-by-street enumeration of all households. Simple random sampling was then used to select households within each of the six neighborhoods. In the outlying towns and the surrounding rural areas, household registration lists maintained by the local authorities were used as sampling frames. A spot-check in the field of a subset of the household registration lists confirmed that they were accurate and complete. Simple random samples of households were drawn independently from each of the towns and rural areas. The total study sample includes 21 locations, six city neighborhoods, three towns, and twelve rural communities. Sample weights were developed to account for differential sampling probabilities across the locations and are used in the analysis.

The household survey interviews were conducted with the household head and the spouse of the head when present by multilingual (Amharic, Afan Oromo, and English) interviewers recruited from the study area. The baseline household survey collected demographic, occupational, and migration information for all current household members and independent adult children of the household head. It also collected extensive information on household assets, expectations of assistance and the provision of assistance through exchange networks, dietary diversity, and food insecurity. Up to one adolescent male and one adolescent female ages 13-17 were randomly selected from each household for a separate interview at a later date. The adolescent survey interviews were conducted by interviewers of the same sex as the respondent in a private space within the residential compound. The adolescent questionnaires collected information on educational, occupational and family expectations, school and work experience, health status and health seeking behavior, nutritional status, and sexual knowledge, attitudes, and practices. The survey questionnaires were developed in English, and then translated from English into the two dominant local languages, Amharic and Afan Oromo. The questionnaires were independently back-translated into English, and all three versions were compared question-by-question for accuracy by the interviewers and project directors collectively. The first round Amharic and Afan Oromo questionnaires and new questions in subsequent survey rounds were pre-tested with randomly selected samples of rural and urban households. For potentially sensitive questions regarding sex and mental health, the interviewers used a non-verbal response card that was specifically developed for this study to reduce social desirability bias. The non-verbal response card method was tested in rural and semi-urban communities adjacent to the JLFSY study area, and it's efficacy for reducing social desirability bias among adolescent and young adult respondents has been thoroughly documented (Lindstrom et al. 2010, 2012).

We restrict our analysis to respondents who completed all three adolescent survey rounds. From an initial round-one sample of 1,917 adolescent respondents, 1,464 youth completed the round-two and round-three adolescent surveys. The majority of the 30 percent of round-one respondents who were lost to follow-up moved to other locations in Ethiopia and abroad. Popular migrant destinations include the capital city Addis Ababa, other urban areas in Ethiopia, the Arab Gulf states, and Sudan.

We measure reproductive health knowledge with questions on HIV knowledge, condom knowledge, and contraceptive knowledge that were asked in the round-three survey when the youth were ages 17-21. The question on HIV knowledge asked the youth what a person can do to prevent infection of HIV. The interviewers prompted the respondents for all the methods they knew and checked-off their responses on a list of 14 preventive methods, which was pretested in the study area. The list included ineffective methods as well as the most commonly recommended preventive methods. Table 1 presents the percentages of male and female respondents who mentioned each of the eight most commonly reported preventive methods. Most youth identified abstain from sex, use condoms, and limit sex to one partner as ways to prevent HIV infection. Less than one-half of the youth mentioned avoid injections with unclean needles, and relatively few youth mentioned limit the number of sexual partners, avoid sex with persons who have many partners, avoid sex with sex workers, and avoid sex with intravenous drug users as preventive methods. Overall, the levels of HIV knowledge reported by male and female youth are fairly comparable, with the important exception of condoms. The percent of female youth who mentioned using condoms as a method for preventing HIV infection (70 percent) is significantly below the percent of male youth (83 percent) who reported the same.

[Table 1 about here]

The round-three questionnaire also asked youth whether they knew a place where they would feel comfortable obtaining condoms. Around one-in-four male youth and close to one-in-two female youth did not know a place where they would feel comfortable obtaining condoms. Finally, female respondents only were asked whether they had ever heard of the pill, the IUD, injectable contraceptives, and implants (Norplants) as ways women can avoid pregnancies when they have sex. All four methods are widely known among young women in the sample, with knowledge of the pill almost universal and recognition of the other three methods ranging from 70 to 92 percent. Nevertheless, a significant minority of women, close to one-in-five, only recognized two or fewer of the four female controlled methods.

Although knowledge of HIV, condoms, and contraceptives is fairly widespread among adolescents and young adults in the sample, a significant proportion of youth have incomplete knowledge, especially with respect to the importance of condoms for preventing HIV infection and knowing a place where condoms can be comfortably obtained. To model variation in reproductive health knowledge at ages 17-21 we developed measures of cognition, self-efficacy, planfulness, the family and health service environment, and peer behavior and knowledge. We also include in our models current relationship status and gender as control variables. Table 2 presents the definitions of the outcome and predictor variables and descriptive statistics for male and female respondents. At the time of the round-three survey roughly one-in-five male youth and one-in-four female youth had experienced first sexual intercourse. Virtually none of the males and around one-in-ten of the females were married. Most of the youth, 70 percent of the

males and 60 percent of the females, were not in a romantic relationship and had yet to have first sex.

[Table 2 about here]

To measure cognition we constructed four measures of early school engagement based on questions asked in the round-one survey when youth were ages 13-17. The measures include completed years of school by age 12, days per week worked on homework, frequency of school attendance, and the highest expected grade. Higher values on all four variables are associated with greater school engagement. All four variables are scored as zero for the 2.2 percent of youth who never attended school. The completed years of schooling by age 12 captures whether youth started primary school on-time, and whether they exited at an early age. Delayed entry into primary school is very common in the study area. Approximately 32 percent of youth started primary school at age eight or older. Youth who start school at older ages are unlikely to academically catch-up with their age peers, and are more likely than on-time starters to repeat grades and not complete primary (Nega 2012). We took the values for the four school engagement variables and constructed a composite index based on factor loadings derived from factor analysis. Cronbach's Alpha for the four variables is 0.58

We also constructed indexes of planfulness and self-efficacy based on questions asked in the round-three survey when the youth were ages 17-21. Planfulness is measured by nine questions on plans for the future, and self-efficacy is measured by seven questions all with strongly agree, agree, disagree, and strongly disagree as the response options. High values on the indexes correspond to high levels of planfulness and self-efficacy. Cronbach's Alpha is 0.73 for the nine questions on planfulness and 0.82 for the seven questions on self-efficacy. We include three

measures of early family environment: the mean years of schooling completed by the respondent's father and mother, the frequency with which parents reported they spoke with their children about HIV protection, and the frequency with which they spoke with their children about avoiding pregnancy. The questions on parental communication were asked of parents in the round-two household survey when the youth were ages 16-20. To measure the youth program and health services environment we use a question from the round-one survey on the number of clubs, youth groups, and societies in which the youth were members. There are many school-based and out-of-school clubs in the study area that are designed to encourage youth to develop high aspirations and adopt healthy behaviors. Many of the non-school based programs are operated by local and international NGO's and they all include sexual health education as part of their programmatic activities. The round-two survey asked youth whether youth had been to a formal health facility in the last six months, and whether they had ever heard of community based contraceptive distribution and community based reproductive health services, both of which were out-reach activities organized through the government health sector.

Finally, we include four measures of peer behavior and knowledge based on questions from the round-two and round-three adolescent surveys. The number of friends who had first sex out of the five closest same sex friends was asked when the youth were ages 14-18. Peer behavior and knowledge at the neighborhood or community level is measured by aggregating the knowledge of male and female respondents separately at the local level to produce the mean number of HIV preventive methods known by same sex 17-21 year olds, the percent of same sex peers ages 17-21 who know a place where they would be comfortable obtaining condoms, and the mean number of modern contraceptive methods known by female youth ages 17-21.

The descriptive statistics presented in Table 2 reveal that on most of the measures male and female youth have similar values with the exceptions of early contact with the health sector. Female youth are significantly more likely to have been aware of the existence of community contraceptive services at younger ages than males, and males were more likely to have used a health facility.

Table 3 presents the estimated bivariate correlations between each of the three outcome measures of sexual and reproductive health knowledge and the predictor variables. HIV and condom knowledge tend to be lower among females, married youth, and youth who have not had first sex and are not in a relationship. All of the measures of cognition, planfulness and self-efficacy have positive and significant relationships with HIV knowledge and condom knowledge, and with the exception of early school attendance, they all have a positive and significant relationship with contraceptive knowledge among females. Among the cognition, planfulness and self-efficacy variables, completed years of school by age 12 has the strongest relationship to HIV and condom knowledge. Most of the family and community environment variables are significantly correlated with sexual and reproductive health knowledge. Parent's education is positively correlated with knowledge in late adolescence and early adulthood. However, youth whose parents who reported talking frequently to them about HIV do not appear to have more knowledge about HIV preventive methods than other youth. On the other hand, parental communication about avoiding pregnancy does appear to be associated with slightly greater knowledge of where condoms can be comfortably obtained.

[Table 3 about here]

Contact with potential formal sources of information about sexual health and contraception at ages 13-17 is associated with more complete sexual health knowledge at older ages 17-21. Membership in youth clubs is associated with better knowledge on all three measures, and early awareness of contraceptive services is associated with greater condom and contraceptive knowledge. Also, youth who had contact with formal health services at ages 13-17 are more likely to report at ages 17-21 knowing a place where they would feel comfortable obtaining condoms, however, this early contact does not appear to have an impact on subsequent contraceptive knowledge among female youth. Peers also appear to be very important sources of sexual health knowledge. Having same-sex friends who have had first sex, and living in neighborhoods or communities where same-sex age peers have more knowledge are all associated with higher levels of individual sexual and reproductive health knowledge.

The descriptive results provide evidence that early educational experiences, planfulness, self-efficacy, family context, and reproductive health outreach activities in the form of youth clubs and community contraceptive services, have lasting positive effects on sexual knowledge in late adolescence and early adulthood. In the next section we use multivariate models to estimate the effects of these early experiences on knowledge at older ages net of other potential confounding variables.

Multivariate Results

We divide our analysis into three parts. First, we use multivariate regression models to estimate the relative net effects of each of the independent variables on the three outcomes, first using a composite index of school engagement and then using the four distinct measures of school engagement that we used to construct the index. Second, we estimate models of HIV knowledge

and condom knowledge that include all interactions with gender to test for significant gender differences in covariate effects. Finally, we estimate reduced models for each of the three outcomes that use the completed years of school by age 12 of the respondent's sibling rather than the respondent to test if early years of schooling is capturing a household-level effect rather individual cognition. We use linear regression to model the total number of HIV preventive methods known, binary logistic regression to model condom knowledge, and ordered logistic regression to model the number of modern contraceptive methods known.

Table 4 presents parameter results from the models predicting HIV knowledge, condom knowledge, and contraceptive knowledge. Of the three outcomes, the measures of school engagement, planfulness, and self-efficacy appear to have the strongest relationship with HIV knowledge. All three indexes have positive and highly significant effects on HIV knowledge. However, in the case of condom knowledge only school engagement is significant, and in the case of contraceptive knowledge, planfulness is significant and school engagement is marginally significant. The differences across outcomes in the effects of school engagement may relate to the nature of the knowledge that is being measured. HIV knowledge involves an understanding of how HIV is transmitted and how infection can be avoided, whereas condom and contraceptive knowledge relate to knowing where a method can be obtained and what types of methods are available. Of the three indexes, the index of school engagement has the most robust effects. In the models that use the four individual measures of school engagement rather than the composite index, the number of completed years of school by age 12 is the only measure that has positive and significant effects on all three measures of knowledge. Educational expectations are not a

significant predicator of any of the three measures of knowledge, and days spent on homework and school attendance have mixed or null effects.

[Table 4 about here]

In contrast to school engagement, planfulness and self-efficacy, family and community environment appear to matter less for HIV knowledge and more for condom and contraceptive knowledge. Parental communication about avoiding pregnancy has a positive and significant effect on youth knowing a place where they are comfortable obtaining a condom. However, there is no evidence that parental communication about HIV protection has any effect on youth knowledge about HIV prevention. Parent's education also does not appear to have any effect on HIV knowledge, nor on condom and contraceptive knowledge. Beyond the home environment, the sexual and reproductive health service environment does appear to make a difference in youth knowledge. Participation in youth clubs at younger ages is associated with both greater HIV prevention knowledge, and among women, greater contraceptive knowledge at older ages. We also find strong evidence that young people who were aware of community based contraceptive and reproductive health services at younger ages tend to have better condom and contraceptive knowledge at older ages. Knowing a place where one is comfortable obtaining a condom is also associated with having been to a health facility at younger ages.

Peer behavior and knowledge also appear to have significant effects on youth sexual and reproductive health knowledge. Perhaps not surprising, the number of same-sex friends who have had first sex is positively associated with knowing a place where one is comfortable obtaining condoms, but it is not significantly associated with HIV preventive knowledge or contraceptive knowledge. On the other hand peer HIV knowledge, condom knowledge, and

contraceptive knowledge at the neighborhood and community level all have a positive and significant relationship with individual youth knowledge.

The results presented in Table 4 provide clear evidence of the lasting effects of early school engagement, and family and community environment on young people's sexual and reproductive health knowledge at older ages. Early school engagement, participation in school clubs, and awareness of community based contraceptive and reproductive health services are all focal points for educational messaging and therefore are of great policy interest. We next estimated both of the HIV knowledge models (1a and 1b) and the condom knowledge models (2a and 2b) with interaction terms between gender (Male) and each of the other predictor variables to test for significant differences in covariate effects between male and female youth. Only two predictors in the HIV knowledge model had significant interaction terms (membership in youth clubs and days spent on homework), and four predictors in the condom knowledge model had significant interaction terms (never had sex and in a romantic relationship, school attendance, self-efficacy, and aware of community contraceptive services). The interaction effects indicate that early participation in youth clubs is associated with higher HIV knowledge among female youth but not among males, even though both sexes participate in youth clubs at approximately similar rates; and early awareness of community based contraceptive and reproductive health services has a significantly greater association with condom knowledge at older ages among male youth than female youth. On the other-hand higher self-efficacy is more important for condom knowledge among female youth than male youth. Overall, the general pattern of relationships between HIV and condom knowledge and school engagement, planfulness, self-efficacy, family

and community environment, and peer behavior and knowledge are very similar for young men and women.

The most robust covariate effects across outcomes and by gender were for school engagement and in particular for the number of completed years of school by age 12. Decisions about whether children begin primary school on-time or start at older ages are made primarily by the parents. At age six or seven children lack the agency to make the decision themselves on whether or not to attend school. A primary concern for our analysis is that the age at which children start school, or even whether they ever enroll in primary school, is heavily influenced by household level characteristics that are not captured by the variables we include in the models. Completed years of school by age 12 may be capturing unobserved household and community attributes. The presence of unobserved heterogeneity can bias our estimates of early school effects. In preliminary models not presented in this paper we included a composite index of household wealth, and a measure of household income, but neither variable had significant effects on HIV, condom or contraceptive knowledge. Nevertheless, completed years of school by age 12 may be capturing other unobserved household-level attributes that are related to both early school enrollment and sexual and reproductive health knowledge in late adolescence and early adulthood. To check for the robustness of the effect of completed years of school by age 12 we take advantage of sibling data. The JLFSY included 344 households in which one adolescent boy and one adolescent girl were interviewed in the round-one adolescent survey. In 248 of these households both the male and the female youth completed all three adolescent survey rounds. We used these 496 youth to first estimate reduced form models of HIV, condom and contraceptive knowledge that include the completed years of school by age 12, but not the other

three school engagement variables and planfulness and self-efficacy. We then estimated the same model using the sibling's completed years of school by age 12 rather than the value of the youth. By instrumenting the youth's early educational experience with that of the sibling, we can check whether early educational experience is capturing a household-level rather than and individual-level trait. Table 5 presents parameter results for the reduced form models using the observed years of early schooling and the sibling's years of school. For all three outcomes, observed years of early schooling has a positive and significant effect on knowledge, but the sibling's years of early schooling has no significant effect. These results provide additional evidence of the significant, long-term effects of early school experiences on sexual and reproductive health knowledge at older ages when youth are sexually active or about to become sexually active.

Discussion

Youth who are have incomplete knowledge about HIV prevention and the access points and range of contraceptive methods and services are at an elevated risk of STI's, HIV, and unwanted pregnancy when they become sexually active. Achieving a basic level of sexual and reproductive health knowledge among youth before they enter into sexual activity is a goal of sexual educational programs that target youth. The results from this study underscore the important influence of early adolescent experiences on subsequent knowledge, and they provide confirmation of the efficacy of outreach activities that expose youth to sexual health messaging at early ages. Social cognitive theory identifies cognition as an important component of the learning process. Our results for school engagement and early years of completed schooling are consistent with this emphasis. A formal education provides youth not only with literacy skills, but also the capacity to envision future outcomes and develop strategies to realize those outcomes. Education also develops in youth an appreciation of the value of information and the

skills to effectively use information for achieving goals. Ethiopian youth who do not attend primary school or who start late and are out-of-sync with their age peers are at distinct disadvantage with respect to information gathering and processing, and therefore are less likely than their more educated peers to possess complete sexual and reproductive health knowledge. Cognition is closely intertwined with planfulness and self-efficacy. Youth who value and develop plans for the future, and who believe they have the ability and power to achieve those plans, also tend to be more knowledgeable about HIV preventive methods. Planfulness was also significantly related to better contraceptive knowledge among women. Young women who envision and plan for a future recognize the importance of contraception for embarking on family building in a planned and intentional way.

The family and community environment within which youth grow-up also influences their sexual and reproductive health knowledge, but the influences are uneven. Parent's level of education and communication with children about HIV appear to have no effect on children's HIV preventive knowledge. It may be that many of the conversations that parents have with their children about HIV focus more on the dangers of contracting HIV than effective preventive methods. On the other hand, youth who have parents who communicate frequently with their about avoiding pregnancy tend to be more knowledgeable about where to find condoms than youth with little or no communication about the subjection from their parents. Beyond the home environment, we find strong evidence of the long-term influence of youth club participation on knowledge, but only for adolescent girls. In a socially and religiously conservative society, such as Ethiopia, youth clubs may be one of the few places that young women can access accurate information about sexual and reproductive health. In addition, the peer-to-peer communication

format of many of the youth clubs likely makes the clubs a place where young women feel safe and comfortable obtaining information. Because Ethiopian society is more tolerant of premarital sex among young men, adolescent males may have access to a wider range of sources of information. Exposure to reproductive health services and contact with the formal health sector during early adolescence also has a positive impact on contraceptive knowledge in late adolescence and early adulthood. Youth who had heard of community based contraceptive and reproductive health services are more knowledgeable about condoms and contraceptive methods at older ages. Contact with the formal health sector among young men is also related to better condom knowledge at older ages. This early connection between the formal health sector and HIV and condom knowledge, especially among young men, is critical because of the important role of health services in condom and contraceptive method distribution.

Beyond the family, school, and service environment, peer networks also influence sexual and reproductive health knowledge. The results suggest that youth behavior and knowledge at the more diffuse community level rather than within youth's most immediate friendship networks matters more for knowledge. The number of same-sex friends who had experienced first sex was important for knowing where condoms could be obtained, but had no impact on HIV preventive knowledge or contraceptive knowledge. It is not surprising that youth would turn to sexual activity friends to find out where it is easy to obtain condoms, but would not turn to friends to get information about HIV prevention or the range of contraceptive methods. In contrast to close friends, the level of sexual and reproductive knowledge among same sex age peers at the neighborhood or community level has a very strong influence on all three types of individual level knowledge. The strong community level peer effects likely proxy the range of services and

outreach activities at the local level, but they also likely capture diffusion effects and the opportunities to learn about sex and protective methods through broader friendship networks.

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Table 1. HIV, Condom, and Contraceptive Knowledge, Ethiopian Youth Ages 17-21, Jimma Longitudinal Family Survey of Youth 2005-2010.

Variable	Males %	Females %
HIV preventive methods known (ages 17-21)		
Abstain from sex	96.0	89.5
Use condoms	87.3	70.4
Limit sex to one partner	83.0	76.6
Avoid injections with unclean needles	40.0	43.4
Limit number of sexual partners	16.8	21.4
Avoid sex with persons who have many partners	5.9	6.5
Avoid sex with sex workers	4.8	2.2
Avoid sex with intravenous drug users	4.5	1.3
Know a place where comfortable obtaining condoms (ages 17-21)	72.5	53.1
Contraceptive methods known (women ages 17-21)		
Pill		95.8
IUD		69.9
Injectables		91.8
Implants		86.1
Number of observations	838	623

Table 2. Variable Definitions and Descriptive Statistics, Ethiopian Youth Ages 17-21, Jimma Longitudinal Family Survey of Youth 2005-2010.

Outcomes and explanatory variables	Percents/means Males	Females
Outcomes (ages 17-21)		
HIV preventive methods known: range 0-8	3.38	3.11
Know a place where comfortable obtaining a condom	72.5%	53.1%
Modern contraceptive methods known: range 0-4	NA	3.43
Relationship status (ages 17-21)		
Married	0.9%	10.2%
Ever had sex and unmarried	21.7%	16.6%
Never had sex and in romantic relationship	7.8%	13.1%
Never had sex and not in a relationship	69.6%	60.1%
Cognition, Planfulness and Self-efficacy		
Completed years of school by age 12: range 0-6.	4.48	4.61
Days spent on homework (ages 13-17): range 0-7, youth who never went to school scored 0.	2.22	2.00
School attendance (ages 13-17): range 0-4, higher values correspond to more regular attendance.	3.33	3.22
Educational expectations (ages 13-17): highest year of schooling expected or achieved for youth not in school.	13.50	13.65
School engagement (ages 13-17): index based on factor loadings from 4 questions (above) on school involvement and expectations, high values correspond to higher engagement, Cronbach's Alpha=0.58.	0.01	-0.01
Plans for future (ages 17-21): index based on factor loadings from 9 questions on future plans, high values correspond to more planfulness, Cronbach's Alpha=0.73.	-0.05	0.07
Self-efficacy (ages 17-21): index based on factor loadings from 7 questions on self-efficacy, Cronbach's Alpha=0.82.	-0.14	0.18
Family and community environment		
Parent's education: mean years of schooling completed by father and mother.	4.31	5.17
Parents discuss HIV protection (ages 16-20): parent's report, range 1-4, higher values correspond to greater frequency.	2.80	2.77
Parents discuss avoiding pregnancy (ages 16-20): parent's report, range 1-4, higher values correspond to greater frequency.	3.50	3.54
Membership in youth clubs (ages 13-17): clubs, groups, societies a member of.	0.60	0.57
Aware of community contraceptive services (ages 14-18): ever heard of comm. based contraceptive distribution or community based reproductive health services.	45.2%	73.5%
Been to a health facility in last six months (ages 14-18)	67.3%	50.6%
Peer behavior and knowledge		
Number of friends ever had sex (ages 14-18): 5 closest same sex friends, range 0-5.	0.72	0.75
Peer HIV prevention knowledge (ages 17-21): mean number of preventive methods known by same sex age peers in the neighborhood.	3.38	3.11
Peer condom knowledge (ages 17-21): % of same sex age peers in the neighborhood who know a place they are comfortable obtaining condoms.	80.0%	68.1%
Peer contraceptive knowledge (ages 17-21): mean number of contraceptive methods known by females age peers in the neighborhood.	NA	3.43
Number of observations	838	623

Table 3. Bivariate Correlations, HIV, Condom, and Contraceptive Knowledge with Explanatory Variables, Ethiopian Youth Ages 17-21, Jimma Longitudinal Family Survey of Youth, 2005-2010.

	Number of HIV preventive methods known	Know a place where comfortable obtaining condoms	Number of contraceptive methods known (women)
Variable	*r*	*r*	*R*
Male	0.111 ***	0.201 ***	NA
Relationship status (ages 17-21)			
Married	-0.087 ***	-0.102 ***	0.076 *
Ever had sex and unmarried	0.100 ***	0.207 ***	-0.020
Never had sex and in romantic relationship	0.006	0.078 ***	0.048
Never had sex and not in a relationship	-0.048 *	-0.175 ***	-0.065
Cognition, Planfulness, Self-efficacy			
School engagement	0.347 ***	0.295 ***	0.252 ***
Completed years of school by age 12	0.373 ***	0.328 ***	0.278 ***
Days spent on homework (ages 13-17)	0.067 **	0.222 ***	0.134 ***
School attendance (ages 13-17)	0.157 ***	0.053 **	0.057
Educational expectations (ages 13-17)	0.292 ***	0.179 ***	0.160 ***
Plans for future (ages 17-21)	0.249 ***	0.118 ***	0.318 ***
Self-efficacy (ages 17-21)	0.251 ***	0.081 ***	0.151 ***
Family and community environment			
Parent's education	0.287 ***	0.198 ***	0.152 ***
Parents discuss HIV protection (ages 16-20)	-0.057 *		
Parents discuss avoiding pregnancy (ages 16-20)	NA	0.065 **	-0.039
Membership in youth clubs (ages 13-17)	0.113 ***	0.079 ***	0.097 **
Aware comm. contraceptive services (ages 13-17)	NA	0.126 ***	0.242 ***
Been to health facility last 6 months (ages 13-17)	NA	0.181 ***	0.064
Peer behavior and knowledge			
Number of friends ever had sex (ages 14-18)	0.111 ***	0.140 ***	0.083 **
Peer HIV prevention knowledge (ages 17-21)	0.486 ***	NA	NA
Peer condom knowledge (ages 17-21)	NA	0.458 ***	NA
Peer contraceptive knowledge (ages 17-21)	NA	NA	0.269 ***
Number of observations	1362	1431	623

Note. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$

Table 4. Parameter Estimates from Linear Regression Models Predicting HIV Knowledge, Logistic Regression Models Predicting Condom Knowledge, and Ordered Logistic Regression Models Predicting Contraceptive Knowledge, Ethiopian Youth Ages 17-21, Jimma Longitudinal Family Survey of Youth 2005-2010.

	Number of HIV preventive methods known		Know a place where comfortable obtaining condoms		Number of contraceptive methods known (women)	
	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
Variable	β	β	OR	OR	OR	OR
Male	0.079	0.120 **	1.84 ***	1.91 ***	NA	NA
Relationship status (ages 17-21)						
Married	-0.158	-0.108	0.95	0.93	2.34 ***	2.43 ***
Ever had sex and unmarried	-0.034	-0.017	3.38 ***	3.37 ***	0.82	0.79
Never had sex and in romantic relationship	-0.060	-0.048	3.00 ***	3.02 ***	1.36	1.32
Never had sex and not in a relationship (ref)	NA	NA	1.00	1.00	1.00	1.00
Cognition, Planfulness, Self-efficacy						
School engagement	0.131 ***	NA	1.30 ***	NA	1.20 *	NA
Completed years of school by age 12	NA	0.078 ***	NA	1.12 ***	NA	1.17 ***
Days spent on homework (ages 13-17)	NA	-0.061 ***	NA	1.11 **	NA	0.96
School attendance (ages 13-17)	NA	0.039 **	NA	0.98	NA	1.11
Educational expectations (ages 13-17)	NA	0.022	NA	1.02	NA	0.98
Plans for future (ages 17-21)	0.093 ***	0.094 **	0.97	0.97	1.53 ***	1.53 ***
Self-efficacy (ages 17-21)	0.151 ***	0.141 ***	1.10	1.09	0.95	0.99
Family and community environment						
Parent's education	0.010	0.007	1.01	1.01	0.99	0.97
Parents discuss HIV protection (ages 16-20)	0.025	0.020				
Parents discuss avoiding pregnancy (ages 16-20)	NA	NA	1.35 ***	1.36 ***	0.93	0.95
Membership in youth clubs (ages 13-17)	0.060 *	0.062 **	0.99	0.98	1.28 **	1.23 *
Aware comm. contraceptive services (ages 13-17)	NA	NA	1.60 ***	1.51 ***	1.65 **	1.70 ***
Been to health facility last 6 months (ages 13-17)	NA	NA	1.40 **	1.37 **	0.98	0.98
Peer behavior and knowledge						
Number of friends ever had sex (ages 14-18)	0.008	0.009	1.11 **	1.09 *	0.98	0.99
Peer HIV prevention knowledge (ages 17-21)	0.777 ***	0.725 ***	NA	NA	NA	NA
Peer condom knowledge (ages 17-21)	NA	NA	1.04 ***	1.03 ***	NA	NA
Peer contraceptive knowledge (ages 17-21)	NA	NA	NA	NA	6.95 ***	6.37 ***

Note. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$

Table 4. (continued).

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
Constant (β)	0.543 ***	0.060	-3.98 ***	-4.73 ***	NA	NA
Threshold 0 (β)	NA	NA	NA	NA	2.30	2.64 *
Threshold 1 (β)	NA	NA	NA	NA	3.64 ***	3.98 ***
Threshold 2 (β)	NA	NA	NA	NA	4.71 ***	5.05 ***
Threshold 3 (β)	NA	NA	NA	NA	6.49 ***	6.85 ***
Adj R^2/Pseudo R^2 (Cox and Snell)	0.286	0.297	0.256	0.260	0.158	0.167
Number of observations	1362	1362	1461	1461	623	623

Note. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$

Table 5. Parameter Estimates from Linear Regression Models Predicting HIV Knowledge and Logistic Regression Models Predicting Condom Knowledge, Reduced Models using Observed Completed Years of School by Age 12 and Sibling's Completed Years of School by Age 12.Youth from Households with Two Adolescent Study Participants, Ethiopian Youth Ages 17-21, Jimma Longitudinal Family Survey of Youth 2005-2010.

	Number of HIV preventive methods known		Know a place where comfortable obtaining condoms		Number of contraceptive methods known (women)	
	Model 4a Observed years school	Model 4b Sibling's years school	Model 5a Observed years school	Model 5b Sibling's years school	Model 6a Observed years school	Model 6b Sibling's years school
Variable	β	β	OR	OR	OR	OR
Male	0.033	-0.018	1.25	1.15	NA	NA
Relationship status (ages 17-21)						
Married	-0.254	-0.377 *	0.71	0.61	2.07	1.52
Ever had sex and unmarried	-0.227	-0.186	2.55 ***	2.49 **	0.82	0.91
Never had sex and in romantic relationship	-0.160	-0.133	2.02 *	1.91	1.22	1.37
Never had sex and not in a relationship (ref)	NA	NA	1.00	1.00	1.00	1.00
Cognition						
Completed years of school by age 12	0.114 ***	-0.016	1.18 **	1.08	1.28 ***	0.94
Family and community environment						
Parent's education	0.030 *	0.046 ***	0.98	0.99	0.98	1.04
Parents discuss HIV protection (ages 16-20)	0.046	0.023	NA	NA	NA	NA
Parents discuss avoiding pregnancy (ages 16-20)	NA	NA	1.29	1.30	1.07	1.14
Membership in youth clubs (ages 13-17)	0.085	0.093 *	1.02	1.03	1.73 **	1.98 ***
Aware comm. contraceptive services (ages 13-17)	NA	NA	1.52	1.63 **	1.08	1.24
Been to health facility last 6 months (ages 13-17)	NA	NA	1.34	1.32	1.75 *	1.69 *
Peer behavior and knowledge						
Number of friends ever had sex (ages 14-18)	0.037	0.045	1.06	1.08	0.81 *	0.84
Peer HIV prevention knowledge (ages 17-21)	0.719 ***	0.900 ***	NA	NA	NA	NA
Peer condom knowledge (ages 17-21)	NA	NA	1.04 ***	1.04 ***	NA	NA
Peer contraceptive knowledge (ages 17-21)	NA	NA	NA	NA	5.83 **	10.95 ***

Note. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$

Table 6. (continued).

	Model 4a	Model 4b	Model 5a	Model 5b	Model 6a	Model 6b
Constant (β)	0.175	0.184	-4.02 ***	-3.91 ***	NA	NA
Threshold 0 (β)	NA	NA	NA	NA	3.36	4.93 **
Threshold 1 (β)	NA	NA	NA	NA	4.36 *	5.90 **
Threshold 2 (β)	NA	NA	NA	NA	5.60 **	7.11 ***
Threshold 3 (β)	NA	NA	NA	NA	7.46 ***	8.92 ***
Adj R^2/Pseudo R^2 (Cox and Snell)	0.271	0.249	0.264	0.258	0.208	0.178
Number of observations	424	424	496	496	184	184

Note. *** $P < 0.01$, ** $P < 0.05$, * $P < 0.10$