Individual- and Community-Level Influences on the Timing of Sexual Debut Among Youth in Nyanza, Kenya

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CONTEXT: *Delaying sexual debut is an important HIV prevention strategy, yet few studies have examined associations between both community- and individual-level characteristics and sexual debut among youth in Sub-Saharan Africa.*

METHODS: *Cross-sectional survey data collected from 8,183 youth aged 11–17 in 160 schools in Nyanza, Kenya, were used to examine the relationships between individual and community measures and the timing of sexual debut. Multilevel discrete-time hazard models were used to identify bivariate and multivariate associations.*

RESULTS: *At the individual level, youth were more likely to have initiated sex (or had done so at an earlier age) if they had felt pressure to engage in sex from a greater number of sources (odds ratios, 1.3–1.8); perceived that they had a small or (among females) moderate chance, rather than no chance, of contracting HIV (1.2–1.3); or endorsed a greater number of HIV transmission myths (1.1 for both sexes). In addition, males with higher abstinence self-efficacy had a reduced risk of sexual debut (0.95). At the community level, males and females had a reduced risk of sexual debut if they lived in a community where AIDS deaths were publicly acknowledged (0.6–0.8) or the Primary School Action for Better Health program had been implemented (0.8–0.95); risk was also reduced among young men who lived in communities where HIV was discussed at a greater number of parent-teacher association meetings (0.9) or where abstinence was the primary AIDS prevention message conveyed to youth (0.9).*

CONCLUSION: *Community-level variables are frequently associated with sexual debut and should be included in future research.*

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Although the global prevalence of HIV and AIDS has declined substantially, Sub-Saharan Africa continues to have the largest share of the global HIV burden.[1] In Kenya, the prevalence of HIV has stabilized in recent years at 6%.[2,3] It is important to acknowledge, however, that HIV prevalence differs among the country's various demographic groups and regions. For instance, individuals aged 15–24 continue to be disproportionately affected by the epidemic and account for about 60% of new HIV infections.[3] Also, Nyanza Province, which borders Lake Victoria in southwestern Kenya, has a prevalence of 15–20%, the highest of any province in the country.[3,4] The HIV burden among youth in this province is particularly high (22%),[3] and young women are twice as likely as young men to be HIV-positive.[5] The vulnerability of youth in Nyanza to HIV is attributable in part to risky sexual behaviors, including early sexual debut; sexual intercourse begins earlier for youth in Nyanza than for their counterparts in other parts of the country.[6] Compared with their same-aged peers, young people who initiate sex at an early age are sexually active for a longer period of time, are more likely to have multiple partners and have an increased risk of contracting HIV.[7–10] Delaying initiation of intercourse has thus become a prime goal for interventions in Sub-Saharan Africa.[11,12]

Previous studies that examined the timing of first sexual intercourse among youth, including our own work, have focused largely on individual-level variables.[13–16] Although a few studies have acknowledged the relevance of structural and community variables, they have rarely established empirical connections between these variables and sexual debut.[4,17–19] This study, which applies multilevel discrete-time hazard models to data collected from youth in Nyanza, fills an important research gap by examining the association of both individual-level and school- and community-level variables with the timing of first sexual intercourse. The addition of school and community variables is crucial, given that effective and well-designed HIV prevention programs usually attempt to achieve results at multiple levels (e.g., individual, school, community).

THEORETICAL PERSPECTIVES

To examine youths' vulnerability to risky sexual behaviors (operationalized here as early sexual intercourse), we adopt two theoretical models: the Information-Motivation-Behavioral Skills (IMB) model developed by Fisher and Fisher[20,21] and Catherine Campbell's community characteristics framework.[22] The IMB model has demonstrated effectiveness in predicting HIV risk behaviors, including sexual initiation, and has been particularly useful in designing HIV intervention programs.[20,21,23] The model spec-

ifies that individuals will engage in self-protective behaviors, such as delaying sexual debut, when they know that such behaviors reduce their risk of infection, are motivated to engage in the behaviors, and have the requisite skills and self-efficacy to do so.

In our earlier application of the IMB model to Kenyan and Nigerian data, all components of the model proved useful in explaining the timing of first sex.[4] However, our use of only individual-level variables limited the predictive power of those models; some researchers have observed that models of health behavior that focus exclusively on cognitive and intrapersonal measures have limited relevance and that the culture, socioeconomic environment[24–26] and structural contexts in which individual-level decisions are made must also be examined.[22,25,27] Others have noted that research has largely overlooked the role of community-level variables in shaping the sexual behaviors and reducing the HIV risks of adolescents in Sub-Saharan Africa.[28,29] In particular, there is a dearth of research on and a lack of understanding of how such structural characteristics are associated with the timing of sexual debut. The focus on structural variables, such as those related to school and community, is vital because social norms and the socioeconomic environment in some African countries are consistent with a culture of sexual risk-taking.[28,30] Several studies have demonstrated that the school environment, community norms and participation in community festivals are positively or negatively associated with risky sexual behaviors; the majority of these studies found that school-based HIV-prevention programs, and the resources made available to students within schools, reduced the likelihood of early sexual debut and other risky sexual behaviors.[16,25,31–33]

A few studies have also documented associations between community-level variables and sexual behavior. For instance, using the Cape Area Panel Survey, Tenkorang and colleagues demonstrated that youth living in communities with high levels of poverty were more likely than those living in wealthier communities to engage in risky sexual behaviors.[26] Ajuwon et al. showed that some community norms and traditions, as well as community festivals, encouraged or provided an opportunity for unprotected intercourse in rural areas of Nigeria, especially among youth.[34] An important component of the Primary School Action for Better Health (PSABH) program, an intervention delivered and evaluated in Nyanza by the second author, was to mobilize school and community resources (including training teachers to deliver an HIV education program) to address the many challenges that youth face in negotiating safer sex and avoiding HIV infection. The PSABH program was tested in diverse communities that were vulnerable to HIV in different ways, and the evaluation focused on how the various communities responded to the threat of AIDS and to the PSABH intervention itself.[35]

The framework adopted by the PSABH program is consistent with the multilevel approach that numerous public health experts and sociologists have called for to address the HIV epidemic. Campbell's framework may be particularly useful.[22] Campbell's model focused on several community characteristics that are associated with reduced vulnerability to HIV infection. These include the availability of information and resources related to HIV prevention, awareness of the sociocultural conditions that predispose youth to risky behavior, the community's commitment to address threats posed by HIV and the presence of social networks that support behavioral changes among youth. Our own attempt at modeling Campbell's framework to explain condom use among youth in Nyanza indicated that the model was a good bridge between community- and individual-level analyses.[25] Elsewhere, Campbell and colleagues found that the absence of such community characteristics in South Africa undermined young people's ability to protect themselves against HIV infection.[22] Using survey data collected from young people and community members, we examine the association of the cognitive dimensions of the IMB model and the community characteristics outlined by Campbell with the timing of sexual debut among school-going youth in Nyanza.

METHODS

Sample and Data

We analyzed cross-sectional data from 8,183 students aged 11–17 in standards (grades) six and seven who were attending 160 public schools in Nyanza in 2003. Schools were selected using stratified proportional random sampling; from each of the 11 school districts in Nyanza, we randomly selected 8–20 primary schools (the number was proportional to the district's size). Each school was situated in a different community. All students in attendance on data collection days were invited to complete the study survey in gender-segregated classrooms. After the students provided consent, a researcher read the survey aloud in English and Kiswahili while students marked their answers on their own printed copies. School- and community-level data were collected through researcher observations as well as interviews with 8–20 adult key informants (mean, 13) in each community; the informants included tribal and religious leaders, traditional leaders, leaders of women's groups and parents of adolescents.

Ethical Considerations

The research procedures were reviewed and approved by the research ethics board at the University of Windsor, by the Federal Ministry of Education in Kenya and by the District Commissioner of Education in Nyanza. Parents and students were informed about the nature and date of data collection, and students were encouraged to remain at home if they did not wish to participate in the survey. Records from participating schools documented that daily attendance ranged from 31% to 100% (mean, 76%). According to head teachers, attendance on data collection days was not significantly different from that on regular days. To maintain participants' confidentiality, researchers encouraged students to remain in their seats for the dura-

TABLE 1. Selected characteristics of youth in standards 6 and 7, by gender, Nyanza, Kenya, 2003

Characteristic	Males (N=4,146)	Females (N=4,037)
PERCENTAGE DISTRIBUTIONS		
Age		
11–12	7.1	9.9
13–14	35.4	41.1
15–16	43.9	41.1
17	13.7	8.1
Age at first sex*		
Never had sex	44.3	73.3
≤12	36.0	15.7
13–14	12.8	7.7
15–16	5.4	2.7
17	1.4	0.7
Ethnicity		
Luo	57.4	55.7
Kissii	34.9	37.1
Other	7.7	7.2
Religion		
Catholic	48.2	45.1
Protestant	45.4	51.3
Other	6.4	3.6
Perceived risk of HIV		
No chance at all	36.9	54.6
Small chance	25.4	17.2
Moderate chance	14.5	11.7
Great chance	23.2	16.5
Knew someone in village who died of AIDS		
No	45.5	40.3
Yes	51.3	57.1
Does not know	3.2	2.6
Total	100.0	100.0
MEANS		
Socioeconomic status (range, 22.7 to 100.0)	56.0	57.0
Sexual pressure (range, –0.87 to 2.56)*	0.13	–0.13
Knowledge about AIDS (range, –2.09 to 0.94)*	0.02	–0.01
Transmission myths endorsed (range, –1.08 to 1.49)	0.00	–0.02
Talked to male relatives about AIDS (range, –1.89 to 2.46)*	0.39	–0.40
Talked to female relatives about AIDS (range, –2.00 to 1.84)*	–0.48	0.49
Sought information about AIDS (range, –2.08 to 1.33)*	–0.03	0.03
Condom use self-efficacy (range, –2.55 to 1.61)*	0.14	–0.15
Abstinence self-efficacy (range, –2.79 to 1.93)*	–0.07	0.08

*p<.05. *Note:* Percentages may not total 100.0 because of rounding.

tion of the survey, to leave their papers blank if they preferred not to participate (or to leave blank any questions they did not wish to answer), and to return their survey even if they did not complete it. Only 81 surveys (1%) were missing responses for one-third or more of the questions; these surveys were omitted from the database.

Measures

• *Dependent variable.* Our dependent variable was age at first sex. Respondents were asked if they had ever had intercourse (defined as penile-vaginal penetration) and, if so, their age at first sex (categorized as 12 or younger, 13–14, 15–16 or 17 or older).

• *Individual-level variables.* We included a number of self-reported demographic variables as controls. Religion was categorized as Catholic, Protestant or other, and ethnicity as Luo, Kissii or other. A locally derived, continuous measure of socioeconomic status was also employed. Duration dummies (to adjust for the length of time in which sexual debut would have been experienced) were included in all multivariate analyses.

We also included variables that capture components of the IMB model or of Campbell's framework. The first component of the IMB model (information) was measured using two multidimensional scales that assessed whether respondents could identify the truthfulness of six factual statements and six local myths related to HIV prevention. The factual items concerned whether the risk of AIDS can be reduced by avoiding sexual intercourse, having fewer sexual partners, not sharing razor blades, being faithful to an uninfected partner, using condoms and making sure injections are done with clean needles. All six loaded on the same latent construct according to the factor analysis option in LISREL. Responses were coded such that higher values on the resulting scale indicated greater knowledge about HIV. The scale was relatively reliable (Cronbach's alpha=0.82).*

The six items concerning local myths asked whether HIV can be transmitted by wearing clothes of infected individuals, by mosquito bites, by sharing food, by having sex with thin people or by shaking hands; and whether it can be avoided by eating a good diet. Higher values on this scale indicate endorsement of a larger number of myths about HIV transmission. Cronbach's alpha was 0.78.

Campbell's model identified several indicators of respondents' experiences with social support that may reflect their vulnerability to HIV infection. To assess whether students accessed social support as a source of information, we asked them whether they had communicated with family members about HIV and AIDS and whether they had tried to obtain information about HIV from various sources. For the first of these measures, students were asked to specify the family members with whom they had discussed issues related to HIV or AIDS; we used their responses to create two latent constructs: communication with male relatives (father, uncle, older brother, grandfather) and communication with female relatives (mother, aunt, older sister, grandmother). Cronbach's alpha was 0.72 for each. The second question assessed the number of the following sources from which the students had sought information about HIV: the school's question box, a teacher, a parent, the school's information corner and the school's health club. Responses were summed to create a weighted measure (Cronbach's alpha=0.70 for each).

To assess characteristics associated with the motivational axis of the IMB model, we used two variables related to motivation to engage in or delay sexual intercourse: perceptions of one's chances of acquiring HIV and perceived

*All scales were created using principal component analysis or factor analysis and represent the sum of unit-factor scores. The underlying factor scores were extracted on the basis of the identified items or indicators. Because they are standardized, the scales can have positive and negative values.

pressures to have sex. Response options for the former were no chance at all, small chance, moderate chance or great chance. Perceived pressure to have sex was measured using a scale consisting of items asking students if they had ever felt pressured to have sex for the following reasons: their bodies had "pushed them"; their friends had encouraged them; an older person had encouraged them; their boyfriend or girlfriend had wanted to have sex; they would receive money or gifts; someone had arranged for them to have sex; they had not known how to resist their partner; they had watched someone else have sex; or someone had physically forced them. All items loaded on a single latent construct we call sexual pressure. Factor loadings ranged from 0.49 to 0.69; Cronbach's alpha was 0.75. Higher positive values on this scale indicate pressure from a greater number of sources.

For the behavioral component of the IMB model, we used five items to assess respondents' self-efficacy to abstain from sex and to use a condom. Youth were asked whether they believed that they could say no to sex, would be able to have a boyfriend or girlfriend for a long time without having sex, could tell their boyfriend or girlfriend that they planned to abstain from sex until marriage, could tell their boyfriend or girlfriend about condoms, or could insist on condom use during sex. Responses to these questions were on a five-point Likert scale ranging from "definitely yes" to "definitely no." The first three items loaded on a latent construct that we term abstinence self-efficacy, while the last two items loaded on a construct we call condom use self-efficacy. Cronbach's alpha for both scales was 0.59; factor loadings ranged from 0.54 to 0.79.

• *School and community-level measures.* Given that the majority of African youth begin having sex when they are of school-going age, schools are often considered an important site for HIV prevention programs. Moreover, schools and communities have established mechanisms for reaching students and promoting prevention programs. We measured community commitment to prevention by determining, through researcher observations and interviews with adult community members, whether HIV prevention information and motivational messages were incorporated into community festivals. Such messages included promotion of abstinence, monogamy and HIV testing, as well as messages about condoms (both those supporting condom use and those condemning it). A second variable assessed the nature of the predominant HIV prevention message within schools and communities; messages were coded as either promoting abstinence or other. The latter category included messages about the biology of HIV and AIDS, such as what the virus does once it enters the body; nonspecific behavior change; acceptance of people living with HIV and AIDS orphans; encouraging students to talk about HIV and AIDS; and condoms.

Community awareness of HIV and AIDS was measured using an item that asked students whether they lived in communities where it was publicly acknowledged at funerals that AIDS was the cause of death. We expected that students living in communities where AIDS deaths were publicly acknowledged would be more aware than other youth of the severity of the disease, which would motivate them to refrain from behaviors (such as early sexual debut) that could put them at risk of contracting HIV. In addition, we included in our analysis a number of school indicators that captured Campbell's concept of "availability of resources for HIV prevention." These included the number of parent-teacher association (PTA) meetings in the past year at which HIV or AIDS was discussed, whether the PSABH program had been implemented at the school and whether pupils had access to condoms in their communities.

Community awareness of social and cultural practices that contribute to HIV transmission was measured by asking community leaders to name community events and customs they believed exposed students to HIV infection. For example, respondents mentioned such cultural practices as circumcision, widow cleansing,* the use of herbs to dry a woman's vagina in preparation for intercourse, choking a woman to make her more receptive to sex (and other types of sexual coercion), and holding student-oriented

TABLE 2. Selected characteristics of school communities, Nyanza, Kenya, 2003

Characteristic	% or mean (N=160)
PERCENTAGE DISTRIBUTIONS	
Most important HIV message for youth	
Abstinence	47.5
Other	52.5
Deaths due to AIDS publicly acknowledged	
No	92.5
Yes	7.5
HIV programs incorporated into festivals	
No	22.0
Yes	78.0
Primary school received PSABH program	
No	37.1
Yes	62.9
Pupils can get condoms	
No	29.6
Yes	70.4
HIV risk from traditional practices	
No	20.1
Yes	79.9
HIV risk from social events	
No	20.8
Yes	79.2
Total	100.0
MEAN	
No. of PTA meetings where HIV/AIDS discussed (range, 0–9)	1.5

Notes: PSABH=Primary School Action for Better Health. PTA=Parent-teacher association.

*This ritual requires widows to have unprotected sex with an inheritor, typically a relative of her deceased husband.

TABLE 3. Odds ratios (and standard errors) from bivariate multilevel discrete-time hazard models examining associations between selected characteristics and sexual debut, by gender

Characteristic	Males	Females
INDIVIDUAL LEVEL		
Time/duration		
≤12 (ref)	1.00	1.00
13–14	0.35 (0.05)**	0.23 (0.07)**
15–16	0.16 (0.10)**	0.09 (0.12)**
17	0.13 (0.17)**	0.10 (0.24)**
Ethnicity		
Luo (ref)	1.00	1.00
Kissii	1.09 (0.07)	0.73 (0.13)**
Other	0.79 (0.12)	0.46 (0.23)**
Religion		
Catholic (ref)	1.00	1.00
Protestant	1.02 (0.04)	0.87 (0.07)*
Other	0.96 (0.08)	0.83 (0.17)
Perceived risk of HIV		
No chance at all (ref)	1.00	1.00
Small chance	1.34 (0.05)**	1.86 (0.07)**
Moderate chance	1.09 (0.06)	1.58 (0.09)**
Great chance	1.16 (0.05)**	1.20 (0.09)*
Knew someone in village who died of AIDS		
No (ref)	1.00	1.00
Yes	1.14 (0.03)**	1.35 (0.07)**
Does not know	1.13 (0.10)	1.40 (0.17)*
Socioeconomic status	1.01 (0.02)	1.01 (0.03)
Sexual pressure	1.58 (0.03)**	2.11 (0.04)**
Knowledge about AIDS	0.89 (0.02)**	0.88 (0.04)**
Transmission myths endorsed	1.13 (0.02)**	1.24 (0.04)**
Talked to male relative about HIV/AIDS	1.03 (0.02)	1.04 (0.04)
Talked to female relative about HIV/AIDS	1.03 (0.02)	1.07 (0.03)*
Sought information about AIDS	0.98 (0.02)	0.98 (0.04)
Condom use self-efficacy	1.02 (0.02)	1.12 (0.04)**
Abstinence self-efficacy	0.94 (0.02)**	1.01 (0.04)
SCHOOL/COMMUNITY LEVEL		
Most important HIV message for youth		
Abstinence	0.85 (0.07)*	0.90 (0.13)
Other (ref)	1.00	1.00
Deaths due to AIDS publicly acknowledged		
No (ref)	1.00	1.00
Yes	0.86 (0.14)	0.40 (0.32)**
No. of PTA meetings where HIV/AIDS discussed	0.95 (0.04)	1.01 (0.05)
Primary school received PSABH program		
No (ref)	1.00	1.00
Yes	0.87 (0.07)*	0.76 (0.13)*
HIV risk from traditional practices		
No (ref)	1.00	1.00
Yes	1.05 (0.10)	1.23 (0.17)
HIV risk from social events		
No (ref)	1.00	1.00
Yes	0.97 (0.09)	1.00 (0.19)
HIV programs incorporated into festivals		
No (ref)	1.00	1.00
Yes	1.29 (0.10)**	1.24 (0.17)
Pupils can get condoms		
No (ref)	1.00	1.00
Yes	1.02 (0.08)	0.80 (0.14)

*p<0.05. **p<0.01. *Notes:* PSABH=Primary School Action for Better Health. PTA=Parent-teacher association.

social events and activities (e.g., movie nights) in which youth are not supervised by adults. Finally, we created a dichotomous variable indicating whether any informants reported that community customs increased the risk of HIV transmission and a similar measure related to social events.

Analysis

We used discrete-time hazard models to examine associations between selected independent variables and the dependent variable, age at first intercourse. The discrete-time hazard model is often preferable to a continuous time model when the time units of the dependent variable are large and the problem of ties is imminent, as in this case where both age at first sex and age were measured in completed years. Like all event history techniques, discrete-time hazard models allow right censoring (the inclusion) of individuals who have not yet experienced the event in question (in this case, sexual debut).

The use of a discrete-time hazard model requires that our unit of analysis be the person-period (i.e., each individual contributes data on each predictor for each time period, in this case a year) rather than the individual.[36,37] After transforming the data accordingly, we had a total of 106,068 observations–51,900 for males and 54,168 for females. The application of this technique required the creation of a series of dummy variables for each individual indicating whether he or she had experienced sexual intercourse at each time point.

The structure of the data, which has individuals nested within schools, poses challenges for the application of standard regression techniques, as the assumption of independence may be violated because of clustering. To deal with this problem, we employed a multilevel strategy.*

RESULTS

• *Descriptive.* On average, males and females were similar in age (14.7 vs. 14.4 years). The full range of ages (from 11–12 to 17) was present in both standards six and seven. The proportion of youth in older age categories was

*We specify the model as $\text{log}it(P_{itj})=\alpha_0+\sum_{h=1}^{r}\beta_h X_{hitj}+\mu_{0j}$, where $\text{log}it(P_{itj})$ is the log odds of pupil i of school j experiencing first sex at period t; α_0 is the population mean; χ_{hitj} are independent variables at the individual or school level; $\beta_h(h=1,.....,r)$ are the corresponding regression coefficients and *r* is the number of covariates; and u_{0j} is the random deviation from the population average for school *j* or school-level random effect, which is normally distributed with a mean of zero and variance of σ_u^2. Clustering across schools was estimated using the intraclass correlation ρ, calculated here as the ratio of the variance at the school level to the sum of the variances at the individual and school levels. The regression coefficient β can be exponentiated and interpreted as an odds ratio, such that respondents with a given characteristic have higher odds of having had sex or had had first sex at an earlier age (compared to those in the reference category) if $\exp^{\beta}>1$. Conversely, $\exp^{\beta}<1$ indicates lower odds of having had first sex or having had a later age at sexual initiation. (Sources: Raudenbush SW and Bryk AS, *Hierarchical Linear Models: Applications and Data Analysis Methods,* Thousand Oaks, CA: Sage Publications, 2003; Goldstein H, *Multilevel Statistical Models,* London: Edward Arnold, 1995; and Callens M and Croux C, The impact of education on third births: a multilevel discrete-time hazard analysis, *Journal of Applied Statistics*, 2005, 32(10):1035–1050.)

higher among males than among females (Table 1, page 70), reflecting the common phenomenon of females leaving school at an earlier age than males because of family expectations (e.g., to provide care for younger siblings or to help with household and gardening chores) or as a result of pregnancy. The age-by-grade and age-by-sex distributions are consistent with data collected using the same methods in six additional regions of Kenya 2–4 years after the Nyanza study.[35]

Young men were more likely than young women to have had sexual intercourse (56% vs. 27%). In addition, a larger proportion of males than females had had sex by age 12 (36% vs. 16%) and by age 14 (49% vs. 23%). Among both males and females, the majority of respondents identified as Luo (56–57%) or Kissii (35–37%), and most reported that they were Protestant (45–51%) or Catholic (45–48%). More than half of youth indicated that they knew someone in their village who had died of AIDS, yet most thought they had little or no chance of contracting HIV.

Mean socioeconomic status scores were similar for the two sexes. However, compared with females, males reported feeling pressure from a greater number of sources to engage in sexual intercourse, a finding consistent with our earlier observation of higher levels and earlier onset of sexual activity among males than among females.

On the IMB indicators, males scored higher than females on the knowledge scale, and both scored low on the myth endorsement scale. Communication with relatives about HIV and AIDS differed by gender: Males had communicated with a greater number of male relatives than females had, while females had talked to more female relatives than males had. Female students showed greater commitment than males to seeking information about HIV and AIDS. Self-efficacy for condom use was higher among males than among females, which is not surprising given that male condoms are far more accessible than female condoms in most of Sub-Saharan Africa and that the power dynamics governing sexual relationships usually favor men. However, abstinence self-efficacy was greater among females than among males.

In 48% of communities, the predominant HIV prevention message for youth was abstinence (Table 2). However, AIDS deaths were not publicly acknowledged in 93%. In the majority of communities, HIV programs were incorporated into festivals (78%), the PSABH program had been presented at the primary school (63%), condoms were available to pupils (70%) and community leaders identified at least one cultural practice or social event that contributed to students' vulnerability (79–80%). On average, HIV-related messages were discussed 1.5 times per year at PTA meetings.

• *Bivariate.* Among both males and females, the odds of sexual debut at a given age were elevated (or the age at first sex was lower) among youth who perceived a small or great risk of contracting HIV (odds ratios, 1.2–1.9; Table 3), knew someone who had died of AIDS (1.1–1.4), had experienced sexual pressure from a greater number

TABLE 4. Odds ratios (and standard errors) from discrete-time hazard models of associations between selected characteristics and sexual debut among young men

Characteristic	Model 1	Model 2	Model 3
INDIVIDUAL LEVEL			
Time/duration			
≤12 (ref)	1.00	1.00	1.00
13–14	0.38 (0.05)**	0.38 (0.06)**	0.38 (0.05)**
15–16	0.18 (0.09)**	0.18 (0.09)**	0.18 (0.09)**
17	0.15 (0.16)**	0.15 (0.16)**	0.15 (0.16)**
Ethnicity			
Luo (ref)	na	1.00	1.00
Kissii	na	1.09 (0.07)	1.08 (0.08)
Other	na	0.85 (0.08)†	0.86 (0.11)
Religion			
Catholic (ref)	na	1.00	1.00
Protestant	na	1.05 (0.03)	1.05 (0.03)
Other	na	1.02 (0.08)	1.00 (0.08)
Perceived risk of HIV			
No chance at all (ref)	1.00	1.00	1.00
Small chance	1.15 (0.03)**	1.15 (0.06)**	1.15 (0.03)**
Moderate chance	1.06 (0.06)	1.05 (0.07)	1.06 (0.06)
Great chance	1.05 (0.04)	1.12 (0.04)	1.11 (0.04)
Knew someone in village who died of AIDS			
No (ref)	1.00	1.00	1.00
Yes	1.09 (0.02)**	1.08 (0.02)*	1.08 (0.02)*
Does not know	1.09 (0.09)	1.10 (0.10)	1.09 (0.10)
Socioeconomic status	na	1.00 (0.00)	1.00 (0.00)
Sexual pressure	1.34 (0.02)**	1.34 (0.02)**	1.34 (0.02)**
Knowledge about AIDS	0.97 (0.02)	0.97 (0.02)	0.97 (0.02)
Transmission myths endorsed	1.09 (0.02)**	1.09 (0.02)**	1.09 (0.02)**
Talked to male relatives about HIV/AIDS	1.03 (0.01)**	1.03 (0.01)**	1.03 (0.01)**
Talked to female relatives about HIV/AIDS	1.00 (0.02)	1.01 (0.02)	1.01 (0.02)
Sought information about AIDS	0.98 (0.02)	0.97 (0.02)	0.97 (0.02)
Condom use self-efficacy	1.03 (0.02)*	1.02 (0.02)	1.02 (0.02)
Abstinence self-efficacy	0.95 (0.02)**	0.94 (0.02)**	0.95 (0.01)**
SCHOOL/COMMUNITY LEVEL			
Most important HIV message for youth			
Abstinence	na	na	0.87 (0.05)*
Other (ref)	na	na	1.00
Deaths due to AIDS publicly acknowledged			
No (ref)	na	na	1.00
Yes	na	na	0.81 (0.11)*
No. of PTA meetings where HIV discussed	na	na	0.91 (0.06)†
Primary school received PSABH program			
No (ref)	na	na	1.00
Yes	na	na	0.95 (0.07)*
HIV risk from traditional practices			
No (ref)	na	na	1.00
Yes	na	na	1.11 (0.09)
HIV risk from social events			
No (ref)	na	na	1.00
Yes	na	na	0.91 (0.09)
HIV programs incorporated into festivals			
No (ref)	na	na	1.00
Yes	na	na	1.15 (0.07)*
Pupils can get condoms			
No (ref)	na	na	1.00
Yes	na	na	0.97 (0.08)
Random intercepts	*–2.54 (0.04)***	*–2.53 (0.04)***	*–2.58 (0.13)***
Variance components	*0.03***	*0.03***	*0.02**
Intraclass correlation	*0.01*	*0.01*	*0.01*

*p<0.05. **p<0.01. †p<.10. *Notes:* na=not applicable. PTA=Parent-teacher association. PSABH=Primary School Action for Better Health.

TABLE 5. Odds ratios (and standard errors) from discrete-time hazard model of associations between selected characteristics and sexual debut among young women

Characteristic	Model 1	Model 2	Model 3
INDIVIDUAL LEVEL			
Time/duration			
≤12 (ref)	1.00	1.00	1.00
13–14	0.27 (0.07)**	0.27 (0.08)**	0.27 (0.07)**
15–16	0.11 (0.11)**	0.11 (0.12)**	0.11 (0.12)**
17	0.11 (0.24)**	0.12 (0.24)**	0.12 (0.23)**
Ethnicity			
Luo (ref)	na	1.00	1.00
Kissii	na	0.69 (0.09)**	0.75 (0.10)*
Other	na	0.50 (0.18)**	0.57 (0.19)**
Religion			
Catholic (ref)	na	1.00	1.00
Protestant	na	0.92 (0.06)	0.91 (0.06)
Other	na	0.83 (0.19)	0.82 (0.19)
Perceived risk of HIV			
No chance at all (ref)	1.00	1.00	1.00
Small chance	1.34 (0.06)**	1.33 (0.06)**	1.32 (0.06)**
Moderate chance	1.29 (0.08)**	1.32 (0.08)**	1.30 (0.08)**
Great chance	1.06 (0.10)	1.07 (0.09)	1.07 (0.10)
Knew someone in village who died of AIDS			
No (ref)	1.00	1.00	1.00
Yes	1.19 (0.05)**	1.21 (0.05)**	1.21 (0.06)**
Does not know	1.22 (0.15)	1.43 (0.13)**	1.45 (0.13)**
Socioeconomic status	na	1.01 (0.00)	1.01 (0.00)
Sexual pressure	1.79 (0.04)**	1.88 (0.04)**	1.79 (0.04)**
Knowledge about AIDS	1.01 (0.03)	1.01 (0.03)	1.01 (0.03)
Transmission myths endorsed	1.10 (0.03)**	1.10 (0.03)**	1.10 (0.03)**
Talked to male relative about HIV/AIDS	1.01 (0.03)	1.01 (0.03)	1.01 (0.03)
Talked to female relative about HIV/AIDS	1.01 (0.03)	1.01 (0.03)	1.01 (0.03)
Sought information about AIDS	0.97 (0.04)	0.97 (0.03)	0.97 (0.03)**
Condom use self-efficacy	1.05 (0.04)	1.06 (0.04)	1.06 (0.04)
Abstinence self-efficacy	0.97 (0.03)	0.97 (0.03)	0.97 (0.03)
SCHOOL/COMMUNITY LEVEL			
Most important HIV message for youth			
Abstinence	na	na	0.95 (0.12)
Other (ref)	na	na	1.00
Deaths due to AIDS publicly acknowledged			
No (ref)	na	na	1.00
Yes	na	na	0.57 (0.28)*
No. of PTA meetings where HIV discussed	na	na	0.98 (0.04)
Primary school received PSABH program			
No (ref)	na	na	1.00
Yes	na	na	0.83 (0.11)†
HIV risk from traditional practices			
No (ref)	na	na	1.00
Yes	na	na	1.30 (0.13)*
HIV risk from social events			
No (ref)	na	na	1.00
Yes	na	na	0.97 (0.15)
HIV programs incorporated into festivals			
No (ref)	na	na	1.00
Yes	na	na	1.18 (0.15)
Pupils can get condoms			
No (ref)	na	na	1.00
Yes	na	na	0.81 (0.12)
Random intercepts	*–3.24 (0.07)***	*–3.04 (0.08)***	*–3.20 (0.21)***
Variance components	*0.231***	*0.173***	*0.173***
Intraclass correlation	*0.065*	*0.050*	*0.050*

*p<0.05. **p<0.01. †p<.10. *Notes:* na=not applicable. PTA=Parent-teacher association. PSABH=Primary School Action for Better Health.

of sources (1.6–2.1) or endorsed a greater number of HIV transmission myths (1.1–1.2); they were reduced among youth with greater knowledge of HIV (0.9 for both). In addition, sexual debut was negatively associated with abstinence self-efficacy among males (0.9), and positively associated with talking to female relatives about HIV and condom-use self-efficacy among females (1.1 for each).

At the community level, youth of both sexes who attended schools that received the PSABH program were less likely to report sexual debut than were youth who did not (odds ratios, 0.8–0.9). Males who lived in communities where abstinence was the primary message for avoiding HIV reported delayed sexual debut compared with those in communities where other HIV-prevention messages were delivered (0.9). In contrast, young men in communities where HIV programs were incorporated into festivals were more likely to have had sex than youth in other communities (1.3). Finally, young women in communities where AIDS was publicly acknowledged as a cause of death were less likely to have had sex than were their counterparts in communities where AIDS deaths were not acknowledged (0.4).

• *Multivariate.* Before building multivariate models, we created separate null models for males and females (not shown). The null models suggested that school and community variables are relevant in explaining the timing of sexual debut among youth in Nyanza; the variance components were 0.12 ($p<.01$) for males and 0.47 ($p<.01$) for females. The intraclass correlations indicate that 3.5% of the variation in the timing of sexual debut among males and 12.2% of the variation among females is explained by school and community variables.

We created three multivariate models for each gender. Model 1 examined associations between components of the IMB model and the timing of sexual debut; the second model added social and demographic variables as controls; and model 3 also added school- and community-level variables. Results showed that even after controlling for social, demographic, and school- and community-level variables, several IMB indicators were associated with the timing of sexual debut (Table 4, page 73, and Table 5). For example, among both males and females, youth had elevated odds of having ever had sex (or of having had sex at an earlier age) if they perceived a small (and among females, a moderate) risk of HIV (odds ratios, 1.2–1.3), knew someone who had died of AIDS (1.1–1.2), had experienced higher levels of sexual pressure (1.3–1.8) or endorsed a greater number of myths about HIV transmission (1.1 for both). Among males, sexual debut was negatively associated with abstinence self-efficacy (0.95), but positively associated with the number of male relatives with whom they had spoken about AIDS (1.03). Young women were less likely to have had sex (or had had sex at a later age) if they were of Kissii (0.8) or other (0.6) ethnicity than if they were Luo.

Associations between school- and community-level variables and the timing of first sex were largely consistent with bivariate findings. Among both sexes, sexual

debut was delayed among youth who lived in communities where AIDS deaths were publicly acknowledged (odds ratios, 0.6–0.8) or who attended schools where the PSABH program had been presented (0.8–0.95). For males, sexual debut was negatively associated with living in a community where AIDS prevention messages focused on abstinence rather than other messages (0.9), and positively associated with living in a community where festivals incorporated HIV programming (1.2). Females were more likely to have had sex (or had had earlier sexual debut) if they lived in a community where traditional practices were identified as potential sources of HIV risks (1.3).

DISCUSSION

Although sexual abstinence remains an important HIV-prevention strategy among youth in Sub-Saharan Africa, this behavior is not yet fully understood. Previous studies failed to capture the complexity of delaying sexual intercourse because they examined only individual-level variables.[4,13,15,16] This study fills an important gap by identifying school- and community-level variables associated with the timing of sexual debut among school-going youth. The finding that some youth in Nyanza (36% of males and 16% of females) began having sex by age 12 is consistent with studies showing that youth initiate sexual activity earlier in this province than in other Kenyan provinces;[6] the gender difference is consistent with data showing that early sexual experience is more common among males than females.[38] Although some studies point to cultural expectations for boys to have sex, especially after puberty,[16,39] evidence also indicates that boys tend to exaggerate their survey responses to fit these cultural expectations, especially when data are collected in face-to-face interviews.[40,41]

Some individual-level factors associated with the IMB model were related to sexual debut. For instance, youth who endorsed a greater number of myths about HIV experienced sexual debut earlier than other youth, a finding that is consistent with previous research[4,25] and that underscores the relevance of not only providing youth with information about HIV, but also of dealing with the numerous myths that undermine their knowledge of the infection. In addition, young men with greater abstinence self-efficacy tended to postpone sexual debut, a result consistent with the underlying assumptions of the IMB model. The absence of a similar association among young women may be attributable to females' lack of control over their sexuality and sexual outcomes; it suggests that teaching youth to "just say no" to sex may not be enough, and that it is equally important to equip young Kenyans with the skills to negotiate sexual activity, especially given that youth experiencing higher levels of sexual pressures initiated sexual activity earlier.

The association between perceived vulnerability to HIV infection and the timing of sexual debut is inconsistent with the assumptions of the IMB model, but consistent with previous studies.[4,7,26,42] The finding that youth who knew someone who had died of AIDS initiated sexual intercourse earlier than other youth also has been reported previously.[4,12,42] Such counterintuitive findings may largely be a result of the contemporaneous nature of the data, which makes it difficult to establish temporal order between variables that have reciprocal relationships;[4,16,25] longitudinal data are better suited for disentangling these complex, potentially causal connections.[13,16,26]

Communication with relatives about AIDS might be expected to lead to positive behavioral outcomes, including delay of sexual initiation. In Sub-Saharan Africa, parent-child communication about sex (including the risks that HIV poses) is relatively uncommon; when it does occur, it often is the result of the parent discovering that the adolescent is sexually active,[43] which may explain the positive relationship between communication and sexual behavior in our analysis.

A major contribution of this study is the examination of the association of school and community variables with sexual debut. The multilevel models indicate that significant differences in the timing of sexual debut exist across schools and communities. We found, for instance, that youth (particularly females) in schools with the PSABH program initiated sex at a later age than other youth. These results provide further evidence of the effectiveness of the program, whose main objective was to encourage positive behaviors among older primary students by providing accurate information about HIV prevention, promoting abstinence and encouraging youth to delay sexual activity.[44] Notably, PSABH is among the programs included in several reviews and collections of successful school-based HIV-prevention programs in Sub-Saharan Africa.[45–47]

Other community-level measures also showed associations. The delay in the onset of sexual activity among youth in communities where AIDS deaths were publicly acknowledged is consistent with research showing that behavioral change may occur in areas where the suffering and pain resulting from AIDS is apparent.[48] The finding that young men delayed sexual debut if they lived in communities that emphasized and promoted abstinence is consistent with the view that abstinence should be an important component of any AIDS prevention strategy.[49] It also provides a strong basis for promoting school- and community-level interventions aimed at building the skills and confidence youth need to abstain from early sexual initiation.

In most African settings, festivals are communal events that bring families and individuals, both young and old, together. However, prior research[34] and interviews with community members conducted as part of this study[50–52] suggest that community festivals may be hotspots for HIV transmission, as they enable casual sexual relations and complex sexual networking. Nonetheless, young people are sometimes targeted with HIV prevention messages at such festivals. Our study indicates that school-going boys in communities where HIV programs were incorporated into festivals initiated sex earlier than other youth. While this sounds counterintuitive, the qualitative interviews in-

dicated that frequent drunkenness and indiscriminate sex among young people and adults occurred even at festivals with HIV programs. The finding that school-going girls reported earlier sexual debut in communities where parents and community leaders indicated that local traditions may increase youths' vulnerability to HIV infection suggests that adults are aware of the role of festivals and other traditions in the spread of HIV. The challenge remains as to how such traditions may be transformed so as to not increase young people's vulnerability to HIV.

Strengths and Limitations

The validity of our results is supported by several aspects of the study, including the sampling strategy, the sample size, the attention paid to ensuring youth understood the survey questions, the broad range of community members from whom data were collected and the use of teacher reports and researcher observation (in addition to student reports) to obtain information about schools and communities. However, important limitations must be acknowledged.

First, because the data are cross-sectional, the sequence of events and other measures cannot be determined.[53] For example, were the attitudes and knowledge reported by youth a cause or a result of having engaged (or not engaged) in sexual intercourse? Similarly, were youth who had had sex more likely than other youth to subsequently talk to relatives about HIV, or did such conversations contribute to youth engaging in intercourse for the first time? The models tested in this paper were based on two theories that have improved understanding of the individual, social and cultural dynamics related to youths' vulnerability to HIV infection; however, alternative models, with reversed time ordering, may also be supported. Moreover, although some of our covariates were time-varying, they were treated as if they were time invariant. For instance, individuals' risk perceptions change, but such changes were not modeled in this study.

Second, the distribution of females' age at first sex may have been biased upward by the absence of young women who had dropped out of school because of pregnancy. In the schools in our sample, the pregnancy rate was 8% and the number of pregnancies ranged from 0 to 16; the distribution was bimodal (no pregnancies in 33 schools and two in 32 schools).

Third, data on student behaviors and community and school events were from students' reports. For community and school events, the consistency of reports from multiple sources provides validity. This is not the case, however, for self-reports of individual behaviors; sexual behaviors are likely to have been underreported,[54] which may have attenuated effect sizes and masked potentially significant associations.

Conclusions

Several policy suggestions for addressing the threat of AIDS in Sub-Saharan Africa emerge from this study. First, as has been acknowledged before, targeting youth with strategies and programs to reduce their vulnerability is important. In this study, the presence of teachers trained to deliver HIV education in schools (via the PSABH program) was associated with delayed sexual debut, supporting the decision by the Kenyan Ministry of Education to expand such programming to every school in the country.[35] The program's content was designed to improve knowledge, shift attitudes, build awareness of the effects of HIV and AIDS, and foster skills related to reducing vulnerability, all of which are dimensions of the IMB model that were associated with the timing of sexual debut in our study.

However, programs and policy shifts are needed not only at the national level, but at the community level, because events in communities and schools likely contribute to young people engaging in, or delaying, intercourse. Earlier debut was associated with reporting a larger number of sources of pressure to have sex and with living in a community where HIV programming was part of community festivals (typically in the form of condom distribution). Adults appeared to be aware that these local traditions and norms were related to youth engaging in sex. In contrast, acknowledgment of deaths resulting from AIDS was related to delayed sexual initiation. Acknowledging the impact of AIDS on the community by indicating when the disease is the cause of death, and initiating community-level programming that helps shift local norms and practices and reduces the pressure to engage in sex, may help youth delay sexual debut.

Finally, longitudinal research that collects data at the individual, school and community levels is needed. Modeling the interactions between these levels of influence at different time points may also be useful. Such studies are more complex and expensive than most research that has been conducted to date and require prioritization by international funding bodies. However, if we are to develop truly effective policies, strategies and programs to reduce the impact of AIDS, such research is essential.

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RESUMEN

Contexto: *Retrasar el debut sexual es una estrategia importante de prevención del VIH; sin embargo, son pocos los estudios que han examinado las asociaciones entre las características tanto a nivel de la comunidad como a nivel individual y el debut sexual de jóvenes en África subsahariana.*

Métodos: *Mediante una encuesta transversal, se recolectaron datos de 8,183 jóvenes en edades de 11 a 17 años de 160 escuelas en Nyanza, Kenia. Estos datos se utilizaron para examinar las relaciones entre algunas medidas individuales y comunitarias con el momento del debut sexual. Se utilizaron modelos multinivel de análisis de riesgo en tiempo discreto para identificar las asociaciones bivariadas y multivariadas.*

Resultados: *A nivel individual, los jóvenes tuvieron más probabilidad de haber iniciado su actividad sexual (o lo habían hecho a una edad más temprana) si habían sentido presión para tener relaciones sexuales a partir de un mayor número de fuentes (cocientes de probabilidad, 1.3–1,8); si habían percibido que tenían un riesgo pequeño o moderado (entre las mujeres) de contraer el VIH en lugar de ningún riesgo (1.2–1.3); o si estaban de acuerdo con un mayor número de mitos sobre la transmisión del VIH (1.1 para ambos sexos). Además, los hombres con un nivel más alto de autoeficacia en la abstinencia tuvieron un riesgo reducido de debut sexual (0.95). A nivel de la comunidad, tanto hombres como mujeres tuvieron un riesgo reducido de debut sexual si vivían en una comunidad en donde las muertes por SIDA eran reconocidas públicamente (0.6–0.8) o si el programa "Acción en la escuela primaria para una mejor salud" [Primary School Action for Better Health] había sido implementado (0.8–0.95); el riesgo también se redujo en el caso de los hombres jóvenes que vivían en comunidades en donde el VIH era tema de conversación en un mayor número de reuniones de la asociación de padres y maestros (0.9), o donde la abstinencia era el primer mensaje de prevención del SIDA transmitido a los jóvenes (0.9).*

Conclusión: *Las variables a nivel de la comunidad se asocian frecuentemente con el debut sexual y deberían incluirse en investigaciones futuras.*

RÉSUMÉ

Contexte*: Différer les premiers rapports sexuels constitue une importante stratégie de prévention du VIH. Peu d'études ont cependant examiné les associations entre les caractéristiques de niveau communautaire et individuel et le début de l'activité sexuelle parmi les jeunes d'Afrique subsaharienne.*

Méthodes: *Les données d'enquêtes transversales collectées auprès de 8.183 jeunes âgés de 11 à 17 ans dans 160 écoles de Nyanza (Kenya) ont servi à l'examen des liens entre les mesures individuelles et communautaires et le moment des premiers rapports sexuels. Des modèles de risque à temps discret multiniveaux ont permis d'identifier les associations bi- et multivariées.*

Résultats: *Au niveau individuel, les jeunes étaient plus susceptibles d'avoir déjà eu des rapports sexuels (dans cette tranche ou avant) s'ils en avaient ressenti la pression d'un plus grand nombre de sources (RC, 1,3–1,8), s'ils percevaient courir un risque faible ou (côté féminin) moyen, plutôt que nul, de contracter le VIH (1,2–1,3), ou s'ils souscrivaient à un plus grand nombre de mythes concernant la transmission du VIH (1,1 pour les deux sexes). De plus, les garçons ayant une auto-efficacité d'abstinence supérieure présentaient un moindre risque d'avoir déjà eu des rapports sexuels (0,95). Au niveau communautaire, les garçons et les filles présentaient un moindre risque de premiers rapports consommés s'ils vivaient dans une communauté où les décès imputables au sida étaient reconnus publiquement (0,6–0,8) ou dans laquelle le programme Primary School Action for Better Health avait été mis en œuvre dans les écoles (0,8–0,95). Le risque était également moindre parmi les jeunes hommes vivant dans les communautés où le VIH était discuté à un plus grand nombre de réunions de l'association parents-enseignants (0,9) ou dans lesquelles l'abstinence était le principal message de prévention du sida communiqué aux jeunes (0,9).*

Conclusion: *Les variables de niveau communautaire sont souvent associées au début de l'activité sexuelle et doivent être incluses dans la recherche à venir.*

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