Neonatal Mortality Declined and Antenatal Visits Rose After Initiation of India's Safe Motherhood Program

In a national study of a government program designed to encourage Indian women to give birth at health facilities, the proportion of new mothers who had made three antenatal visits rose from 46% before implementation to 54% several years after program initiation, and the proportion who had given birth in a facility increased from 41% to 54%.[1] In addition, the perinatal mortality rate declined from 42 to 37 deaths per 1,000 pregnancies, and the neonatal mortality rate dropped from 34 to 30 deaths per 1,000 live births.

Janani Suraksha Yojana (Safe Motherhood Scheme) was launched by the Indian government in 2005 to reduce the number of perinatal, neonatal and maternal deaths by encouraging women of low socioeconomic status to give birth in a government or accredited private health facility. Under the program, eligible women—those who are having their first or second birth and either live below the poverty line or belong to a scheduled caste or tribe—receive a cash payment (600–700 rupees, equivalent to US$13–16) if they give birth in an appropriate health facility; in 10 high-focus states that have low rates of in-facility births, all women are eligible and the financial incentive is higher (1,000–1,400 rupees). The program has more beneficiaries than any other conditional cash transfer program in the world: During the 2009–2010 financial year, it reached an estimated 9.5 million women, or 36% of the women who gave birth in India.

This study, which is the first full evaluation of the program's impact, used data from household surveys conducted in 2002–2004 and 2007–2009 to examine pregnancy, delivery and birth outcomes; the first study was done prior to implementation of Janani Suraksha Yojana, the second about 2–3 years after program initiation. Both surveys were representative at the district level and focused on women who had given birth in the past 12 months.

The researchers conducted multivariate logistic regression analyses to examine associations between women's demographic and socioeconomic characteristics and participation in the program (i.e., whether they received payments). In addition, they used three analytical approaches—exact matching, with-versus-without comparison and district-level differences in differences—to estimate the program's impact on the probability that women would make at least three antenatal visits, deliver in a health facility or have a skilled attendant at birth, or that they would experience a perinatal death (stillbirth after 28 weeks' gestation or death of a newborn within a week) or neonatal death (within a month of birth). Outcomes were calculated for India as a whole, for the 10 high-focus states, for six remote northeastern states and for all other (nonfocus) states.

Participation in the program was about 9% nationally in 2007–2009, but it varied widely across districts and states; variation was higher between states than between districts within the same state. In four of the 10 high-focus states, participation ranged from 32% (Assam) to 44% (Madhya Pradesh), but it was as low as 7% in others. Nationally, participation was highest among women who had had 1–5 or 6–11 years of schooling (12–13%), were in one of the middle three wealth quintiles (10–12%), belonged to a scheduled caste or tribe (12%) or were having their first or second child (12–14%); participation declined steadily with increasing age (from 16% among 15–19-year-olds to 4% among women aged 40–44), but varied little by residence or distance to a facility.

In the regression analyses for all states and for high-focus states, women in the youngest age-groups (those younger than 30) were more likely than 30–34-year-olds to have received assistance (odds ratios, 1.1–1.9). Other factors associated with program participation were having any education (1.2–1.5) and being from a scheduled caste or tribe (1.1–1.4); the odds of participation were lower among women of higher parity than among those giving birth for the first time (0.5–0.9), and lower among Muslims than among Hindus (0.8). Urban residence was associated with a reduced likelihood of participation, both nationally and in nonfocus states (0.9 and 0.8, respectively), but with an elevated likelihood in high-focus states (1.1).

Nationally, outcomes improved between the two surveys: The proportion of women who had made three antenatal visits increased from 46% to 54%, the proportion who had given birth in a facility rose from 41% to 54% and the proportion whose delivery had been supervised by a skilled attendant rose from 49% to 59%. Furthermore, the perinatal mortality rate declined from 42 to 37 deaths per 1,000 pregnancies, and the neonatal rate dropped from 34 to 30 deaths per 1,000 live births. After adjustment for background characteristics, the three analytical approaches yielded similar estimates of the program's benefits: For every 10 women who participated, one additional woman would obtain proper antenatal care, an additional four or five women would have an in-facility birth and an additional three or four women would have a skilled attendant at the delivery. Moreover, the exact matching and with-versus-without methods found that participation was associated with reductions in the perinatal mortality rate (by 3.7–4.1 deaths per 1,000 births) and the neonatal mortality rate (by 2.3–2.4 deaths per 1,000 births).

In analyses by state type, the exact matching and with-versus-without analyses found that program participation was associated with greater increases in the probability of having an in-facility delivery or a birth attended by skilled personnel in high-focus states (59–65%) than in northeastern states (32–38%) or nonfocus states (5–8%). However, the reductions in perinatal mortality associated with program participation were greater in nonfocus states (5.0–6.0 deaths per 1,000 pregnancies) than in high-focus states (2.5–2.9 deaths per 1,000).

The researchers note several study limitations, including possible unobserved confounding factors and potential underestimation of the program's impact because some women who gave birth at facilities may have been aware of or been encouraged by the program but failed to receive the financial incen-

tive. Despite these limitations, the authors believe that their analysis demonstrated that Janani Suraksha Yojana increased women's use of in-facility delivery and skilled attendants, and reduced perinatal and neonatal mortality. Furthermore, because "continued independent monitoring and evaluation of progress towards these goals is crucial in the coming years," they call on the Indian government to invest in improved data gathering "that will enable conclusive assessment [of whether Janani Suraksha Yojana] is resulting in a reduction in the numbers of neonatal and maternal deaths."*–J. Thomas*

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Microbicidal Gel Reduces Women's HIV Risk by 54% In South African Trial

After two decades of research, investigators may have developed a microbicide that provides substantial protection against HIV.[1] In a randomized trial of tenofovir, the first antiretroviral drug to be formulated as a microbicidal gel, the incidence of HIV infection was lower among sexually active South African women who used the microbicide than among those who used a placebo gel (5.6 vs. 9.1 cases per 100 woman-years). Use of tenofovir gel reduced HIV acquisition by 39% overall, and by 54% among women who used the gel correctly during more than 80% of their sex acts.

The researchers conducted the double-blind, placebo-controlled trial from May 2007 to March 2010. Some 889 women were recruited from two clinics in KwaZulu-Natal, South Africa: one in a rural area with an HIV incidence rate of 11% and the other in an urban area with an incidence rate of 16%. Women were eligible for the study if they were HIV-negative, aged 18–40, not pregnant and using a nonbarrier contraceptive method; had had vaginal sex at least twice in the 30 days prior to screening; and met several other criteria related to health and logistics. At enrollment and monthly follow-up visits, women received comprehensive HIV prevention services, including counseling, condoms and STI treatment.

Participants were instructed to insert one dose of their assigned gel (tenofovir or placebo) vaginally up to 12 hours before sex and another as soon as possible after sex, and to use no more than two doses in 24 hours. Correct and consistent use was encouraged during follow-up visits. During these visits, participants reported the number of times they had had vaginal sex and returned their used and unused gel applicators; the researchers classified the 5% of applicators that were not returned as unused. Participants were tested for HIV and pregnancy each month and were asked about possible adverse effects of the gel. The trial lasted 30 months.

On average, urban participants were slightly older than rural participants (25 vs. 23 years) and had had a greater number of lifetime sex partners (6.0 vs. 2.1). Fewer than 10% of women in either group were married, but most (93% of urban and 77% of rural women) reported having a stable partner. At baseline, the proportion of urban women who reported always using a condom during sex was nearly twice that of rural women (43% vs. 23%). About 80% of participants relied on injectable contraceptives.

During the trial, on average, participants returned 6.0 used applicators and reported 5.0 vaginal sex acts per month. A total of 884 women had had any sexual activity, and 72% of their sex acts were covered by the recommended two doses of gel. Among women who remained HIV-negative, the proportion of sex acts for which women used the gel as instructed increased from 55% during the first six months to 75% during months 18–24. Participants reported using condoms during 80% of sex acts, and the proportion increased slightly over the duration of the study. Nearly all women found the gel to be acceptable (97%) and reported that they would use it if it prevented HIV (98%).

Coital frequency declined over the course of the study, from 7.2 sex acts per month in the first six months to 3.1 per month in months 18–24. Women who reported high adherence to the tenofovir gel regimen reported lower-than-average coital frequency (3.2 sex acts per month vs. 6.7 among those with low adherence). However, coital frequency, condom use and adherence to the gel regimen did not differ between the tenofovir and placebo groups.

HIV seroconversion occurred among 38 tenofovir users and 60 placebo users. After six months of follow-up, the cumulative HIV incidence rate was 47% lower in the tenofovir group than in the placebo group (6.0 vs. 11.2 cases per 100 woman-years); the rate was 50% lower after 12 months (5.2 vs. 10.5 per 100 woman-years) and 39% lower after 30 months (5.6 vs. 9.1 per 100 woman-years). Tenofovir reduced the incidence of HIV to an even greater extent (54%) among the women who adhered best to the gel regimen—those who had used two doses of the tenofovir gel during more than 80% of their sex acts.

The researchers conclude that although corroborating evidence is needed, tenofovir gel appears to be a safe and effective method of preventing sexually transmitted HIV and that its benefits can be observed soon after initiation. They point out that the highest adherence to the gel regimen—and the highest level of effectiveness—was achieved among women with the lowest coital frequency, suggesting that the gel may have the "potential to alter the course of the HIV epidemic in southern Africa" by protecting women who have "infrequent but very high-risk sex with migrant men." Thus, the researchers posit, "this antiretroviral microbicide could potentially fill an important HIV prevention gap, especially for women unable to successfully negotiate mutual monogamy or condom use."*–H. Ball*

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Antiretroviral Therapy May Lower HIV Transmission Risk Within Couples

Antiretroviral therapy may greatly reduce the risk of HIV-1 transmission, according to a study of serodiscordant heterosexual couples in seven African countries.[1] Antiretroviral therapy was associated with a 92% reduction in the transmission rate—from 2.2 cases per 100 person-years among nonusers to 0.4 per 100 person-years among participants who had initiated treatment (incidence rate ratio, 0.08). The transmission rate was highest (8.8 cases per 100 person-years) among participants not on antiretroviral therapy who had CD4 cell counts lower than 200 per microliter (i.e., those with the weakest immune systems); it was also elevated among individuals with the highest viral loads.

The data were collected in Botswana, Kenya,

Rwanda, South Africa, Tanzania, Uganda and Zambia as part of a randomized, placebo-controlled trial of aciclovir, a drug used to treat herpes simplex virus type 2 (HSV-2). The trial was designed to examine whether treatment with aciclovir reduces the incidence of HIV transmission in couples where one partner is infected with both viruses. Although aciclovir did not prevent HIV transmission, the researchers conducted a secondary analysis to see whether antiretroviral therapy (which some infected individuals began using) was associated with reduced transmission rates.

Couples in which both partners were 18 or older were eligible to participate if one partner was HIV-1 seronegative and the other had tested positive for HIV-1 and HSV-2, had a CD4 count of 250 per microliter or higher, did not have AIDS and was not receiving antiretroviral therapy. Couples were also required to have had vaginal intercourse at least three times in the three months prior to screening. A total of 3,381 couples participated in the study for up to 24 months between November 2004 and October 2008.

Each month, HIV-1–positive participants received study drugs, a clinical examination and a behavioral risk assessment; their HIV-1 viral load was measured at baseline; at months 3, 6 and 12; and at their last study visit. In addition, their CD4 counts were assessed every six months, and those whose counts indicated a need for antiretroviral therapy (according to national guidelines) were referred to local clinics for treatment. Every three months, HIV-1–positive participants reported whether they had taken any antiretroviral drugs in the previous three months; treatment was assumed to be ongoing after initiation, whether or not participants reported it as such at subsequent visits. Uninfected partners were tested for HIV-1 every three months. All participants received condoms, STI treatment, and HIV and risk-reduction counseling throughout the study. Some 98% of HIV-1–positive participants completed at least one follow-up assessment of HIV status; 89% of uninfected partners participated for at least 12 months, and 84% participated for the full 24 months. The researchers used logistic regression to assess associations between antiretroviral therapy use and HIV-1 transmission, and genetic testing to establish whether new infections were the result of transmissions within couples.

Sixty-eight percent of HIV-positive participants were women. The average age at baseline was 32 for participants with HIV-1 and 33 for uninfected partners. CD4 cell counts were lower and viral loads higher among infected men than among infected women. Ten percent of HIV-1–infected participants began antiretroviral therapy during the trial, after a median of 13 months' participation; 13% of antiretroviral therapy users reported nonuse at a subsequent follow-up visit.

Genetically confirmed HIV-1 transmissions occurred among 102 of the 3,032 couples in which the HIV-1–positive partner did not initiate antiretroviral therapy, corresponding to a rate of 2.2 per 100 person-years. Only one case occurred among the 349 couples in which the infected partner was using antiretroviral therapy (0.4 per 100 person-years). After adjustment for time since enrollment and CD4 count, use of antiretrovirals was associated with a 92% reduction in the incidence of transmission (incidence rate ratio, 0.08). No transmissions occurred among antiretroviral therapy users with CD4 counts below 200 per microliter during 132 person-years of follow-up.

For couples who had not initiated antiretroviral therapy, HIV-1 transmission was highest (8.8 cases per 100 person-years) if the infected partner had a CD4 count below 200 per microliter; otherwise, transmission rates were 1.7–2.8 per 100 person-years. In addition, transmission rates among nonusers were positively associated with plasma HIV-1 concentrations; for example, among those with CD4 counts of 200–349 cells per microliter, transmission rates were 4.7 cases per 100 person-years for participants with plasma HIV-1 concentrations of at least 50,000 copies per milliliter, compared with 0.3–1.9 per 100 person-years among those with lower concentrations.

The proportion of HIV-1–infected participants who reported having had unprotected sex in the previous month dropped from 29% at baseline to an average of 7% at all follow-up visits. The proportion decreased even further among participants who received antiretroviral therapy: They reported unprotected sex at 6% of follow-up visits before initiation of treatment and only 4% of visits afterward (odds ratio, 0.6)

Because antiretroviral therapy was associated with reduced transmission in the sickest study participants, the researchers argue that providing antiretroviral therapy to patients with CD4 cell counts lower than 200 should be a priority "for both treatment and prevention of HIV-1." However, they recommend that countries prioritize treatment as well for those with high viral loads. In addition, they note that "counselling is needed to reinforce understanding that potential for HIV-1 transmission to partners remains after [antiretroviral therapy] initiation."–*H. Ball*

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Female Genital Mutilation Complications Lead to Lost Lives and High Costs

In an analysis using simulated cohorts of women aged 15–45 from six African nations, the estimated annual cost of treating obstetric complications associated with female genital mutilation was $3.7 million (in international dollars).[1] Researchers calculated that the average 15-year-old who undergoes the most severe type of female genital mutilation loses nearly one-fourth of a year of life and generates $5.82 of associated medical costs over her lifetime; the averages for women who undergo any degree of female genital mutilation are 0.07 years lost and $1.71 in costs.

Currently, 100–140 million girls and women are living with female genital mutilation, defined as any procedure that involves the partial or total removal of female genitalia, or as injury to the genitals for nonmedical reasons. These women have an elevated risk of suffering serious health consequences, including pain, bleeding, infection, infertility, susceptibility to STIs, psychological trauma, obstetric complications and perinatal death. This analysis, which estimated the medical costs associated with obstetric complications related to female genital mutilation, was based on a 2006 World Health Organization (WHO) study in which some 28,000 women and their newborns were monitored for adverse health outcomes at obstetric centers in Burkina Faso, Ghana, Kenya, Nigeria, Senegal and Sudan. Female genital mutilation status was determined by direct examination of external genitalia, using WHO's four-category classification: type 1, excision of the prepuce (with or without partial or total excision of the clitoris); type 2, excision of the clitoris, with partial or total removal of the labia minora; type 3, partial or total excision of the ex-

ternal genitalia, and stitching or narrowing of the vaginal opening; and type 4, unclassified (e.g., piercing or incising the clitoris or labia; this type was excluded from the analysis).

For each of the six nations, data from the WHO study were used to create four simulated cohorts of 100,000 women: one in which no women had female genital mutilation, and three others in which all women had type 1 mutilation, all had type 2 mutilation or all had type 3 mutilation. A woman's risk of experiencing adverse outcomes depended on her mutilation status and her likelihood of receiving medical obstetric care; the survival and birth history of each woman from age 15 to 45 was constructed using the fertility and mortality rates for each country, as well as Demographic and Health Survey data on the proportion of births attended by a physician. Unit costs were calculated for care associated with cesarean section, postpartum hemorrhage, prolonged hospitalization, inpatient perinatal death, infant resuscitation and episiotomy; costs were calculated in international dollars, which adjust for the cost of living in each country. For each type of mutilation, the relative risk for each obstetric outcome was taken from the overall WHO estimates for the six countries. Because women who have undergone female genital mutilation have an increased risk of fatal hemorrhage during childbirth, years of life lost were calculated for each type of mutilation. To make savings from preventing female genital mutilation today equivalent to the present value of future savings, costs and life-years were discounted by 3% per year.

Compared with a hypothetical 15-year-old who underwent no female genital mutilation, one who experienced a type 3 procedure would lose 0.23 years of life and generate $5.82 of associated medical costs over her lifetime. The years of life lost and medical costs were lower for women who underwent types 1 or 2 (0.02 and 0.08 years, and $0.11 and $2.50, respectively); the weighted average for women who experienced any of the three major types was 0.07 years lost and $1.71. The consequences of the procedure varied across countries, depending on rates of fertility and medically attended deliveries. The estimated annual cost of female genital mutilation–related obstetric complications totaled $3.7 million for the 53 million women living in the six countries; national costs ranged from 0.1% to 1% of government health spending on women aged 15–45.

For the current population of 2.8 million 15-year-old females in these countries, the analysis estimated that obstetric hemorrhage associated with the female genital mutilation procedures performed in one year would cause a loss of nearly 130,000 life-years—equivalent to a half month per woman. Multivariate sensitivity analyses confirmed that female genital mutilation imposes an economic burden on these nations' health systems: The proportion of simulations in which female genital mutilation resulted in elevated costs, years of life lost or both was 77%, 85% and 93% for types 1, 2 and 3, respectively.

The researchers note that their study has a number of limitations. First, it did not address the medical complications of the initial procedure—pain, bleeding and infection—or any psychological or psychosexual consequences. Second, the data were collected from a small number of obstetric care centers in each country, and some of the estimated costs may have been paid by patients' families and not by the heath care system. Finally, costs did not include treatment of postdelivery complications for women who delivered at home, and some estimated costs were extrapolations and not specific to each country. Nonetheless, the researchers assert that female genital mutilation "is not only a severe form of discrimination against women, but also a violation of the rights of girls." They believe that "efforts to combat [female genital mutilation] have been traditionally underfunded, but ... African health ministries that invest in curbing the practice ... are likely to recover a large portion of the investment by saving money from prevented obstetric complications."*–J. Thomas*

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Men with HPV May Have Elevated HIV Risk, Kenyan Study Reveals

Human papillomavirus (HPV) infection may be a risk factor for HIV acquisition, according to findings from a Kenyan study.[1] Young men who had HPV at the beginning of the four-year trial had a higher risk than uninfected men of subsequent HIV infection (hazard ratio, 1.6). The risk was elevated to an even greater extent among men infected with the HPV strains that can lead to cervical and other cancers (2.4).

If HPV infection increases the risk of HIV, then a vaccine for the former could be a valuable method of reducing the incidence of the latter. However, the literature on HIV incidence among men with HPV has been limited to men who have sex with men. To examine whether having HPV increases the chances of becoming infected with HIV among a broader sample of men, researchers analyzed data from a community-based, randomized trial focused on circumcision and HIV prevention.

Men were eligible for the trial, which was conducted between February 2002 and December 2006 in Kisumu, if they were aged 18–24, sexually active, uncircumcised and HIV-negative. The final sample consisted of 2,168 men who were monitored for 3.5 years. Participants were randomly chosen to undergo immediate circumcision or to have the procedure after two years (if they still desired it).

At the initial visit, men answered questions about their sexual behavior and social and demographic characteristics, gave blood and urine samples, and provided penile cell samples (from the glans and shaft) for HPV testing; they were also tested for several other STIs, including HIV. The polymerase chain reaction assay was used to detect and identify 44 strains of HPV, including those responsible for most cervical cancers (16 and 18) and most genital warts (6 and 11). Half of the respondents tested positive for HPV at the first survey visit; almost all of the positive test results were obtained from glans samples.

During the follow-up period, respondents were classified as having HIV once results were consistently positive across multiple office tests and lab tests. In these cases, the baseline blood sample was tested more rigorously to confirm that the infection occurred after the trial began. The investigators used Kaplan-Meier analyses to estimate the cumulative incidence of seroconversion and multivariate proportional hazard models to identify associations between risk factors and HIV infection.

In bivariate analyses, men had an increased likelihood of HPV infection if they earned a salary or were self-employed (odds ratio, 1.4 for each), did not bathe every day (2.2), had genital warts (5.0), were infected with herpes simplex virus type 2 (HSV-2), chlamydia or gonorrhea (1.3–2.2) or had had more than one lifetime sexual partner (1.5). The odds of

testing positive for HPV were reduced among those who had at least a secondary education (0.7) or had used a condom with their most recent partner (0.8).

According to Kaplan-Meier estimates, 5.3% of men who had tested positive for HPV at baseline became infected with HIV over the course of the 42-month trial, compared with 4.0% of men who had tested negative. Among those who had had HPV-positive glans samples, the proportions were 5.8% and 3.7%, respectively.

In hazard models that adjusted for men's age, circumcision status, employment and HSV-2 infection, among other factors, men with HPV had a higher risk of HIV infection than did men who were HPV-negative (hazard ratio, 1.6). The risk of HIV acquisition was also elevated among men who had multiple strains of HPV (1.8), either of the two strains that cause most cervical cancers (2.4) or any of the four strains that together cause most cervical cancers and genital warts (1.9). A separate model that focused on glans samples revealed that earning a salary (2.4), having HSV-2 (1.8), and having any strain of HPV (1.8) were associated with an elevated risk of HIV infection, while age was negatively associated with HIV risk (0.8 per year). Results were generally similar in analyses limited to the first two years of the trial.

The researchers note that the study's strengths include its comprehensive assessments of HPV and HIV infection and its inclusion of a large cohort of men. However, they also acknowledge that the study had limitations: Men were not examined for lesions or other symptoms that may have made them more vulnerable to HIV, and the HPV, HSV-2 and behavioral data were cross-sectional rather than longitudinal. Nonetheless, given the potential benefits of reducing HIV risk by preventing HPV infection, the investigators conclude that the "results warrant...a randomized controlled trial to determine whether prophylactic HPV vaccination reduces the acquisition of HIV infection."–*S. Ramashwar*

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Predictors of Condom Use Among Kenyan Adolescents Are Wide-Ranging, Vary by Gender

Individual-, community- and school-level factors all play a role in whether young people use condoms, according to a study of upper primary students in Kenya.[1] The odds of having used a condom at last sex were elevated among both male and female adolescents who had experienced pressure to have sex from a greater number of sources (odds ratios, 1.3 and 1.8, respectively) or had high condom self-efficacy (1.4 and 1.3). Other individual characteristics were predictive for members of only one sex. For example, among males, condom use was positively associated with having talked to male relatives about AIDS (1.2) and negatively associated with believing oneself to be at low risk (as opposed to no risk) for AIDS (0.8); among females, self-efficacy for abstaining from sex was associated with reduced odds of condom use (0.8). Community- and school-level factors associated with condom use were living in a community where HIV programs are incorporated into festivals (among females) and attending a school that has high levels of resources or a Catholic or mainline Protestant sponsor (among males).

In October 2003, researchers surveyed 3,645 sexually experienced sixth- and seventh-grade adolescents from 160 randomly selected schools in Nyanza Province. The students were asked about their religious affiliation, age, ethnicity (Luo, Kisii or other) and socioeconomic status, as well as the gender of any relatives with whom they had talked about AIDS and whether they had sought information about HIV and AIDS (e.g., by talking to a teacher or reading about the topic). The survey also ascertained adolescents' knowledge of HIV transmission (measured according to their agreement with six factual statements and six local myths), the number of ways in which the adolescents had felt pressured to have sex (including pressure from peers, pressure during dating, offers of money or gifts, or physical force), the degree to which they felt at risk for AIDS, and their abstinence and condom-use self-efficacy (i.e., their confidence in their ability to abstain from sex and to use condoms).

Data on community and school variables were collected in 2002 through observation and through interviews with tribal and religious leaders, parents, women's group leaders and others. For each community, the researchers assessed the dominant messages about condom use conveyed by religious leaders—whether they discouraged condom use or provided misinformation, encouraged use only among adults, or also encouraged use among sexually active youth. Other community-level variables were awareness of ways in which HIV could be transmitted through the community's cultural practices or youth-oriented events, commitment to HIV prevention (whether prevention-related information or messages were incorporated into festivals or other community events) and the availability of condoms at local clinics. School variables included socioeconomic status (determined by the school's physical characteristics and resources), religious sponsorship (Catholic, mainline Protestant, independent or none) and the availability of a box in which students could, as part of an HIV-prevention program, deposit anonymous questions to be answered. Multilevel logistic regression was used to identify individual-, school- and community-level predictors of condom use.

The mean age of participants was slightly younger than 15. Most students (57% of males and 63% of females) were of Luo ethnicity; 45–50% were Protestant and 47–48% Catholic. Overall, the sample was representative of the region's sixth- and seventh-grade students.

In 46% of communities, the dominant messages from local religious leaders about condoms were negative or based on misinformation and myths; messages were supportive of condom use among youth in only 21%. Although traditional practices and social events that put youth at risk for HIV were identified by leaders in most communities (80%), HIV-prevention programs or messages were incorporated into festivals in 78% of communities, and the same proportion had condoms available at clinics. Some 76% of schools had religious sponsorship, and 69% had a question box.

Females scored higher than males on measures of HIV knowledge, pursuance of information about AIDS and abstinence self-efficacy. Males had higher condom self-efficacy scores than did young women, and they were more likely than females to consider themselves at risk for HIV (67% vs. 57%). A greater proportion of males than females reported having discussed AIDS with a male relative,

while a greater proportion of females than males had discussed the subject with a female relative.

In the multivariate analysis, both males and females had elevated odds of condom use at last sex if they reported higher condom self-efficacy (odds ratios, 1.4 and 1.3 per one-unit increase in scores, respectively) or had experienced pressure to have sex from a greater number of sources (1.3 and 1.8). Other factors associated with condom use differed by gender. Among males, condom use was more likely if the adolescents were older (1.2 per each additional year); were Kisii rather than Luo (1.6); and had talked to more male relatives about AIDS (1.2 for each additional male relative). Males' odds of condom use were lower, however, if they were Protestant rather than Catholic (0.7); were unable to identify myths about AIDS (0.9); attended a higher-resource school (0.96 per one-unit increase in score); attended a school with a Catholic (0.5) or mainline Protestant (0.6) sponsor, rather than no sponsor; or believed themselves to be at low risk, rather than no risk, for AIDS (0.8).

Among females, living in a community where HIV programming is incorporated into festivals was associated with increased odds of condom use (odds ratio, 1.4), while being of Kisii, rather than Luo, ethnicity (0.6) and reporting self-efficacy for abstaining from sex (0.8) were associated with decreased condom use.

Further analysis revealed that the multivariate models were adequate for explaining the variance in condom use among young men, but did not fully capture all of the school- and community-level factors that influence condom use among females. The latter finding, according to the researchers, "may, in part, reflect male control of condoms." They posit that the range of individual-, community- and school-level influences on condom use, as well as the lack of association between AIDS-related knowledge and condom use, indicate a need for a multipronged approach to HIV prevention. They suggest that "merely providing factual information is insufficient: Myths must be addressed, confidence must be built in one's ability to use condoms, and family members must be involved in communicating with youth about AIDS." Moreover, the associations between condom use and community factors indicated that programs should not only target individuals at risk for HIV but also consider "interventions aimed at entire communities."*–H. Ball*

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