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Abstract

This paper examines the effects of girl's early marriage on the risks of acquiring HIV/AIDS. It explores the counterintuitive finding that married adolescent girls in urban centers in Kenya and Zambia have higher rates of HIV than sexually active unmarried girls, by comparing several underlying HIV risk factors. In both countries, we find that early marriage increases coital frequency, decreases condom use, and virtually eliminates girls' ability to abstain from sex. Moreover, husbands of married girls are more likely to be HIV-positive than boyfriends of single girls. While married girls are less likely than single girls to have multiple partners, estimates from cumulative risk equations suggest that for STIs with low transmission rates (such as HIV) reducing the number of partners offers only minimal protection. These results challenge commonly believed assumptions about sex within marriage and raise several policy questions about meeting the needs of married adolescent girls.

Keywords: HIV/AIDS, early marriage, adolescents, sexual behaviors, sub-Saharan Africa

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Introduction

Marriage, as a central social and cultural institution and as the most common milieu for bearing and rearing children, profoundly shapes sexual behaviors and practices (Caraël 1995). In countries where HIV is predominately transmitted via heterosexual intercourse, these differences in sexual practices associated with marriage may substantially affect the likelihood of acquiring HIV by either increasing or decreasing certain HIV risk factors. Yet, surprisingly, the relationship between marriage, particularly the decision to marry at a younger age, and several key HIV risks has remained largely uninvestigated. In this paper we examine how marriage before the age of 20 affects the risks of HIV for adolescent girls in two countries, Zambia and Kenya. Our attention is limited to adolescent girls for two reasons. First, in a growing number of countries in sub-Saharan Africa adolescent girls shoulder the greatest burden of HIV infections. In some cities, the infection rate among sexually active females aged 15-19 is two to eight times higher than among their male counterparts (Laga et al. 2001); (Glynn et al. 2001). Second, in contrast with adolescent boys who are rarely married, early marriage is common for girls in developing countries, where 40-60% of girls in many places are married before the age of 20. Consequently, a majority of sexual activity among adolescent girls occurs within marriage. Recent Demographic and Health Surveys (DHS) show that in 82% of the 45 countries analyzed over 60% of girls aged 15-19 who report being sexually active are married.

One reason potential HIV risks associated with early marriage have remained largely unexplored rests on a widespread perception that marriage is relatively "safe." Although marriage marks the sexual debut of many, and in some countries most,

adolescent girls, generally sex within marriage is considered “safer” than sex outside of marriage, which is implicitly assumed to be the only alternative. Some researchers, policy makers, and parents may even actively encourage early marriage as a protective strategy to avoid the perceived dangers of premarital sex including both unwed pregnancy and STIs. Parents in Malawi, for example, deliberately seek earlier marriages to shield their daughters from the perceived risks of premarital sex (Bracher, Santow and Watkins 2002).

Empirical evidence on the HIV risks associated with marriage, particularly early marriage, is scant and the data are often misleading. Population-based epidemiological studies which report HIV prevalence among ever-married and never-married adolescent girls in various countries typically find higher infection rates among married than among unmarried girls (Nunn et al. 1994)). However, the category “never-married" includes virgins at little or no risk of exposure to HIV. In contrast, estimates of HIV prevalence from surveillance antenatal clinics (ANC) data suffer from another form of bias. In these data, all the unmarried girls are sexually active, but since these unmarried girls are also pregnant, they over-represent those unmarried girls who are most sexually active and least likely to use condoms (leading to both pregnancy and STIs) (Fylkesnes et al. 1998; Zaba, Boerma and White 2000). Consequently, studies conducted in ANCs usually report that being unmarried increases the probability of infection (Lindan et al. 1991; Kilian et al. 1999).

Few studies collect data on HIV status from the *general population* (rather than ANC’s), limit their analyses to *sexually active* women, and disaggregate their findings by age and martial status. One exception, a multicenter study which presents data from two

cities (Kisumu, Kenya and Ndola, Zambia), casts doubt on the assumption that early marriage offers protection from HIV. It reports that among sexually active girls aged 15-19, HIV infection rates were about 10 percentage-points higher for married than for unmarried girls (Kisumu: married 32.9%, unmarried 22.3%; Ndola: married 27.3%, unmarried 16.5%) (Glynn et al. 2001). Thus, the likelihood of being infected is 48% higher for married girls in Kisumu and 65% higher for married girls in Ndola than for their respective unmarried sexually active counterparts.

These intriguing findings prompt the question of why, at least under some circumstances, early marriage may actually increase the risk of HIV. Drawing on two sources of data on sexual practices of adolescents in Kenya and Zambia, this paper examines the underlying sexual behaviors and risks associated with early marriage and evaluate ways in which they might either increase or decrease the risk of acquiring the AIDS virus. After briefly describing key socio-demographic differences between married and unmarried adolescent girls found in these two data sets (Section 1 under results), we use a multivariate model to determine whether these differences account for the higher HIV rates found among married adolescent girls (reported above, Glynn 2001). In Section 3, we explore how martial status is associated with several key HIV risk factors such as sexual behaviors, condom use, and partner characteristics. Using these reported differences in sexual behaviors, we attempt to assess the overall risk of HIV to married and unmarried girls by simulating the estimated cumulative risk of acquiring HIV (Section 4). Lastly, we explore differences between married and unmarried adolescent girls with respect to their knowledge about HIV/AIDS, perceived risks, and protection strategies.

Data and Methods

The analyses below employ two sources of data from both Kenya and Zambia. The first data set was collected by the Study Group on the Heterogeneity of HIV Epidemics in African Cities, with support from UNAIDS and WHO (Auvert et al. 2001). This study was conducted in 1997-98 in two cities with high HIV prevalence (Kisumu, Kenya and Ndola, Zambia). Households were selected by two-stage cluster sampling based on census lists. About 1,000 men and 1,000 women aged 15-49 were randomly selected from the general population and interviewed in each city. In addition to being asked questions about sexual behaviors and practices, men and women who consented were tested for several STIs including HIV, herpes simplex virus type 2 (HSV-2), syphilis, gonorrhea, chlamydia, and trichomoniasis. Serum samples were tested for HIV by ELISA (enzyme-linked immunosorbent assay) and confirmed by a rapid test. A full description of these data and the collection methods, as well as summaries of the main findings, are reported in a special supplement to the journal *AIDS* (supplement (4) 15, 2001).

In this paper, we focus mainly on *sexually active* girls aged 15-19 from the two sites with high HIV prevalence, Kisumu, Kenya and Ndola, Zambia, excluding the 30% and 40%, respectively, who reported never having had penetrative sexual intercourse.[1] Within this age group a total of 197 girls from Kisumu and 150 girls from Ndola were interviewed and 85% and 90%, respectively, agreed to HIV testing. Although the sample sizes in this age group are quite small and the data are restricted to urban areas, this study

[1] A small percentage of girls who claimed to be sexually inexperienced tested positive for some STIs, including HIV.

collected useful information on sexual behaviors and marital status, as well as biomarkers for STIs.

Data from this multicenter survey is also used to calculate HIV prevalence among men aged 15-49 who report being the sexual partners of adolescent girls. In addition to being tested HIV, these men were asked about the age and marital status of their spouses and sexual partners (allowing up to four wives and eight non-spousal partners). From these responses we identify the respective pools of male partners for married and unmarried girls. Partners of married girls include all men who reported having sex with a married girl aged 15-19 in the last year. (About 80% of these are men married to adolescent girls.) Men who reported having sex with an unmarried girl aged 15-19 were classified as potential partners for the single girls.[2]

To supplement these data from the urban multicenter study, we use the nationally representative Demographic and Health Surveys from Zambia (1996) and the Kenya (1998). These data are publicly available and a full description is provided at http://www.measuredhs.com. For the purposes of these analyses, we restrict our sample to sexually active girls aged 15-19 in each country, resulting in 1,137 girls from Zambia and 762 girls in Kenya. Again, we removed 57% of adolescent girls in Kenya and 40% in Zambia who reported no sexual activity, and a small number of girls who were formerly married.

While these DHS data lack biomarkers for STIs, they provide more detailed information about basic socio-demographic characteristics, marital status, sexual behaviors, pregnancy intentions, knowledge about HIV/AIDS, perception of personal risk

[2] These two groups are not mutually exclusive, but the overlap is minimal and does not affect the results presented.

of HIV, and behavior modifications in response to concerns about HIV/AIDS. In particular, they ask about the number of partners in the last twelve months, use of condoms during last sex, and whether the respondent has ever received money or gifts in exchange for sex during the last year. The DHS data provide large, nationally representative samples of girls from both urban and rural areas in each country and, thus, serve as a useful complement to the multicenter data.

In the bivariate analyses, chi-squared statistics and t-tests are used to test for significant differences in percentages and means, respectively, between married and unmarried sexually active girls with respect to socio-demographic characteristics, sexual behaviors, and knowledge of and protective strategies with respect to HIV/AIDS. Multivariate ordinary least squares and logistic regression models are employed to examine the effects of marital status on HIV status and selected sexual behaviors, while controlling for some of the socio-demographic factors that may affect selection into marriage. Probability weights are used in all bivariate and multivariate analyses of DHS data.

Lastly, we employ a cumulative risk equation derived as follows. First we calculate the risk (R) of having sex with one (randomly selected) partner multiple times. (This equation for risk with one partner is also used by (Hearst and Hulley 1988)).

(1) $R=P(1-(1-I*C)^{n})$

where:

I = infectivity rate

C = condom failure rate

P = probability of selecting an infected partner (prevalence rate among partners)

The condom failure rate can be understood as either the method failure rate (breaking or slipping) or the user failure rate (incorrect use or non-use) or a combination of the two. Thus, if condoms are not used at all, the failure rate is 100%, whereas if they are used but are only 90% effective in blocking HIV transmission, the rate is 10%.

Selecting q partners from the pool and having sex with each partner n times results in a cumulative risk of

(2) $1-(1-R)^q$

Results

Section 1: Socio-Demographic Characteristics

Table 1 compares HIV prevalence rates and socio-demographic characteristics of married and unmarried sexually active girls in both countries and from both sources of data. In the nationally representative DHS data, we find that girls who marry early differ considerably from those who become sexually active but remain unmarried (Table 1). On average, married girls are older, less educated and more likely to live in rural areas. In the multicenter data, which is limited to urban girls, we find nearly identical age differences between the two groups, while both married and unmarried urban girls report higher levels of education.

(Insert Table 1 about here)

Married and single girls differ dramatically with respect to two other important characteristics: pregnancy intentions and likelihood of having engaged in transactional sexual activity within the last year. Married adolescents often face considerable pressure to become pregnant shortly after marriage; we find that between a fifth and fourth of all married adolescent girls are currently pregnant, with an additional 20% to 30% hoping to become pregnant in the next year. Pregnancy may also hasten a marriage. In contrast, single girls are more likely to accept gifts or money in exchange for sex, although this is not entirely absent from married girls' behavior. Over 20% of unmarried girls in Kenya and nearly 40% in Zambia report some transactional sexual activity.

Section 2: HIV Status

National rates of HIV for girls and young women in both Kenya and Zambia are high. According to the UNAIDS report, among girls 15-24 between 16.8% and 18.7% in Zambia, and 11.1% to 15.0% in Kenya, are infected with HIV (UNAIDS 2000). Rates are typically higher in urban settings. Moreover, the HIV rates in the western province of Nyanza, where Kisumu is located, are higher than in the rest of Kenya. As reported by Glynn (2001), in both Kisumu and Ndola, ever-married girls aged 15-19 have a higher prevalence of HIV than their never-married counterparts (Kisumu: 32.9% vs. 22.2%; Ndola: 27.3% vs. 16.5%). Higher rates among married young women are also found in the age group 20-24 (Kisumu: 41.4% vs. 34.8%; Ndola: 45.9% vs. 38.3%).

Nonetheless, as evident in Table 1, even within a five-year age group married girls tend to be older and less educated, which could confound the effect of marriage on HIV prevalence. Unfortunately, in the multicenter data some variables which may affect selection into or out of marriage, such as the desire to become pregnant or current pregnancy status, are not reported and therefore cannot be included in the model. Other variables, however, such as having received payment in exchange for sex are reported in these data. Due to sample size constraints, data from Kisumu and Ndola are combined in the models in Table 2 and a dummy variable for the city of residence is included in all models.

Model 1 in Table 2 examines the effects of marital status among sexually active girls controlling only for city of residence. For girls aged 15-19 being married is associated with more than a 75% increase in the odds of being HIV-positive compared to sexually active unmarried girls. The odds ratio of being married is also elevated for young women aged 20-24, but this effect is insignificant. In Model 2 we control for age, education and receiving payment for sex. These variables have an insignificant effect on HIV status in most models, except for age which is a significant positive predictor of HIV in the combined age group 15-24. The coefficient on marital status within the age group 15-19 remains virtually constant although the standard error increases, making it significant only at the 10% level.

(Insert Table 2 about here)

Section 3: HIV Risk Factors.

In this section, we examine several underlying sexual behaviors and partner characteristics, which affect the risk of contracting HIV. Despite a remarkable lack of consensus on their relative importance, we can identify four factors that determine (in some combination) an individual's probability of contracting HIV (or any other STI) via heterosexual intercourse.[3] These four HIV risk factors are:

1. Frequency and duration of unprotected intercourse,
2. Number of partners,
3. HIV prevalence among partners, and
4. Biological transmission rates.

We will examine each of these HIV risk factors in turn.

1. Frequency and Duration of Unprotected Intercourse

The level of possible exposure to HIV via unprotected heterosexual intercourse is a function of the duration the girl has been sexually activity, the frequency of intercourse, and the use of condoms or other STI protective methods. The bivariate analysis in Table 3 uses data from the DHS and multicenter study and shows that compared to unmarried girls, married girls have unprotected sex much more often and have been engaged in

[3] While these risk factors are often used in epidemiological models and logically should be highly predictive of HIV status, empirical evidence linking these behaviors to HIV status is weak. For example, several studies which regress HIV on condom use (and a variety of other variables) fail to show a strong

sexual activity for longer period of their lives. Data from both studies show that married girls have been sexually active for up to 1.4 years longer than single girls (mainly because they are on average older). Single girls have engaged in sexual intercourse much less frequently and, unlike married girls, sometimes suspend or entirely stop sexual activity for up to a year or longer. A quarter of non-virginal unmarried adolescent girls in Kisumu and half in Ndola report no penetrative intercourse within the last year (Table 3). Over half of the married girls in each city had had sex within the last week, while among single girls only 11% in Kisumu and 2% in Ndola had done so (Table 3). When single girls did have sex, they were significantly more likely to use condoms.

(Insert Table 3 about here)

Here again, however, since these two groups of girls have difference characteristics, it is unclear whether it is the institution of marriage, *per se*, or the types of girls who select into marriage that drives the correlation between marital status and these sexual behaviors. For example, married girls are more likely to want to (or be under pressure to) become pregnant and, therefore, use condoms less and have sex more often.

(Insert Table 4 about here)

In the analysis of the DHS data, we are able to minimize some of these selection effects, by including controls for age, educational level, urban residence, desire to

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association. Such results may be indicative of either a non-linear effect of these risk factors or poorly reported sexual behaviors, or both.

become pregnant in the next year, and transactional sex. Table 5 reports the coefficients or odds ratios (and p-values) of marital status on selected sexual behaviors. The difference between married and unmarried girls' duration of sexual activity disappears once we control for age, suggesting that age of sexual debut does not differ significantly between these two groups. Among sexually active girls in Zambia and Kenya, married adolescent girls have eight to sixteen times higher odds of having had sex last week compared to sexually active unmarried girls. Marriage significantly decreases condom use in Kenya (though not in Zambia). Results from the combined analysis of the two multicenter cites are quite similar, those they control only for city of residence, age, education, and receiving payment for sex.

2. Number of Partners

In terms of HIV risks, it matters not only who is having frequent unprotected sex, but also with whom they are having it. Specifically, we would like to know how many partners girls have and the prevalence of HIV among those partners. While single girls might be expected to have more partners than married girls, the empirical data do not entirely support this intuition. While single girls have much greater variance in their number of partners, ranging from 0 to 21, married girls have at least one partner. On average married and sexually active unmarried girls have the same number of partners. Table 3 shows that while single girls in Kisumu are more than twice as likely as married girls to have had more than one partner in the last year (16% vs. 7%), they are also much more likely to have had no partners in the last year (25% vs. 0%). In Ndola, there are no statistically significant differences between the proportions who had more than one

partner last year, but since nearly half of single girls had no partners last year, single girls had on average significantly *fewer* partners than married girls (even though girls who report *never* having had sex are excluded altogether). Results from the DHS data reiterate the finding that single girls have greater variation in their number of partners but, on average, about the same number of partners as married girls over the last year. In the multivariate model the results are mixed. We find that being married lowers the probability of having more than one partner in the last year in Zambia, has no effect in Kenya, and surprisingly raises the probability in multicenter study data. This relationship, however, is strongly mitigated by the likelihood of having ever been paid in exchange for sex, which is positively correlated with having more than one partner and negatively correlated with being married. If the dummy variable for transactional sex is excluded, we find that being married is associated with having fewer partners in both of the DHS surveys and has no effect in the multicenter study, which is more consistent with our expectations (results not shown).

3. HIV Prevalence Among Partners

Contrary to our initial assumption, prevalence rates for HIV were nearly twice as high among the partners of married girls than among those of single girls (Table 3).[4] About a third of the partners of married girls in both cities were HIV-positive, while only 12% of the men who had sex with unmarried girls in Kisumu and 17% in Ndola were infected with HIV. Further investigation of partner characteristics showed that while differences in the average number of male respondents' partners over the last year are not large

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[4] This result is consistent with previous findings that marriage is a risk factor for HIV in men as well (Auvert et al. 2001).

(never exceeding more than one partner on average) the partners of married girls are considerably older (by 3-5 years) than the partners of single girls (results not shown).[5] These results suggest that although most work on intergenerational sex focuses mainly on unmarried girls, large age differences may be even more common within the context of marriage (Gregson 2002; Luke and Kurz 2002).

4. Biological Transmission Rates

Previous research estimates that male-to-female transmission rates are two to three times higher than female-to-male rates (0.003 vs. 0.001) (Downs and De Vincenzi 1996; Gray et al. 2001). Transmission rates to adolescent girls may be higher still, since their physical immaturity may be compounded by vaginal tearing or trauma experienced during first intercourse (Bouvet et al. 1989). Controlling for age, however, we have little *a priori* reason to believe that married and unmarried adolescent girls differ with respect to their physiological susceptibility to HIV.

Other studies however, show that higher viral loads among partners appear to be associated with higher infectivity rates; thus, even though husbands are more likely to be infected than boyfriends, it is possible that their viral loads are lower depending on how long ago they became infected (Quinn et al. 2000). Downs and de Vincenzi (1996) argue that HIV infectivity rates are higher shortly after infection, and during advanced symptomatic stages of AIDS. Viral loads beneath a certain level may effectively render an infected person "non-infectious" for a lengthy period.

[5] Age of partner calculated from the girl's responses uses the age of her most recent partner. Instead using the average age of all of her partners in the last year generates nearly identical results.

Given the data available, we cannot determine the viral loads of the partners. On the one hand, it seems plausible that since the partners of unmarried girls are on average younger that they may be more recently been infected and therefore have higher viral loads. On the other hand, married girls may be more likely to remain with symptomatic partners.

Section 4: Translating HIV Risk Factors into Probabilities of Infection

The previous analyses provide consistent evidence that marital status powerfully shapes sexual behaviors. In short, married girls have unprotected sex more frequently and their partners are more likely to be infected, but they are less likely to have multiple partners. Which of these risks (or combinations of risks) will ultimately prove most detrimental with respect to HIV, however, depends on how these risk factors translate into overall probabilities of infection.

To illustrate how these different sexual practices influence overall risks, we turn to simple probability models of cumulative risk of described above in the methods section. This model uses the equation $1-(1-R)^q$, where $R=P(1-(1-I*C)^n)$, to examine the cumulative risk associated with having sex with q partners n times each. Figure 1 uses this equation to calculate expected infection rate of HIV among a hypothetical cohort of 10,000 girls assuming different numbers of partners (q), prevalence rates among partners (P), number of sexual acts (n), condom failure rates (C), and a infectivity rates (I) of male-to-female transmission rate of 0.003.

(Insert Figures 1 & 2 about here)

The most striking result in Figure 1 is that even a dramatic increase in the number of partners per year from one to ten barely changes the probability of becoming infected with HIV (illustrated by the solid and dashed lines), while the other risk factors—frequency of sex, condom use, and prevalence among partners—have substantial effects. Figure 2, however, suggests that the opposite is true for STIs with high transmission rates, such as gonorrhea with an infectivity rate of 0.5. Here we find that the number of sexual partners is a strong determinant of the likelihood of infection, where the main risk rests on the likelihood of encountering an infected partner. At a 10% prevalence level shown, both condom use also matters, but only when there are multiple partners. Thus, these simulated results suggest that for STIs with low transmission rates like HIV, the sexual behaviors of unmarried girls will be more protective than those of married girls.

Table 5 uses the same probability equation, but—instead of using a hypothetical group of girls and stipulating their sexual behaviors—employs sexual-behavioral data from DHS and the multicenter study to estimate the risks of acquiring HIV over the last year for married and unmarried girls in Kenya and Zambia. In particular, we let q equal their total number of partners last year. To approximate the number of sexual acts last year (n), we divided the total number of days in a year by the number of days since last intercourse reported by each girl. Condom use is treated as a dichotomous variable which equals "1" if used at last sex in the DHS data or if often/always used in the multicenter data. Clearly, not all girls who used a condom at last sex always do so, and some girls who did not may have done so at some point last year. The top panel of Table 5 assumes treats girls who report using a condom at last sex or usually as having a

condom failure rate of 10%. The middle panel, however, employs a combined method *and user* failure rate of 50%, assuming that girls who used a condom at last sex or usually only do so about half of the time. All panels treat *not* having used a condom at last sex as equivalent to never doing so. In the bottom panel, we retain the assumption of 50% condom failure rate, but increase the infectivity of boyfriends to 0.01, which is on of the upper estimates of per act transmission rates and allows for the possibility that viral loads are higher among younger men (Downs and De Vincenzi 1996; Mastro and Vincenzi. 1996). Since we do not know the prevalence of HIV among their partners, we calculate different infection probabilities based on a range of prevalence levels among male partners.

(Insert Table 5 about here)

Table 5 shows that holding partners' prevalence rates constant, married girls are predicted to have higher HIV rates than unmarried girls regardless of the assumptions made about condom efficacy and infectivity rates. In fact, based on our previous analyses, we might expect the prevalence rate among the partners of married girls to be about 30%, and the prevalence among unmarried girls' partners to be about 20%. Given that the average married adolescent girl has been sexually active for about three years, an estimated probability of becoming infected of 8-9% roughly accords with the reported prevalence levels found among married urban girls aged 15-19 in the multicenter data. In contrast, the simulation results greatly under-estimate the prevalence levels found among 15-19 year olds single girls. Although boosting the infectivity rate for all unmarried girls

(bottom panel) greatly increased the predicted probability of infection, these estimates are still lower than those found among single sexually active girls. This finding is consistent with the argument put forward by Downs and de Vincenza (1996) that the assumption of constant infectivity rates across persons and over the course of the infection may underestimate chances of HIV infection with relatively few sexual encounters (as are reported by single girls). Single girls may also substantially under-report frequency of intercourse and potentially over-report condom use compared to married girls, resulting in lower risk estimates. Thus we urge considerable caution in evaluating the predicted probabilities in Table 5. As with all models, the results of this simple cumulative risk simulation are contingent on the validity of the assumptions and the quality of the data. Nonetheless, these simulations can help provide a mathematically intuitive understanding of why despite fewer multiple partnerships, HIV rates among married girls are higher than among sexually active unmarried girls.

Section 5: Knowledge, Perceived Risk and Protection Strategies.

Given their contrasting HIV risks and sexual experiences, in this last section we compare married and unmarried girls' level of knowledge about HIV/AIDS, their level and sources of perceived risk, and behavioral changes adopted to minimize HIV risks, using DHS data (Table 6). Nearly all girls (over 99%), both married and single, had heard of HIV/AIDS. The vast majority could name at least one way to avoid HIV, although married adolescents appear to be slightly less well informed about ways to protect themselves. Unmarried girls were significantly more likely to mention using condoms, while married women in Zambia mentioned having only one sex partner.

Perceptions of risks, as well as accurate knowledge of ways to avoid risks, play a crucial role in HIV/AIDS prevention. Respondents were asked whether they considered their chances of getting the AIDS virus to be none, small, moderate, or great. Those who reported being at moderate or great risk were queried as to their perceived sources of risks. Perhaps surprisingly, married girls in Zambia consider themselves to be at much higher risk than sexually active, single girls (30% vs. 18%). Both types of girls most often report that their partner represented their greatest source of risk, although married adolescents are significantly more likely to believe that their husbands' behaviors placed them at greatest risks of HIV/AIDS (Kenya 63% and Zambia 90%). Interestingly, in Kenya married girls were more likely to suspect their partners of infidelity than were single girls.

The DHS data also include information about changes in sexual behaviors in response to HIV, which allow us to examine not only the current sexual practices but also the protective strategies most likely to be employed by single and married girls. Specifically, women were asked, "Has your knowledge of AIDS influenced or changed your decisions about having sex or your sexual behavior? If yes, in what way?" Unmarried girls were much more likely to report ceasing to have sex (18% in Kenya and 27% in Zambia); doing so was almost never reported by married girls. Surprisingly few unmarried girls reported starting to use condoms (8%). Even fewer married girls (<2.5%) increased their use of condoms. Having only one partner represented the most popular behavioral change among both married and unmarried girls, with married girls using this strategy more often than unmarried girls. In contrast, unmarried girls in both countries were more likely to reduce their number of partners. Clearly, for married girls who

typically only have one partner, reducing number of partners is unlikely. Finally, married girls reported having been more willing to ask their partners to be faithful.

Discussion and Limitations

While the use of data containing biomarkers for STIs coupled with nationally representative data on sexual behaviors and socio-demographic characteristics allow us to examine the relative risks of HIV from several different perspectives, these data remain fraught with limitations. First, the multicenter sample of adolescent girls is fairly small and restricted to a particular city within each country, which is not necessarily representative of other urban centers. In Kenya, for instance, Kisumu is much smaller, poorer and has a higher burden of disease including HIV than either Nairobi or Mombassa. Its location on Lake Victoria also ties its economy to fishing and facilitates greater trading with neighboring Uganda and Tanzania.

Second, while we can estimate prevalence among girls' partners, we cannot measure incidence or viral loads. We do not know when or from whom girls who had other premarital partners acquired HIV. Thus, we cannot rule out the possibility that single, sexually active girls who become infected are more likely to get married than sexually active girls who are not infected (although most girls are unlikely to know whether or not they have HIV). Nor can we ignore the possibility that viral loads are much higher among partners of unmarried girls even if the prevalence of HIV is much lower.

Third, both sources of information on sexual behaviors rely on self-reports. If married and unmarried girls differ in the accuracy or veracity of their responses to

questions about sexual behavior, the true differences between them might be smaller than those reported here. (Selective misreporting might lead to either understating or overstating the true differences.) Nonetheless, we doubt that even substantial misreporting could entirely account for the magnitude of the differences reported and the sharply divergent sexual profiles that emerge from the data.

Most importantly, because these data are cross-sectional, we cannot satisfactorily determine whether early marriage *causes* or is merely *associated* with riskier sexual behaviors. Although we found that marital status remains correlated with a variety of HIV risks and sexual behaviors even controlling for observable characteristics, it is possible that married girls also differ from their unmarried counterparts with respect to a variety of unobservable characteristics. The distinction between causation and association has important policy implications. If marriage causes changes in sexual behaviors that increase risks, then delaying marriage should reduce these risks. If early marriage is only associated with riskier behaviors, then marital status can be used as an easily identifiable marker of girls engaged in particularly risky practices.

Cross-sectional data also prevent taking a longitudinal or "life-cycle" approach to understanding adolescent girls' HIV risks. While cross-sectional analyses can shed considerable light on which types of girls are most likely to be HIV-positive by the age of 20 and which girls currently engage in risky sexual behaviors, they can explain little about the process that leads some girls to marry young or how their sexual behaviors evolve over time. In the African context this represents an important drawback, since the transition into marriage is usually a long and gradual process. It may involve not only premarital sexual activity, but also cohabitation and childbearing before the couple is

formally recognized as married (Bledsoe and Pison 1997). Given these practices, searching for a husband may be as dangerous as finding one, as sexual contacts become more frequent and condom use with a regular partner declines.

Additional questions about the effect of marriage on HIV risks remain. For example, the type of marriage, either monogamous or polygamous, may also affect married girls' relative risks. Despite very small sample sizes, data from Kisumu (where 18% of the unions of girls aged 15-24 are polygamous) suggest that girls in polygamous unions have higher HIV rates than girls in monogamous marriages. Moreover, while findings from these cross-sectional data clearly show that girls who delay marriage are less likely to have HIV by their twentieth birthdays, we know little about the longer-term consequences of delaying marriage. Almost all of these unmarried adolescent girls, whether virgins or sexually active, will eventually enter marriage and face its concomitant risks. In other words, delaying marriage may just delay the inevitable.

Conclusions and Policy Implications

This study builds upon previously reported epidemiological findings that married adolescent girls and young women have higher rates of HIV prevalence than their sexually active unmarried counterparts. Given commonly expressed views about the dangers of premarital sex and deeply held beliefs about the relative safety of marriage, these finding may initially seem counterintuitive. Yet the most plausible explanations for these differences are fairly straightforward, even obvious.

Marriage increases sexual frequency, decreases condom use, and virtually eliminates girls' ability to abstain from sex. Furthermore, since husbands tend to be older

than partners of single girls, HIV prevalence rates found among the husbands are much higher than those found among the unmarried girls' partners. On the other hand, marriage offers one significant protection: it reduces the number of girls' multiple partnerships. Unfortunately, from the perspective of individual risks, reducing the number of partners appears to have only a minimal effect on the probability of becoming infected by STIs with low transmission rates (such as HIV). Risk factors exacerbated by marriage, such as lack of condom use, frequency of sex, and prevalence among partners, play a much larger role in determining the likelihood of acquiring HIV via heterosexual intercourse.

In comparing and contrasting the relative HIV risks of married and sexually active unmarried adolescent girls and finding evidence of some elevated risks for the former, these findings in no way contradict or diminish the well-established high HIV risks associated with unprotected premarital sex in high HIV settings. Neither do they imply that all sex with marriage is risky. Rather, they identify married adolescent girls as a large "at risk" population whose needs are typically ignored by HIV programs and educational messages, which focus primarily on unmarried adolescent girls while either excluding married girls or treating marital status as irrelevant. Common HIV prevention messages encourage young girls to abstain from sex, reduce their number of partners, or use condoms, even though for most married girls these strategies are impractical, if not entirely impossible. Identifying specific policies and programs appropriate for married adolescent girls is beyond the scope of this paper. However, these analyses do suggest some possible points of intervention. For example, could increasing the age at marriage help delay to age of sexual debut and reduce the overall HIV risks for adolescents? Since

selection of an HIV-negative spouse is nearly essential for avoiding HIV after marriage, might younger, sexually inexperienced grooms be considered more attractive or might counseling and testing for HIV become part of the marriage process? Can the development of new technologies such as non-contracepting microbicides or the promotion of new social behaviors such as delaying the first birth after marriage help resolve the currently conflicting goals of becoming pregnancy and avoiding HIV? By highlighting the divergent risks faced by single and married adolescent girls and demonstrating the acute vulnerabilities of the latter, this research challenges us to rethink common assumptions about the relations between sex, early marriage and HIV and to find ways of either delaying marriage or making marriage safer for the young women who enter it.

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Table 1. Socio-Demographic Characteristics and HIV Awareness of Married and Unmarried Sexually Active Girls (aged 15-19) in Kenya and Zambia (source: DHS Kenya 1998, DHS Zambia 1996 and Multicenter Study 1998).

	Demographic Health Surveys						*Multicenter Study*					
	Kenya			**Zambia**			**Kisumu, Kenya**			**Ndola, Zambia**		
	Unmarried	**Married[a]**	**Sig.**	**Unmarried**	**Married[a]**	**Sig.**	**Unmarried**	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**
	n=478	**n=284**		**n=636**	**n=501**		**n=110**	**n=87**		**n=87**	**n=63**	
Age												
Age of girl (mean)	17.4	18.1	***	17.2	17.9	***	17.1	18.1	***	17.4	17.9	*
Residence												
Urban (%)	29.2	22.2		48.4	35.9	***	100.0	100.0		100.0	100.0	
Education												
Completed primary school (%)	45.5	36.8	*	55.0	34.4	***	52.7	48.3		62.1	46.0	*
Transactional sexual activity												
Receives cash/gifts for sex (%)	21.1	4.2	***	39.9	8.2	***	35.5	3.5	***	23.0	4.8	***
Pregnancy Intentions												
Wants pregnancy in < 12 months (%)	3.5	20.2	***	7.5	25.0	***	na			na		
Currently pregnant (%)	6.2	22.2	***	7.4	28.7	***	na			na		
Had at least one child (%)	23.5	65.2	***	18.8	64.8	***	na	46.5		na	62.5	

[a]Married women include women in formal marriages as well as women who live with their partners. Virgins and girls aged 15-19 who are divorced, widowed or separated are excluded.

[b]of those who preceive themselves to be of great or moderate risk.

Significance: +p=0.1, *p<=0.05, **p<=0.01, ***p<0.001

Table 2. Effects of Marital Status on HIV Among Sexually Active Girls Aged 15-24 in Kisumu, Kenya and Ndola, Zambia. (source: Multicenter Study 1998)

	HIV Ages 15-19		**HIV Ages 20-24**		**HIV Ages 15-24**	
	Odds Ratio	**P-value**	**Odds Ratio**	**P-value**	**Odds Ratio**	**P-value**
	n=305		**n=398**		**n=703**	
Model 1						
Never married (ref)	1.00	--	1.00	--	1.00	--
Ever married	***1.76***	***0.036***	***1.34***	***0.233***	***1.91***	***0.000***
Kisumu (ref)	1.00	--	1.00	--	1.00	--
Ndola	0.72	0.224	1.20	0.361	1.04	0.168
Model 2						
Never married (ref)	1.00	--	1.00	--	1.00	--
Ever married	***1.74***	***0.072***	***1.45***	***0.159***	***1.58***	***0.020***
Kisumu (ref)	1.00	--	1.00	--	1.00	--
Ndola	0.72	0.24	1.23	0.325	1.01	0.951
Age 15-16 (ref)	1.00	--	1.00	--	1.00	--
Age 17-18	1.58	0.243	na		1.63	0.202
Age 19-20	1.87	0.150	na		2.78	0.007
Age 21-22	na		0.83	0.478	2.93	0.006
Age 23-24	na		0.90	0.701	3.24	0.003
Less than primary education (ref)	1.00	--	1.00	--	1.00	--
Completed primary education	1.08	0.781	1.03	0.892	1.06	0.757
Ever received payment for sex	1.34	0.435	1.59	0.304	1.43	0.209

Table 3. HIV Risk Factors for Married and Unmarried Sexually Active Adolescent Girls (aged 15-19) in Kenya and Zambia (source: DHS Kenya 1998, DHS Zambia 1996 and Multicenter Study 1998).

	Demographic Health Surveys						***Multicenter Study***					
	Kenya			**Zambia**			**Kisumu, Kenya**			**Ndola, Zambia**		
	Unmarried	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**
	n=478	**n=284**		**n=636**	**n=501**							
Exposure via Unprotected Sex							**n=110**	**n=87**		**n=87**	**n=63**	
Duration Sexually Active												
Age of sexual debut (mean)	14.9	15.1		14.6	15.0	***	15.1	14.7		15.9	15.2	**
Number of years sexually active (mean)	2.5	3.1	***	2.6	2.9	***	2.0	3.4	***	1.5	2.7	***
Frequency of Intercourse												
Had sex in last year (%)	81.1	100.0	***	78.2	98.1	***	75.5	100.0	***	50.6	100.0	***
Had sex in last week (%)	17.2	67.9	***	17.7	62.8	***	10.9	64.4	***	2.3	52.4	***
Condom Use												
Often/always use condoms (%)[a]	NA	NA		NA	NA		19.5	3.5	***	25.6	6.8	***
Condom used last sex (%)	14.2	3.6	***	18.8	7.6	***	22.9	NA		31.8	NA	
Number of Partners												
Girl's Partners in Last 12 Months												
Zero partners (%)	22.7	0.0	***	23.0	0.0	***	24.6	0.0	***	50.0	0.0	***
More than one partner (%)	10.3	5.0	*	14.5	1.4	***	15.5	6.9	+	5.8	4.8	
Range of number of partners	0-21	1-4		0-11	1-12		0-3	1-3		0-2	1-3	
Ave. number of partners (%)	1.0	1.1		1.0	1.0		0.9	1.1		0.6	1.1	***
HIV Prevalence												
HIV prevalence (%) [b]	na	na		na	na		11.5	30.0	***	16.8	31.6	+
Biological Transmission Rate												
Susceptibility	?	?		?			?	?		?	?	
Infectivity of partner (viral load)	?	?		?			?	?		?	?	

Significance: ***p<=0.001, **p<=0.01,*p<=0.05, +p<=0.1.

[a] Data missing on respondents who did not have sex in the last year.

[b] HIV status determined from male respondents aged 15-59 who reported having had sex with a married or unmarried female younger than 20 in the last year. HIV rates among the partners of unmarried girls are similar to those reported by Glynn *et al.* (2000), who uses three different methods to estimate infection rates among partners.

Table 4. Effects of Marital Status on Selected HIV Risks Among Sexually Active Girls Aged 15-19 in Kenya and Zambia (source: DHS Kenya 1998, DHS Zambia 1996 and Multicenter Study 1998).

	Demographic Health Surveys [a]				***Multicenter Study*** [b]	
	Kenya		**Zambia**		**Kisumu & Ndola**	
	Odds Ratio on Married	**P-value**	**Odds Ratio on Married**	**P-value**	**Odds Ratio on Married**	**P-value**
	n=757		**n=1135**		**n=347**	
Exposure via Unprotected Sex						
Duration sexually active (coef.)	*0.18*	0.265	*-0.06*	0.636	*0.94*	0.000
Had sex last week	*11.90*	0.000	*7.65*	0.000	*28.67*	0.000
Used condom last sex	*0.23*	0.000	*0.50*	0.003	*na*	
Used condoms often/always[c]	*na*		*na*		*0.14*	0.000
Unprotected sex last week	*13.07*	0.000	*7.58*	0.000	*29.41*	0.000
Number of Partners						
More than 1 partner in last year	*0.54*	0.256	*0.10*	0.000	*3.41*	0.054

[a] Models using DHS data use multivariate logistic regression to control for urban/rural residence, age, education, recieving payment in exchange for sex, and desire to become pregnant in next year.

[b] Multicenter Models control for city of residence, age, education and receiving payment in exchange for sex.

[c] Data missing on respondents who did not have sex in the last year.

Table 5. Simulated Probability of Acquiring HIV for Sexually Active Married and Unmarried Girls Using Reported Sexual Behaviors, by Condom Use and Prevalence Among Partners (source: DHS Kenya 1998, DHS Zambia 1996 and Multicenter Study 1998).

	Demographic Health Surveys						***Multicenter Study***		
	Kenya			**Zambia**			**Kisumu & Ndola**		
	Unmarried	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**
	n=444	***n=270***		***n=586***	***n=491***		**n=347**		
	Condom Failure 10%, Infectivity=0.003								
Prevalence Among Partners									
40%	2.1%	10.9%	***	2.7%	11.9%	***	1.0%	10.0%	***
30%	1.6%	8.2%	***	2.0%	8.9%	***	1.0%	7.8%	***
20%	1.1%	5.5%	***	1.3%	6.0%	***	0.5%	5.2%	***
10%	0.5%	2.7%	***	0.7%	3.0%	***	0.2%	1.3%	***
	Condom Failure 50%, Infectivity=0.003								
Prevalence Among Partners									
40%	2.2%	11.0%	***	2.8%	12.2%	***	1.0%	10.5%	***
30%	1.7%	8.3%	***	2.1%	9.1%	***	0.8%	7.9%	***
20%	1.1%	5.5%	***	1.4%	6.1%	***	0.5%	5.3%	***
10%	0.6%	2.8%	***	0.7%	3.0%	***	0.3%	2.6%	***
	Condom Failure 50%, Infectivity Unmarried=0.01, Infectivity Married=0.003								
Prevalence Among Partners									
40%	5.8%	11.0%	***	6.8%	12.2%	***	3.2%	10.5%	***
30%	4.3%	8.3%	***	5.2%	9.1%	***	2.4%	7.9%	***
20%	2.9%	5.5%	***	3.5%	6.1%	***	1.6%	5.3%	***
10%	1.5%	2.8%	***	1.7%	3.0%	***	0.8%	2.6%	***

Significance: ***p<=0.001, **p<=0.01,*p<=0.05, +p<=0.1.

Table 6. Knowledge, Perceived Risks, and Behavioral Changes in Response to HIV Among Married and Unmarried Sexually Active Girls (aged 15-19) in Kenya and Zambia (source: DHS Kenya 1998 and DHS Zambia 1996).

	Kenya			Zambia		
	Unmarried	**Married**	**Sig.**	**Unmarried**	**Married**	**Sig.**
	n=478	**n=284**		**n=636**	**n=501**	
Knowledge about HIV	**n=478**	**n=284**		**n=636**	**n=501**	
Knows ways to avoid AIDS (%)	82.3	76.5		80.2	75.1	+
Those who know ways to avoid HIV	**n=389**	**n=219**		**n=499**	**n=371**	
Abstain from sex (%)	28.5	14.3	***	29.2	22.9	*
Condom during sex (%)	48.7	41.1	+	47.6	32.8	***
Only one sex partner (%)	NA	NA		31.9	44.2	***
Avoid prostitutes (%)	5.2	6.7		2.4	4.5	
Avoid multiple partners (%)	27.3	29.9		NA	NA	
Perceived risks of HIV	**n=478**	**n=284**		**n=636**	**n=501**	
At moderate or great risk (%)	31.0	28.8		17.5	29.7	***
Those with moderate or great risk	**n=145**	**n=78**		**n=119**	**n=157**	
No condom use (%)	28.9	14.8	***	19.4	6.8	**
More than 1 partner (%)	19.6	5.5	*	23.1	4.8	***
Many partners (%)	7.9	1.0		8.1	5.7	
Spouse or other partner (%)	32.5	63.0	***	51.0	90.2	***
Blood transfusions (%)	15.4	12.8	***	6.5	3.2	***
Had injections (%)	27.9	17.2	*	1.9	1.0	*
Doubts partners' faithfulness (%)	10.8	17.4	**	NA	NA	
Behavioral Changes	**n=478**	**n=284**		**n=636**	**n=501**	
Stopped sexual behavior (%)	17.9	2.5	***	26.5	1.3	***
Started using condoms (%)	7.9	2.1	**	7.5	0.8	***
Only one partner (%)	47.9	62.1	***	48.1	76.0	***
Reduced no. of partners (%)	15.0	5.5	***	7.3	1.7	***
Ask spouse/partner to be faithful (%)	9.9	18.3	***	2.0	11.6	***

Significance: +p=0.1, *p<=0.05, **p<=0.01, ***p<0.001

Figure 1. Predicted HIV Prevalence (Infectivity = 0.003)

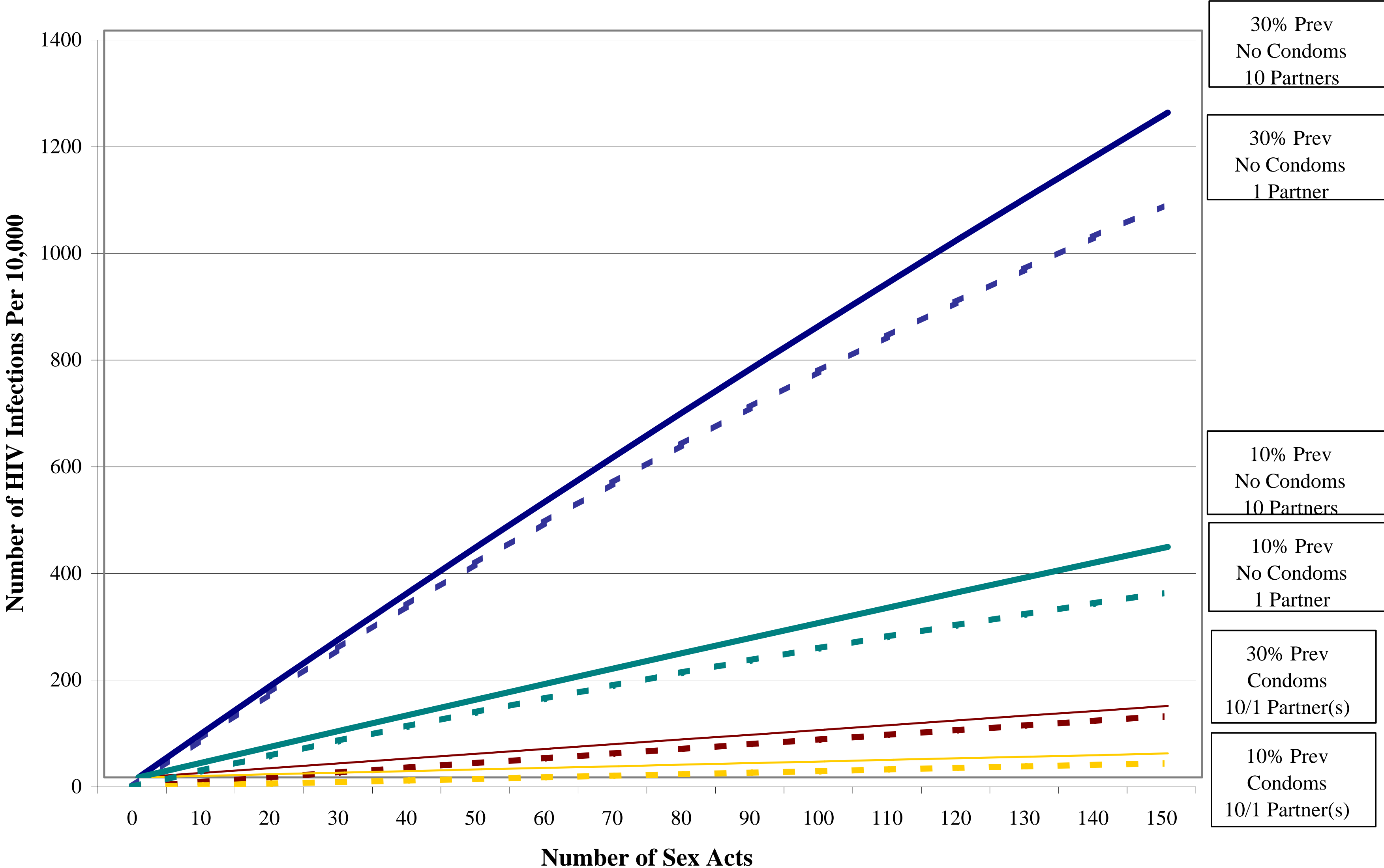

Figure 2. Predicted Gonorrhea Prevalence (Infectivity = 0.5)