Understanding Perceptions of HIV Risks Among Married Couples in Malawi:

Why do Wives Worry More?

Shelley Clark
Harris School of Public Policy
University of Chicago
1155 E. 60th Street
Chicago, IL 60637
E-mail: sclark1@uchicago.edu

Annual Meeting of the Population Association of America
Philadelphia, PA
April 2, 2005

Abstract:
This paper aims to understand why wives perceive themselves to be at greater risk of having HIV/AIDS than their husbands when both biological measures and *a priori* expectations indicate that married couples largely share risks and have comparable rates of HIV infection. Using data from the Malawi Diffusion and Ideational Change (MDIC) survey conducted in 2001, we postulate and test three possible explanations for these stark differences in HIV risk perception by sex. While we cannot eliminate the problem of reporting errors with respect to self-reported sexual behaviors, we show that controlling for different sources of risk does not reduce the disparity between husbands' and wives' perception of risk. Moreover, it does not appear that husbands and wives assess these sources of risk differently. Specifically, wives are not simply "bigger worriers" nor are husbands more likely to perceive themselves as being "invulnerable" given specific risk factors. Instead, by using an instrumental variable approach to minimize measurement error associated with suspicion of spouse's sexual behaviors, we conclude that much of women's worry about HIV is driven by their uncertainty regarding their spouses' extra-marital sexual relationships and the potential risks they pose.

Introduction:

Several theoretical health behavior models, such as the Health Belief Model, the Theory of Reasoned Action, Social Cognitive or Learning Theory, and the AIDS Risk Reduction Model (Catania, Kegeles and Coates 1990; Fisher and Fisher 1992; Fisher 1997; UNAIDS 1999), have been proposed to understand behavioral change in response to HIV/AIDS threats. These models identify perception of HIV risks as one of the main prerequisites for effective behavior change. Several empirical studies throughout sub-Saharan Africa have shown an association between risk perception and behavioral change (Cleland 1995). For example, in Kenya, Akwara and colleagues (2003) found a strong positive association between respondents' perceptions that they were HIV-positive and risky sexual behaviors in the last 12 months. In Mozambique, one study showed that individuals who correctly assess their risk of HIV are more likely to use condoms (Prata et al. 2003). Another study in Malawi suggests that wives who are more worried about HIV risks are more likely to divorce their spouses (Smith and Watkins 2003). Individuals' perceptions of their own HIV risks are also likely to motivate them to get tested for HIV or to modify their sexual and other behaviors to reduce HIV risks. Thus, gaining insights into the determinants of risk perceptions is, therefore, essential for developing better intervention strategies.

Yet, much less is known about how risk perceptions are formed. While the majority of studies investigate the effect of risk perception on sexual behaviors, they acknowledge that sexual behaviors are also likely to be the dominate factors affecting risk perception (Akwara, Madise and Hinde 2003; Cleland 1995; Prata et al. 2003; Prohaska et al. 1990b). Partners' sexual behaviors, or more precisely beliefs about partners' behaviors, also appear to shape individuals' worries about having or getting HIV/AIDS (Moore, Sly and Harrison 2004; Smith 2003). Theoretical and empirical models of risk perception tend to also emphasize a variety of other factors such as knowledge about HIV risks,

awareness about engaging or avoiding such risks, social and cultural perceptions of HIV, and unobserved personal characteristics such as one's inclination to worry and sense of vulnerability (Akwara 2003; Barden-O'Fallon et al. 2004; Behrman, Kohler and Watkins. 2003; Prohaska et al. 1990a; Scherer and Cho 2003; Smith 2003). Given the multitude of factors that can potentially affect risk perception, finding instances where individuals' *actual* risk of acquiring HIV is expected to be similar, but where their *perceived* risk of HIV differs systematically, could potentially help disentangle some of these effects.

One of the largest and most puzzling inconsistencies between self-reported *perceptions* of HIV risk and *actual* risk is found among married couples throughout much of sub-Saharan Africa. Married couples tend to have the same HIV status and sero-discordance among married couples is relatively rare, which is unsurprising given the high levels of unprotected sexual intercourse that typically occurs within marriage. Surveillance data documenting the HIV status of married couples show a very high degree of baseline concordance in the HIV-status of married couples, ranging between 90% and 95% (Carpenter et al. 1999; Hugonnet et al. 2002; Serwadda et al. 1995). Moreover, among discordant couples, the HIV-positive partner was as likely, if not slightly more likely, to be the husband. One study found that while sero-discordant married couples began with equal portions of husbands and wives being infected, during the seven years these couples were followed, "men [were] twice as likely as women to bring HIV infection into the marriage, presumably through extra-marital sexual behaviors" (Carpenter et al. 1999). Given their similar prevalence rates, we contend, the married men and women share, on average, nearly identical "real" risks of having HIV.

Yet, wives *perceive* themselves to be at much higher risk then husbands. To illustrate this point, Table 1 uses matched couples data from recent Demographic and Health Surveys conducted in sub-Saharan African countries. Of the 16 countries with relevant data, we find that only in Burkina Faso and Ghana (differences not significant) are husbands more likely than wives to report being at moderate or great risk of getting HIV/AIDS. In the 14 other countries, many of which are experiencing severe HIV/AIDS epidemics, wives express a much greater belief that they are a risk. In some of these more than twice as many wives as husbands perceive themselves to be at moderate or great risk. Several surveys have found that wives tend to be more worried about HIV than their husbands, but none of these studies attempts to explain why these differences emerge (Akwara, Madise and Hinde 2003; Behrman, Kohler and Watkins. 2003; Smith 2003)

(insert Table 1 about here)

In this paper, we explore three possible explanations for the discrepancy between husbands' and wives' perception of risk. First, on average, husbands and wives are likely to have different predictors of perceived HIV risk. Previous literature suggests that husbands' perception of risks is more likely to be dominated by their own sexual behaviors while wives' risks are more likely to be governed by perceptions of their spouses' sexual behaviors (Akwara, Madise and Hinde 2003; Smith and Watkins 2003). Men and women may also exhibit different levels of knowledge about HIV or have

experienced different levels of personal exposure to the consequences of HIV. Thus, we begin by testing whether the differences between husbands' and wives' HIV risk perceptions can be explained by differences in their sexual behaviors, their perceptions of their spouses' sexual behaviors, or their level of awareness about HIV risks.

In addition to having different sources of HIV risk and different levels of awareness about HIV, husbands and wives may also interpret these factors differently when formulating their perceptions of HIV risk. For example, the death of a close friend due to AIDS may raise both men's and women's awareness about the effects of HIV, but it may cause women to become extremely worried about their own risks of acquiring HIV, while it may only slightly elevate men's level of concern. Similarly, if a man engages in extra-marital intercourse he may believe that this will raise his probability of getting HIV by, say, 10%, while women may believe that if she has a non-marital sexual partner she will certainly get AIDS. In short, a second explanation is that women may be greater "worriers" and exhibit a stronger reaction to each of the factors affecting risk perception. Alternatively, one might think that men "don't worry enough" and are too inclined to perceive themselves as invulnerable despite the dangers confronting them. The assumption that men and women not only face different risks, but also assess these risks differently is implicit in much of the previous research on HIV risk perceptions which run separate models for men and women. Yet this assumption is rarely explicitly stated or tested empirically.

Finally, we consider that not only do men and women have different sources of risk affecting their perceptions, but also some of these sources of risk are known with greater precision or accuracy than others. Unlike with their own sexual behaviors, husbands and wives usually perceive their spouses' sexual behaviors, particularly whether or not they have extra-marital sexual partners, with considerable uncertainty. Thus, a third possible explanation is that it is this uncertainty surrounding risks posed by spouses, rather than simply the risk itself, that may cause wives to perceive higher levels of risk.

These three proposed explanations are not meant to be either mutually exclusive or exhaustive. By systematically exploring each of them, however, we hope to gain a better understanding of how individuals within the marital union evaluate and express their perceptions about their own risks of HIV.

HIV/AIDS, marriage, and perceived risk in Malawi

Malawi is a small, sliver-shaped country running along the western shore of Lake Malawi in south-eastern Africa. The majority of its residents are rural and live by subsistence farming and fishing. HIV/AIDS rates are relatively high with estimates among adults ages 15-49 ranging from 11.3% to 17.7% at the end of 2003 (UNAIDS 2004), with higher rates reported in urban areas than in rural settings (Slutsker et al. 1994).

Marriage is nearly universal with an average age of first marriage for women of about 17.8 and for men of 22.8 (DHS Malawi 2000). As in many countries in sub-Saharan Africa, marriage can be an evolving process with no clear or official date of

commencement. Somewhat unusually for Africa, marital dissolution is quite common (Schatz 2003). Remaining sexually exclusive with one partner throughout one's life is uncommon for men as well as women, with relatively high numbers of premarital partners, extramarital partners, and polygamous unions. Nonetheless, for 31.7% of men and 66.3% of women finding their future spouse marks their sexual debut. Moreover, as found in many developing countries, marriage significantly alters sexual behaviors dramatically increasing sexual frequency and reducing condom use, while simultaneously possibly reducing the number of concurrent sexual partners at least for women, if not for men (Caraël, Ali and Cleland 2001; Caraël et al. 1995; Clark 2004).

Given the large proportion of persons in marital relationships and spouses' high rates of sexual exposure to each other, it would be surprising if marriage did not constitute one of the major contexts in which HIV was transmitted. This study explores the perception of HIV risks among married couples. In this sample over 50% of wives and nearly a quarter of husbands consider their spouse to be the main source of HIV/AIDS risk (author's calculations). By focusing this study on rural, married couples, we hope to examine HIV perceptions among "typical" Malawians and to hone in on the impact of particularly important sexual partners, namely spouses, on perceived risk.

Conceptual framework

In this paper, we attempt to discover what explains the higher perception of HIV risk among women, by testing whether women actually experience higher levels of risk, interpret these risks differently, or face greater uncertainty when assessing their risks. We begin with the simple framework that ***actual*** HIV risk via heterosexual intercourse among married couples is primarily a function of each person's past and current sexual behaviors and his or her spouse's sexual behaviors (see Figure 1). Individual knowledge, cultural beliefs, social networks, and power dynamics greatly affect these sexual behaviors and relationships, but do not directly affect HIV risks.

In contrast to ***actual*** HIV risk, the ***perception*** of HIV risk depends on several other factors as depicted in Figure 2. For example, in addition to one's own sexual behaviors, *beliefs* about or *perceptions* of ones' spouse's sexual behaviors are also important. While perception of one's spouse's sexual behaviors may reflect his or her actual behaviors, other factors may also influence or distort this perception. In addition, a host of other personal and community-level characteristics, many of which are unobservable, are likely to determine one's information about and attitudes toward HIV/AIDS. For example, some individuals may be better informed about HIV risks than others. Others may know how HIV is transmitted but may harbor a sense of invincibility or denial. Still others may be inherently risk-averse or feel acutely vulnerable. In Figure 2, we bundle all of these factors under "awareness about HIV" to signify both knowledge of and responsiveness to information about HIV/AIDS. Information about HIV transmission is viewed as being particularly salient in shaping risk perceptions.

Previous studies have emphasized the importance of both formal and informal information distribution mechanisms, such as public education campaigns about HIV/AIDS and social networks, in raising awareness about HIV risks. However, most of the empirical studies on perceptions of HIV risk have found surprisingly little effect of either information about HIV transmission or access to the media on perceptions of risks (Akwara 2003; Barden-O'Fallon et al. 2004; Prohaska et al. 1990a). Interestingly, however, in Malawi, Behrman, Kohler, and Watkins (2003) find that having friends perceived to be at high risk of HIV increases one's own perception of being at risk. Smith and Watkins (2003) also find that characteristics of one's social networks and social characteristics are associated with level of worry about HIV among both men and women in Malawi. Both of these studies are consistent with the social network contagion theory of risk perception (Scherer and Cho 2003). Indeed, some researchers have even contended that community- or societal- level factors, such as the number of HIV-related deaths in the village, may be more important than individual behaviors in determining risks (Gregson et al. 1998; Smith 2003).

(insert Figures 1 and 2 about here)

Many of these measures of "HIV awareness" which influence one's perception of personal HIV risks may also directly influence one's perception of one's spouses' sexual behaviors (see Figure 2). For example, an individual who may have a pessimistic view about their chances of having HIV may be equally pessimistic about the likelihood that their spouse has forsaken other extra-marital sexual partners. Similarly, an educational campaign which notifies individuals about sources of HIV risks and thereby increases the perception that an individual is at risk may also heighten that individuals' suspicion that their partner is at risk as well.

Husbands and wives are likely to differ systematically with respect to their own sexual behaviors as well as their perceptions of their spouses' sexual behaviors. However, the effects of these behaviors on risk perceptions may be stronger or weaker for wives than for husbands. In some settings husbands may also be better informed about HIV/AIDS risks than wives. However, men may be less likely to personalize this information and translate it into greater concern about HIV risks. By empirically testing several of the relationships depicted by the arrows in Figure 2 of our conceptual model, we can determine which factors appear to maximize and minimize the differences in perceptions of HIV risk between husbands and wives.

Data and methods:

The data used in these analyses come from the second wave of the Malawi Diffusion and Ideational Change (MDIC) survey conducted in 2001 in three rural areas, Balaka in the south, Michinji in the central region, and Rumphi in the north. Detailed information about this survey can be found at http://www.ssc.upenn.edu/Social_Networks/. We limit our analyses to 963 currently-married couples where both the husband and wife were

interviewed; thus our final sample consists of 963 wives and 963 husbands (note that the sample contains 14 husbands who are married to one or more additional wives).

To measure perception of HIV risk, we use responses to three questions (see Table 2). The first question asks respondents how worried they are that they might catch AIDS (1=not much, 2=somewhat, and 3=very). The second and third outcome variables report respondents' self-perception of the likelihood that they currently have HIV/AIDS or will get HIV/AIDS, respectively. (The questions read "In your opinion, what is the likelihood that you are infected with HIV/AIDS now?" and "In your opinion, what is the likelihood that you will become infected with AIDS in the future?".) The respondents rate their likelihood on a four-point scale ranging from "0" (no likelihood) to "3" (high likelihood). While virtually all respondents evaluated their level of worry about HIV, about 200 respondents (about 10% of the sample) responded that they "didn't know" their likelihood of being currently infected and about 300 respondents (15%) reported that they did not know their likelihood of becoming infected in the future. Further analyses of respondents who reported that they "don't know" their probability of having HIV showed no differences in socio-demographic characteristics. However, they were less likely to have engaged in premarital sex, but were significantly more likely to suspect that their spouse has had extra-marital sexual partners.

(insert Table2 about here)

Consistent with findings from other countries (see Table 1), we find that wives are significantly more likely to worry about HIV/AIDS and to believe that they either currently have or will acquire the disease. 16.8% of wives believe that they are moderately or highly likely to be currently infected with HIV compared to only 10.7% of husbands. If infection rates in these rural communities are around 13% and if spouses have comparable rates, this suggests that women may be overestimating their risk of HIV infection, while men underestimate it.[1]

Table 3 shows several of our key independent variables including some socio-demographic characteristics, own sexual behaviors, perceptions of spouse's sexual behaviors, and awareness about HIV. We find that husbands are on average about seven years older than wives, and are significantly more likely to have completed secondary school, but are similar to their wives with respect to religion, tribe, and economic status (except ownership of a radio).

With respect to sexual behaviors, women initiated sexual activity two years before men and got married five years earlier. However, women were about twice as likely to marry their first sexual partner (66.3% women, 31.7% men). In general, men reported more non-marital sexual partners, with an additional 21% acknowledging having had a sexual partner other than their first sexual partner and their spouse(s). Husbands were also more likely to have been previously married. In addition to the number of sexual partners, recent studies have strongly indicated that concurrency (having more than one sexual

[1] Since these data lack biomarkers, we are unable to determine whether husbands or wives are more accurate in assessing their individual risks.

partner during a given time period) may have an important effect on HIV risks. Nearly 10% of husbands admit to having had more than one non-marital partner at the same time, compared with only 1.4% of women. Men were also more likely to report having at least sometimes used condoms with their non-marital partners (13.0% vs. 2.5%), but the percentages for both remain relatively low. In comparison, over 19% of husbands and almost 6% of wives stated that they had used a condom with their spouse at least once.

(insert Table 3 about here)

Of particular interest to this study are respondents' beliefs about spousal sexual behaviors, specifically their infidelity. Both wives and husbands were asked "Do you suspect or know that your husband (wife) has had sexual relations with other women (men) apart from you since you were married?" The response categories are yes, suspect him or her, can't know what he or she does, and probably not. One could argue that the "can't know" category consists primarily of individuals who "suspect" their spouses of infidelity but who are reluctant to state so explicitly (personal communication, Susan Watkins). Nonetheless, in these analyses we create a dummy variable for suspicion that spouse has been unfaithful which equals "1" if the respondent reported that she or he knew or suspected their spouse of infidelity and "0" if the respondent either could not tell or thought their spouse was probably not unfaithful.

Lastly, we use two measures of "awareness about HIV". Knowledge about HIV/AIDS is very high in Malawi and commonly discussed within social networks. Practically everyone has heard of HIV/AIDS and nearly everyone can correctly name at least one means of transmission, including via heterosexual intercourse. In our first measure of HIV knowledge, we ask respondents whether a person who looked healthy could be infected with HIV. The overwhelming majority, over 90% of both men and women, correctly responded that they could. Respondents were also asked about the number of HIV-related funerals they attended in the last year, as previous studies have found that funeral attendance had a profound effect on individuals' personal sense of vulnerability to HIV. On average men attended slightly more funerals than women, but nearly all men and women in our study said they knew at least one person who had died of AIDS in the past year.

In our multivariate analyses, we further investigate the bivariate discrepancy between husbands' and wives' perceptions of risk using the following linear specification:[2]

$$RiskPerception = \alpha + Sex\beta_1 + X\beta_2 + Y\beta_3 + Z\beta_4 + K\beta_5 + e \qquad (1)$$

We are particularly interested in the coefficient on sex (β_1), which we would expect to be equal to zero if all relevant predictors of risk perception were included and husbands' and wives' had the same risk perception function. In this equation X is a vector of respondent's observed characteristics: age, education, religion, region, tribe, and

[2] In the appendix, we also present these models using ordered logistic regression, but as our substantive conclusions do not differ by model specification, we use the OLS models in our results section.

economic status. Y is a vector of respondent's sexual behaviors including whether they married their first sexual partner, and whether they had other non-marital partners. It also includes measures for whether they have been married before and whether they have had multiple non-marital partners during the same time. A dummy variable indicates whether the respondent ever used condoms with non-marital partners. The variables designated by Z include the perceived sexual behaviors of spouses. Although we do not have measures of the perception of spouses' sexual behaviors before marriage, we do know whether the respondent suspects their spouse of having had extra-marital sexual partners during the time they have been married. Lastly, the vector of K indicates the respondents' awareness about HIV/AIDS. Specifically, it includes whether the respondent knows that a healthy-looking person can have HIV and the number of individuals the respondent knew who died of HIV/AIDS in the preceding year.

To examine differences in husbands' and wives' functional form, we test for interaction effects between sex of the respondent and sexual behaviors.

$$RiskPerception = \alpha + Sex\beta_1 + X\beta_2 + Y\beta_3 + Z\beta_4 + Sex * Y\beta_5 + Sex * Z\beta_6 e \qquad (2)$$

Finally, since spouses' sexual behaviors are reported with considerable "mismeasurement", we attempt to identify a valid instrumental variable for suspicion about spouse's infidelity. We draw on a paper by Ashenfelter and Krueger (1994), in which the authors use another person's assessment of the variable of interest as an instrument for the respondent's own report. In particular, they use twin siblings' reports of the respondent's educational level as an instrument for self-reports of educational attainment to reduce measurement error in estimating the effects of returns to education. Similarly, we propose correcting for the mismeasurement inherent in respondent's reporting of spouse's infidelity by using their spouse's self-reports of their own infidelity as an instrument. For spouse's self-reports of infidelity to be a valid instrument it needs to fulfill two criteria. First, spouse's admissions of infidelity must be correlated with respondent's belief that their spouse's have been unfaithful. To test this assumption, we regress respondent's suspicion of spouse's infidelity (Z) on spouse's self-reported infidelity and the other control variables. In all three first-stage regressions, the F-statistic is greater than 10, suggesting that spouse's self-reports of infidelity is a sufficiently strong instrument.

$$Z = \alpha + Sex\beta_1 + X\beta_2 + Y\beta_3 + Z\beta_4 + (Spousal - Infidelity)\beta_4 + e \qquad (3)$$

A more difficult assumption to verify is whether spouse's infidelity reports are uncorrelated with the error term. Given only one proposed instrumental variable, we are unable to test this empirically. From a theoretical perspective, however, we argue that whether a spouse has been unfaithful should affect ***perceived*** HIV risk only through the respondent's awareness of their spouse's indiscretions. Lastly, Hausman tests for endogeneity were conducted to examine whether the variable "suspicion of infidelity," is endogenously correlated with perceptions of risk. All estimates provide evidence that this variable is indeed endogenous, although the predicted value from equation (2) is only significant at the 10% level in the equation for current likelihood of having HIV/AIDS.

Therefore, our final and preferred model instruments perceptions of spousal infidelity with spouses' self-reports of having extra-marital sexual partners ($\hat{Z}$).

$$RiskPerception = \alpha + Sex\beta_1 + X\beta_2 + Y\beta_3 + \hat{Z}\beta_4 + K\beta_5 + e \qquad (4)$$

Results:

Tables 4, 5 and 6 examine the determinants of three outcome variables pertaining to HIV risk perception: level of worry about HIV/AIDS, perceived probability of currently having HIV/AIDS, and perceived likelihood of getting HIV/AIDS in the future, respectively. We begin by testing whether husbands continue to worry less (or alternatively that wives worry more) after controlling for a series of basic socio-demographic characteristics (results shown in Model 1 of Tables 4, 5, and 6). We then examine what happens to the coefficient on sex of the respondent as we add control measures of the respondent's own sexual behaviors (Model 1), spouse's sexual behaviors (Model 2), and awareness about HIV (Model 4), sequentially.

(insert Table 4, 5 and 6 about here)

For all three outcome variables of risk perception, we find that husbands perceive themselves to have significantly lower risk of HIV/AIDS than wives. For example, in Model 1 of Table 4, wives are 28% more likely to report a higher category of worry about HIV/AIDS than husbands. Similarly in Table 5, we find that husbands are 25% less likely to report that they are, for example, somewhat likely to be currently infected with HIV, holding socio-demographic factors constant. In Model 2, we include controls for a variety of self-reported sexual behaviors including whether the respondent engaged in premarital sex, had other non-marital sexual partners, and ever had concurrent sexual partners. Since husbands are much more likely to report engaging in these behaviors, it is not surprising the coefficient on sex of the respondent actually increases in magnitude in Model 2 (increasing to -0.37 in Table 4 and to -.31 in Table 5). Thus, once we account for their own sexual behaviors, husbands are even less likely to worry about HIV/AIDS or to believe that they have or will get HIV in the future relative to wives, further emphasizing the stark differences in men's and women's perceptions.

Self-reported sexual behaviors have several different effects on risk perception, depending on how risk perception is measured. Having had non-marital partners, including not having married one's first sexual partner and having had other pre- or extra-marital partners, both elevate the overall level of worry about HIV/AIDS. In comparison, respondent's beliefs that they either currently have or will become infected are only significantly and consistently increased by having had other non-marital partners . As suggested by the literature, concurrency of sexual partnerships as measured by having more than one non-marital partner during the same time period has a significant effect on current risk assessment (Table 5) but not on future risk assessment (Table 6). In comparison, being in a polygamous union where husbands have more than one spouse simultaneously significantly increases risk perception for all three outcome measures.

(Note: While polygamy represents one of husband's own sexual behaviors, it should technically be considered a known spousal sexual behavior for wives.) Lastly, condom use in Malawi remains relatively uncommon, thus it may not be surprising that use of condoms outside of marriage does not significantly affect our measures of perceived risk.

To the extent the husbands are simply more willing to report engaging in risky sexual behaviors, the increased difference in perceived risk between men and women observed in Model 2 may be exaggerated. Given the magnitude of these differences, however, these findings suggest that wives' relatively elevated concern about HIV risks are not primarily driven by their own sexual behaviors.

In Model 3 of Tables 4, 5 and 6, we add the respondent's belief about whether or not their spouse has had extra-marital sexual relations to our model. For all three of our measures of HIV risk perception, we find that believing that one's spouse to have had extramarital sexual relationships is an important positive predictor of risk perception and is highly significant. Including this variable for suspicion also significantly diminishes the magnitude of the coefficient on sex of the respondent, suggesting that wives are more likely to be concerned about their husbands' extra-marital sexual partnerships than vice versa. The effects on the coefficient for sex in both Models 2 and 3 are consistent with the existing literature, which suggests that men's own sexual behaviors tend to increase their perception of risk, while women's concerns about HIV are more likely to be elevated by their spouse's behavior. Nonetheless, despite controlling for both own sexual behaviors and perceptions of spouses' sexual behaviors, the coefficient on sex of the respondent remains highly significant, leaving much of the difference between husbands' and wives' perception of risk unaccounted for. Since the coefficient on sex remains significant, we can rule out one possible explanation for why wives perceive themselves to be at greater risk than husbands. Specifically, if wives felt themselves to be at greater risk because they grossly overestimated the risky sexual behaviors of their husbands, then controlling for perceptions of spouse's behaviors should fully account for the differences between husbands' and wives' perceptions.

In our last model specification (Model 4), we include the two measures of "awareness about HIV" (whether a person who looks healthy have HIV and the number of HIV-related funerals the respondent attended last year). Neither of these measures has a significant effect on either worry about HIV (Table 4) or the perception that the respondent is currently infected (Table 5). In Table 6, we find that for each additional HIV-related funeral the respondent attended there is a small, positive, and marginally significant effect on the respondent's belief that they are likely to become infected in the future. Including these measures for awareness about HIV has no appreciable effect on the coefficient for sex of the respondent, suggesting that husbands and wives are roughly equally aware of the risks posed by HIV in the community. Given the negligible effects of these measures and our concerns about their likely endogeneity, they are dropped from subsequent linear models.

As a check on the robustness of our findings thus far and on their sensitivity to model specification, we also estimate Model 4 using ordered logitistic regression rather than

OLS. The results, presented in the Appendix, show no substantive differences with respect to the sign or significance of any measure of own sexual behaviors, perception of spouses' sexual behaviors, and awareness about HIV for any measure of perceived risk. Thus for ease of computation, we retain these OLS regressions when we turn to our interaction and instrumental variable models below.

Since controlling for what we consider to be many of the primary determinants of risk perception (namely own sexual behaviors and perceptions of spouses' sexual behaviors) fails to fully explain the difference between husbands' and wives' risk perceptions, we next investigate whether husbands and wives interpret these different factors differently when formulating their perceptions about risk. For example, while both husbands and wives may think that having non-marital partners will increase their likelihood of being infected with HIV, wives may place a greater emphasis on this risk factor believing that having a non-marital partner will almost certainly give them HIV, while husbands may think that having a non-marital partner poses a much smaller risk.

To test whether husbands and wives emphasize different factors, we interact sex of the respondent with self-reported sexual behaviors and perceptions about spouses' sexual behaviors (results not shown). In all three models of risk perception, an F-test of all the interaction terms reveals that these variables are not jointly significant ($p=0.37$, $p=0.54$, and $p=0.32$, respectively). When tested individually, only the interaction between sex of respondent and perception that one's spouse had extra-marital partners was significant, suggesting that wives perceived even greater risk than husbands if their spouse was thought to have extra-marital sex. The effect, however, was only significant at the 0.05 level. Thus, while these is clear evidence that on average men and women perceive their risk coming from different sources, there is little compelling evidence that men and women to evaluate these sources very differently when calculating their perception of risk, suggesting that running separate models for men and women is unnecessary.

Yet, if men and women interpret risk factors in the same manner then presuming that (at least the most important) factors determining risk perception have been included in our model, we have yet to resolve the puzzle for why wives persist in reporting higher levels of risk. As final explanation, we return to our conceptual model and recall that respondents' perception of their spouses' sexual behaviors is likely to be measured with considerable uncertainty. Spouses may have numerous ways of knowing about their spouses' extra-marital sexual relationships; for example by finding a condom in their husbands' pocket or wives' purse or hearing from a neighbor that their spouse was seen with another man or woman. Yet, the majority of persons are unlikely to be entirely certain about their spouses' behaviors, even in the presence of such "evidence". Perhaps more importantly, many spouses may not want to know with certainty their spouses' behavior for fear that such knowledge would lead to fights or even to divorce. Thus beliefs about spousal infidelity are often based on considerable uncertainty and fraught with measurement error. If this is the case, then correcting for the "measurement error" by using an instrumental variable approach could help eliminate or at least minimize this bias.

In Table 6, we instrument reported suspicion about spousal infidelity with spouses' own self-reports. For all three outcome measures of risk, we find that after instrumentation the coefficient on suspicion of spousal infidelity becomes substantially larger. The coefficient on sex of the respondent, however, approaches zero, rendering it insignificant. in all models. One plausible explanation for these results is that it is the uncertainty about spouses' sexual behaviors that causes individuals to worry about HIV risks. Since wives are more likely to suspect their husbands of infidelity, they are also more likely to experience greater uncertainty in calculating their perception of HIV risk. If wives were able to minimize their uncertainty, perhaps through greater communication with their husbands, then these results suggest that they would not be any more or less likely to worry about HIV risks than their husbands.

Discussion and conclusions:

The conclusion that uncertainty about their husbands' non-marital sexual behaviors causes many wives to worry about HIV/AIDS seems highly plausible. An equally valid interpretation of these results would suggest that husbands may be overly confident that they know whether their wives have had extra-marital partners, and this may cause them to worry too little. Without data on individuals' HIV status, it is impossible to know whether husbands or wives are "better" at assessing their risks. In addition, we assert that risk perceptions are largely driven by own sexual behaviors, perceptions of spouse's behaviors, and awareness about HIV. Unfortunately none of these measures are likely to be entirely objective and most studies have found that information on sexual behaviors is ridden with reporting errors that draw our associations into question. Men and women may also either interpret or respond to questions differently. Other studies have found that husbands are more likely to respond positively than wives to several survey questions such as ownership of economic goods and plans regarding fertility (Bignami-Van Assche and Watkins 2004; Miller, Watkins and Zulu 2001). Our models also do not include all aspects of one's or one's spouse's sexual behaviors, nor a comprehensive assessment of their knowledge and beliefs about HIV/AIDS. Yet, despite these important limitations, we believe that exploring differences in risk perception, particularly when most individuals are not aware of their own HIV status, can provide some insights.

These analyses allow us to distinguish between several possible explanations for the large differences in perceived HIV risk levels between husbands and wives. First, consistent with the existing literature, we find evidence that husbands' and wives' concerns about HIV/AIDS are driven by different factors. Wives perceive that their main source of risk of infection stems from their husbands' extra-marital relationships, while husbands' concerns about HIV are primarily driven by their *own* past and current sexual behaviors. Yet, even after controlling these different sources of risk, wives continue to perceive themselves to be at greater risk of having or getting HIV/AIDS. Also consistent with previous studies on risk perception, we find that "awareness about HIV," as measured both by general knowledge of specific risks and personal exposure via the death of a relative or friend, has very little effect on overall risk perception and no effect on differences in perception by sex.

Yet, despite these differences in sources of risk, we find little evidence that men and women evaluate potential HIV risks differently. Women do not appear to "worry more" about particular HIV risks than do men. Conversely, men do not seem to be any more "unresponsive" to the implications of their own behaviors for their risk of getting HIV than women. Thus, the common, often implicit, assumption that women either exaggerate the risks they experience or that men minimize the consequences of their actions is not borne out in these analyses.

Instead, based on our final models, we contend that it is the uncertainty about their spouses' sexual behaviors that causes wives to perceive themselves to be at greater risk of acquiring HIV/AIDS. It is important to emphasize that these findings do *not* suggest that wives have an *"inflated"* perception of their HIV risks because they face greater uncertainty, but only that wives are more likely to perceive themselves at risk than husbands because they are less certain of the risks they face. It is highly possible, as has been suggested elsewhere, that when individuals feel that they are fully aware and in control of the factors that determine their likelihood of getting HIV/AIDS, they may underestimate their chances of having HIV. As both control and certainty about these factors diminishes, however, one's level of worry is likely to increase-- a common situation for many married women throughout sub-Saharan Africa.

The implications of this conclusion for programmatic efforts are clear. Many program interventions rely on individuals to assess their own level of HIV risk and to either seek testing for HIV, adopt condom use, abstain from sex, or employ some other mechanism of protection, such as microbicides (when they become available). Understanding how perceived HIV risks may differ from actual risks can help policy makers and program officers anticipate and adjust for these biases. Moreover, some interventions may be designed to help individuals improve the accuracy with which they perceive that they are at risk of acquiring HIV. Our study suggests that improving partner communication, especially spousal communication, may play an important role. High uncertainty about spouses' behaviors may generate substantial fear but it may also lead to inaction. Individuals who perceive themselves to be at risk via their spouses sexual behaviors are likely to report having a high risk of HIV but may be less likely to seek services or adopt protective behaviors. Encouraging clients to gain more certain information about their spouses can help minimize this gap between reported need and effective action. Of course, such information may also come at a very high cost. Program implementers should think carefully about proper counseling procedures and potential coping strategies should the individuals' suspicions be confirmed. Much of the stigma around openly acknowledging non-marital sexual partners would also need to be addressed.

REFERENCES

Akwara, Pricilla. 2003. "AIDS Related Knowledge and Perception of Risk of HIV in Kenya." *Macro International*.

Akwara, Pricilla, N Madise, and A Hinde. 2003. "Perception o Risk of HIV/AIDS and Sexual Behaviour in Kenya." *Journal of biosoc Sci* 35:385-411.

Ashenfelter, Orley, and Alan Krueger. 1994. "Estimates of the economic return to schooling for a new sample of twins." *American Economic Review* 84:11571173.

Barden-O'Fallon, Janine L., Joseph deGraft-Johnson, Thomas Bisika, Sara Sulzbach, Aimee Benson, and Amy O. Tsui. 2004. "Factors associated with HIV/AIDS knowledge and risk perception in rural Malawi." *AIDS and Behavior* 8:131-140.

Behrman, Jere, Hans-Peter Kohler, and Susan Watkins. 2003. "Social Networks, HIV/AIDS and Risk Perceptions." *in submission*.

Bignami-Van Assche, Simona, and Susan Cotts Watkins. 2004. "Husband-Wife Disagreement in Rural Malawi: A Longitudinal Analysis." *Paper Presented at the Population Association of America's Annual Meeting*.

Caraël, Michel, Mohamed Ali, and John Cleland. 2001. "Nuptiality and Risk Behaviour in Lusaka and Kampala." *African Journal of Reproductive Health* 5:83-89.

Caraël, Michel, John Cleland, Jean-Claude Deheneffe, Benoit Ferry, and Roger Ingham. 1995. "Sexual behavior in developing countries: Implications for HIV control." *AIDS* 9:1171-1175.

Carpenter, Lucy, Anatoli Kamali, Anthony Ruberantwari, Samuel Malamba, and James Whitworth. 1999. "Rates of HIV-1 transmission within marriage in rural Uganda in relation to HIV sero-status of the partners." *AIDS* 13:1083-1089.

Catania, J., S. Kegeles, and T. Coates. 1990. "Towards an Understanding of Risk Behavior: An AIDS Risk Reduction Model (ARRM)." *Health Education Quarterly* 17:121-41.

Clark, Shelley. 2004. "Early marriage and HIV risks in sub-Saharan Africa." *Studies in Family Planning* 35:149-160.

Cleland, J. 1995. "Risk Perception and Behavioural Change." Pp. 157-193 in *Sexual Behavior and AIDS in the Developing World*. New York: Taylor & Francis.

Fisher, J.D., and William Fisher. 1992. "Changing AIDS Risk Behavior." *Psychological Bulletin* 111:455-74.

Fisher, William. 1997. "A Theory-Based Framework for Intervention and Evaluation in STD/HIV Prevention." *STDs and Sexual/Reproductive Health* 6.

Gregson, S, T. Zhuwau, R Anderson, and S Chandiwana. 1998. "Is There Evidence for Behaviour Change in Response to AIDS in Rural Zimbabwe." *Social Science and Medicine* 46:321-330.

Hugonnet, Stephane, Frank Mosha, James Todd, Kokugonza Mugeye, Arnold Klokke, Leonard Ndeki, David Ross, Heiner Grosskurth, and Richard Hayes. 2002. "Incidence of HIV Infection in Stable Sexual Partnerships: A Retrospective Cohort Study of 1802 Couples in Mwanza Region, Tanzania." *Journal of Aquired Immune Deficiency Syndromes* 30:73-80.

Miller, Kate, Susan C. Watkins, and Eliya M. Zulu. 2001. "Husband-Wife Survey Responses in Malawi." *Studies in Family Planning* 32:161-74.

Moore, T, D Sly, and D Harrison. 2004. "Partner Awareness Risk and Percieved HIV Vulnerability Among Seronegative Heterosexual Couples." A paper prepared for the 2004 Annual Meeting of the Population Association of American.

Prata, Ndola, L Morris, M Stehr, and E Mazive. 2003. "Does self-perceived risk of contracting HIV change sexual behavior and condom use? The case of Mozambican youth." Pp. 1-20. Gaborone, Botswana: IUSSP.

Prohaska, Thomas, Gary Albrecht, Judith Levy, Noreen Sugrue, and Joung-Hwa Kim. 1990a. "Determinants of Self-Perceived Risk for AIDS." *Journal of Health and Social Behavior* 31:384-394.

—. 1990b. "Determinants of Self-Perceived Risks for AIDS." *Journal of Helath and Social Behavior* 31:384-94.

Schatz, Enid. 2003. ""Take Your Mat and Go!" Rural Malawian Women's Strategies in the HIV/AIDS Era." in *Population Association of America*. Minneapolis, Minnesota.

Scherer, Clifforrd W., and Hichang Cho. 2003. "A social network contagion theory of risk perception." *Risk Analysis* 23:261-267.

Serwadda, David, Ronald H. Gray, Maria J. Wawer, Rebecca Y. Stallings, Nelson K. Sewankambo, Joseph K. Konde-Lule, Bongs Lainjo, and Robert Kelly. 1995. "The Social Synamics of HIV Transmission as Reflected Through Discordant Couples in Rural Uganda." *AIDS* 9:745-50.

Slutsker, Laurence, Jeanne Cabeza, Jack J. Wirima, and Richard W. Steketee. 1994. "HIV-1 infection among women of reproductive age in a rural district in Malawi." *AIDS* 8:1337-40.

Smith, Kirsten P. 2003. "Why are they worried?" Concern about HIV/AIDS in rural Malawi." *Demographic Research* Special Collection 1:Article 9.

Smith, Kirsten P., and Susan Cotts Watkins. 2003. "Perceptions of risk and strategies of prevention: Responses to HIV/AIDS in rural Malawi." Pp. 1-48 in *Population Association of America*. Minneapolis, Minnesota.

UNAIDS. 1999. "Sexual Behavior change for HIV: Where have the theories taken us?" Pp. 3-55. Geneva, Switzerland: WHO.

UNAIDS, UNICEF, WHO. 2004. "Epidemiological fact sheets on HIV/AIDS and sexually transmitted infections: Malawi."

Figure 1. Conceptual Framework for Actual HIV Risk.

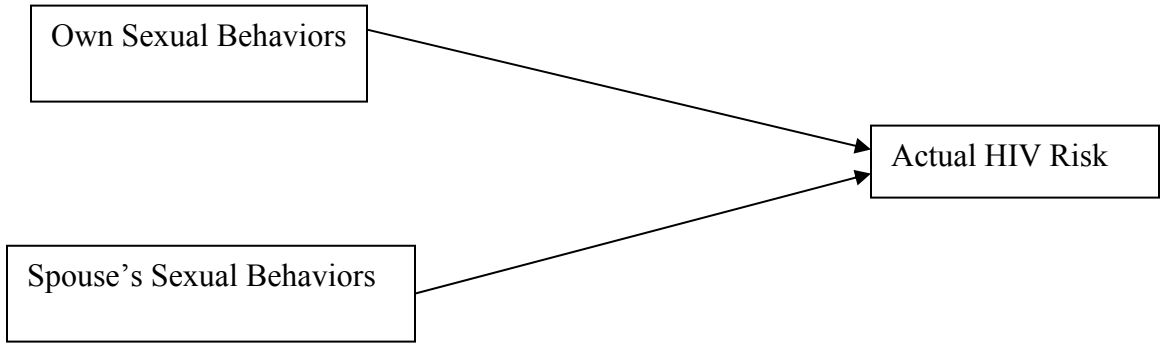

Figure 2. Conceptual Framework for Perceptions of HIV Risk.

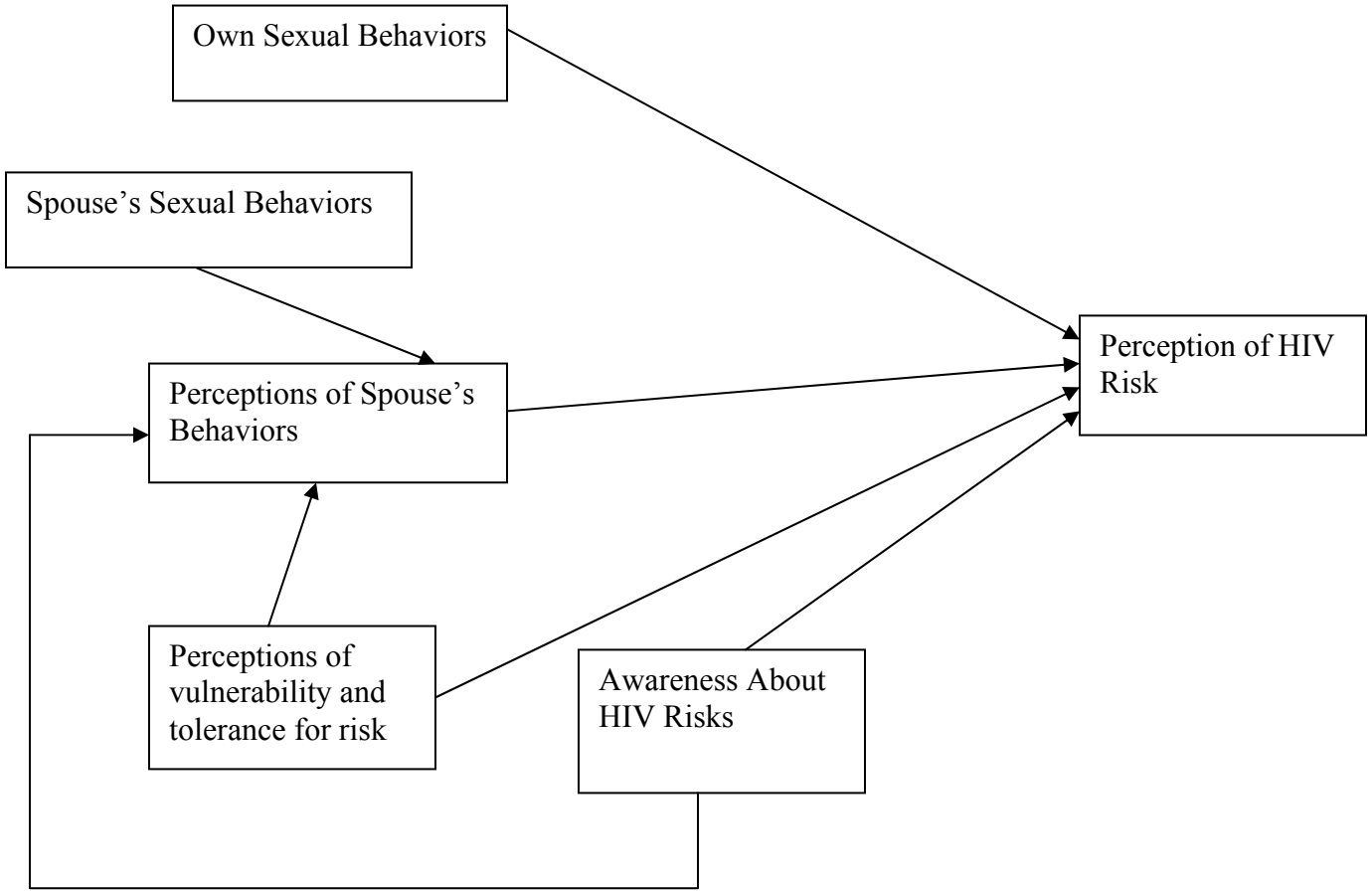

Table 1. *Percentage of matched husbands and wives who report being at moderate or great risk of getting HIV/AIDS in selected countries in sub-Saharan Africa (source: Demographic and Health Surveys)*

Country	**Husbands**	**Wives**	***Signif.***	**N**
Benin (1996)	17.4	27.7	***	909
Burkina Faso (1998/99)	25.1	17.4	***	1432
Cameroon (1998)	13.4	21.2	***	891
Cote d'Ivoire (1998/99)	10.5	21.6	***	311
Ghana (1998)*	12.1	9.6		442
Guinea (1999)	9.3	27.9	***	1001
Kenya (1998)	24.6	37.4	***	1342
Mali (1995/96)	7.9	29.2	***	1182
Mozambique (1997)*	30.0	32.6		515
Niger (1998)	5.3	6.7	*	1238
Nigeria (1999)	5.0	8.3	**	927
Tanzania (1996)*	23.1	36.6	***	564
Togo (1998)	14.2	26.2	***	1793
Uganda (1995)	14.5	34.5	***	1049
Zambia (1996)	15.5	39.7	***	837
Zimbabwe (1994)	13.7	29.1	***	693

*Indicates countries where a substantial number of respondents answered "don't know." In all three countries women were more likely to report that they didn't know their risk of HIV/AIDS (Ghana 13.7% vs. 10.3%; Mozambique 43.1% vs. 0.05; Tanzania 33.7% vs. 24.9%)

Notes: 1. data weighted

2. Response "has AIDS" coded as "having great/moderate risk"

Table 2. L*evels of worry about HIV/AIDS and likelihood of having or getting HIV/AIDS as reported by matched husbands and wives in Malawi.*

	Wives	Husbands	Sig.	N
DEPENDENT VARIABLES				
Worry about HIV			***	1,806
Not worried at all	29.6	43.0		
Worried a little	22.7	21.6		
Worried a lot	47.7	35.4		
Likelihood of having HIV now			***	1,510
No likelihood	63.8	73.9		
Low	19.5	15.4		
Medium	7.0	6.4		
High	9.7	4.4		
Likelihood of getting HIV in the future			***	1,322
No likelihood	39.8	52.7		
Low	32.4	29.5		
Medium	17.4	13.8		
High	10.4	4.1		

Table 3. *Characteristics of Matched Husbands and Wives in Malawi.*

INDEPENDENT VARIABLES	Wives *n=903*	Husbands *n=903*	Sig.
Socio-Demographic Characteristics			
Age	33.5	40.3	
Education			***
None	33.1	16.7	
Primary	61.9	69.2	
Secondary	5.0	14.1	
Region			ns
Balaka (South)	28.2	28.2	
Mchinji (Central)	40.3	40.3	
Rumphi (North)	31.5	31.5	
Religion			ns
Catholic	19.8	18.4	
Protestant	56.0	54.8	
Moslem	19.2	20.4	
Other	5.0	6.3	
Tribe			ns
Yao	20.0	20.9	
Chewa	34.4	33.3	
Tumbuka	28.7	28.5	
Other	17.0	17.2	
Roof	90.8	90.8	ns
House			
Sun-burnt bricks/ Other	25.5	25.5	ns
Fired bricks	25.3	25.3	
Mud	49.3	49.3	
Radio	68.6	74.3	***
Own Sexual Behaviors			
Sexual Partners Outside of Marriage			
Had other sexual partner before marriage	33.2	68.7	***
Had other sexual partners	2.9	21.0	***
Previously married (dum)	34.5	51.2	***
Ave. num of previous marriages	1.4	1.8	
Concurrancy--had more than 1 non-marital partr	1.3	9.3	***
Polygamy	19.4	18.1	ns
Used condom with non-marital parnters	2.4	13.0	***
Awareness about HIV			
Persons who died from HIV last year (ave)	3.8	4.2	*
Knows a healthy-looking person can have HIV	93.9	95.0	ns
Spouse's Behaviors			
Suspect Spouse of Infidelity (dum)	49.1	15.3	***
Spouse's self-report of infidelity (IV)	16.2	1.6	***

Table 4. *Effects of Sex, Own Sexual Behaviors, Perceptions of Spouse's Sexual Behaviors, and Knowledge on Worry About HIV/AIDS Risks.*

	Model 1 n=1772			**Model 2** n=1757			**Model 3** n=1641			**Model 4** n=1569		
	coef.	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**
Sex (male)	**-0.28**	**0.04**	*******	**-0.37**	**0.05**	*******	**-0.26**	**0.05**	*******	**-0.26**	**0.05**	*******
Own Sexual Behaviors												
Polygamy				0.15	0.06	**	0.13	0.06	*	0.15	0.06	*
Had other sexual partner before marriage				0.13	0.05	**	0.12	0.05	*	0.11	0.05	*
Had other sexual partners ever				0.25	0.07	**	0.23	0.07	**	0.24	0.07	***
Previously married (dum)				0.09	0.05	*	0.07	0.05		0.07	0.05	
Concurrancy				0.16	0.10		0.16	0.10		0.15	0.10	
Used condom with non-marital parnters				-0.05	0.08		-0.05	0.09		-0.07	0.09	
Perception of Spouse's Sexual Behaviors												
Suspect has had extra-marital sexual partners							0.27	0.05	***	0.28	0.05	***
Knowledge and Awareness about HIV												
Knows someone who died of HIV										0.01	0.01	
Someone who looks healthy can have HIV										-0.02	0.09	
Constant	1.95	0.23	***	1.84	0.23	***	1.87	0.23	***	1.92	0.25	***

*p<0.05, **p<0.0.01, ***p<0.001

All models control for age, educational level, religion, ethnicity, type of housing and roof material, ownership of a radio, and region.

Table 5. *Effects of Sex, Own Sexual Behaviors, Perceptions of Spouse's Sexual Behaviors, and Knowledge on Perception that Currently Have HIV/AIDS.*

	Model 1 n=1485			**Model 2** n=1471			**Model 3** n=1388			**Model 4** n=1326		
	coef.	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**
Sex (male)	**-0.24**	**0.05**	*******	**-0.31**	**0.05**	*******	**-0.24**	**0.06**	*******	**-0.24**	**0.06**	*******
Own Sexual Behaviors												
Polygamy				0.29	0.06	***	0.26	0.06	***	0.24	0.07	***
Had other sexual partner before marriage				0.02	0.05		-0.01	0.05		-0.01	0.05	
Had other sexual partners ever				0.19	0.08	*	0.22	0.08	**	0.20	0.09	*
Previously married (dum)				0.00	0.05		0.01	0.05		0.03	0.05	
Concurrancy				0.50	0.11	***	0.48	0.11	***	0.47	0.11	***
Used condom with non-marital parnters				0.00	0.10		0.01	0.10		-0.02	0.10	
Perception of Spouse's Sexual Behaviors												
Suspect has had extra-marital sexual partners							0.25	0.05	***	0.26	0.06	***
Knowledge and Awareness about HIV										0.00	0.01	
Knows someone who died of HIV										0.07	0.10	
Someone who looks healthy can have HIV												
Constant	0.53	0.27	*	0.48	0.27		0.45	0.28	0.099	0.35	0.30	

*p<0.05, **p<0.0.01, ***p<0.001

All models control for age, educational level, religion, ethnicity, type of housing and roof material, ownership of a radio, and region.

Table 6. *Effects of Sex, Own Sexual Behaviors, Perceptions of Spouse's Sexual Behaviors, and Knowledge on Perception that Will Get HIV/AIDS in Future.*

	Model 1 n=1297			**Model 2** n=1285			**Model 3** n=1207			**Model 4** n=1156		
	coef.	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**
Sex (male)	**-0.26**	**0.06**	*******	**-0.33**	**0.06**	*******	**-0.22**	**0.07**	******	**-0.22**	**0.07**	******
Own Sexual Behaviors												
Polygamy				0.26	0.07	***	0.23	0.07	**	0.22	0.08	**
Had other sexual partner before marriage				0.15	0.06	**	0.11	0.06		0.08	0.06	
Had other sexual partners ever				0.20	0.10	*	0.21	0.10	*	0.24	0.10	*
Previously married (dum)				0.04	0.06		0.04	0.06		0.07	0.06	
Concurrancy				-0.11	0.13		-0.14	0.13		-0.19	0.13	
Used condom with non-marital parnters				0.01	0.11		-0.02	0.11		-0.03	0.11	
Perception of Spouse's Sexual Behaviors												
Suspect has had extra-marital sexual partners							0.26	0.06	***	0.27	0.06	***
Knowledge and Awareness about HIV												
Knows someone who died of HIV										0.02	0.01	*
Someone who looks healthy can have HIV										0.12	0.12	
Constant	1.01	0.30	**	0.94	0.30	**	0.96	0.31	**	1.06	0.34	**

*p<0.05, **p<0.0.01, ***p<0.001

All models control for age, educational level, religion, ethnicity, type of housing and roof material, ownership of a radio, and region.

Table 7. *Effects of Sex, Own Sexual Behaviors, and Perceptions of Spouse's Sexual Behaviors,(IV) on Three Measures of Risk Perception*

	Worry About HIV/AIDS			**Currently Have HIV/AIDS**			**Will Get HIV/AIDS**		
	s = 1637			s = 1385			s = 1203		
	coef.	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**
Sex (male)	**0.08**	**0.14**		**0.06**	**0.17**		**0.02**	**0.17**	
Own Sexual Behaviors									
Polygamy	0.00	0.08		0.14	0.09		0.13	0.10	
Had other sexual partner before marriage	0.06	0.05		-0.07	0.06		0.07	0.07	
Had other sexual partners ever	0.21	0.08	*	0.18	0.09	*	0.18	0.10	
Previously married (dum)	0.11	0.05	*	0.05	0.06		0.07	0.06	
Concurrancy	0.15	0.11		0.50	0.12	***	-0.14	0.14	
Used condom with non-marital parnters	-0.11	0.10		-0.03	0.11		-0.07	0.12	
Perception of Spouse's Sexual Behaviors									
Suspect has had extra-marital sexual partners (IV)	1.16	0.33	***	1.07	0.43	*	0.97	0.44	*
constant	1.55	0.28	***	0.27	0.31		0.77	0.34	*

*p<0.05, **p<0.0.01, ***p<0.001

All models control for age, educational level, religion, ethnicity, type of housing and roof material, ownership of a radio, and region.

Appendix A. Ordered Logits of the *Effects of Sex, Own Sexual Behaviors, Perceptions of Spouse's Sexual Behaviors, and Knowledge on Three Measures of Risk Perception.*

	Worry About HIV/AIDS n=1569			**Currently Have HIV/AIDS** n=1326			**Will Get HIV/AIDS** n=1156		
	coef.	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**	**coef.**	**std. error**	**sig.**
Sex (male)	**-0.63**	**0.13**	*******	**-0.60**	**0.16**	*******	**-0.42**	**0.14**	******
Own Sexual Behaviors									
Polygamy	0.35	0.14	*	0.56	0.16	***	0.44	0.15	**
Had other sexual partner before marriage	0.26	0.11	*	-0.07	0.14		0.16	0.13	
Had other sexual partners ever	0.60	0.18	**	0.62	0.22	**	0.54	0.21	**
Previously married (dum)	0.17	0.11		0.13	0.14		0.17	0.13	
Concurrancy	0.30	0.23		0.93	0.26	***	-0.36	0.27	
Used condom with non-marital parnters	-0.14	0.20		-0.03	0.27		-0.06	0.24	
Perception of Spouse's Sexual Behaviors									
Suspect has had extra-marital sexual partners	0.62	0.11	***	0.62	0.14	***	0.56	0.13	***
Knowledge and Awareness about HIV									
Knows someone who died of HIV	0.02	0.01		0.00	0.02		0.04	0.02	*
Someone who looks healthy can have HIV	-0.09	0.22		0.28	0.28		0.29	0.25	
cut1	-0.39	0.60		0.83	0.74		-0.68	0.69	
cut2	0.65	0.60		1.99	0.75		0.84	0.69	
cut3				2.77	0.75		2.20	0.70	

*p<0.05, **p<0.0.01, ***p<0.001

All models control for age, educational level, religion, ethnicity, type of housing and roof material, ownership of a radio, and region.