Title: Does HIV Increase the Risk of Spousal Violence in sub-Saharan Africa?

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Abstract

Although a positive association is found between HIV prevalence and intimate partner violence, a causal interpretation is hard to establish due to eneogeneity of the HIV prevalence. Using the distance from the origin of the virus as an instrument, I find that an exogenous increase in HIV prevalence in a cluster increases the risk of physical and sexual violence against women within marriage. A positive effect on emotional violence is also found in some sub-sample. I explore three channels that potentially mediate the effect of HIV on spousal violence. While I do not find convincing evidence on the effects through changing marriage market conditions or shorter expected lifespan, I find evidence that suggests the increased conflicts over condom use as a channel through which HIV increases the risk of spousal violence.

Keywords

HIV, Intimate Partner Violence, Condom Use

JEL classification

I18, J12, J17

1. Introduction

For more than three decades, human immunodeficiency virus (HIV) has affected the lives of millions of people. Although the spread of HIV has slowed down since 1999, the year in which the epidemic peaked, there are still 33.3 million people living with HIV globally (UNAIDS, 2010). Given that the effect of the epidemic is not confined to deteriorating health and increasing mortality of the infected, previous economic studies have assessed its socio-economic impact on a broad range of issues including but not limited to marriage and fertility (Fortson, 2009, Ueyama and Yamauchi, 2009), sexual behavior (Oster, 2012), economic growth (Bonnel, 2000), and human capital investment (Fortson, 2011). There is, however, one important issue that has been overlooked in economic analysis of the HIV epidemic. Public health researchers and practitioners have pointed the importance of understanding the association between HIV and intimate partner violence in addressing the HIV epidemic. For example, intimate partner violence, another epidemic that has long plagued women all over the world[1], is considered to be a key contributor to feminization of HIV.[2] While much research has been done in public health to analyze the interrelation between the two epidemics, virtually no study in economics addressed this issue.

Despite multitudes of research in public health, however, there are some shortcomings to overcome. Most studies use cross-sectional data and find correlations, but do not establish a causal interpretation. Also, studies are generally conducted in a clinical setting and look into the

[1]According to WHO (2005), between 15% and 71% of ever-partnered women experienced physical and/or sexual violence by an intimate partner in their life time.

[2] Feminization of HIV refers to a fast increase in new infections among females. The HIV epidemic mostly affected men at its initial stage, but today one half of the people living with HIV are women, with a greater proportion in Sub-Saharan Africa (UNFPA, 2005).

association between HIV and violence among the infected or the individuals with high risk, but do not define whether and how the two epidemics interact among a broader population.

I address shortcomings of the previous literature by examining a causal relationship between HIV and spousal violence among a general population. More specifically, I analyze how exogenous changes in HIV prevalence affect the risk of spousal violence against women using a set of nationally representative random sample of women. Intimate partner violence is certainly both a driver and a consequence of the spread of HIV, as many studies in public health suggest. However, the main interest of this paper is how people change their behaviors in response to proliferation of HIV, as in other economic papers. Therefore, the focus lies in a causal effect of HIV on the risk of spousal violence.

In identifying a causal effect, I follow Oster (2012) and exploit distance from the origin of the virus as an instrument for HIV prevalence. Further, I examine potential mechanisms through which HIV changes the risk of spousal violence. Apart from a direct effect, three possible channels are suggested and tested. First, HIV prevalence increases the demand for condom use, which could subsequently increase a marital conflict in a patriarchal society where discussion of condom use by females is a social taboo. Second, HIV prevalence can reduce bargaining power of women by disproportionately undermining their options outside of marriage relative to men's, which in turn would lead to unfavorable treatment of women within marriage. Third, lower life expectancy driven by proliferation of HIV can induce men to be more myopic and indulged in hazardous behaviors that yield short-term thrill but long-run costs, and spousal violence would be one such example.

Using the distance from the origin of the virus as an instrument for HIV prevalence, empirical analysis of this paper finds that an exogenous increase in HIV prevalence increases the probability of physical and sexual violence. Some sub-sample shows a positive effect on

emotional violence as well. The positive effect on all three types of violence is significantly larger for women with knowledge of where to obtain condoms, which suggests condom use as a potential channel through which HIV increases the risk of spousal violence. On the other hand, I do not find convincing evidence on the hypotheses that changing marriage market conditions or shorter life expectancy serve as potential channels. The effect of HIV is not significantly different for women who are subject to disadvantageous marriage market conditions, such as residing in a region where the risk of transmission for females is higher or having previous marriage experiences. The effect also does not differ by male's subjective belief on their HIV status, which invalidates the hypothesis that the effect of HIV on violence would be larger for men with shorter expected lifespan.

The remainder of this paper is organized as follows. Section 2 provides background literature review and Section 3 outlines conceptual framework of the analysis. Section 4 discusses the empirical method and Section 5 presents results. Section 6 concludes.

2. Background

A general consensus among public health researchers and practitioners is that HIV and intimate partner violence are two important epidemics that have extensive and profound impacts on many people. More importantly, they are interrelated, each being a driver as well as a consequence of the other (Garcia-Moreno et. al, 2000, Mamans et. al, 2000, WHO, UNAIDS, 2010). Multiple channels are suggested and examined (Mamans et. al, 2002, Jewkes et. al, 2010). Some studies are based on the notion that rape or sexual violence can be a direct transmitter of the virus from an infected perpetrator to an uninfected victim. The empirical evidence on this

direct association, however, is weak, possibly because its effect realizes through a longer term exposure rather than through a one-time act (Jewkes et. al, 2010, WHO, UNAIDS, 2010). Other studies define violence or the threat of violence as a significant barrier to safe sex, given that the number and timing of sex, condom use, or other circumstances of sex are not negotiable in an abusive relationship. It is found that women accept intimate partner's risky sexual demands, given the choice between the immediate threat of violence and the hypothetical risk of HIV infection (Kalichman et. al, 1998, Go et. al, 2003). Relatedly, violent male partners are more likely to be infected in the first place by having extramarital or multiple sexual relationships in an attempt to embody their masculinity, thereby increasing the risk of infection for their abused partners (Dunkle et. al, 2004, Silverman et. al, 2008, Decker et. al, 2009). On the other hand, psychological trauma resulting from the experience of violence is often associated with risky sexual behaviors of women such as concurrent or transactional sexual relations and substance use, which subsequently increase the risk of HIV acquisition. Many studies find that women who experienced intimate partner violence or childhood sexual abuse are more likely to report current risky sexual behaviors (Cohen et. al, 2000, Wyatt et. al, 2002, Wu et. al, 2003, Koenig et. al, 2004, Bogart et. al, 2005, Fonck et. al, 2005). Lastly, violence can be a consequence of HIV infection, if women suffer from intimate partner violence after disclosure of their HIV status (North and Rothenberg, 1993, Rothenberg et. al, 1995). The empirical evidence on disclosure-triggered violence is inconclusive. Studies find that violence does occur after the diagnosis, but some report that it is not necessarily attributable to HIV status (Gielen et. al, 2000, Koenig et. al, 2002), while others attribute it to HIV status (Zierler et. al, 2000).

Despite a large amount of previous research, several limitations stand out. First, a majority of studies are based on cross sectional data. Causality, therefore, is conjectured but not

identified.[3] Second, the analysis is centered on either the HIV-infected or the subjects at a risk of infection, given that many studies are conducted in a clinical setting or use samples of vulnerable people. This is appropriate to figure out the effective methods of prevention or treatment for the infected or the ones at high risk. It should be, however, noted that the link between the two epidemics might not be confined to the infected. It could be functioning among a broader population. I address these shortcomings by addressing endogeneity of HIV and identifying a causal effect of HIV prevalence on the risk of violence among a general population, based on a set of nationally representative random samples. Details follow in the next sections.

3. Conceptual Framework

How does the HIV prevalence affect spousal violence of a general population? Studies find that macroeconomic shocks serve as determinants of marital dissolution even for those not directly experiencing shocks (Hellerstein and Morrill, 2011). Likewise, proliferation of HIV, as a sexually transmitted communicable disease, might perturb marital or sexual relationships of both infected and uninfected, thereby affecting spousal violence. As the epidemic spreads, there would be increased fear of own infection or suspect of partner's infection, which operates as a stressor in a relationship and a trigger for spousal violence. On the other hand, the epidemic can affect the risk of spousal violence in ways other than as a direct stressor.

First, condom use can be a potential channel through which HIV prevalence increases the risk of spousal violence. The use of condom is found to be quite responsive to the prevalence of

[3] An exception is a longitudinal study by Jewkes et.al (2010), where they find that the scale of gender power inequity and intimate partner violence of HIV negative women measured at baseline positively affects the risk of HIV acquisition later at a follow-up test in two years.

AIDS in the U.S (Ahituv et al., 1995). Likewise, condom use has increased in response to proliferation of the epidemic in sub-Saharan Africa, although the general use rate still remains low in most countries (UNAIDS, 2006; 2010).[4] Even though the effectiveness of condom for prevention of HIV has been proven and propagated throughout Africa, cultural barriers deter the active use of it. Women generally find it difficult to negotiate condom use with their long-term partners, because even the suggestion of using it might be seen as an accusation of the partner's infidelity or an admission of adultery on the part of the woman herself, which could provoke violence (Burgoyne and Drummond, 2008, Drezin et al., 2007, Mash et al., 2010). This dissonance between the growing demand for condom -- or the growing acknowledgement of condom as a disease prevention method -- and the cultural norms that taboo the negotiation for condom use by women could generate a tension in a marital relationship. Some men might try to restore his loss in satisfaction or loss in control over sexual matters by exercising more spousal violence in return for condom use. Others might suppress women's direct or nuanced requests for condom use by threatening or exercising violence towards their spouse (Wingwood et al., 1997). Therefore the increased need for condom use driven by the increased HIV prevalence could be a mechanism through which HIV affects spousal violence.

Second, marriage market conditions might be another channel through which HIV affects the risk of spousal violence. In economics, intimate partner violence is often analyzed by bargaining models (Tauchen et. al, 1991, Lundberg and Pollak, 1994, Farmer and Tiefenthaler, 1997, Aizer, 2011), which predict that an increase in the threat point of women would reduce violence within marriage by making their threat of leaving the relationship more credible.

[4] The two reports are based on the DHS data 2001-2005 (UNAIDS, 2006) and 2003-2009 (UNAIDS, 2010). The first report in 2006 finds that the percentage of young men and women aged 15-24 who report the use of condom with a non-regular partner is lower than 50% in most countries. In the second report, 14 countries in sub-Saharan Africa report condom use rates of 20% or less at last sex for those with more than one partner in the past year.

McElroy (1990) refers to shifters of the threat points as extrahousehold environmental parameters, which are factors that exogenously change individual utility outside of marriage. HIV prevalence can serve as an extrahousehold environmental parameter, given that it shapes marriage market conditions. It does more so in sub-Saharan Africa, where HIV transmission is predominantly through heterosexual relationship (Hunter, 1993, UNAIDS, 2010). As the HIV prevalence increases, the risk of searching a new partner in the remarriage market increases. While the epidemic affects both men and women, the risk of searching a new partner would be generally higher for women, given that male-to-female transmission rate is about twice of female-to-male transmission rate (Oster, 2005). Cultural norms interact with HIV to further restrict women's opportunity for remarriage. In an era of increased HIV/AIDS mortality, in which agents adjust their marriage behavior to avoid the risk (Reniers, 2008, Ueyama and Yamauchi, 2009), the prospect of remarriage for formerly married individuals would be relatively poor, given that formerly married individuals are at significantly higher risk for HIV (De Walque and Klein, 2012). This adverse effect would be larger for women than for men due to social expectations and cultural norms.[5] Disadvantageous marriage market conditions would decrease the bargaining power of women, thereby forcing them to accept more unfavorable allocations and treatment such as spousal violence.

Third, a shorter life expectancy could be another potential mechanism. Risky behaviors are often understood as a result of myopia, a trade-off between short-term benefits and heavily discounted long-term costs (Donahue and Rabin, 2001). As much as the prevalence of HIV

[5] For example, while widows find it difficult to find a new partner after spousal death due to a fear that AIDS has caused the death of the late husband, it is easier for widowers to remarry due to social expectation and the livelihood insecurities facing single women, despite any fears that may exist over the cause of their late wife's death (Thomas, 2008).

shortens the expected average lifespan and makes the future discounted, it would increase the short-term benefit of hazardous behaviors relative to their long-run consequences. More specifically, a shorter life expectancy driven by HIV can induce men to value more an instantaneous thrill from a violent act than its long-run cost in terms of loss in health of women or distrust between husband and wife. Then, more spousal violence could result.

4. Empirical Method

4.1. Data

The data for the analysis come from the Demographic and Health Survey (DHS) -- 2008 Kenya Demographic and Health Survey, 2007 Liberia Demographic and Health Survey, 2010 Malawi Demographic and Health Survey, 2006 Mali Demographic and Health Survey, 2007 Zambia Demographic and Health Survey, and 2010 Zimbabwe Demographic and Health Survey. While there are other DHS surveys available in Africa, the current analysis uses the six surveys because they report all three types of spousal violence (emotional, physical, and sexual) [6], HIV testing result, and GIS data of survey clusters.

Table 1 reports descriptive statistics of key variables of the entire sample. Given that the main outcome variables are binary indicators of the three types of spousal violence in the past 12 months, samples are confined to currently married women who are covered in the domestic violence module. A woman is considered to experience emotional violence, if she experiences any of the following acts from her husband: 1) humiliating her; 2) threatening her with harm; 3)

[6] 2010 Rwanda DHS and 2007 Congo DHS are excluded because the former has no emotional violence data and the latter has s lightly different items for physical and emotional violence.

insulting her or making her feel bad. Physical violence is defined by any of the following assaults from husband: 1) pushing, shaking, or throwing something at her; 2) slapping; 3) punching her with fist or something harmful; 4) kicking or dragging her; 5) trying to strangle or burn; 6) threatening with knife/gun or other weapon; 7) twisting arm or pulling hair. Further, sexual violence is defined by any of the following acts exercised by a husband: 1) physically forcing sex when not wanted; 2) forcing other sexual acts when not wanted. In average, currently married women are subject to the highest risk of physical violence followed by emotional, and sexual violence.

HIV prevalence rate is the explanatory variable of interest and computed at the cluster level as a percentage of HIV positive individuals among those who take the test. HIV testing was performed through blood testing. In average, 9.15% of the tested are HIV infected, which is quite high prevalence rate even for sub-Saharan Africa standard.[7] It might be because the sample countries are mostly located in areas close to the presumed origin of the virus, Demographic Republic of the Congo. Distance is the instrumental variable and is defined as straight-line distance between a survey cluster and the origin of the virus. Following Oster (2012), the origin of the virus is assumed to be the middle point of Democratic Republic of the Congo whose latitude and longitude is (-6.31, 23.59). Details of the identification strategy are discussed in the next section.

Other demographic variables controlled in the analysis are female and male age in single years, female and male education in single years, number of children living at home, binary indicator variables for being in a polygamous marriage, female work, urban residence, being a

[7] The average adult HIV prevalence rate (ages 15-49) in sub-Saharan Africa is 5.0% (UNAIDS, 2010).

Muslim. Further, wealth index[8] and violence acceptance index are included in the analysis. These indices are constructed using principal component analysis, which reduces a number of correlated variables to a smaller number of underlying principal components (Jolliffe, 2002).

[Insert Table 1]

[Insert Table 1-1]

4.2. Estimation Equation and Identification Strategy

The main equation to measure the effect of HIV prevalence on spousal violence is defined by:

$$V_{i,c} = \beta_0 + \beta_1 HIV_c + \Pi X_{i,c} + \varepsilon_{i,c} \quad (1)$$

where $V_{i,c}$ is a binary indicator of the occurrence of spousal violence towards woman *i* in cluster *c*, HIV_c is the HIV prevalence in that cluster (the percentage of the peopling living with HIV), and $X_{i,c}$ is a set of demographic characteristics of the couple defined in Table 1.

Endogenous HIV prevalence posits a threat to the identification of β_1. Given that spousal violence is a risk factor of HIV infection, regions where violent relationships are common might have higher rates of HIV. This reverse causality would generate a positive bias in OLS estimate. Similarly, if unobservable violence propensity and HIV related sexual behavior are positively correlated, β_1 is likely to be overestimated. On the other hand, if underreporting of violence is more prevalent in regions with more risky sexual behaviors, β_1 would be underestimated. I address this identification problem in two folds. First, I use current violence – violence

[8] Wealth index is computed and reported by DHS based on household ownership of various items.

perpetrated in the past 12 months – instead of ever-violence – violence perpetrated any time during marriage --. While this does not entirely eliminate the concern for a reverse causality, it reduces room for a reverse causality, because current violence is certainly less likely to be a cause of HIV infection than ever-violence is. Second, I use distance from the origin of the virus as an instrument for HIV prevalence.

The first stage equation, therefore, is defined by:

$$HIV_c = \delta_0 + \delta_1 d_c + \Omega X_{i,c} + \nu_c \quad (2)$$

where d_c is the distance between a survey cluster c and the origin of the HIV virus.

The identification assumption in this approach is that distance is correlated with HIV prevalence but uncorrelated with underlying violence propensity or underreporting behavior. Oster (2012) establishes a model that explains mechanics of how distance predicts HIV prevalence. She takes advantage of the fact that the arrival date of the virus at a given region, which is a strong predictor of a regional HIV rate, is closely related to the distance of each region to the origin of the virus. The identification strategy, therefore, exploits distance from the origin, which is well measured, instead of the arrival date, which is not readily available. The intuition is that people who live further apart are less likely to interact and have a sexual relationship, and therefore the virus is introduced later and grows more slowly in areas far away from the origin. As mentioned earlier, I set the middle point of the Democratic Republic of the Congo as the origin point: (-6.31, 23. 59) following Oster (2012). Then, I calculate the distance between each survey cluster and the origin using the straight-line distance method.

Table 2 presents the first stage regression results using OLS regression model.[9] Column 1 reports that distance has a significant negative effect on the HIV rate, when distance is the only control variable. This negative effect has been already noted in Table 1-1, which shows that countries far away from the origin tend to have lower HIV prevalence, whereas countries closer to the origin tend to have higher HIV rates. While this strong negative trend is encouraging, a concern is that some regional behavioral differences might drive the trend. If people in areas closer to the origin tend to undertake more HIV related sexual behaviors, the negative association between distance and HIV rate might be a result of a spurious correlation. More importantly, if such sexual behaviors are correlated with violence propensity, the identification strategy would fail. To address such a potential threat to the identification, I additionally control latitudes and longitudes of each survey cluster (Column 2) and country dummies (Column 3).[10] Although the coefficient of distance changes once additional controls are included, it remains significantly negative. Moreover, the negative effect becomes stronger once country fixed effects are controlled, suggesting that country specific unobservables rather cause underestimation of the distance effect than to drive a spurious negative trend between distance and HIV prevalence. Column 4 presents the first stage regression result when all the included and excluded variables are fully controlled. The coefficient of the distance declines slightly, but again, remains significant and negative.

[9] While Oster (2012) uses log HIV prevalence and linear distance in her analysis, I use the level of HIV prevalence and linear distance. It is because log transformation is somewhat problematic for clusters with zero HIV rate in my sample which covers fewer countries and clusters than hers. I tried log transformation by assigning positive but very small number (0.01 percent and smaller values) for clusters with zero prevalence, and found that the magnitude of the distance effect was sensitive to the assigned values in my case, although its sign and significance remained the same. Therefore, I use the level of HIV prevalence and linear distance, which does not require replacing a zero prevalence rate with a somewhat arbitrary positive number. However, the sign and significance of the distance effect is the same for both functional forms.

[10] In another specification, I control latitudes, longitude, a region dummy (whether located in West Africa or not), and latitude and longitude quintile dummies similar to the analysis by Oster (2012), and find that the distance effect is still significantly negative. I choose the current specification because confounding behavioral factors would be more effectively controlled at a country level

[Insert Table 2]

I further check whether the exclusion restriction is violated by directly looking at the relationship between distance and spousal violence experience of a woman's mother –whether her father beats her mother --. Given that the act of violence in the previous generation, if at all, would have taken place before the proliferation of the epidemic, it is not likely to be driven by the epidemic. Therefore, it would make a good falsification test to examine the relationship between distance from the origin and spousal violence of the past generation. If a significant relationship is found between the two variables, it would suggest that distance is correlated with spousal violence of the current generation through channels other than the HIV prevalence. More specifically, the violence experience of the past generation would certainly contribute to formation of the underlying violence propensity and acceptance of the current generation. Therefore, a significant relationship in the falsification test would suggest that distance is correlated with the unobservable violence culture of the current generation, which invalidates distance as an instrument. Column 1 in Table 3 reports the effect of the distance on the violence experience of a woman's mother (yes=1, no=0). The effect is positive but largely insignificant, relieving the concern regarding unobservable violence propensity.

Underreporting of spousal violence experience is undesirable but common. It does not bias the result as long as it is random. However, if reporting behavior somehow systematically differs by the distance from the origin, it can constitute another threat to the exclusion restriction. While I cannot directly measure the degree of underreporting, I indirectly test whether it could be a relevant concern. DHS ask female victims of violence whether and to whom they ask for help

after victimized.[11] I exploit this information for the test. The assumption is that help seeking behavior of women after the incidence of violence would mirror violence reporting behavior. More specifically, a woman is defined to have a tendency for reporting, if she seeks help after the incidence, but defined to have tendency for underreporting, if she does not seek help.[12] Therefore, the relationship between help seeking behavior and distance would reflect the relationship between reporting behavior and distance. Column 2 in Table 3 reports the effect of the distance on help seeking behavior of women (yes=1, no=0) when sources of help cover both family members and non-members.[13] No significant relationship is found between the two variables. Column 3 reports the result when sources of help are only non-family members. If at all, the incentive for underreporting would be stronger against people outside of the family. But again, there is no evidence that it is significantly related to distance from the origin. Column 4 deals with cases of help seeking towards non-family members, conditional on help-seeking towards anyone. The result echoes the previous two columns.

The results in Table 2 and 3 suggest that distance has a significant negative effect on the HIV prevalence but no significant effects on violence experience of the previous generation and help seeking behavior of female victims of violence, supporting the validity of distance as an instrument for HIV prevalence.

[11] The question is not confined to spousal violence but covers all other types of violence perpetrators from family members to strangers. As is well known, however, violence against women is perpetrated predominantly by their husbands.

[12] Certainly, both types of women – help seeking and non-seeking – did report the incidence of violence. However, the idea is that the likelihood of underreporting would be generally higher in clusters where women are less likely to seek help after victimization, because both cases – no help seeking and no reporting – are likely to be driven by same factors such as patriarchal social norms or culture of silence around abuse.

[13] They include own family, husband/partner family, current/former husband or boyfriend, neighbor, friend, social service organization, community or religious leader, lawyer, doctor, police, and other person.

[Insert Table 3]

5. Results

5.1. Baseline results

Table 4 reports the OLS and the instrumental variable (IV) estimation results of the effect of HIV prevalence on three types of spousal violence. The OLS estimates suggest that HIV has significant positive effects on all three types of violence, although the effects are fairly small in magnitude. Once instrumented, the effects become large for all of them, although it is insignificant for emotional violence. A one percentage point increase in HIV prevalence increases the risk of physical and sexual violence by 1.8 and 2.0 percentage points, respectively. On the other hand, a falsification test in Column 9 reports that the likelihood of spousal violence in the past generation is not affected by HIV prevalence, supporting the validity of the identification strategy.

These IV results indicate that the positive effect of the HIV prevalence on spousal violence is real for physical and sexual violence, and potential confounders cause rather underestimation of the effects than spurious positive effects. These findings suggest that an increase in the HIV prevalence generally increases the fear of infection for individuals, which serves as a stressor in a marital relationship. Apart from being a direct stressor, HIV prevalence might affect the risk of spousal violence through other channels such as conflicts over condom use, marriage market conditions, and changes in life expectancy. I examine these possibilities in the following sections.

[Insert Table 4]

5.2. Effect through Condom Use

As noted earlier, condom use in sub-Saharan Africa has increased over time in response to the HIV epidemic. Likewise, while the rate of condom use is low in the current sample, it is positively associated with HIV prevalence. Column 4 in Table 4 reports a positive but small effect of HIV prevalence on condom use rate at the district level in the OLS regression. However, the effect becomes larger once HIV prevalence is instrumented. An exogenous increase in HIV prevalence by one percentage point increases the condom use rate by 0.86 percentage point (Column 8). A reverse causality might explain the gap between OLS and IV results. Overall, the findings in Table 4 indicate that both condom use and the likelihood of spousal violence increase in response to the HIV epidemic.

Despite the increase in condom use over time, the level of condom use in Africa is still low. For example, about 4 % of women report the use of condom at last intercourse in the current sample. The low level of condom use in Africa might be attributable to cultural norms that taboo negotiation for safer sex by women (Burgoyne and Drummond, 2008, Drezin et al., 2007, Mash et al., 2010). About 68% of women in the current sample think that a wife is justified to ask to use condom when her husband has a sexually transmitted disease, whereas 25% think she is not justified. However, for a question that asks whether they personally could ask husbands to use condom when they wanted to, only 48% of the women answered yes, while 46% of them said no. The discrepancy between their belief on what should be done and the actual outcome reflects a clash between public health needs and the patriarchal culture, which could be a potential cause of marital conflict or violence.

In order to examine whether a tension over condom use can be a channel through which HIV affects spousal violence, I use information on women's knowledge of formal sources of condom in the data. Studies find that knowledge of a place to obtain condoms is associated much higher likelihood of using condoms in Africa (Kamya et al., 1997, Meekers and Calves, 1999). While women's knowledge might not lead to an actual condom use given their lack of control over sexual matters, it might be an important source of tension and conflict in a sexual relationship, if women who know where to obtain condoms are more likely to express their opinions on the use directly or indirectly. Figure 1 presents that women with knowledge of the sources of condom are more likely to think that a wife is justified to ask to use condom when her husband has a sexually transmitted disease. Similarly, Figure 2 shows that they are more likely to ask their husbands to use condom when they want to than their counterpart. The greater the risk of HIV is, the stronger their opinions would be. The stronger their opinions are, the greater the tension would be. Then, the effect of HIV on spousal violence would be greater among women who have knowledge of a place to obtain condoms.

[Insert Figure 1]

[Insert Figure 2]

Table 5 reports the effects of HIV on spousal violence through women's knowledge on sources of condom. Women's knowledge on source of condom is a dummy variable that takes the value of one if a woman knows any of the following places as sources of condom: Government hospital, government health center, government dispensary, other public places,

private hospital or clinic, pharmacy, and shop/bar/lodge.[14] About 52% of the women who answer these questions know at least one of the mentioned places as a source of condom, whereas about 48% recognizes none of the places as a source. Column 1 reports that HIV increases the risk of emotional violence at the 10% significance level. This positive effect of HIV is found to be mostly through a potential tension over condom use between husband and wife. In Column 2, the main effect of HIV becomes fairly small and largely insignificant, while its effect is significantly positive and large in magnitude if a woman knows at least one source of condom. For physical and sexual violence, the main effect of HIV prevalence is still large and significant when the interaction term is included (Columns 3 and 6). The effects through a potential tension over condom use are significantly positive, albeit smaller than the main effect in magnitude. A one percentage point increase in HIV prevalence increases the risk of physical violence by 0.7 percentage point, while it increases the risk of sexual violence by 0.6 percentage point, when a woman knows at least one source of condom. Findings in Table 5 suggest that condom use or a tension over condom use might be a channel through which HIV prevalence increases the risk of spousal violence.

5.3. Effect through Marriage Market Conditions

Marriage market conditions can be another channel through which the HIV epidemic increases the risk of spousal violence against women. In the bargaining framework, if proliferation of the epidemic establishes unfavorable marriage market conditions for women relative to men, women might have to bear adverse intra-household allocations, including but not limited to a greater risk of violence.

[14] Some of the places (e.g. mobile clinic, church hospital, friends and relatives and etc.) are not included, because classifications on minor sources are different across countries. Also, only small portions of women report them as formal sources.

Table 6 reports the effect of HIV on three types of violence through several parameters that represent marriage market conditions. In Panel A, higher transmission risk is a dummy variable that takes the value of one if a woman resides in a cluster in which the probability of infection from a new partner is greater for women than for men or the same for both, and zero otherwise. The probability of infection from a new partner is defined by 0.125 x female HIV rate in that cluster for men and 0. 245 x male HIV rate in that cluster for women. 0.125 and 0.245 are per-partnership female-to-male and male-to-female transmission rate, respectively (Oster, 2005). The idea is that women would be in an unfavorable position in bargaining, if the search of a new partner is riskier for them than for men. The regression results, however, do not support the effect of HIV through higher transmission risk. The interaction term is not significant for either emotional or physical violence (Columns 1 and 2). For sexual violence, the effect is significant at the 10% significance level, but the sign is opposite to what is expected (Column 3).

Panel B presents the effect of HIV interacted with a dummy variable that indicates whether a woman has a prior marriage experience. In a patriarchal society, a woman with prior marriage experience would be at a disadvantageous bargaining position due to her poorer remarriage prospect after divorce, and the disadvantage associated with prior marriage experience would be magnified in response to the HIV epidemic, given that formerly married women would be even less attractive in the marriage market due to their higher risk of infection. If so, the interaction between HIV and the dummy for prior marriage would have a significant positive effect on the likelihood of violence. The regression results in Panel B, however, do not support the HIV effect through prior marriage experience. The interaction terms are largely insignificant for all three types of violence. Therefore, combining the results in Panel A and B, I

do not find evidence that HIV increases the risk of spousal violence through marriage market conditions.

5.4. Effect through Male Assessment on Risk of AIDS

Changing life expectancy due to the HIV epidemic might be another avenue through which spousal violence is affected. If a shorter life expectancy induces individuals to discount the future greatly and get indulged in hazardous behaviors, an increase in spousal violence might be one of such outcomes. In order to check such possibility, I use the information on men's subjective belief on their chances of AIDS. The DHS Kenya 2008 asks individuals whether their chances of getting AIDS are small, moderate, great, or no risk at all. I classified men into low belief (not at all or small), moderate belief (moderate), and high belief (great or has AIDS) group and check whether the effect of HIV on spousal violence differs by group. If a shorter life expectancy is an avenue, the effect of HIV on spousal violence would be strongest for men who believe that their chances of getting AIDS are great, followed by those with moderate belief and then by those with low belief. Table 7 reports the regression results including the effect of HIV interacted with men's subjective belief.[15] There is no significant evidence that the men's subjective belief on their chances of AIDS serves as an avenue for HIV to increases the risk of spousal violence for any of the three types of violence. While the HIV effects are significantly positive on physical violence for men with low belief and moderate belief (Column 4), they are almost the same in magnitude and not significantly different (p-value 0.95). On the other hand, the effect through men with high belief is much smaller in magnitude and largely insignificant,

[15] In Columns 2, 4, and 6, the specification does not include HIV prevalence as a separate independent variable, because groups are mutually exclusive and the interaction term is constructed to allow for the effect to differ by group. Oster (2012) takes a similar approach.

contrary to the expectation that a man with subjective belief of high likelihood of getting AIDS would be more likely to exercise spousal violence. For sexual violence, only the effect through men with low belief is statistically significant (Column 6). It is different from the effect through men with high belief at 10% significance level (p-value 0.06), but the signs of the effects are opposite to what is expected. While the HIV effect through men with low belief is positive, the effect through those with high belief is negative. Therefore, I do not find any evidence that suggests that a shorter life expectancy could be an avenue through which HIV increases the risk of violence.

6. Conclusion

This paper analyzes the changes in the probability of emotional, physical, and sexual violence against women within marriage in response to HIV. While naïve OLS regression suggests a positive association between the two, a causal interpretation is hard to obtain due to cross-sectional data. Using the distance from the origin of the virus as an instrument for HIV prevalence, I find that an exogenous increase in HIV prevalence increases the risk of physical and sexual violence against women in marriage. A positive effect on emotional violence is also found in some sub-sample. Further, the positive effect of HIV on spousal violence is found to be larger for women who know where to obtain condoms. This result suggests that an increased demand for condoms and a subsequent conflict over condom use might be a potential channel through which HIV increases the risk of spousal violence. On the other hand, there is no convincing evidence on that changing marriage market conditions or shorter life expectancy mediates the effect of HIV on spousal violence.

"This epidemic unfortunately remains an epidemic of women," states Michel Sidibe, Executive Director of UNAIDS (UN News Service, 2010). Women bear disproportionately large share of the burden of HIV epidemic, including a greater risk of heterosexual transmission, economic hardship, and responsibility for care of the infected and children. The result of this study adds one more dimension to the burden of women, namely the increased risk of violence. To put it another way, the result implies a greater positive externality of preventing and treating the HIV epidemic for women. Also, the finding that condom use is one channel through which the two epidemics are connected implies the importance of understanding socio-cultural context of an epidemic in combating a communicable disease. While this study confirms HIV as a cause of further intimate partner violence, the two epidemics are believed to be a driver as well as a consequence of each other, generating a multiplier effect. In breaking this vicious cycle, it is essential to find ways to allow for more choices and independence to women in sexual matters without going head-to-head with deep-rooted cultural norms and social taboo. The result of this study, therefore, lends supports to promotion of female-initiated prevention technologies such as female condoms.

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Figure 1. Opinion on Justification of Request for Condom Use by Knowledge of Condom Source

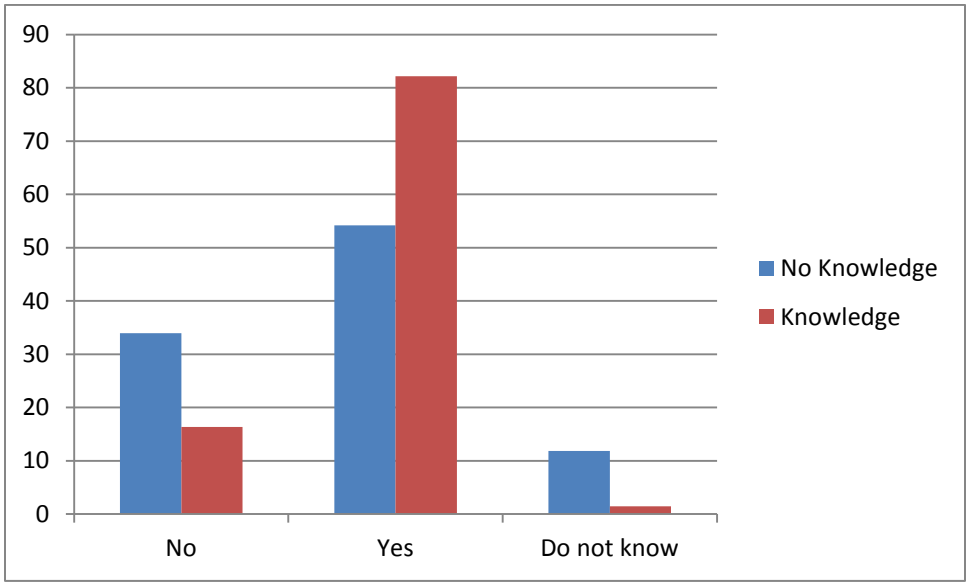

Figure 2. Personal Capability of Request for Condom Use by Knowledge of Condom Source

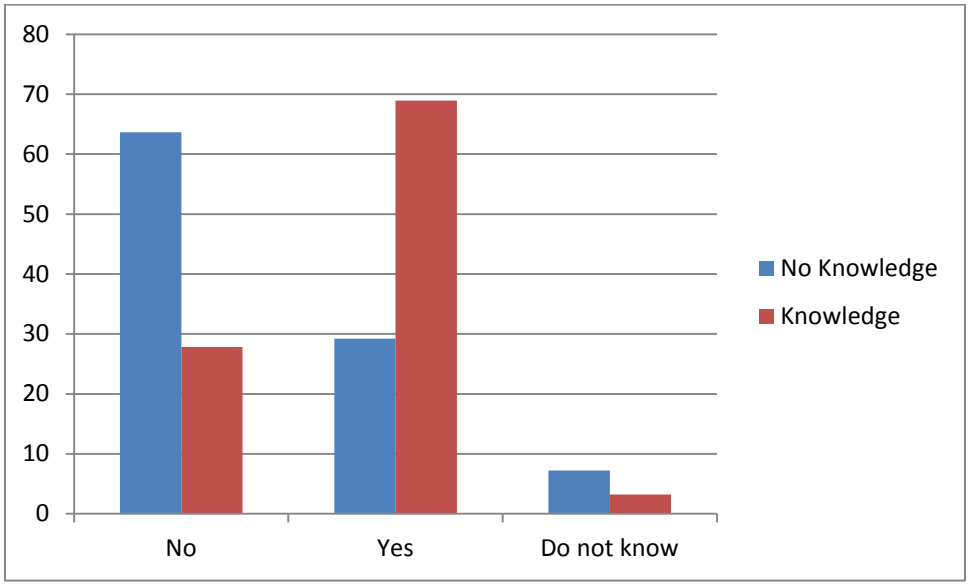

Table 1. Summary Statistics on Distance, HIV, Distance, Violence, and Demographics

(All Sample, Weighted)

	All	
	Average	Std Dev
Distance	2,115	1,131
HIV	9.15	10.68
Emotional violence (yes=1, no=0)	0.21	0.41
Physical violence (yes=1, no=0)	0.25	0.43
Sexual violence (yes=1, no=0)	0.11	0.31
Female age	30.68	8.44
Male age	38.38	10.95
Female education	5.62	4.43
Male education	6.84	4.77
No. of children at home	2.54	1.84
Polygamy (yes=1, no=0)	0.19	0.39
Female work status (yes=1, no=0)	0.58	0.49
Urban residence (yes=1, no=0)	0.26	0.44
Muslim (yes=1, no=0)	0.22	0.42
Wealth index	0.04	0.98
No. of clusters	2,587	
No. of observations	26,705	

Results are from the DHS for Kenya 2008, Liberia 2007, Malawi 2010, Mali 2006, Zambia 2007, and Zimbabwe 2010. The unit of observation for HIV and distance is the survey cluster. HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Distance is in km, and is measured from the origin of the virus (-6.31, 23.59). The unit of observation for all the other variables is currently married women covered in domestic violence module. Summary statistics of three types of violence and the demographic variables are weighted by domestic violence sampling weights adjusted by population. Age and education variables are in years. Wealth index is reported by the DHS and represents a wealth status of a household in the population. It is constructed using principal component analysis, based on household ownership of consumer items and dwelling characteristics. The index has a normal distribution with a mean of zero and a standard deviation of one.

Table 1-1. Summary Statistics on Distance, HIV, Distance, Violence, and Demographics (by Country, Weighted)

	Kenya 2008		Liberia 2007		Malawi 2010		Mali 2006		Zambia 2007		Zimbabwe 2010	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Distance	1,606	197	3,910	234	1,480	165	3,930	219	1,009	187	1,580	135
HIV	7.10	9.13	1.86	2.80	10.84	11.73	1.46	3.48	14.10	10.03	16.84	9.95
Emotional violence (yes=1, no=0)	0.25	0.28	0.34	0.82	0.21	0.40	0.10	0.39	0.22	0.42	0.23	0.45
Physical violence (yes=1, no=0)	0.28	0.28	0.31	0.80	0.14	0.34	0.20	0.52	0.38	0.49	0.21	0.43
Sexual violence (yes=1, no=0)	0.12	0.21	0.09	0.50	0.13	0.33	0.04	0.25	0.14	0.35	0.14	0.36
Female age	31.41	5.27	32.52	15.07	30.09	8.29	29.92	11.52	30.61	8.43	29.95	8.59
Male age	38.72	6.66	39.89	19.44	35.79	9.93	41.88	15.56	36.95	10.24	36.74	11.89
Female education	7.37	2.54	2.81	8.03	4.85	3.64	1.01	3.49	5.74	3.65	8.79	3.24
Male education	8.41	2.69	6.39	8.63	6.52	3.91	1.43	4.62	7.60	3.79	9.83	3.33
No. of children at home	2.69	1.23	2.20	2.91	2.65	1.74	2.57	2.49	2.73	1.89	1.89	1.47
Polygamy (yes=1, no=0)	0.14	0.22	0.17	0.65	0.15	0.35	0.40	0.63	0.14	0.35	0.12	0.34
Female work status (yes=1, no=0)	0.64	0.31	0.68	0.81	0.58	0.49	0.62	0.63	0.51	0.51	0.38	0.51
Urban residence (yes=1, no=0)	0.22	0.27	0.34	0.82	0.18	0.38	0.29	0.59	0.34	0.48	0.32	0.49
Muslim (yes=1, no=0)	0.09	0.18	0.01	0.14	0.02	0.13	0.93	0.34	0.00	0.07	0.14	0.37
Wealth index	-0.12	0.59	0.08	1.75	0.16	1.06	0.00	1.34	0.01	1.06	0.36	0.79
No. of clusters	358		291		823		405		318		392	
No. of observations	3,939		3,004		4,237		8,148		3,459		3,918	

Results are from the DHS for Kenya 2008, Liberia 2007, Malawi 2010, Mali 2006, Zambia 2007, and Zimbabwe 2010. The unit of observation for HIV and distance is the survey cluster. HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Distance is in km, and is measured from the origin of the virus (-6.31, 23.59). The unit of observation for all the other variables is currently married women covered in domestic violence module. Summary statistics of three types of violence and the demographic variables are weighted by domestic violence sampling weights adjusted by population. Age and education variables are in years. Wealth index is reported by the DHS and represents a wealth status of a household in the population. It is constructed using principal component analysis, based on household ownership of consumer items and dwelling characteristics. The index has a normal distribution with a mean of zero and a standard deviation of one.

Table 2. First Stage Estimation Results: HIV Prevalence and Distance from Origin

	Dependent Variable: HIV Prevalence			
	(1)	(2)	(3)	(4)
Explanatory variables				
Distance (1,000 kms)	-3.4562	-3.0214	-4.1631	-3.7966
	(0.1479)***	(0.7618)***	(1.2532)***	(1.3174)***
Latitude		-0.3957	-0.9778	-0.8288
		(0.0392)***	(0.1289)***	(0.1287)***
Longitude		-0.1843	-0.4744	-0.4774
		(0.0356)***	(0.1032)***	(0.1028)***
Female age				-0.0741
				(0.1001)
Female age^2				0.0001
				(0.0014)
Male age				0.1688
				(0.0536)***
Male age^2				-0.0014
				(0.0005)***
Female education				0.0061
				(0.0369)
Male education				-0.0092
				(0.0285)
No. of children at home				-0.1760
				(0.0746)**
Polygamy (yes=1, no=0)				-0.0541
				(0.2981)
Female work status (yes=1, no=0)				-0.6166
				(0.2056)***
Urban residence (yes=1, no=1)				3.1407
				(0.6271)***
Muslim (yes=1, no=0)				-0.5984
				(0.4491)
Wealth index				0.3733
				(0.2510)
Constant	14.9878	17.1396	18.2314	18.0550
	(0.5218)***	(2.5039)***	(4.9473)***	(5.3335)***
Country dummies	No	No	Yes	Yes
No. of observations	26,705	26,705	26,705	26,705
R^2	0.146	0.254	0.276	0.309

HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Distance is in 1,000 km, and measured from the origin of the virus (-6.31, 23.59). Latitude and Longitude are in decimal degrees. Age and education variables are in years. Wealth index is reported by the DHS and represents a wealth status of a household in

the population. It is constructed using principal component analysis, based on household ownership of consumer items and dwelling characteristics. The index has a normal distribution with a mean of zero and a standard deviation of one. All regressions are OLS regressions weighted by domestic violence sampling weights, adjusted by population. Robust standard errors, adjusted for clustering by survey cluster, are in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3. First Stage Falsification: Effect of Distance on Parent Violence Experience and Help Seeking Behavior

Dependent Variables	Parent violence (yes=1, no=1)	Seeking help (yes=1, no=0)	Seeking help other than family (yes=1, no=0)	
	(1)	(2)	(3)	(4)
Explanatory variables				
Distance	0.0078	0.0120	0.0147	0.0315
	(0.0321)	(0.0567)	(0.0246)	(0.0587)
No. of observations	24,091	8,231	8,231	3,488
R^2	0.067	0.017	0.012	0.024

Parent violence is a dummy variable that takes the value of one if father of a woman beats her mother and zero otherwise. Seeking help is a dummy variable that take the value of one if a female victim of violence seeks help and zero otherwise. Seeking help other than family is a dummy variable that take the value of one if a female victim of violence seeks help from people other than family members and zero otherwise. In Column 4, seeking help other than family take the value of one when a female victim seeks help from people other than family members conditional on help seeking from anyone. Distance is in 1,000 km, and measured from the origin of the virus (-6.31, 23.59). Other controls included are latitude, longitude, female age, female age squared, male age, male age squared, female education, male education, the number of children at home, a dummy for being in a polygamous marriage, a dummy for female working, a dummy for urban residence, a dummy for being Muslim, and wealth index. All regressions are OLS regressions weighted by domestic violence sampling weights, adjusted by population. Robust standard errors, adjusted for clustering by survey cluster, are in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Effect of HIV on Emotional, Physical, Sexual Violence, Parent Violence, and Condom Use

Dependent Variables	Emotional violence (yes=1, no=0)	Physical violence (yes=1, no=0)	Sexual violence (yes=1, no=0)	Condom use rate	Emotional violence (yes=1, no=0)	Physical violence (yes=1, no=0)	Sexual violence (yes=1, no=0)	Condom use rate	Parent violence (yes=1, no=0)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	IV	IV	IV	IV	IV
Explanatory variables									
HIV prevalence	0.0014	0.0032	0.0009	0.0020	0.0105	0.0179	0.0204	0.0086	-0.0021
	(0.0006)**	(0.0006)***	(0.0004)**	(0.0003)***	(0.0072)	(0.0100)*	(0.0081)**	(0.0031)***	(0.0090)
No. of observations	26,705	26,705	26,705	26,705	26,705	26,705	26,705	26,705	24,091

Emotional violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) humiliating her; 2) threatening her with harm; 3) insulting her or making her feel bad. Physical violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) pushing, shaking, or throwing something at her; 2) slapping or twisting her arm; 3) punching her with a fist or something that could hurt; 4) kicking or dragging her; 5) strangling, kicking or burning her. Sexual violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) physically forcing sex when not wanted; 2) forcing other sexual acts when not wanted. Condom use rate is the percentage of women who used condom at the last intercourse in decimal form at the cluster level weighted by individual (women) sampling weights. Parent violence is a dummy variable that takes the value of one if father of a woman beats her mother and zero otherwise. HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Other controls included are latitude, longitude, female age, female age squared, male age, male age squared, female education, male education, the number of children at home, a dummy for being in a polygamous marriage, a dummy for female working, a dummy for urban residence, a dummy for being Muslim, and wealth index. All regressions are OLS regressions (Columns 1 through 4) or IV regressions (Columns 5 through 9) weighted by domestic violence sampling weights, adjusted by population. Robust standard errors, adjusted for clustering by survey cluster, are in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Effect of HIV through Condom

Dependent Variables	Emotional violence		Physical violence		Sexual violence	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV	IV	IV	IV	IV	IV
Explanatory variables						
HIV prevalence	0.0172	0.0092	0.0246	0.0193	0.0213	0.0168
	(0.0091)*	(0.0092)	(0.0119)**	(0.0116)*	(0.0098)**	(0.0093)*
HIV prevalence X Knowledge on source of condom		0.0104		0.0070		0.0059
		(0.0034)***		(0.0031)**		(0.0022)***
No. of observations	18,093	18,093	18,093	18,093	18,093	18,093

Emotional violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) humiliating her; 2) threatening her with harm; 3) insulting her or making her feel bad. Physical violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) pushing, shaking, or throwing something at her; 2) slapping or twisting her arm; 3) punching her with a fist or something that could hurt; 4) kicking or dragging her; 5) strangling, kicking or burning her. Sexual violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) physically forcing sex when not wanted; 2) forcing other sexual acts when not wanted. HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Knowledge on source of condom is a dummy variable that takes the value of one if a woman recognizes any of the following places as a source of place where a person can get male condoms: Government hospital, government health center, government dispensary, other public places, private hospital or clinic, pharmacy, and shop/bar/lodge. Other controls included are latitude, longitude, female age, female age squared, male age, male age squared, female education, male education, the number of children at home, a dummy for being in a polygamous marriage, a dummy for female working, a dummy for urban residence, a dummy for being Muslim, and wealth index. In this regression, knowledge – a dummy that takes the value of one if a woman knows that condom use can reduce chances of HIV infection and zero otherwise—is additionally controlled. All regressions are IV regressions weighted by domestic violence sampling weights, adjusted by population. Robust standard errors, adjusted for clustering by survey cluster, are in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Effect of HIV through Marriage Market Conditions

Panel A: HIV Prevalence Effect through Higher Transmission Risk for Women			
Dependent Variables	Emotional violence	Physical violence	Sexual violence
	(1)	(2)	(3)
	IV	IV	IV
Explanatory variables			
HIV prevalence	0.0117	0.0246	0.0285
	(0.0105)	(0.0150)*	(0.0121)**
HIV prevalence x Higher transmission risk	-0.0006	-0.0070	-0.0082
	(0.0045)	(0.0063)	(0.0049)*
No. of observations	26,705	26,705	26,705
Panel B: HIV Prevalence Effect through Women's Prior Marriage Experience			
Dependent Variables	Emotional violence	Physical violence	Sexual violence
	(1)	(2)	(3)
	IV	IV	IV
Explanatory variables			
HIV prevalence	0.0103	0.0179	0.0206
	(0.0073)	(0.0100)*	(0.0082)**
HIV prevalence x Prior marriage experience	0.0032	-0.0031	-0.0006
	(0.0021)	(0.0024)	(0.0017)
No. of observations	26,547	26,547	26,547

Emotional violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) humiliating her; 2) threatening her with harm; 3) insulting her or making her feel bad. Physical violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) pushing, shaking, or throwing something at her; 2) slapping or twisting her arm; 3) punching her with a fist or something that could hurt; 4) kicking or dragging her; 5) strangling, kicking or burning her. Sexual violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) physically forcing sex when not wanted; 2) forcing other sexual acts when not wanted. HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Higher transmission risk is a dummy variable that takes the value of one if 0.245 x male HIV rate > 0.125 x female HIV rate in a cluster and zero otherwise. Prior marriage experience is a dummy variable that takes the value of one if a woman has more than one marital union in her life and zero otherwise. Other controls included are latitude, longitude, female age, female age squared, male age, male age squared, female education, male education, the number of children at home, a dummy for being in a polygamous marriage, a dummy for female working, a dummy for urban residence, a dummy for being Muslim, and wealth index. All regressions are OLS regressions weighted by domestic violence sampling weights, adjusted by population. Robust standard errors, adjusted for clustering by survey cluster, are in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Effect of HIV through Male Assessment on Chances of AIDS

Dependent Variables	Emotional violence		Physical violence		Sexual violence	
	(1)	(2)	(3)	(4)	(5)	(6)
	IV	IV	IV	IV	IV	IV
Explanatory variables						
HIV prevalence	0.0049		0.0205		0.0088	
	(0.0075)		(0.0067)***		(0.0053)*	
HIV prevalence X Belief low		0.0028		0.0234		0.0147
		(0.0095)		(0.0094)**		(0.0071)**
HIV prevalence X Belief moderate		0.0027		0.0243		0.008
		(0.0183)		(0.0122)**		(0.0085)
HIV prevalence X Belief high		0.0059		0.0022		-0.0082
		(0.0108)		(0.0094)		(0.0119)
Test on Differential Effect of HIV by Belief						
Low=Moderate		p=0.99		p=0.95		p=0.55
Low=High		p=0.81		p=0.12		p=0.06
Moderate=High		p=0.88		p=0.13		p=0.25
No. of observations	1,258	1,258	1,257	1,257	1,257	1,257

Emotional violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) humiliating her; 2) threatening her with harm; 3) insulting her or making her feel bad. Physical violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) pushing, shaking, or throwing something at her; 2) slapping or twisting her arm; 3) punching her with a fist or something that could hurt; 4) kicking or dragging her; 5) strangling, kicking or burning her. Sexual violence is a dummy variable that takes the value of one if a woman experiences any of the following acts by her husband in the past 12 months and zero otherwise: 1) physically forcing sex when not wanted; 2) forcing other sexual acts when not wanted. HIV prevalence is the percentage of women and men aged 15 to 49 living with HIV, weighted by HIV sampling weights. Belief low is a dummy variable that takes the value of one if a man assesses his likelihood of getting AIDS as zero or very small and zero otherwise. Belief moderate is a dummy variable that takes the value of one if a man assesses his likelihood of getting AIDS as moderate and zero otherwise. Belief high is a dummy variable that takes the value of one if a man assesses his likelihood of getting AIDS as high or he does have HIV and zero otherwise. Other controls included are latitude, longitude, female age, female age squared, male age, male age squared, female education, male education, the number of children at home, a dummy for being in a polygamous marriage, a dummy for female working, a dummy for urban residence, a dummy for being Muslim, and wealth index. In this regression, knowledge – a dummy that takes the value of one if a woman knows that condom use can reduce chances of HIV infection and zero otherwise—is additionally controlled. All regressions are IV regressions weighted by domestic violence sampling weights, adjusted by population. Robust standard errors, adjusted for clustering by survey cluster, are in parenthesis; * significant at 10%; ** significant at 5%; *** significant at 1%.