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Antiretroviral Therapy Awareness and Risky Sexual Behaviors

Evidence from Mozambique

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Abstract

This paper studies the effect of increased access to antiretroviral therapy on risky sexual behavior, using data collected in Mozambique in 2007 and 2008. The survey sampled both households of randomly selected HIV positive individuals and households from the general population. Controlling for unobserved individual characteristics, the findings support the hypothesis of disinhibition behaviors, whereby risky sexual behaviors increase in response to the perceived changes in risk associated with increased access to antiretroviral therapy. Furthermore, men and women respond differently to the perceived changes in risk. In particular, risky behaviors increase for men who believe, wrongly, that AIDS can be cured, while risky behaviors increase for women who believe, correctly, that antiretroviral therapy can treat AIDS but cannot cure it. The findings suggest that scaling up access to antiretroviral therapy without prevention programs may not be optimal if the objective is to contain the disease, since people would adjust their sexual behavior in response to the perceived changes in risk. Therefore, prevention programs need to include educational messages about antiretroviral therapy, and address the changing beliefs about HIV in the era of increasing antiretroviral therapy availability.

This paper—a product of the Human Development and Public Services Team, Development Research Group—is part of a larger effort in the department to better understand the determinants of the HIV/AIDS epidemic. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at ddewalque@worldbank.org, harounan.kazianaga@okstate.edu, mover@cgdev.org

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1 Introduction

Access to HIV/AIDS treatment has transformed the perception of AIDS from a death sentence to a manageable chronic condition (Lakdawalla, Sood, and Goldman, 2006), no different from any other chronic disease. Expanding access to treatments has become one of the key strategies of the international community to confront AIDS. For instance, universal access to treatment is one of the stated goals of the joint United Nations programs on HIV/AIDS (UNAIDS). The call for scaling up treatment, especially in low income countries, has generated a debate on how treatment may affect the dynamics of the disease.

Increased access to treatment can influence the spread of the disease in many ways. On the one hand, access to treatment may provide incentives for HIV testing by reducing the costs of finding one's seropositivity. Once people find that they are sero-negative, they would have more incentives to adopt safer sexual behaviors[1](e.g. Mechoulan, 2007). On the other hand, decreased fear of contracting HIV, resulting from access to treatment, may increase risky behavior, reduce serosorting and increase the mixing between higher- and lower-risk groups in the population. Moreover, as survival increases, the incidence of exposure to partners with HIV infection may increase (Hammer et al., 2006). There are anecdotal reports which suggest that in some parts of Sub-Saharan Africa, increasing beliefs that AIDS can be treated or cured have cause a decline of safe sexual practices, which in turn have led to an increase in sexually transmitted infections[2]. Such disinhibition behaviors, if confirmed, would imply that scaling up antiretroviral treatment (ART) would not be as effective if treatment expenditures crowd out prevention programs (Over et al., 2007, 2006).

[1]Note that increased demand for testing could also lead to early detection, which would make treatment more effective.

[2]See http://www.voanews.com/english/news/africa/WHO-Reports-Increase-in-STDs-in-Sub-Saharan-Africa–102459929.html (last accessed on October 18, 2010)

In this paper, we present an empirical analysis of the effects of highly active antiretroviral therapy (ART) awareness on sexual behaviors. Our measures of risky sexual behaviors consist of unprotected sex with non co-residing partners, extra-marital sexual intercourse and abstinence. We chose these three measures of sexual behaviors to reflect the so called A, B and C (abstinence, be faithful or condom) that have been promoted in HIV/AIDS prevention programs and are believed to have been critical in controlling the spread of the disease in some parts of Sub-Saharan Africa (e.g. Singh et al., 2004). Our measures of ART awareness consist of "the belief that ART can cure AIDS", "the belief that ART can treat AIDS, but cannot cure it", "knowing someone who is or has been under ART treatment", and "whether the health of that person has improved as a result of the ART treatment". Our goal is to test whether people adjust their sexual behaviors as they become more aware of ART.

We make three main contributions to the literature on individual risk offsetting behaviors. First, the survey instrument asked individuals about their awareness of ART. We show how these ART awareness variables correlate strongly with sexual behaviors. In particular, we are able to contrast the "false" belief that ART can cure AIDS with the correct assessment that ART can treat but not cure AIDS. Second, our paper is unique in the attempt to exploit the panel structure of the data to control for unobserved individual characteristics that may otherwise influence both sexual behavior and ART awareness. Third, our sample covers three categories of respondents: HIV positive individuals, individuals who live in a household where there is at least one identified HIV positive person, and individuals who live in comparison households, i.e. households where there is no identified HIV positive person. This feature of our sample allows us to directly test how response to ART awareness varies between HIV positive individuals and the general population.

Mozambique offers an interesting setting for exploring potential disinhibition behaviors. Mozambique ranks among the 10 countries most affected by the HIV/AIDS epidemic. The prevalence rate is estimated to be between 14 percent and 17 percent in 2009, and has remained that high since at least 2002 (UNGASS, 2010). With a growing population, a constant prevalence rate implies that the disease is still spreading. The national effort to confront the disease includes increased access to ART. The number of patients under ART drugs has increased from 3,314 in 2003 to 170,198 in 2009 (UNGASS, 2010). Treatment coverage, however, remains low. In 2009, it was estimated that 42 percent of adults and 19 percent of children in need of ART were receiving treatment (UNGASS, 2010)[3]. Mozambique illustrates the ongoing debate on how to optimally allocate limited resources between treatment and prevention in Sub-Saharan Africa (e.g. Marseille et al., 2002), if the ultimate goal is to contain the disease. In this context, as stressed by Schultz (2004), robust estimates of the magnitude of disinhibition behaviors are critical for any informed decision making, since such estimates would allow accounting for externalities (whether negative or positive) associated with increased access to ART.

This paper is related to a strand of literature that focuses on disinhibition (or risk compensation) behaviors. The main proposition of this literature is that people may alter their behavior in response to perceived changes in risk[4]. In the specific case of HIV/AIDS and increased access to ART, the concern is that decrease in the perceived risk and the costs of contracting HIV associated with increased access to ART may lead to an increase of risky sexual behaviors (e.g. Eaton and Kalichman, 2007). Such disinhibition behaviors, if large enough, may (at least partially) offset the benefits of scaling up access to ART. This conjec-

[3]See Arndt (2006) for a simulation analysis of the long run impact of HIV/AIDS on economic growth in Mozambique, and in particular on human capital accumulation.

[4]See Peltzman (1975) for an early study on the introduction of mandatory car seat belts in the US.

ture is supported by several studies in the United States and Europe which have identified an upward trend in risky sexual behaviors since the introduction of ART in 1996 (e.g. Gremy and Beltzer, 2004; Lakdawalla et al., 2006). More specifically, an association has been identified between decreased concern about HIV due to ART availability and unprotected sex, and in particular among men who have sex with men (e.g. Dukers et al., 2001; Kalichman, 1998; Lakdawalla et al., 2006; Mechoulan, 2007).

Investigations of disinhibition behaviors associated with increased access to ART in Sub-Saharan Africa are, however, limited. One of the earliest studies looked at change in the use of condoms by sex workers in Nairobi, Kenya (Jha et al., 2001). The findings are summarized in figure 1. There is at least some suggestive evidence that condom use by sex workers decreased when "fake" cures for AIDS were announced. Such a pattern is consistent with disinhibition behaviors, although the result may not be generalizable to the general population since it uses a very selected segment of the population. Cohen et al. (2009) is one of the few studies that use population based surveys to test risk compensation behavior in a Sub-Saharan African context. The authors found that in Kisimu (Kenya), ART-related risk compensation[5], and the belief that ART cures HIV, were associated with an increased HIV seroprevalence in men but not women.

We differ from Cohen et al. (2009) in two ways. First, we focus on sexual behavior instead of HIV seroprevalence. Changes in sexual behaviors resulting from the introduction of ART can be viewed as a first order effect, while changes in sero-prevalence (as long as these changes are taking place through changes in sexual behaviors as theorized by Cohen et al. (2009)) are second order effects. Second, the panel structure of our data allows us to control for unobserved individual characteristics that can influence both sexual behavior (or HIV

[5]The authors define risk compensation by increased sexual risk taking now that ART is available.

seroprevalence) and perceptions on ART, and thus lead to biased estimates of disinhibition behaviors. This source of bias remains a concern with the results of Cohen et al. (2009) despite the careful design of their field survey[6].

Controlling for unobserved individual characteristics, we find suggestive evidence of disinhibition behaviors: individuals who are more aware of ART engage more in risky sex. Moreover, men and women respond differently to the perceived changes in risk. In particular, risky behaviors increase for men who believe, wrongly, that AIDS can be cured, while risky behaviors increase for women who believe, correctly, that ART can control AIDS but cannot cure it. These findings have two main implications. First, our results suggest that prevention programs that provide the correct information on ART may reduce disinhibition behaviors for men, although given the small and declining percentage of individuals believing wrongly that AIDS can be cured (see table 1, 8% in 2007 and 6% in 2008) the impact of such a program is bound to be limited. Prevention messages for women, however, need to go beyond the correct information on ART and stress the importance of safe sexual behaviors. The second implication is that to effectively control AIDS, prevention programs should not be traded away in order to scale up access to treatment.

The remainder of the paper is organized as follows. We begin by providing a conceptual framework to motivate our empirical results in section 2. Next, we discuss our survey, and show a summary of the main variables used in the analysis in section 3. We discuss our empirical strategy in section 4, and report our estimation results in sections 5. Section 6 concludes.

[6]Cohen et al. (2009) conduct their field survey in two steps. First, they administer a survey including questions on sexual behaviors and perceptions on ART. The second step consists of HIV testing of respondents. Note that individuals who knew their sero-prevalence were excluded from the sample. The approach prevents respondent to associate their answers to the HIV test, and therefore adjust the formers. However, it does not solve the issue associated with unobservable individual characteristics.

2 Access to ART and Risky Sexual Behavior

When people become aware of ART, they may adjust their sexual behavior to account for the decline in the costliness of the new treatable disease. Such a response may create a compensation effect that partially reduces the benefits of expanded treatment. Such possible offsetting behaviors have been discussed in the economic literature in the context of other safety (e.g. Peltzman, 1975) and health issues (e.g. Oza, 2009)[7].

We assume that individuals derive utility from both safe sex and risky sex (e.g. unprotected sex with non co-residing partner). Moreover, the marginal utility of risky sex is greater than that of safe sex[8]. The cost of risky sex is, however, higher than that of safe sex. In particular the cost of risky sex includes the probability of contracting HIV and the ensuing disutility from developing AIDS (this includes the physical pain after the individual develops AIDS, the monetary costs from lost earnings, stigma, premature death, etc.)[9]. The cost of safe sex is kept lower because it does not include all the risks and costs associated with contracting HIV. If the consumer is maximizing her utility subject to a budget constraint, standard economic reasoning implies that at the optimum, the ratio of the marginal utility

[7]A long debated issue is the introduction of seat belts in cars in the US. For instance, Lave and Weber (1970) and Peltzman (1975) argued that seat belt use might produce careless driving and in turn greater risks for non-occupants. As a result, mandatory seat belt laws might increase total fatalities rather than reduce them. However, empirical analyses focusing on the safety regulation of motorized vehicles have generated mixed results. For instance, Cohen and Einav (2003) found that while seat belts usage has a small negative effect on traffic fatalities, there is no evidence suggesting that seat belts usage increases reckless driving. In contrast, using data from recreational boats, McCarthy and Talley (1999) found that the passenger was less likely to wear a personal floatation device (PFD) when the driver had received a formal training. Oza (2009) hypothesizes that the introduction of over-the-counter access to the "morning after pill" lowered the risk of unintended pregnancies, but also lowered the opportunity costs of unprotected sex. She shows that for women who were exposed to the policy, abortion rates decreased while STIs increased, corroborating disinhibition behaviors.

[8]For example, Rao, Gupta, Lokshin, and Jana (2003) found that prostitutes in Calcutta, India who agree to condom-free sex are paid more, implying that clients derive more satisfaction from condom-free sex. Gertler, Shah, and Bertozzi (2005) found similar results using data from the states of Morelos and Michoacan in Mexico.

[9]We abstract from other sexually transmitted diseases and birth control.

and the cost is equalized between safe sex and unprotected sex.

Starting from the optimal choice of risky sexual behavior and safe sexual behavior, the introduction of ART lowers the cost of risky sex. Holding everything else constant, risky sex becomes relatively cheaper compared to safe sex. The effect is an increase in the demand for risky sex, as the basic law of demand would predict. To the extent that risky sex and safe sex are substitutes, we would expect a decrease in the demand for safe sex as people become more aware of ART (i.e. the price of risky sex decreases, while everything else is kept constant).

This framework, while overly simplified, provides a context for interpreting our empirical results[10]. Considering our independent variables, we could argue that the cost of risky sex is lower when "ART is believed to cure AIDS" than when "ART is believe to treat AIDS but not cure it". Similarly, the cost of risky sex is lower for someone who "has seen the health of an ART patient improved" than for "someone who only knows a patient under ART treatment". Thus, we hypothesize that disinhibition is stronger for respondents who believe, wrongly, that "ART can cure AIDS" than those who believe that ART can treat AIDS, and for those who have been in contact with someone whose health has improved after that person started an ART treatment than those who know someone under treatment. Furthermore, if access to ART indeed makes safe sex relatively expensive, then safe sex (abstinence in our case) would react negatively to ART awareness.

Obviously this framework leaves out adjustments in sexual behavior that could limit disinhibition. An important externality of ART is that it increases the benefits of testing, and therefore leads to increased demand for testing. As mentioned earlier, people who

[10]We abstract from other potential complementarities from the expansion of ART (e.g. Dow et al., 1999). In particular, individuals may invest in other health inputs or in their firms because their chances of surviving increase with ART. This would imply that access to ART may affect other health outcomes as well as broader economic outcomes.

discover that they are HIV negative may decrease their demand for risky sex, especially if prevalence is high among potential sexual partners (e.g. Ahituv et al., 1996)[11].

3 Data

The data were collected in 2007 and 2008 in 4 provinces of Mozambique (Maputo City, Maputo Province, Sofala, Manica). The survey was designed to collect data in order to assess the impact of the scale-up of ART in Mozambique. The project delivering ART began in 2004 and had a 4-year duration. The HIV/AIDS patients of the survey were identified at the health facility where they received treatment and were interviewed at home along with the rest of the household. The questionnaire includes information on consumption, time use, labor force participation and earnings, and education as well as other health measures of the identified patient and their household members. It also included questions on adherence to treatment, health of adults and children, anthropometric measurements, and quality of life.

A group of comparison households was included in the sample, in which there were no identified HIV positive persons, to control for general trends in socio-economic circumstances. The comparison households were randomly selected in the neighborhood of each HIV household. The first wave of the survey, conducted between August and December of 2007, included 658 HIV households and 341 comparison households. In the second wave, one year later, HIV households that could not be found and interviewed were not replaced, but comparison households were. The panel consists of 896 households interviewed in both waves: 616 HIV households and 280 comparison households. At the individual level, there are 616 identified HIV positive patients, 2579 individuals living in HIV households but not

[11] Using the National Longitudinal Survey of Youth (NLSY-1979) Ahituv et al. (1996), estimate that a 1 percent increase in the prevalence of AIDS in the state of residence increases the propensity to use a condom significantly and up to 50 percent for the most prevalence-responsive groups.

identified as HIV positive, and 1431 individuals belonging to comparison households.

In addition to health and socio-economic questions, respondents were interviewed on their sexual behavior, their knowledge on HIV, and on ART. Questions on sexual behaviors include the number of sexual partners during the 12 months preceding the survey, the relationship to each sexual partner and whether a condom was used during the last sexual act with that partner. Each respondent was also asked to assess the likelihood of his or her partner being HIV positive. All our variables, in particular the sexual behaviors as well as the ART awareness, are self-reported.

For the analysis, relationships are reduced to two categories: co-residing partners (whether legally married or not), and all other partners. Four questions are used to assess the respondent's ART awareness: whether the respondent thought (wrongly) that AIDS could be cured, (correctly) that AIDS could be treated (but not cured), whether the respondent knew any person who was under ART treatment, and whether that person's health has improved.

Table 1 contains a summary of the key variables used in the study. While the proportion of individuals reporting risky sexual intercourse (unprotected sexual intercourse with a non co-residing partner) is relatively small (7 percent in 2007 and 8 percent in 2008), more than a third of the married sub-sample (37 percent in 2007 and 42 percent in 2008) reports extra-marital sex during the last 12 months preceding the survey. Abstinence is practiced by around 18 percent of the sample. This would suggest that in addition to promoting abstinence and fidelity, prevention programs (starting from the current situation) should focus also on the use of condoms since abstinence is low, and extra-marital sex is relatively high. The low rate of unprotected sex with non co-residing partners, is by itself encouraging from the disease containment perspective.

ART awareness variables are summarized in columns 4-7. About 8 percent of respondents

in 2007 and 6 percent in 2007 report that AIDS can be cured, while around 80 percent report that AIDS can be treated, but cannot be cured. About 45 percent of respondents know someone currently under ART treatment (column 6), and on average 42 percent (column 7) think that the health of the person under ART has improved as a result of the treatment.

4 Empirical Strategy

The general hypothesis we want to test is whether ART awareness increases risky sexual behavior, i.e. whether there is a behavioral disinhibition or risk compensation. Our primary interest is estimating how individuals adjust their sexual behavior as they become aware of ART and form their perceptions on how effective ART is at treating AIDS, or (falsely) at curing AIDS. To proceed, we specify the following regression.

$$y_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 X_{it} + \delta_i + \varepsilon_{it} \tag{1}$$

where y is a behavioral outcome, A is a variable summarizing ART awareness and X summarizes other variables that could influence sexual behavior, t indexes time periods (2007 and 2008), and i indexes individuals. In this specification, δ_i is a time-invariant individual level variable which is unobserved, and which may be correlated with A.

There are two main sources of concern with regression 1. The first concern is an omitted variable (δ_i) bias that could bias β_1 in one direction or the other. For instance, people who engaged in risky sex may have an incentive to seek out information about ART. The resulting spurious positive association between risky sexual behaviors and ART would create an upward bias. Conversely, people who engage in risky sex may be "in denial" about HIV/AIDS and therefore less aware of treatment possibilities, creating a negative association

between risky sexual behavior and ART awareness, hence a downward bias. It is quite plausible that these two effects could offset each other so that $\beta_1 = 0$. Because of the panel structure of our data, we can use individual fixed effects to control for unobservable individual characteristics.

The second concern is a reverse causation bias, which may arise from non random placement of HIV/AIDS programs (including prevention, voluntary counseling and ART treatment). The main concern is that policy makers may place HIV/AIDS programs in places where HIV prevalence is high which may correspond to places with riskier sexual behaviors. Thus, by attracting more HIV/AIDS programs, risky sexual behaviors may be contributing to increase ART awareness among the population. We can, however, argue the following. First, given the way we sampled them, all households are within a reasonable distance of a health facility delivering ART, so that the individual fixed effects would control any differences of exposure to ART that are due to non random placement of ART delivery centers. Second, for other HIV/AIDS programs on prevention, we do not expect big changes in intensity across areas over one year, between our two survey rounds. Therefore, we argue that while there might have been a placement bias initially, it is less likely that any change in perceptions about ART over one year could be due to a differential change of prevention program placement across areas. And in any case, we control for district wide-time variant effects by including district-year interaction terms in the regressions.

Our rationale is that once we condition on individual-fixed effects and district-year interaction effects, the scaling up of HIV/AIDS treatment activities would affect awareness of ART but would not have any direct effects on sexual behaviors. Formally, our identification

condition can be stated as follows:

$$A_{it} \perp \varepsilon_{it} \mid \delta_i, \eta_{dt} \tag{2}$$

where the η_{dt} are district-time interaction terms, and all other variables have been defined previously. Time-variant individual fixed effects that are both correlated with sexual behavior and awareness of ART would, however, bias our estimations. This would be the case if for example ART scale-up influences unobservable characteristics such as the discount factor or "taste for risky sex". Because we cannot control for this source of heterogeneity, we refrain from interpreting our estimations as causal.

5 Results and Discussion

5.1 Risky sexual behaviors and ART awareness

Our dependent variables are risky sex (any unprotected sexual intercourse with a non-cohabiting partner), extra-marital (any sexual intercourse by a married person with a partner other than their spouse), and abstinence (no sexual intercourse during the 12 months preceding the survey). Given the cultural context of Sub-Saharan Africa where men have relatively higher bargaining power than women in choices on sexual conduct, we conjectured that the association of ART awareness and sexual behaviors may vary systematically between men and women (Dunkle et al., 2004; Jewkes et al., 2003). Consequently, we run separate regressions for men and women. We use linear probability models, and the standard errors are clustered at the health facility-district level.

In tables 2 to 4 we report household fixed effects estimation results. The estimated

coefficients indicate how different measures of ART awareness associate with risky sexual behaviors, for men and for women. Disinhibition behavior corresponds to a positive sign in tables 2 and 3 (more unprotected sex with non co-residing partners, and more extra-marital sex, respectively), and to a negative sign in table 4 (less abstinence). The signs of the point estimates shown in these three tables broadly support the presence of disinhibition behaviors, except in four instances (table 2, columns 3, 5, and 8; and table 3, column 5) where the sign runs against disinhibition behavior.

We now focus on coefficients which are significant. Table 2 shows the demand for risky sex (unprotected sex with non co-residing partner). The point estimates indicate that for men, the belief that AIDS can be cured is associated with more risky sex (column 2). The estimated coefficient is .066 and is significant at the 10 percent level. For women, the demand for risky sex correlates significantly and positively with "knowing someone who is currently under ART treatment (column 9), and "knowing that the ART patient's health has improved" (column 12): the point estimates are .026 and .027, and are significant at the 5 percent 10 percent levels, respectively. Extra-marital sex (table 3) correlates significantly and positively with the "belief that AIDS can be cured" (column 2) and "knowing someone currently under ART treatment (column 8), for men. For women, only the "belief that AIDS can be treated" correlates significantly and positively. In table 4, the dependent variable is abstinence (individuals who have started their sexual life, but have not been sexually active during the 12 months preceding the survey). From columns 7-9, it can be seen that "knowing someone under ART treatment" correlates significantly and negatively with abstinence for both men and women. On the other hand, the "belief that AIDS can be cured" (column 3) and "knowing that an ART patient's health has improved" (column 9) correlate significantly and negatively with abstinence for women but not for men.

Overall, while the signs of the point estimates are consistent with disinhibition, it is difficult to draw any conclusive evidence. In particular, because ART awareness is endogenous as discussed earlier, these estimates should be interpreted as correlations, providing at best the direction of the causal effects.

5.2 Controlling for unobservable individual characteristics

We repeat exactly the same regressions, but control for individual fixed effects, and district-year interaction effects. The results are reported in tables 5 to 7. Consistent with the results discussed above, the signs of the point estimates are broadly consistent with disinhibition behavior.

We show our results on the demand for risky sex in table 5. Conditional on all individual time-invariant characteristics, men who believe that "AIDS can be cured" (column 2) are 8 percent (significant at the 1 percent level) more likely to engage in risky sex, while women who believe that "AIDS can be treated" are 5 percent (significant at the 5 percent level) more likely to engage in risky sex. Knowing a person whose health has improved after ART treatment negatively impacts the men's demand for risky sex, hence running against risk compensation behavior.

Estimations of the demand for extra-marital sex are shown in table 6. Consistent with the demand for risky sex discussed above, we find that the demand for extra-marital sex is 12 percent higher (significant at the 1 percent level) for men who believe that "AIDS can be cured" (column 2). Women who believe that "AIDS can be treated" are 12 percent more likely to engage in extra-marital sex. The point estimate is, however, significant at the 10 percent level only. More notably, men who have the correct information that "AIDS can be treated" (column 5) are 10 percent less likely to engage in extra-marital sex. Estimation

results for abstinence are presented in table 7. Abstinence decreases for women who believe that "AIDS can be cured" (column 3), and for men who know someone under ART treatment.

There are three interesting findings from this set of results. First, it is apparent that men's risky behaviors (risky sex and extra-marital sex) are elastic to the "false" belief that ART can cure AIDS, while women's risky behaviors are elastic to the "correct" belief that AIDS can be treated but not cured by ART. Second, the results suggest that the correct knowledge on ART reduces risky behaviors for men. From a prevention perspective, it may be easier to correct the "false" belief by providing the correct information. This suggests that, by simply providing the correct information on ART, prevention programs may reduce disinhibition for men. Prevention messages for women, however, should go beyond just giving the correct information about treatment, and should stress the need for safer sexual behaviors. That prevention campaigns, if not well targeted, may not be effective across the entire population, and thus may raise redistributional issues has been argued in a different context by de Walque (2007). Third, the negative association between abstinence (our measure of safe sexual behavior) and ART awareness seems to corroborate our conjecture that access to ART changes the relative costs of safe and risky sex, making risky sex relatively cheaper.

As a robustness check, each regression shown in table 8 includes two ART awareness variables on the right hand side at a time, "belief that AIDS can be cured" and "belief that AIDS can be treated", and "know someone under ART treatment" and "know someone whose health has improved as a result of ART treatment". To save space, we have dropped the regressions that pool men and women. The last row reports the probability of an F-test that the estimated coefficients for the two awareness variables are equal in each specification.

We can use these estimates to assess the conjectures that we made in section 2[12]. Columns 1 and 5 for men, and column 10 for women corroborate our conjecture that disinhibition effects are greater when ART is believed to cure AIDS than when ART is believed to treat AIDS. We also hypothesized in section 2 that the disinhibition effect would be greater for respondents who have seen an ART patient's health improves than for respondents who only know someone under ART treatment. That hypothesis is supported only in column 4 for women, but rejected in columns 3, 4, 11 and 12. Nevertheless, the tests on the beliefs that "AIDS can be cured" and "AIDS can be treated" seem to reinforce the theory that risky sexual behaviors increase in response to the cost of contracting AIDS because of the introduction of ART.

5.3 The role of HIV status

The sample includes three categories of respondents: identified HIV positive persons, persons who live in a household with an identified HIV positive person, and comparison households. We are able to employ this structure of our sample to test whether sexual behavior response to ART awareness varies with HIV status. We interact the individual's category with each ART awareness variable. The estimations are reported in tables 9 to 11.

Of particular interest is the behavioral response to an identified HIV positive person, i.e. the ART awareness variable interacted with HIV positive. The signs of the point estimates are consistently negative for risky sex (table 9), and positive for abstinence (table 11). This suggests that HIV positive persons are less likely to experience disinhibition. The results suggest, however, that HIV positive men who believe that AIDS can be cured are more likely

[12]We hypothesized that disinhibition effect would be greater for those who "believe that AIDS can be cured" than for those who "believe that AIDS can be treated but not be cured", and for those "who know an ART patient whose health has improved" than those "who know someone under ART treatment".

to engage in extra-marital sex (table 10, column 5).

6 Conclusion

We use data from Mozambique to test for disinhibition behaviors resulting from increased access to ART. The main hypothesis is that people may alter their sexual behaviors in response to a perceived decrease in the opportunity costs of contracting AIDS that results from expected access to ART. Such compensating behaviors, if large enough, could potentially offset some of the positive effects of increased access to ART. After controlling for individuals fixed effects, we find some suggestive evidence of disinhibition behaviors, consistent with prior literature on risk-taking in the USA and Europe, following the introduction of ART. We find that out of 24 estimated coefficients reported in tables 5-7, six coefficients that are statistically significant are consistent with disinhibition, while three of the statistically significant coefficients run contrary to disinhibition. If we take a less conservative approach and focus only on the sign of the point estimates, 19 coefficients are consistent with disinhibition and 5 coefficients run against disinhibition.

Our findings suggest that men and women responded differently to perceived changes in risk that occurs with greater access to ART. Men's demand for risky sexual behaviors increased with the "false" belief that "AIDS can be cured", and decreased with the "correct" belief that "AIDS can be treated but not cured". Women's demand for risky sexual behaviors increased only with the correct belief that "AIDS can be treated". We do not have a straight explanation of the observed gender difference. One possible explanation may stem from the cultural context of Sub-Saharan Africa, which in general grants more autonomy on sexual choices to men than to women, so that in general it would be easier for men than for women

to adjust their sexual behaviors when new information becomes available. Regardless of the reason, it appears that providing the correct information on ART is associated with reduced disinhibition behaviors for men and increased disinhibition for women. If these associations were to be confirmed as causal relationships, then overall women may be benefiting less from ART-scale up than men. But we also observe that the proportion of individuals who wrongly believe that AIDS can be cured remains small and is declining (8% in 2007, 6% in 2008) so that the impact of programs correcting the wrong perceptions about AIDS treatment is bound to be limited.

To sum up, our results suggest that scaling up access to ART without prevention programs may not be optimal if the objective is to contain the disease, since people would adjust their sexual behavior in response to the perceived changes in risk. Therefore, prevention programs need to include educational messages about ART, and address the changing beliefs about HIV in the era of increasing ART availability. Finally, prevention messages would need to account for the gender difference in disinhibition behaviors. From a different perspective, our results provide a framework for assessing public effects of occasional media coverage of "false" cures for AIDS (e.g. Amon, 2008; Herbst, 2005)[13]. Our findings suggest that men may respond to these types of announcements by increasing their demand for risky sexual behaviors, hence contributing to the spread of the disease.

[13]For instance, in 2007 the president of Gambia declared that he could cure AIDS. Despite having raised some concerns, his "discovery" is still celebrated here http://www.statehouse.gm/hiv-aids.htm (last accessed on October 15, 2010).

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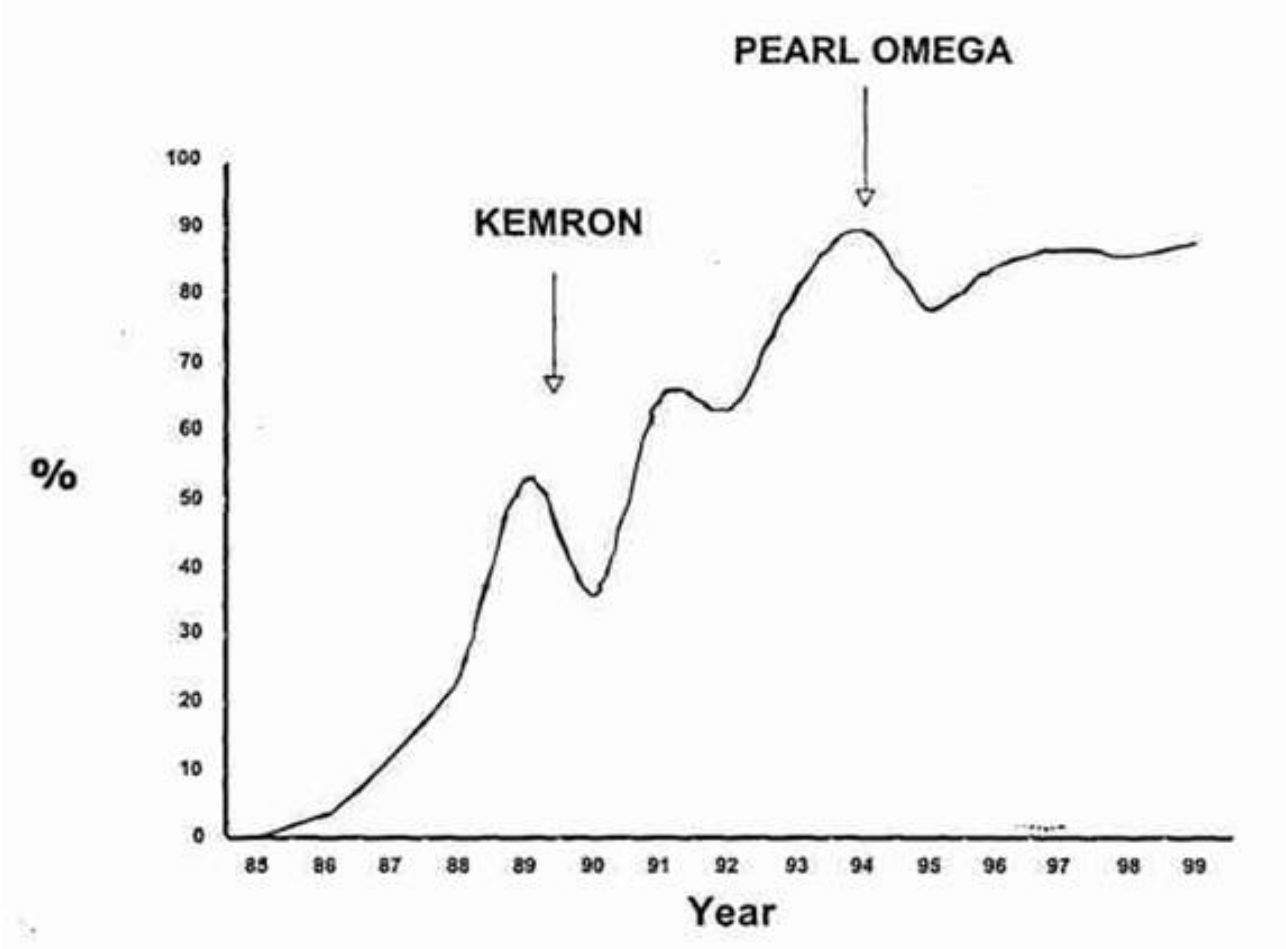
Figure 1: Percent condom use in a cohort of sex workers: Nairobi, 1985-1999



Source: Jha et al. (2001)

Table 1: Summary of key variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				AIDS can be:		Know ART	Know health			HIV+	Lives with	Comparison
Year	Risky	Extra-marital	Abstinence	Cured	Treated	patient	improved	Age	Married	Person	HIV+pers.	household
2007 (n=2524)												
mean	0.07	0.37	0.18	0.08	0.86	0.46	0.43	29.43	0.42	0.22	0.44	0.34
std. dev.	0.26	0.48	0.38	0.27	0.35	0.50	0.49	10.55	0.49	0.42	0.50	0.47
min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
max	1.00	1.00	1.00	1.00	1.00	1.00	1.00	65.00	1.00	1.00	1.00	1.00
2008 (n= 2213)												
mean	0.08	0.42	0.17	0.06	0.79	0.45	0.42	29.91	0.42	0.22	0.42	0.36
std. dev.	0.27	0.49	0.38	0.24	0.41	0.50	0.49	10.65	0.49	0.41	0.49	0.48
min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
max	1.00	1.00	1.00	1.00	1.00	1.00	1.00	60.00	1.00	1.00	1.00	1.00
Total (n=4737)												
mean	0.08	0.39	0.17	0.07	0.83	0.46	0.42	29.66	0.42	0.22	0.43	0.35
std. dev.	0.27	0.49	0.38	0.25	0.38	0.50	0.49	10.60	0.49	0.41	0.50	0.48
min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00
max	1.00	1.00	1.00	1.00	1.00	1.00	1.00	65.00	1.00	1.00	1.00	1.00

Note: Individuals in column 10 (i.e. 22% of our sample) are identified as HIV positive, but the status of the remaining 78% (columns 11 and 12) is unknown.

Table 2: Demand for risky sex and ART awareness in Mozambique (household fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	0.015	0.066	-0.003									
	[0.022]	[0.032]*	[0.023]									
AIDS can be Treated				0.007	-0.015	0.031						
				[0.014]	[0.039]	[0.020]						
Know SO on ART							0.007	-0.016	0.026			
							[0.010]	[0.017]	[0.010]**			
Pers. on ART improved										0.009	-0.013	0.027
										[0.010]	[0.013]	[0.014]*
age	-0.001	0.001	-0.001	-0.001	0.001	-0.001	-0.001	0.001	-0.002	-0.001	0.001	-0.002
	[0.000]**	[0.001]	[0.002]	[0.000]**	[0.001]	[0.002]	[0.000]**	[0.001]	[0.002]	[0.000]**	[0.001]	[0.002]
age2	0.000	0.000	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]**	[0.000]	[0.002]	[0.000]**	[0.000]	[0.002]	[0.000]**	[0.000]	[0.002]	[0.000]**	[0.000]	[0.002]
primary ed.	0.028	0.018	0.025	0.027	0.019	0.022	0.028	0.019	0.024	0.027	0.019	0.024
	[0.012]**	[0.036]	[0.019]	[0.012]**	[0.036]	[0.020]	[0.012]**	[0.036]	[0.020]	[0.012]**	[0.036]	[0.019]
secondary ed.	0.051	0.058	0.021	0.051	0.058	0.020	0.050	0.058	0.019	0.050	0.058	0.019
	[0.015]***	[0.041]	[0.025]	[0.015]***	[0.040]	[0.025]	[0.015]***	[0.040]	[0.025]	[0.015]***	[0.040]	[0.025]
Married	-0.086	-0.093	-0.103	-0.087	-0.090	-0.105	-0.087	-0.090	-0.106	-0.087	-0.090	-0.106
	[0.012]***	[0.017]***	[0.017]***	[0.012]***	[0.017]***	[0.017]***	[0.011]***	[0.017]***	[0.017]***	[0.011]***	[0.017]***	[0.017]***
female	0.015			0.016			0.016			0.016		
	[0.009]*			[0.008]*			[0.008]*			[0.008]*		
year2008	0.013	0.016	0.007	0.013	0.015	0.011	0.012	0.015	0.007	0.012	0.016	0.007
	[0.005]**	[0.009]*	[0.010]	[0.005]**	[0.008]*	[0.011]	[0.005]**	[0.008]*	[0.010]	[0.005]**	[0.009]*	[0.010]
Constant	0.080	0.034	0.144	0.075	0.050	0.122	0.080	0.040	0.144	0.080	0.039	0.145
	[0.016]***	[0.045]	[0.052]**	[0.018]***	[0.032]	[0.055]**	[0.016]***	[0.043]	[0.051]**	[0.016]***	[0.044]	[0.051]**
Observations	5002	2183	2819	5002	2183	2819	5002	2183	2819	5002	2183	2819
Nb. of hh.	1047	847	973	1047	847	973	1047	847	973	1047	847	973
R-sq.	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04	0.03	0.02	0.04

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 3: Demand for extra marital sex by married individuals and ART awareness in Mozambique (household fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	0.033	0.192	0.003									
	[0.038]	[0.067]**	[0.083]									
AIDS can be Treated				0.044	-0.06	0.127						
				[0.027]	[0.066]	[0.043]***						
Know SO on ART							0.028	0.063	0.037			
							[0.022]	[0.027]**	[0.055]			
Pers. on ART improved										0.03	0.044	0.038
										[0.026]	[0.037]	[0.042]
age	-0.025	-0.032	-0.035	-0.025	-0.034	-0.036	-0.026	-0.034	-0.036	-0.026	-0.034	-0.036
	[0.005]***	[0.008]***	[0.008]***	[0.005]***	[0.008]***	[0.009]***	[0.005]***	[0.009]***	[0.008]***	[0.005]***	[0.009]***	[0.008]***
age2	0.019	0.023	0.028	0.019	0.024	0.029	0.02	0.024	0.028	0.02	0.024	0.028
	[0.005]***	[0.008]**	[0.008]***	[0.005]***	[0.008]***	[0.009]***	[0.005]***	[0.009]**	[0.008]***	[0.005]***	[0.009]**	[0.008]***
primary ed.	0.022	0.161	-0.073	0.022	0.16	-0.077	0.024	0.156	-0.069	0.024	0.157	-0.068
	[0.035]	[0.096]	[0.076]	[0.034]	[0.101]	[0.068]	[0.034]	[0.106]	[0.071]	[0.034]	[0.105]	[0.072]
secondary ed.	0.032	0.167	-0.078	0.034	0.157	-0.07	0.033	0.163	-0.075	0.034	0.163	-0.074
	[0.043]	[0.121]	[0.085]	[0.043]	[0.123]	[0.085]	[0.044]	[0.126]	[0.086]	[0.044]	[0.125]	[0.086]
female	-0.098			-0.094			-0.097			-0.097		
	[0.020]***			[0.019]***			[0.020]***			[0.020]***		
year2008	0.029	0.056	0.021	0.031	0.053	0.034	0.028	0.054	0.02	0.027	0.053	0.02
	[0.035]	[0.042]	[0.039]	[0.035]	[0.042]	[0.038]	[0.035]	[0.042]	[0.040]	[0.035]	[0.042]	[0.040]
Constant	1.039	1.11	1.266	1	1.206	1.178	1.039	1.135	1.258	1.038	1.133	1.258
	[0.105]***	[0.250]***	[0.182]***	[0.099]***	[0.236]***	[0.185]***	[0.109]***	[0.268]***	[0.183]***	[0.108]***	[0.267]***	[0.182]***
Observations	2088	979	1109	2088	979	1109	2088	979	1109	2088	979	1109
Nb. of hh.	654	582	621	654	582	621	654	582	621	654	582	621
R-sq.	0.03	0.06	0.06	0.03	0.05	0.07	0.03	0.06	0.06	0.03	0.05	0.06

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 4: Abstinence and ART awareness in Mozambique (household fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	-0.053	-0.028	-0.069									
	[0.014]***	[0.036]	[0.022]***									
AIDS can be Treated				-0.002	-0.012	-0.003						
				[0.011]	[0.026]	[0.028]						
Know SO on ART							-0.038	-0.046	-0.056			
							[0.014]**	[0.025]*	[0.010]***			
Pers. on ART improved										-0.029	-0.040	-0.040
										[0.019]	[0.028]	[0.015]**
age	0.012	0.007	0.027	0.012	0.007	0.027	0.013	0.008	0.028	0.013	0.007	0.027
	[0.001]***	[0.002]***	[0.003]***	[0.001]***	[0.002]***	[0.003]***	[0.001]***	[0.002]***	[0.003]***	[0.001]***	[0.002]***	[0.003]***
age2	-0.001	0.000	-0.016	-0.001	0.000	-0.016	-0.001	0.000	-0.017	-0.001	0.000	-0.017
	[0.000]***	[0.000]***	[0.003]***	[0.000]***	[0.000]***	[0.003]***	[0.000]***	[0.000]***	[0.003]***	[0.000]***	[0.000]***	[0.003]***
primary ed.	-0.089	-0.051	-0.108	-0.090	-0.051	-0.109	-0.089	-0.052	-0.106	-0.089	-0.051	-0.107
	[0.025]***	[0.079]	[0.030]***	[0.025]***	[0.079]	[0.029]***	[0.025]***	[0.081]	[0.029]***	[0.025]***	[0.080]	[0.030]***
secondary ed.	-0.129	-0.059	-0.149	-0.129	-0.059	-0.149	-0.126	-0.058	-0.145	-0.127	-0.058	-0.146
	[0.024]***	[0.078]	[0.038]***	[0.024]***	[0.078]	[0.039]***	[0.023]***	[0.079]	[0.037]***	[0.023]***	[0.078]	[0.038]***
Married	-0.241	-0.157	-0.278	-0.241	-0.157	-0.278	-0.237	-0.155	-0.273	-0.238	-0.156	-0.274
	[0.015]***	[0.041]***	[0.021]***	[0.015]***	[0.041]***	[0.022]***	[0.014]***	[0.040]***	[0.021]***	[0.014]***	[0.040]***	[0.020]***
female	0.102			0.100			0.101			0.100		
	[0.013]***	[0.000]	[0.000]	[0.014]***	[0.000]	[0.000]	[0.014]***	[0.000]	[0.000]	[0.014]***	[0.000]	[0.000]
year2008	-0.003	-0.013	-0.002	-0.003	-0.014	-0.001	-0.002	-0.014	-0.001	-0.002	-0.014	-0.001
	[0.026]	[0.019]	[0.034]	[0.025]	[0.019]	[0.033]	[0.026]	[0.018]	[0.035]	[0.026]	[0.018]	[0.035]
Constant	-0.038	0.041	-0.178	-0.038	0.049	-0.181	-0.034	0.046	-0.184	-0.037	0.044	-0.185
	[0.049]	[0.089]	[0.069]**	[0.052]	[0.089]	[0.072]**	[0.050]	[0.091]	[0.068]**	[0.050]	[0.090]	[0.068]**
Observations	5002	2183	2819	5002	2183	2819	5002	2183	2819	5002	2183	2819
Nb. of hh.	1047	847	973	1047	847	973	1047	847	973	1047	847	973
R-sq.	0.18	0.04	0.22	0.18	0.04	0.21	0.18	0.04	0.22	0.18	0.04	0.21

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 5: Demand for risky sex and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	0.041	0.082	0.023									
	[0.018]**	[0.017]***	[0.023]									
AIDS can be Treated				0.029	0.000	0.045						
				[0.024]	[0.046]	[0.016]***						
Know SO on ART							0.001	-0.026	0.015			
							[0.013]	[0.017]	[0.015]			
Pers. on ART improved										0.003	-0.034	0.023
										[0.012]	[0.016]**	[0.015]
Married	-0.135	-0.216	-0.060	-0.139	-0.214	-0.063	-0.136	-0.215	-0.064	-0.136	-0.215	-0.067
	[0.047]***	[0.050]***	[0.059]	[0.043]***	[0.048]***	[0.055]	[0.045]***	[0.050]***	[0.056]	[0.045]***	[0.050]***	[0.057]
year2008	0.012	0.013	0.012	0.013	0.012	0.016	0.011	0.012	0.011	0.011	0.012	0.011
	[0.005]**	[0.002]***	[0.009]	[0.006]**	[0.001]***	[0.010]	[0.005]**	[0.003]***	[0.009]	[0.005]**	[0.003]***	[0.009]
Constant	0.053	0.101	0.027	0.034	0.103	-0.006	0.055	0.116	0.025	0.055	0.117	0.025
	[0.054]	[0.028]***	[0.064]	[0.066]	[0.047]**	[0.075]	[0.055]	[0.033]***	[0.066]	[0.056]	[0.031]***	[0.066]
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5303	2322	2981	5303	2322	2981	5303	2322	2981	5303	2322	2981
R-sq.	0.66	0.68	0.65	0.66	0.67	0.65	0.66	0.67	0.65	0.66	0.67	0.65

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 6: Demand for extra marital sex by married individuals and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	0.044	0.116	-0.006									
	[0.060]	[0.026]***	[0.071]									
AIDS can be Treated				0.046	-0.097	0.123						
				[0.062]	[0.042]**	[0.068]*						
Know SO on ART							0.020	0.012	0.018			
							[0.033]	[0.052]	[0.025]			
Pers. on ART improved										0.019	0.010	0.021
										[0.029]	[0.032]	[0.031]
year2008	0.013	0.022	-0.018	0.015	0.012	-0.005	0.011	0.019	-0.017	0.011	0.019	-0.017
	[0.017]	[0.042]	[0.036]	[0.016]	[0.039]	[0.033]	[0.018]	[0.046]	[0.037]	[0.018]	[0.043]	[0.037]
Constant	0.453	-0.570	0.335	0.423	-0.885	0.240	0.449	-0.667	0.330	0.450	-0.642	0.329
	[0.083]***	[2.033]	[0.067]***	[0.085]***	[2.005]	[0.083]***	[0.076]***	[2.158]	[0.071]***	[0.076]***	[2.054]	[0.071]***
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2208	1037	1171	2208	1037	1171	2208	1037	1171	2208	1037	1171
R-sq.	0.69	0.71	0.68	0.69	0.71	0.68	0.69	0.71	0.68	0.69	0.71	0.68

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 7: Abstinence and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	-0.057	-0.020	-0.083									
	[0.015]***	[0.037]	[0.030]**									
AIDS can be Treated				-0.011	-0.032	-0.002						
				[0.018]	[0.028]	[0.037]						
Know SO on ART							-0.038	-0.029	-0.043			
							[0.020]*	[0.010]**	[0.029]			
Pers. on ART improved										-0.022	-0.011	-0.029
										[0.027]	[0.020]	[0.031]
Married	-0.183	-0.133	-0.228	-0.180	-0.130	-0.222	-0.179	-0.135	-0.214	-0.179	-0.134	-0.215
	[0.028]***	[0.080]	[0.106]**	[0.026]***	[0.079]	[0.100]**	[0.026]***	[0.079]	[0.097]**	[0.026]***	[0.080]	[0.096]**
year2008	-0.002	-0.005	-0.002	-0.002	-0.006	0.000	-0.001	-0.005	0.000	-0.001	-0.005	0.000
	[0.035]	[0.025]	[0.043]	[0.034]	[0.025]	[0.040]	[0.035]	[0.024]	[0.044]	[0.036]	[0.024]	[0.044]
Constant	0.260	0.131	0.337	0.265	0.149	0.331	0.270	0.145	0.342	0.262	0.135	0.334
	[0.029]***	[0.059]**	[0.029]***	[0.026]***	[0.070]**	[0.036]***	[0.027]***	[0.057]**	[0.031]***	[0.026]***	[0.052]**	[0.029]***
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5303	2322	2981	5303	2322	2981	5303	2322	2981	5303	2322	2981
R-sq.	0.73	0.73	0.72	0.73	0.73	0.72	0.73	0.73	0.72	0.73	0.73	0.72

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 8: Sexual behavior and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Risky sex				Extra-marital sex				Abstinence			
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
AIDS can be Cured	0.082	0.022			0.124	0.003			-0.020	-0.077		
	[0.017]***	[0.025]			[0.031]***	[0.056]			[0.036]	[0.036]**		
AIDS can be Treated	0.001	0.045			-0.108	0.127			-0.030	0.002		
	[0.046]	[0.016]**			[0.049]**	[0.069]*			[0.027]	[0.039]		
Know SO on ART			0.029	-0.042			0.035	-0.001			-0.107	-0.094
			[0.024]	[0.026]			[0.134]	[0.063]			[0.049]**	[0.026]***
Pers. on ART improved			-0.060	0.060			-0.025	0.028			0.084	0.054
			[0.012]***	[0.028]**			[0.100]	[0.075]			[0.055]	[0.028]*
Married	-0.216	-0.057	-0.214	-0.063	0.000	0.000	0.000	0.000	-0.130	-0.226	-0.137	-0.216
	[0.048]***	[0.051]	[0.051]***	[0.051]	[0.000]	[0.000]	[0.000]	[0.000]	[0.079]	[0.105]**	[0.078]*	[0.096]**
year2008	0.014	0.018	0.014	0.012	0.037	-0.006	0.037	-0.019	-0.004	-0.002	-0.003	0.000
	[0.002]***	[0.011]	[0.003]***	[0.010]	[0.010]***	[0.031]	[0.014]**	[0.036]	[0.025]	[0.040]	[0.023]	[0.044]
Constant	0.151	0.054	0.168	0.091	0.472	0.254	0.376	0.351	0.214	0.359	0.204	0.370
	[0.051]***	[0.030]*	[0.028]***	[0.022]***	[0.042]***	[0.057]***	[0.026]***	[0.023]***	[0.065]***	[0.059]***	[0.044]***	[0.039]***
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2324	2985	2324	2985	1039	1173	1039	1173	2324	2985	2324	2985
R-squared	0.68	0.65	0.67	0.65	0.71	0.68	0.70	0.68	0.73	0.72	0.73	0.72
Prob F-test (two awareness coefficients equal)												
	0.05	0.34	0.02	0.06	0.00	0.31	0.80	0.83	0.81	0.00	0.08	0.00

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 9: HIV Status, demand for risky sex and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	0.030	0.074	-0.001									
	[0.055]	[0.037]*	[0.067]									
Interacted with												
HIV+	-0.061	-0.082	-0.033									
	[0.058]	[0.036]**	[0.073]									
Lives in hh with HIV+ indv.	0.064	0.050	0.083									
	[0.056]	[0.057]	[0.063]									
AIDS can be Treated				0.017	-0.011	0.031						
				[0.048]	[0.049]	[0.048]						
Interacted with												
HIV+				-0.001	0.061	-0.025						
				[0.062]	[0.075]	[0.061]						
Lives in hh with HIV+ indv.				0.028	0.006	0.051						
				[0.051]	[0.058]	[0.071]						
Know SO on ART							0.016	0.001	0.027			
							[0.018]	[0.020]	[0.034]			
Interacted with												
HIV+							-0.013	0.004	-0.029			
							[0.016]	[0.028]	[0.026]			
Lives in hh with HIV+ indv.							-0.025	-0.053	-0.008			
							[0.012]*	[0.040]	[0.041]			
Pers. on ART improved										0.029	-0.009	0.056
										[0.020]	[0.023]	[0.033]
Interacted with												
HIV+										-0.032	0.008	-0.065
										[0.026]	[0.031]	[0.032]*
Lives in hh with HIV+ indv.										-0.037	-0.051	-0.027
										[0.021]*	[0.048]	[0.037]
Year2008	0.011	0.012	0.012	0.013	0.012	0.017	0.011	0.012	0.011	0.011	0.012	0.012
	[0.005]**	[0.002]***	[0.009]	[0.006]**	[0.001]***	[0.010]	[0.005]**	[0.003]***	[0.009]	[0.005]**	[0.004]***	[0.009]
Married	-0.140	-0.220	-0.063	-0.138	-0.215	-0.059	-0.135	-0.212	-0.064	-0.136	-0.209	-0.067
	[0.047]***	[0.052]***	[0.058]	[0.045]***	[0.049]***	[0.055]	[0.044]***	[0.049]***	[0.057]	[0.045]***	[0.049]***	[0.058]
Constant	0.053	0.103	0.027	0.037	0.099	0.000	0.054	0.114	0.027	0.056	0.116	0.030
	[0.055]	[0.030]***	[0.067]	[0.065]	[0.042]**	[0.074]	[0.055]	[0.031]***	[0.065]	[0.054]	[0.031]***	[0.064]
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5303	2322	2981	5303	2322	2981	5303	2322	2981	5303	2322	2981
R-squared	0.66	0.68	0.65	0.66	0.67	0.65	0.66	0.67	0.65	0.66	0.68	0.65

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 10: HIV Status, demand for extra marital sex by married individuals and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	0.024	-0.002	0.025									
	[0.187]	[0.284]	[0.178]									
Interacted with												
HIV+	0.004	0.251	-0.094									
	[0.297]	[0.330]	[0.292]									
Lives in hh with HIV+ indv.	0.043	0.126	-0.004									
	[0.336]	[0.447]	[0.329]									
AIDS can be Treated				0.035	-0.108	0.117						
				[0.105]	[0.129]	[0.103]						
Interacted with												
HIV+				0.030	0.266	-0.111						
				[0.111]	[0.120]**	[0.102]						
Lives in hh with HIV+ indv.				0.013	-0.082	0.082						
				[0.070]	[0.123]	[0.066]						
Know SO on ART							-0.009	0.042	-0.074			
							[0.039]	[0.126]	[0.059]			
Interacted with												
HIV+							0.042	-0.014	0.128			
							[0.057]	[0.158]	[0.114]			
Lives in hh with HIV+ indv.							0.042	-0.059	0.137			
							[0.063]	[0.110]	[0.123]			
Pers. on ART improved										0.014	0.068	-0.054
										[0.051]	[0.109]	[0.051]
Interacted with												
HIV+										-0.020	-0.066	0.061
										[0.081]	[0.114]	[0.129]
Lives in hh with HIV+ indv.										0.026	-0.091	0.137
										[0.070]	[0.125]	[0.098]
Year2008	0.013	0.022	-0.018	0.014	0.002	-0.003	0.011	0.020	-0.017	0.011	0.022	-0.016
	[0.017]	[0.042]	[0.034]	[0.016]	[0.029]	[0.034]	[0.018]	[0.042]	[0.037]	[0.017]	[0.043]	[0.036]
Constant	0.453	-0.589	0.335	0.422	-1.479	0.255	0.446	-0.623	0.326	0.453	-0.537	0.334
	[0.085]***	[1.949]	[0.064]***	[0.086]***	[1.689]	[0.078]***	[0.073]***	[1.858]	[0.085]***	[0.073]***	[1.960]	[0.085]***
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2208	1037	1171	2208	1037	1171	2208	1037	1171	2208	1037	1171
R-squared	0.69	0.71	0.68	0.69	0.71	0.68	0.69	0.71	0.68	0.69	0.71	0.68

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets

Table 11: HIV status, abstinence and ART awareness in Mozambique (individual fixed effects estimates)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women
AIDS can be Cured	-0.045	0.001	-0.075									
	[0.079]	[0.064]	[0.106]									
Interacted with												
HIV+	-0.052	-0.170	0.000									
	[0.123]	[0.102]	[0.142]									
Lives in hh with HIV+ indv.	0.007	0.029	-0.018									
	[0.074]	[0.056]	[0.094]									
AIDS can be Treated				-0.024	-0.111	0.018						
				[0.031]	[0.064]	[0.065]						
Interacted with												
HIV+				0.012	0.115	-0.030						
				[0.034]	[0.073]	[0.059]						
Lives in hh with HIV+ indv.				0.024	0.134	-0.034						
				[0.030]	[0.065]*	[0.056]						
Know SO on ART							-0.053	-0.037	-0.066			
							[0.024]**	[0.030]	[0.028]**			
Interacted with												
HIV+							0.052	0.100	0.039			
							[0.077]	[0.060]	[0.088]			
Lives in hh with HIV+ indv.							0.004	-0.019	0.024			
							[0.050]	[0.041]	[0.063]			
Pers. on ART improved										-0.053	-0.024	-0.073
										[0.021]**	[0.027]	[0.030]**
Interacted with												
HIV+										0.080	0.113	0.074
										[0.078]	[0.070]	[0.084]
Lives in hh with HIV+ indv.										0.016	-0.023	0.048
										[0.041]	[0.036]	[0.054]
Year2008	-0.002	-0.006	-0.002	-0.002	-0.006	-0.001	-0.002	-0.005	0.000	-0.002	-0.005	0.000
	[0.035]	[0.025]	[0.043]	[0.035]	[0.026]	[0.040]	[0.035]	[0.022]	[0.043]	[0.035]	[0.023]	[0.044]
Married	-0.185	-0.140	-0.228	-0.180	-0.135	-0.222	-0.177	-0.126	-0.214	-0.174	-0.117	-0.215
	[0.027]***	[0.084]	[0.104]**	[0.026]***	[0.079]	[0.101]**	[0.026]***	[0.079]	[0.096]**	[0.025]***	[0.079]	[0.096]**
Constant	0.260	0.133	0.337	0.266	0.161	0.330	0.266	0.136	0.341	0.256	0.129	0.330
	[0.029]***	[0.059]**	[0.027]***	[0.026]***	[0.074]**	[0.037]***	[0.027]***	[0.053]**	[0.033]***	[0.025]***	[0.050]**	[0.032]***
Indiv. Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
district*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	5303	2322	2981	5303	2322	2981	5303	2322	2981	5303	2322	2981
R-squared	0.73	0.73	0.72	0.73	0.73	0.72	0.73	0.73	0.72	0.73	0.73	0.72

Standard errors in brackets

* significant at 10%; ** significant at 5%, *** significant at 1%

Robust standard errors in brackets