Antiretroviral Therapy Perceived Efficacy and Risky Sexual Behaviors: Evidence from Mozambique[1]

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Abstract

This paper studies the effect of increased access to antiretroviral therapy (ART) for AIDS on self-reported risky sexual behavior, using data collected in Mozambique in 2007 and 2008. The survey sampled both households from randomly selected HIV positive individuals and comparison households from the general population. Controlling for unobserved individual characteristics, our findings support the hypothesis of disinhibition behaviors, in which people report more sexual risk taking when they perceive ART as more efficacious. In particular, risky behaviors are more positively associated with efficacious ART for family members of HIV positive persons and for individuals from comparison households. However, over the study period, we find that increased experience with ART at the nearest health facility has decreased, rather than increased, the perceived efficacy of ART. To the degree that the perceived efficacy of ART has declined, perhaps because people have known more patients who have failed treatment, peoples' sexual behavior has become more cautious. Our findings suggest that risk behavior is sensitive to the perceived efficacy of ART programs and that efforts to expand ART access or reduce ART failure rates must be supplemented with programs to prevent a resurgence of risky sexual behavior. We stress that our identification strategy reveals associations, and therefore our findings should not be interpreted as causal.

1. Introduction

Access to HIV/AIDS treatment has likely 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 (e.g. Mechoulan, 2007)[2]. Moreover, HIV positive individuals may become less infectious if treatment is initiated early enough (e.g. Cohen et al, 2011). 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 by ART (antiretroviral treatment) or

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

cured by ART have caused a decline of safe sexual practices, which in turn have led to an increase in sexually transmitted infections (e.g. Green and Ruark, 2011). Such disinhibition behaviors, if confirmed, would imply that scaling-up antiretroviral treatment (ART) would not be as effective if treatment expenditures crowd out behavioral prevention programs (Over et al., 2007, 2006).

In this paper, we present an empirical analysis of the perceived efficacy of ART on sexual behaviors. Our measures of risky sexual behaviors consist of individuals' reports of (a) unprotected sex with non co-residing partners in the last 12 months (risky sex), (b) any casual sex (sexual intercourse with non co-residing partners with or without a condom) and (c) 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 contributed to controlling the spread of the disease in some parts of Sub-Saharan Africa (e.g. Singh et al., 2004). Our measures of ART perceived efficacy consist of "the belief that ART can cure AIDS" and "the belief that ART can treat AIDS, but cannot cure it". We combine these two measures into a single indicator of how easily respondents believe AIDS can be managed. The study covers a period when access to ART was increasing in Mozambique, due in part to the Treatment Acceleration Program (TAP)[3]. The TAP was a World Bank project which aimed at piloting strategies for strengthening capacity to scale up comprehensive HIV/AIDS programs in Africa (ACTAfrica and Global HIV Program, 2007).

[3] The TAP was also piloted in Burkina Faso and in Ghana.

We make four main contributions to the literature on individual risk offsetting behaviors. First, the survey instrument asked individuals about their perceived efficacy of ART. We show how these ART perceived efficacy variables correlate strongly with self-reported sexual behaviors. Second, through a matched survey of health facilities we are able to correlate local ART experience with the ART perceived efficacy variables. Third, our paper is unique in the attempt to exploit the panel structure of the data to control for time-invariant unobserved individual characteristics and time-varying community level unobserved characteristics that may otherwise influence both sexual behavior and ART perceived efficacy. Fourth, 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 perceived efficacy 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 was estimated to be between 14 percent and 17 percent in 2009, and has remained that high since at least 2002 (UNGASS, 2010). 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)[4]. 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[5]. The main proposition of this literature is that people may alter their behavior in response to perceived changes in risk. 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 conjecture 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,

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[4] 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.

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

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) when fraudulent AIDS cures (Kemron and Pearl Omega) received wide coverage in the press (Jha et al., 2001). The findings are summarized in figure 1. This data provides at least some suggestive evidence that condom use by sex workers decreased when the fraudulent cures for AIDS were announced. However, after a year or more the sampled cohort resumed condom use, perhaps because they had learned that the proposed "cures" did not work. Such a pattern is consistent with disinhibition behaviors, although the result may not be generalizable to the general population since it uses a selected segment of the population. Cohen et al. (2009) is one of the few studies that use population based surveys to investigate risk compensation behavior in a Sub-Saharan African context. The authors found that in Kisumu (Kenya), ART-related risk compensation[6], 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 self-reported sexual behavior instead of HIV sero-prevalence. People respond to increased access to ART by changing their sexual behaviors, and these changes in sexual behaviors could lead to change in sero-prevalence. Second, the panel structure of our data allows us to control for

[6] The authors define risk compensation as increased sexual risk when ART is available.

unobserved individual characteristics that can influence both sexual behavior (and HIVseroprevalence) 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[7].

We find a strong and positive association between the perception that ART is effective and self-reported risky sexual behaviors. Disinhibition behaviors are less likely among persons living with HIV/AIDS than among the general population (at least as defined in this study) i.e. family members of persons living with HIV/AIDS and respondents from households with no identified HIV positive individual. Our findings are robust to controlling for individual fixed effects, time-varying community level unobservable characteristics and time-varying household unobservable characteristics. Our specifications, however, cannot account for time-varying unobserved individual characteristics. Our results should therefore be interpreted with this potential source of endogeneity in mind. Nevertheless, the association that we estimate appears strong enough to suggest that increased access to ART without prevention programs may lead to increased unsafe sexual behaviors.

The remainder of the paper is organized as follows. In section 2, we provide a conceptual

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[7] 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 seroprevalence 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.

framework to motivate our empirical work. In section 3, we discuss our survey and summarize the main variables used in the analysis. We discuss our empirical strategy in section 4, and report our estimation results in sections 5. Section 6 concludes.

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 newly treatable disease. Such a response may create a compensation effect that exacerbates HIV transmission, and thus 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)[8].

[8] 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

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[9]. 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.)[10]. 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 and the cost is equalized between safe sex and unprotected sex.

Assume that, prior to the availability of ART, a sexually active population is aware of the danger of HIV infection from unprotected sex and has selected an optimal mix of safe and risky sexual behavior which equates the ratio of the marginal utility to the "cost" of the two behaviors. From this starting position, a change in policy that increases peoples' confidence that ART is accessible and effective lowers the cost of risky sex 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

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unprotected sex. She shows that for women who were exposed to the policy, abortion rates decreased while STIs increased; hence corroborating disinhibition behaviors.

[9] 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.

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

extent that risky sex and safe sex are substitutes, we would expect a decrease in the demand for safe sex as people become more confident of ART's availability and efficacy (i.e. the perceived private cost or "price" of risky sex decreases, while everything else is kept constant).

This framework, while overly simplified, provides a context for interpreting our empirical results. The usual presumption is that ART scale-up will create and reinforce a popular perception that AIDS is less threatening. However, the news that a country is rolling out free and effective ART might also create unwarranted optimism about the accessibility and efficacy of AIDS treatment, such that the eventual experience of local ART availability reduces rather than increases the population's confidence that AIDS is treatable. Considering our independent variables, we argue that the cost of risky sex is lower when people believe, rightly or wrongly, that increased access to ART has made it easier for them individually to manage or even to cure HIV/AIDS. Thus, we hypothesize a positive association between risky sexual behavior and perceived ART efficacy. Furthermore, if accumulated experience with local ART service delivery increases (decreases) the population's confidence that ART "works," then safe sex (abstinence or condom use) would react negatively (positively) to increased local experience with ART.

Obviously this framework leaves out adjustments in sexual behavior that could limit disinhibition. An important externality of ART is that it increases the private benefits of testing, and therefore leads to increased demand for testing. As mentioned earlier, people who discover that they are HIV negative would logically decrease their demand for risky sex, especially if prevalence is high among potential sexual partners (e.g. Ahituv et al.,

1996). However, other studies have shown a positive association between an HIV-negative test result and subsequent risky sexual behavior (e.g. Clark et al, 1998, Kabiru et al, 2010, Wang et al, 2007), perhaps because people who know they have taken risks and learn they are uninfected mistakenly conclude they are immune. Further consideration of HIV testing is beyond the scope of this paper.

3. Context and Data

The primary goal of the Treatment Acceleration Program was to pilot strategies for strengthening each participant country's capacity to scale up comprehensive programs providing care and treatment, and it ran from 2004 to 2008. The pilot treatment system ensured that people living with HIV/AIDS (PLWHA) and their immediate families benefit from care and treatment. The TAP resulted in the increase of both HIV/AIDS treatment centers and number of AIDS patients under treatment (ACTAfrica and Global HIV Program, 2007). The number of patients receiving ART increased from 88,211 in December 2007 to above 128,000 patients in December 2008 (Mozambique Ministry of Health, 2009). Conceivably, more people would have become more aware of ART during this period because access to ART was being scaled-up. Figure 2 shows the scale-up in the fourteen public health facilities which match to our household sample in both waves of data collection, measured as the cumulated number of patients ever initiated on ART.

The data were collected in 2007 and 2008 in 4 provinces of Mozambique (Maputo City, Maputo Province, Sofala, Manica)[11]. The HIV positive persons of the survey were

[11] Five ART clinics were sampled in the city of Maputo, seven ART clinics were sampled in the

sampled at the health facility where they received treatment or were in line to receive treatment at a later date. These patients were interviewed at home along with their household members. A group of households in which there were no identified HIV positive persons were also sampled to control for common trends in socio-economic circumstances. These households were randomly selected in the neighborhood of each household with at least one identified HIV positive person.

The first wave of the survey, conducted between August and December of 2007, included 658 HIV households and 341 matching households. In the second wave, one year later, HIV households that could not be found and interviewed were not replaced, but matching households were. The panel consists of 896 households interviewed in both waves: 616 HIV households and 280 matching households. For the analysis, we restrict the sample to men aged between 15 and 55 and women aged between 15 and 49. This corresponds to 1807 individuals at baseline and 1917 individuals at follow up. At baseline, there were 1134 and 673 individuals in the treatment and in the comparison groups, respectively. At follow up, there were 1208 individuals in the treatment group and 709 individuals in the treatment groups.

Respondents were asked about their sexual behavior and their beliefs on whether AIDS could be cured or treated by 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. All

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province of Maputo (besides the city), four ART clinics were sampled in the province of Sofala and two ART clinics were sampled in the province of Manica.

our variables, in particular the sexual behaviors, are self-reported.

Our analysis uses three dependent variables measuring different aspects of unsafe sexual behavior: "casual" stands for casual sex and is an indicator for any sexual intercourse during the last 12 months with a non-regular partner[12], "risky" stands for risky sex and is defined as unprotected sex with a non-cohabiting partner during the last 12 months and abstinence is the absence of sexual relationship over the last 12 months. On the right hand side, our main variable of interest is "AIDS easy" (perceived efficacy of ART) a measure of an individual's perception of how easily AIDS can be tackled. The variable is defined as follows: it is equal to 2 if the individual believes (wrongly) that AIDS is curable, equal to 1 if the individual believes (correctly) that AIDS can be treated but is not curable and equals to 0 if he believes (wrongly) that AIDS is not treatable.

We summarize the key variables in Table 1. From column 1, it appears that a large proportion of respondents engage in casual sex: about 34 percent in 2007 and 32 percent in 2008. Persons living with HIV are, however, less likely to engage in casual sex. Fewer respondents (7.4 percent in 2007 and in 2008) engage in unprotected casual sex. The substantial difference between columns 1 and 2 suggests that when people engage in sexual intercourse with non co-residing partners, they are likely to use a condom.

Abstinence is practiced by around 18 and 16 percent of the sample in 2007 and in 2008, respectively, suggesting a rather high sexual activity. This would suggest that in addition to promoting abstinence and fidelity, prevention programs should focus also

[12] For the analysis, relationships are reduced to two categories: co-residing partners (whether legally married or not), and all other partners.

on the use of condoms since abstinence is low, and casual sex is relatively high. The low rate of unprotected sex with non co-residing partners is by itself encouraging from the disease containment perspective. Overall, between the 2007 and the 2008 panels, the descriptive statistics reveal a general decline in Casual and Risky sex, but also a decline in Abstinence.

ART perceived efficacy variables are summarized in columns 5-7. About 6 percent of respondents in 2007 and 5 percent in 2008 report that AIDS can be cured by ART, while around 80 percent report that AIDS can be treated, but cannot be cured by ART. The proportion of respondents (especially those living with HIV) who believed that AIDS could be cured by ART declined slightly between 2007 and 2008. We observe the same pattern for "AIDS can be treated". Compared to 2007, fewer respondents believe that AIDS can be treated in 2008. It is plausible that people adjust their beliefs about the true nature of ART over time as they are more exposed to ART. In the AIDSeasy variable, the perceptions or beliefs are not ordered by whether they are factually correct or incorrect but rather by the degree by which the individual believes that AIDS can easily be managed[13]. Overall, the pattern over time is consistent with the pattern that we observed for the two separate measures of ART perceived efficacy. Between the two survey rounds, as shown in Figure 3, all three

[13] While we think this is the most useful specification for our analysis of disinhibition behavior, for robustness, we present in appendix tables 1-6 similar analyses where we have entered "AIDS can be cured" and "AIDS can be treated" as separate independent variables.

groups of people become to some degree disillusioned about the benefits of ART.

4. Empirical Strategy

The general hypothesis we want to test is whether ART perceived efficacy 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. A positive association of perceived efficacy of ART (AIDSeasy) with casual sex and risky sex, and a negative association with abstinence would provide suggestive evidence of disinhibition behavior. To proceed, we specify the following regression.

$$y_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 X_{it} + \beta_3 Followup + \delta_i + \varepsilon_{it} \qquad (1)$$

where y is a behavioral outcome, A is a variable summarizing the perceived efficacy of ART 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-constant individual level variable which is unobserved, and which may be correlated with A.

Obviously, perceived efficacy of ART is likely endogenous in regression (1) since unobserved variables absorbed in the error term may also be correlated with ART perceived efficacy. Such unobserved variables can be categorized in three types. First, there are unobserved time-invariant individual characteristics. 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 the perceived efficacy of 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 the perceived efficacy of ART, 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 (δ) to control for unobservable time-invariant individual characteristics.

Second, between the two survey rounds, treatment and other prevention programs may have expanded faster in some communities than in others. Such scale-ups could affect both perceived efficacy of ART and sexual behaviors. Because these changes occur over time, they are not controlled for by the inclusion of individual fixed effects in our regressions. Instead, we use time indicators interacted with health facility indicators to control for community level time-varying variables, including both observed and unobserved variables[14]. We estimate the following regression:

$$y_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 X_{it} + \beta_3 Followup + \delta_i + \lambda_{t*hf} + \varepsilon_{it} \qquad (2)$$

Where λ_{t*hf} indicates time and health facility interaction terms, and all other variables are as previously defined. Since our household sample was constituted starting from a list of patients at the health facility level, we use health facility indicators as indicators of the catchment area or community surrounding the health facility.

[14] This is akin to the specification of aggregate shocks in the consumption smoothing literature (e.g. Kazianga and Udry, 2006).

The third source of endogeneity is time-varying individual unobserved characteristics. Time-varying individual fixed effects that are both correlated with sexual behavior and perceived efficacy of ART would still 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". Alternatively, individuals could learn new information that affects both perceived efficacy of ART and sexual behaviors. Unfortunately, absent valid instruments we cannot address this last source of endogeneity. However, we observed more than one individual in each household in each of the two rounds. Hence, we can use household fixed effects interacted with time dummies to control for time varying household level unobservables.

$$y_{it} = \beta_0 + \beta_1 A_{it} + \beta_2 X_{it} + \beta_3 Followup + \delta_i + \gamma_{t*hh} + \varepsilon_{it} \quad (3)$$

Where λ_{t*hh} indicates time and household interaction terms, and all other variables are as previously defined. This does not eliminate the concern with time-varying individual level unobservables, but it provides a rough idea on whether the association would remain significant if time-varying individual level unobserved characteristics were controlled for.

Our different specifications do not identify a causal relation between ART perceived efficacy and sexual behaviors. Instead, a statistically significant β2 across alternative specifications would suggest a rather robust association between ART perceived efficacy and sexual behavior. At the most, we could show that that such association is robust to time-constant individual unobservable characteristics and to time-varying community and household level unobservable characteristics.

As discussed above, our AIDSeasy variable measuring the individual's perception of the efficacy of ART is correlated in our sample with a community's accumulated experience with

ART, a variable we call *cumestpts*. Figure 4 displays the average change in the AIDSeasy score between the two rounds of the survey for all three groups, each subdivided according to how great an increase in treatment experience had occurred in that group. Consistent with Table 1, all six bars show a decline in the "AIDSeasy" score between survey rounds, suggesting that disillusionment with ART was general in this area of Mozambique at this time. For two of the three groups, those with HIV infection and those in the surrounding neighborhood, the degree of disillusionment was greater when the percentage increase in treatment experience was greater than 75%.

5. Results and discussion

Table 2 present results for the entire sample with individual fixed effects controlling for unobservable time-invariant characteristics at the individual and community levels. The results are presented for men and women jointly and then separately by gender. AIDS easy is positively associated with casual sex for both men (column 1) and women (column 2). The same positive association is found for risky sex, although it is only significant for women (column 4). The coefficients on abstinence are negative but not statistically significant. Taken together, these results suggest a robust positive association between perceptions that ART is efficacious with riskier sexual behaviors. The suggestion is strong that the decline in confidence in AIDS treatment between survey rounds measured by declining average values of our variable AIDS easy is associated in the data with a decline in risky sexual behavior.

AIDSeasy is, however, an endogenous variable. Hence our specification with individual fixed effects can only control for time-invariant unobservable characteristics. By adding to the

specifications interaction terms between community (health facility) fixed effects and an indicator for the survey round, table 3 allows to further account for time varying unobservable characteristics at the community/health facility level. Overall, the results in table 3 are very similar to the results described in table 2: AIDS easy is positively associated with casual sex for both men (column 1) and women (column 2), and with risky sex for women (column 4). The coefficients are not statistically significant for abstinence (columns 5 and 6).

Table 4 goes one step further in attempting to account for time-varying unobservable characteristics by adding to the individual fixed effects a set of interaction terms between household fixed effects and an indicator for the survey round. While, with the exception for abstinence, the associations have the same signs as in table 2, several coefficients lose their statistical significance in table 4. However, the results still indicate a statistically positive association between AIDSeasy and casual sex for men (statistically significant at the 10%).

Tables 2 to 4 report results of regressions using the entire sample. However, our sample contains three distinct sub-samples: individuals known to be living with HIV/AIDS, family members of those individuals and members of neighboring households. These three groups should have very different perceptions about AIDS and might also react differently to those different perceptions. A separate analysis for each of these three groups does therefore allow a finer analysis of potential disinhibition behaviors. We take our specification in table 4 which goes the furthest in attempting to control for time variant endogeneity and we apply it separately to those three groups in tables 5-7.

Table 5 focuses on individuals identified in our sample as living with HIV/AIDS. Because in most households there is only one individual identified as living with HIV/AIDS, we cannot apply for this sub-sample the specification in table 4 adding interaction terms between

household fixed effects and an indicator for the survey round. Instead, we revert to the specification in table 3 adding interaction terms between community/health facility fixed effects and an indicator for the survey round. None of the coefficients on AIDSeasy in table 5 are statistically significant. This suggests that disinhibition behaviors are not found among individuals living with HIV/AIDS.

Tables 6 and 7 revert to the specification in table 4 adding to the individual fixed effects interaction terms between household fixed effects and an indicator for the survey round. Table 6 focuses on family members of individuals living with HIV/AIDS. In that group, there is some suggestive evidence of disinhibition behaviors: AIDSeasy is positively associated with casual sex for men and women and with risky sex for women. Table 7 analyzes the behaviors of members of households living in the neighborhood of individuals living with HIV/AIDS. For that group as well, there is suggestive evidence of disinhibition behaviors: even though the positive association between AIDSeasy and risky sex is not statistically significant, the positive association between AIDSeasy and casual sex is significant for men and women.

Taken together, the results in tables 5 to 7 are suggestive that there might be disinhibition behaviors in the population (at least in our sample of household members of individual living with HIV/AIDS and of comparison households living in their neighborhood), but that those behaviors are not found among people living with HIV/AIDS. We should however stress that our specifications, while they account for time-invariant unobserved characteristics and time-variant unobservables at the community or the household level, cannot account for time-variant unobserved individual characteristics. Our results should therefore be interpreted with this potential source of endogeneity in mind.

Tables 1-6 in the appendix reproduces the same specifications as in tables 2-7, but instead

of using AIDSeasy as the independent variable of interest, we have entered "AIDS can be cured" and "AIDS can be treated" as separate independent variables, for robustness. For lack of space, we cannot describe the results of those tables in detail, but overall the results are similar and go in the same direction. In the overall sample, there is evidence of disinhibition when only individual fixed effects (appendix table 1) and individual fixed effects with interaction terms between health facility indicators and time indicators (appendix table 2) are entered. When interaction terms between household fixed effects and time indicators are entered (appendix table 3), only a few of the positive association between the AIDS treatment perceived efficacy variable and the sexual behaviors variable persist. But in the analysis by sub-sample (appendix tables 4-6), the same pattern emerges as in tables 5-7: no evidence of disinhibition behaviors for individuals living with HIV/AIDS, but several coefficients suggestive of disinhibition behaviors for family members of individuals living with HIV/AIDS (appendix table 5) and in comparison households (appendix table 6).

Descriptive statistics in Table 1 and Figure 4 suggest that the decline in the AIDSeasy variable between the two survey rounds is associated with the population's accumulation of treatment experience, as measured by the variable *cumestpts*. Appendix Table 7 presents individual fixed effect regression estimates of the impact of *cumestpts* on the variable AIDSeasy. The estimated association between the logarithm of *cumespts* and the variable *AIDSeasy* is negative in every subset of the population and is statistically significant at the 1% level in the pooled samples for men and women and for men alone.

While supporting the narrative that experience with AIDS treatment can decrease a population's confidence in the efficacy of ART, the results in Appendix Table 7 also show that, with the possible exception of the samples of pooled men and women and pooled men, the

logarithm of *cumestpts* explains too little of the variation in *AIDSeasy* to serve as its instrument in a second stage instrumental variables regression[15].

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 result from expected access to efficacious ART. Such compensating behaviors, if large enough, could potentially increase HIV transmission, thus offsetting some of the positive effects of increased access to ART. After controlling for individual fixed effects, time-varying health facility and time-varying household unobserved, we find a strong positive association between the perception that ART is efficacious and risky sexual behaviors. Such an association is suggestive of disinhibition behaviors, consistent with prior literature on risk-taking in the USA and Europe, following the introduction of ART.

The association between ART perceived efficacy and risky sexual behaviors is the strongest for respondents from comparison households and for family members of persons living with HIV/AIDS. One could speculate that increased access to ART might lead to increased risky sexual behaviors for the general population but not for HIV positive persons. If this were confirmed, then ART programs may need to be supplemented with behavioral prevention

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[15] The variable "cumestpts" is measured at the health facility and could change from the first round of the survey to the next one. Hence this variable is absorbed by the health facility*time interaction terms or the household*time interactions terms.

programs which target the general population. Absent such supporting prevention programs, increased risky sexual behaviors could offset some of the benefits from increased access to treatment.

Our finding of a positive association between confidence that ART works and risk behavior comes from a Mozambican context in which confidence in ART declined between the two rounds of our survey. Thus, our findings suggest that peoples' disillusionment with ART between 2007 and 2008 led in many cases to increased inhibition of their sexual behavior.

To sum up, our results suggest that scaling up access to ART without behavioral 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 the limitations as well as the health benefits of ART, and address the changing beliefs about HIV in the era of increasing ART availability. Finally, prevention messages must accommodate the gender difference in disinhibition behaviors.

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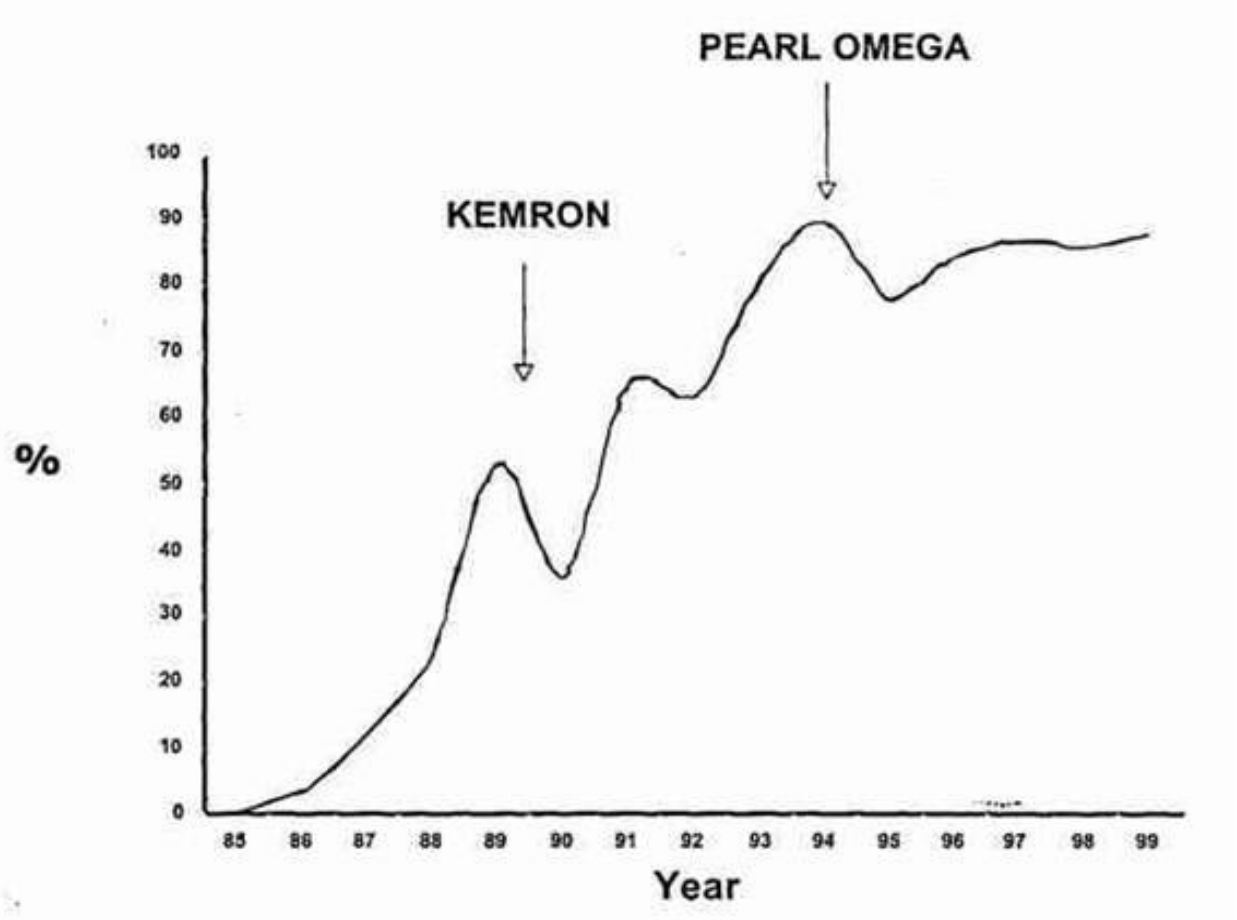

Figure 1. Percent condom use in a cohort of sex workers declined after the local announcement of each of two fraudulent "cures" for AIDS: Nairobi, 1985-99 (source: Jha et al, 2001)

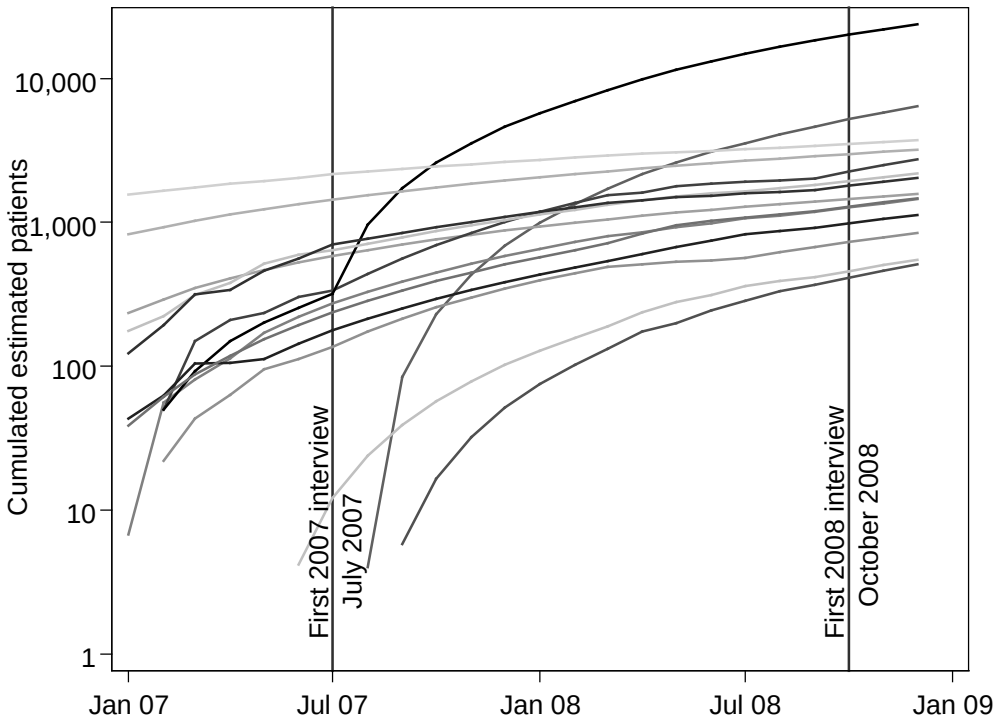

Figure 2. Cumulated experience initiating ART patients for the 14 facilities observed in both survey waves and matched to survey households

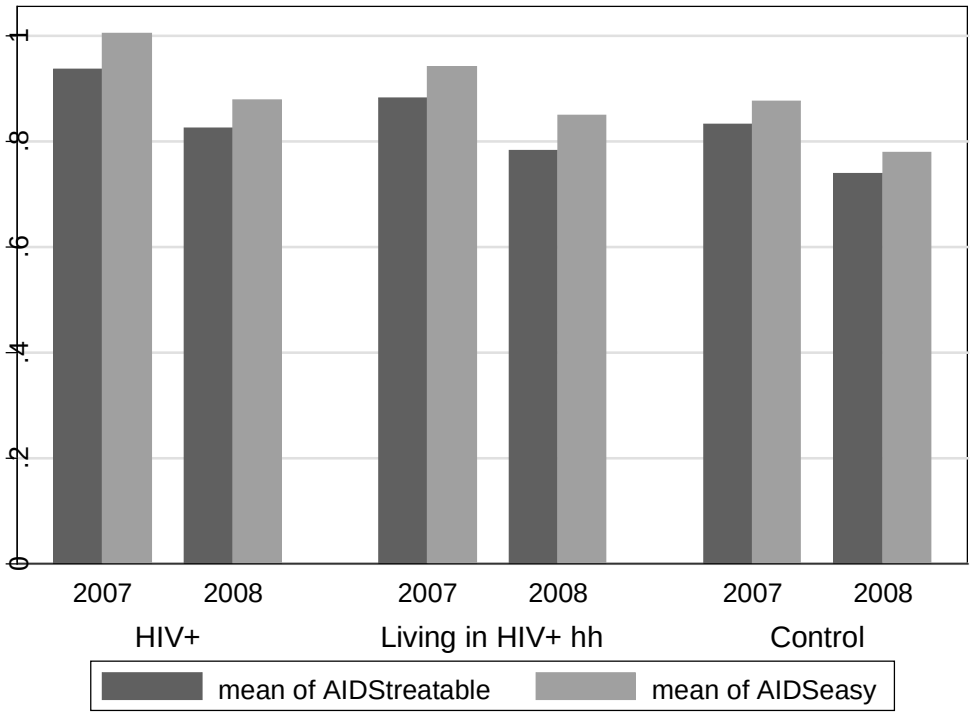

Figure 3. The proportion of respondents believing that AIDS is treatable or curable decline for all groups between the two waves of the survey

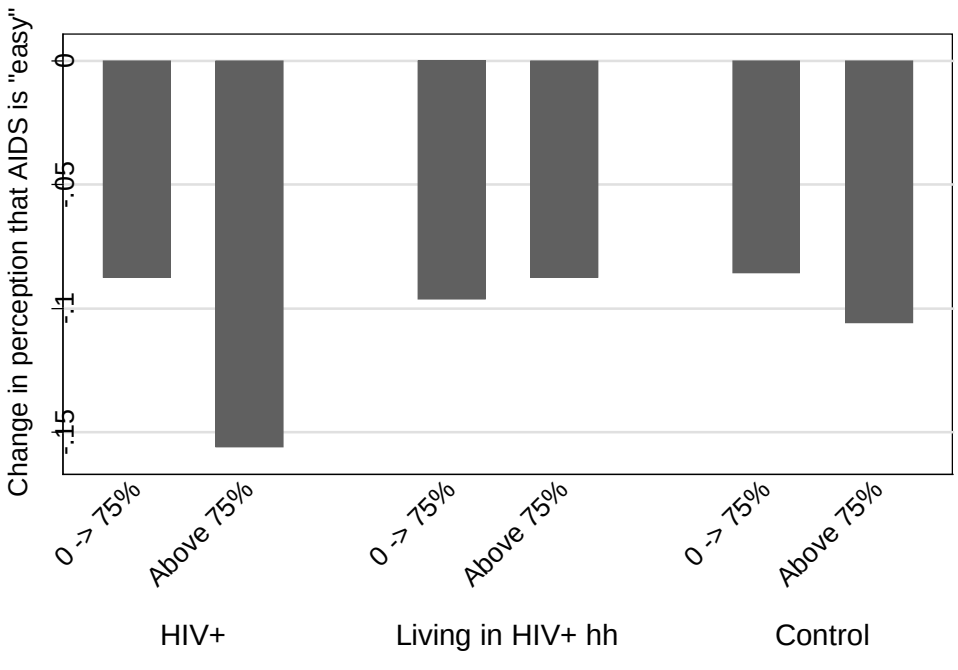

Figure 4. Among two of three groups change in perception that ART is "easy" is negatively associated with the percent change in local treatment experience

Table 1: Descriptive statistics

	(1) Casual	(2) Risky	(3) Abstin-ence	(4) AIDS Curable	(5) AIDS Treatable	(6) AIDS easy	(7) Age	(8) Female
Panel A: First wave (2007)								
Pooled sample	0.341	0.074	0.177	0.064	0.872	0.937	29.412	0.537
	[0.005]	[0.009]	[0.007]	[0.005]	[0.007]	[0.008]	[0.207]	[0.010]
HIV+ persons	0.260	0.039	0.354	0.086	0.933	1.019	36.200	0.620
	[0.008]	[0.018]	[0.020]	[0.012]	[0.010]	[0.016]	[0.355]	[0.020]
Family of HIV+	0.355	0.073	0.122	0.068	0.888	0.956	26.516	0.511
	[0.008]	[0.014]	[0.010]	[0.007]	[0.009]	[0.012]	[0.304]	[0.015]
Comp. hh.	0.376	0.099	0.130	0.045	0.811	0.856	28.685	0.516
	[0.010]	[0.016]	[0.011]	[0.007]	[0.013]	[0.016]	[0.340]	[0.017]
Panel B: Second wave (2008)								
Pooled sample	0.320	0.074	0.159	0.052	0.743	0.795	29.719	0.525
	[0.005]	[0.009]	[0.007]	[0.004]	[0.009]	[0.010]	[0.216]	[0.010]
HIV+ persons	0.236	0.035	0.324	0.057	0.819	0.876	37.059	0.623
	[0.008]	[0.019]	[0.021]	[0.010]	[0.017]	[0.021]	[0.376]	[0.022]
Family of HIV+	0.326	0.084	0.111	0.060	0.724	0.784	26.970	0.487
	[0.009]	[0.014]	[0.010]	[0.007]	[0.014]	[0.017]	[0.327]	[0.016]
Comp. hh.	0.362	0.083	0.121	0.039	0.723	0.762	28.757	0.513
	[0.009]	[0.016]	[0.011]	[0.007]	[0.015]	[0.017]	[0.333]	[0.017]

Robust standard errors in brackets

Table 2: The association between perceptions about AIDS and sexual behaviors, controlling for individual fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSeasy	0.1031***	0.0691***	0.0256	0.0462**	-0.0165	-0.0068
	[0.027]	[0.022]	[0.025]	[0.019]	[0.035]	[0.032]
Followup	-0.0008	0.0029	-0.0008	0.0196	-0.0364	-0.0033
	[0.018]	[0.037]	[0.013]	[0.018]	[0.029]	[0.045]
age	0.0079	0.1051*	0.0084	0.0403	0.0748*	-0.0451
	[0.049]	[0.057]	[0.024]	[0.026]	[0.040]	[0.060]
age2	0.0002	-0.0014**	0.0000	-0.0005	-0.0008	0.0007
	[0.001]	[0.001]	[0.000]	[0.000]	[0.001]	[0.001]
Constant	-0.2002	-1.4507	-0.2220	-0.6471	-1.2169*	0.9160
	[0.888]	[1.124]	[0.459]	[0.415]	[0.651]	[1.216]
Observations	2,350	2,663	2,350	2,663	2,350	2,663
R-squared	0.800	0.785	0.657	0.663	0.710	0.680

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Table 3: The association between perceptions about AIDS and sexual behaviors, controlling for individual fixed effects and time varying community/health facility level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSeasy	0.1114***	0.0601**	0.0275	0.0479**	-0.0209	0.0066
	[0.028]	[0.027]	[0.024]	[0.020]	[0.038]	[0.028]
Followup	-0.0357	-0.3197***	-0.0163	0.0116	0.0179	0.3372***
	[0.022]	[0.030]	[0.016]	[0.011]	[0.027]	[0.029]
age	-0.0001	0.1004*	0.0056	0.0361	0.0688	-0.0459
	[0.049]	[0.059]	[0.023]	[0.025]	[0.043]	[0.064]
age2	0.0003	-0.0013*	0.0001	-0.0004	-0.0007	0.0006
	[0.001]	[0.001]	[0.000]	[0.000]	[0.001]	[0.001]
Constant	-0.0423	-1.0986	-0.2172	-0.5900	-1.2026	0.6385
	[0.915]	[1.148]	[0.460]	[0.399]	[0.721]	[1.282]
Observations	2,350	2,663	2,350	2,663	2,350	2,663
R-squared	0.803	0.790	0.660	0.668	0.719	0.693

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Table 4: The association between perceptions about AIDS and sexual behaviors, controlling for individual fixed effects and time varying household level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSeasy	0.2417*	0.1535	0.0337	0.0883	-0.0106	0.0145
	[0.142]	[0.101]	[0.082]	[0.137]	[0.123]	[0.060]
Followup	-0.0186	0.0161	-1.1509***	-0.0310	0.0538	-0.0569
	[0.311]	[0.186]	[0.143]	[0.081]	[0.292]	[0.227]
age	0.0008	0.1273	-0.0649	0.0186	0.0380	-0.0307
	[0.102]	[0.140]	[0.051]	[0.091]	[0.126]	[0.156]
age2	-0.0000	-0.0020	0.0008	-0.0005	-0.0005	0.0002
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.002]
Constant	0.1623	-1.6506	1.9340*	-0.0609	-0.5227	0.9405
	[2.003]	[2.762]	[0.983]	[1.534]	[2.313]	[3.331]
Observations	2,350	2,663	2,350	2,663	2,350	2,663
R-squared	0.933	0.927	0.871	0.888	0.919	0.913

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Table 5: The association between perceptions about AIDS and sexual behaviors among individual living with HIV/AIDS, controlling for individual fixed effects and time varying community/health facility level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSeasy	-0.0064	0.0258	0.0246	-0.0305	-0.0573	0.0037
	[0.099]	[0.049]	[0.025]	[0.024]	[0.064]	[0.042]
Followup	-0.0231	0.0047	-0.0357***	-0.0165	-0.0056	-0.9100***
	[0.021]	[0.114]	[0.012]	[0.022]	[0.033]	[0.047]
age	-0.3416***	0.0560	0.0668	-0.0336	0.2559*	0.1023
	[0.101]	[0.184]	[0.053]	[0.052]	[0.126]	[0.100]
age2	0.0043***	-0.0012	-0.0004	0.0004	-0.0029*	-0.0003
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.002]
Constant	6.7072***	-0.2278	-2.0808*	0.7601	-5.0077**	-1.8978
	[1.851]	[4.431]	[1.050]	[0.919]	[2.438]	[1.875]
Observations	412	677	412	677	412	677
R-squared	0.724	0.699	0.557	0.718	0.748	0.695

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: The association between perceptions about AIDS and sexual behaviors among family members of individual living with HIV/AIDS, controlling for individual fixed effects and time varying household level unobservables.

	(2)	(3)	(5)	(6)	(8)	(9)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSeasy	0.1244***	0.0721*	0.0376	0.0972**	0.0247	-0.0222
	[0.037]	[0.040]	[0.035]	[0.042]	[0.054]	[0.022]
Followup	-0.0093	-0.0251	0.0057	-0.0196	-0.1024**	0.5299***
	[0.063]	[0.032]	[0.019]	[0.014]	[0.038]	[0.036]
age	0.0641	0.0932	0.0043	0.0058	0.1172***	-0.0774
	[0.057]	[0.067]	[0.032]	[0.038]	[0.037]	[0.103]
age2	-0.0014	-0.0012	-0.0003	0.0002	-0.0004	0.0008
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Constant	-0.2278	-1.2473	0.1487	-0.2669	-2.7939***	1.0411
	[1.646]	[1.219]	[0.533]	[0.455]	[0.995]	[1.701]
Observations	1,086	1,084	1,086	1,084	1,086	1,084
R-squared	0.819	0.804	0.660	0.686	0.690	0.643

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Table 7: The association between perceptions about AIDS and sexual behaviors among members of neighboring households, controlling for individual fixed effects and time varying household level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSeasy	0.1676***	0.0881**	0.0186	0.0600	-0.0612	0.0160
	[0.053]	[0.035]	[0.035]	[0.040]	[0.063]	[0.054]
Followup	-1.0403***	-0.1559**	0.0055	-0.0565	0.0221**	0.0017
	[0.024]	[0.062]	[0.015]	[0.046]	[0.010]	[0.059]
age	0.0533	0.1154	-0.0321	0.0323	-0.1176***	0.0012
	[0.081]	[0.101]	[0.067]	[0.066]	[0.034]	[0.094]
age2	-0.0002	-0.0010	0.0005	-0.0007	0.0016***	-0.0004
	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.002]
Constant	-0.0565	-2.0083	0.5699	-0.1528	1.9829***	0.4674
	[1.378]	[1.913]	[1.087]	[1.134]	[0.622]	[1.492]
Observations	852	902	852	902	852	902
R-squared	0.836	0.855	0.676	0.668	0.727	0.729

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 1: The association between perceptions about AIDS and sexual behaviors, controlling for individual fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSTreatable	0.1111***	0.0799***	0.0115	0.0646**	-0.0126	0.0265
	[0.025]	[0.027]	[0.028]	[0.025]	[0.038]	[0.037]
AIDSCurable	0.0825*	0.0460	0.0618	0.0068	-0.0264	-0.0779**
	[0.046]	[0.041]	[0.039]	[0.020]	[0.044]	[0.030]
Followup	-0.0003	0.0040	-0.0017	0.0215	-0.0361	0.0001
	[0.018]	[0.037]	[0.013]	[0.018]	[0.028]	[0.045]
age	0.0082	0.1044*	0.0079	0.0390	0.0749*	-0.0474
	[0.049]	[0.058]	[0.024]	[0.027]	[0.040]	[0.061]
age2	0.0002	-0.0014*	0.0000	-0.0005	-0.0009	0.0007
	[0.001]	[0.001]	[0.000]	[0.000]	[0.001]	[0.001]
Constant	-0.2116	-1.4501	-0.2019	-0.6460	-1.2224*	0.9178
	[0.887]	[1.123]	[0.461]	[0.423]	[0.656]	[1.240]
Observations	2,350	2,663	2,350	2,663	2,350	2,663
R-squared	0.800	0.785	0.657	0.664	0.711	0.682

Robust standard errors in brackets, clustered at the health facility level. AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner, abstinence is defined over the last 12 months and risk score is defined as: casual sex + risky sex + (1-abstinence).

*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 2: The association between perceptions about AIDS and sexual behaviors, controlling for individual fixed effects and time varying community/health facility level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSTreatable	0.1220***	0.0731**	0.0120	0.0661**	-0.0193	0.0347
	[0.026]	[0.030]	[0.028]	[0.026]	[0.042]	[0.033]
AIDSCurable	0.0859*	0.0313	0.0649	0.0076	-0.0247	-0.0558*
	[0.048]	[0.045]	[0.038]	[0.020]	[0.044]	[0.032]
Followup	-0.0355	-0.0599*	-0.0166	-0.0355***	0.0179	0.3503***
	[0.022]	[0.035]	[0.016]	[0.013]	[0.027]	[0.036]
age	0.0004	0.0996	0.0049	0.0350	0.0689	-0.0477
	[0.049]	[0.059]	[0.023]	[0.026]	[0.043]	[0.064]
age2	0.0003	-0.0013*	0.0001	-0.0004	-0.0007	0.0007
	[0.001]	[0.001]	[0.000]	[0.000]	[0.001]	[0.001]
Constant	-0.0587	-1.3587	-0.1927	-0.5434	-1.2051	0.6450
	[0.914]	[1.132]	[0.463]	[0.399]	[0.726]	[1.294]
Observations	2,350	2,663	2,350	2,663	2,350	2,663
R-squared	0.803	0.790	0.660	0.669	0.719	0.694

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 3: The association between perceptions about AIDS and sexual behaviors, controlling for individual fixed effects and time varying household level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSTreatable	0.2469	0.1866*	0.0271	0.0699	0.0423	-0.0264
	[0.160]	[0.109]	[0.096]	[0.110]	[0.114]	[0.086]
AIDSCurable	0.2267	0.0704	0.0529	0.1344	-0.1634	0.1168
	[0.284]	[0.229]	[0.191]	[0.240]	[0.284]	[0.151]
Followup	-0.0191	0.0190	-1.1503***	-0.0326	0.0488	-0.0604
	[0.316]	[0.192]	[0.142]	[0.080]	[0.300]	[0.231]
age	0.0008	0.1258	-0.0648	0.0194	0.0376	-0.0288
	[0.102]	[0.144]	[0.051]	[0.091]	[0.129]	[0.159]
age2	-0.0000	-0.0020	0.0008	-0.0005	-0.0005	0.0001
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.002]
Constant	0.1642	-1.6706	1.9443*	-0.0533	-0.5429	0.9669
	[1.984]	[2.815]	[0.978]	[1.489]	[2.386]	[3.402]
Observations	2,350	2,663	2,350	2,663	2,350	2,663
R-squared	0.933	0.928	0.871	0.889	0.920	0.913

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 4: The association between perceptions about AIDS and sexual behaviors among individual living with HIV/AIDS, controlling for individual fixed effects and time varying community/health facility level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSTreatable	-0.0845	-0.0020	0.0455	-0.0147	-0.0667	0.0538
	[0.075]	[0.051]	[0.036]	[0.038]	[0.095]	[0.065]
AIDSCurable	0.1233	0.0659	-0.0100	-0.0535	-0.0418	-0.0688
	[0.158]	[0.097]	[0.011]	[0.037]	[0.104]	[0.052]
Followup	-0.0226	0.0061	-0.0374***	-0.0173	-0.0055	-0.9125***
	[0.020]	[0.117]	[0.011]	[0.023]	[0.033]	[0.051]
age	-0.3487***	0.0610	0.0687	-0.0365	0.2550*	0.0931
	[0.093]	[0.188]	[0.054]	[0.052]	[0.125]	[0.103]
age2	0.0044***	-0.0013	-0.0004	0.0004	-0.0029*	-0.0001
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.002]
Constant	6.9220***	-0.2668	-2.1367*	0.7897	-4.9820**	-1.8037
	[1.712]	[4.538]	[1.066]	[0.940]	[2.369]	[2.002]
Observations	412	677	412	677	412	677
R-squared	0.726	0.699	0.560	0.718	0.748	0.696

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 5: The association between perceptions about AIDS and sexual behaviors among family members of individual living with HIV/AIDS, controlling for individual fixed effects and time varying household level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSTreatable	0.1276***	0.0993*	0.0187	0.1144*	0.0455	0.0107
	[0.043]	[0.055]	[0.040]	[0.060]	[0.055]	[0.021]
AIDSCurable	0.1167*	0.0205	0.0829	0.0647	-0.0251	-0.0845**
	[0.068]	[0.040]	[0.073]	[0.041]	[0.074]	[0.039]
Followup	-0.0094	-0.0249	0.0060	-0.0195	-0.1028***	0.5301***
	[0.063]	[0.032]	[0.019]	[0.014]	[0.037]	[0.036]
age	0.0644	0.0909	0.0024	0.0043	0.1193***	-0.0801
	[0.057]	[0.067]	[0.031]	[0.038]	[0.037]	[0.105]
age2	-0.0014	-0.0011	-0.0002	0.0003	-0.0004	0.0008
	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.001]
Constant	-0.2403	-1.2304	0.1776	-0.2548	-2.8256***	1.0664
	[1.664]	[1.218]	[0.522]	[0.470]	[0.988]	[1.724]
Observations	1,086	1,084	1,086	1,084	1,086	1,084
R-squared	0.819	0.805	0.660	0.686	0.690	0.644

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 6: The association between perceptions about AIDS and sexual behaviors among members of neighboring households, controlling for individual fixed effects and time varying household level unobservables.

	(1)	(2)	(3)	(4)	(5)	(6)
	Casual		Risky		Abstinence	
	Men	Women	Men	Women	Men	Women
AIDSTreatable	0.1939***	0.1059**	0.0029	0.0794*	-0.0867	0.0172
	[0.043]	[0.045]	[0.047]	[0.045]	[0.075]	[0.059]
AIDSCurable	0.0891	0.0178	0.0656	-0.0165	0.0150	0.0114
	[0.095]	[0.060]	[0.042]	[0.076]	[0.080]	[0.085]
Followup	-1.0396***	-0.0894	0.0051	0.0161	0.0214**	0.0060
	[0.025]	[0.092]	[0.015]	[0.084]	[0.010]	[0.080]
age	0.0494	0.1152	-0.0298	0.0321	-0.1138***	0.0012
	[0.082]	[0.101]	[0.064]	[0.064]	[0.033]	[0.094]
age2	-0.0002	-0.0009	0.0004	-0.0006	0.0016***	-0.0004
	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.002]
Constant	-0.0132	-2.1501	0.5440	-0.3073	1.9409***	0.4581
	[1.402]	[1.880]	[1.055]	[1.081]	[0.602]	[1.538]
Observations	852	902	852	902	852	902
R-squared	0.836	0.856	0.677	0.669	0.728	0.729

Robust standard errors in brackets, clustered at the health facility level.
AIDS easy is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12.
*** p<0.01, ** p<0.05, * p<0.1

Appendix Table 7: The association between cumulated local experience with ART (*cumestpts*) and the perception that ART is efficacious (*AIDSeasy*), controlling for individual fixed effects.

	Men				Women			
	Pooled	HIV+	Family	Comp. hh	Pooled	HIV+	Family	Comp. hh
Followup	0.022	0.019	0.068	-0.007	-0.124**	-0.089	-0.134*	-0.127
	(0.043)	(0.073)	(0.113)	(0.074)	(0.049)	(0.114)	(0.076)	(0.104)
age	0.034	0.118	0.051	-0.011	0.072	0.106	0.119	0.035
	(0.067)	(0.125)	(0.128)	(0.138)	(0.073)	(0.199)	(0.106)	(0.165)
age^2	-0.001	-0.002	-0.001	0.000	-0.001	-0.002	-0.002	0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
ln(cumestpts)	-0.074***	-0.030	-0.073	-0.092**	-0.033	-0.040	-0.044	-0.030
	(0.027)	(0.048)	(0.048)	(0.043)	(0.028)	(0.047)	(0.052)	(0.045)
N	1,444	296	662	486	1,718	490	712	516

The dependent variable, AIDSeasy, is defined as follows: =2 if the individual believes that AIDS is curable, =1 if individual believes that AIDS can be treated but is not curable and = 0 if he believes that AIDS is not treatable. Casual sex is any sexual intercourse with a non-regular partner, risky is defined as unprotected sex with a non-cohabiting partner and abstinence is defined over the last 12 months.

The sample size is smaller than that from the rest of the tables because “cumestpts” is estimated from a separate health facility level survey, and some observations from the household survey did not match with the health facility level survey. These observations are dropped from the estimations shown in this table.