Changing Attitudes towards HIV Prevention, HIV Risk and a Woman's Right to Protect Against HIV Risk: The Effect of an HIV Prevention Program

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PAA 2014, Session 163
Friday, May 2, 2014

Abstract

A fair amount of pessimism exists concerning the effectiveness of behavioral interventions and education programs in response to the HIV/AIDS epidemic in sub-Saharan Africa. This is largely because it is often quite difficult to measure the positive effects of such programs. In this paper, I propose that even in programs that do not find large behavioral changes in response to prevention programs, there may still be unobserved benefits in the form of changing attitudes and beliefs toward HIV and HIV prevention, essential precursors to wide scale behavioral changes and a potential indicator of longer-term program effects. Furthermore, there may be even more nuanced changes in attitudes towards sexual relationship and a woman's right to protect against HIV infection that are changing over time due to HIV prevention programs. I compare participants and non-participants in a program providing extensive HIV counseling and testing in Malawi. Results suggest that participants are more likely to believe that women have the right to take steps to protect themselves from HIV risk, are less likely to be extremely worried about HIV infection, and are more likely to think condom use is acceptable to protect against HIV.

Introduction

A fair amount of pessimism exists concerning the effectiveness of behavioral interventions and education programs in response to the HIV/AIDS epidemic in sub-Saharan Africa. This is largely because it is often quite difficult to measure the positive effects of such programs. As a result, HIV prevention research has increasingly become focused on biomedical interventions that are able to show encouraging, concrete results (Behrman and Kohler 2011; Grinstead et al. 2001; Kippax and Stephenson 2012; Padian et al. 2010; Stoneburner and Low-Beer 2004) . This line of thinking is certainly justifiable, but it sometimes overlooks the necessity of continued focus on behavioral change programs and their important role in HIV prevention efforts, even if the ability to measure the results of such programs in terms of reduced risky behavior is sometimes quite difficult and in terms of actual reduced HIV incidence is nearly impossible. However, previous work has convincingly argued that the pace of change for sexual risk reducing behavior in sub-Saharan Africa is actually very good, but that previous expectations have simply been unrealistic for a change that requires such broad cultural shifts in attitudes towards sexuality and sexual behavior (Cleland and Ali 2006) . Others have also argued that behavioral interventions are crucial, even if finding concrete evidence of reduced risky sexual behavior and incidence rates of HIV is difficult (Kippax and Stephenson 2012) . In this paper, I propose that even in programs that do not find large behavioral changes in response to prevention programs, there may still be unobserved benefits in the form of changing attitudes and beliefs toward HIV prevention and HIV risk perception. These attitudinal changes are essential precursors to wide scale behavioral changes. Changes in sexual practices first require changes in deeply rooted beliefs about sexuality and sexual behavior, making shifting attitudes potentially an important first measurable step towards reducing HIV risk.

Changing patterns of culturally dominant beliefs towards sexual behavior may also involve changing attitudes towards women's rights in sexual relationships. This has been suggested and documented in some previous research exploring changing ways in which women navigate HIV risk (Schatz 2005; Smith and Watkins 2005) Changing attitudes towards women's right within sexual relationships may be influenced by HIV risk prevention programs, at least in so far as a woman's ability to make choices in her sexual relationships affects her ability to lower her HIV risk. In this paper I explore how an HIV prevention program may have influenced attitudes towards condom use for HIV prevention, personal HIV risk perception, as well as attitudes towards a woman's right to protect herself against HIV risk.

Background

Mixed evidence exists in terms of the effectiveness of voluntary counseling and testing, condom promotion and other programs designed to reduce risky sexual behavior (Behrman and Kohler 2011; Grinstead et al. 2001; Padian et al. 2010; Stoneburner and Low-Beer 2004) . Randomized control trials (RCTs) are one particular line of HIV prevention research that has not generally found significant reductions in HIV incidence in response to participation (Corbett et al. 2007; Jewkes et al. 2008; Kamali et al. 2003; Kamb et al. 1998; Patterson et al. 2008). The most successful results found in RCTs are generally for biomedical interventions such as male circumcision, STI treatment or vaccines (Padian et al. 2010). Several potential reasons have been suggested for the lack of significant reductions in HIV incidence in behavioral trials. Many studies lack the necessary statistical power required to find an effect on HIV incidence, sometimes stemming from an inability to accurately estimate expected incidence prior to implementation of a RCT (Lagakos and Gable 2008; Padian et al. 2010) . There is also sometimes too much overlap of the intervention with the control group, which essentially

suppresses the ability of researchers to see any positive change even if it is there (Padian et al. 2010). Low uptake and adherence to participation are also a common problem, meaning that there are sometimes low participation rates and those who do participate may not stay for the whole trial (Lagakos and Gable 2008; Padian et al. 2010; Ross 2010) .

In the case of HIV prevention programs focused on providing information about behavioral changes that can lower personal HIV risk, the line between intervention and control group may be particularly blurred if participants are likely to share information they find important with friends and family, which is most likely often the case in HIV endemic communities. Furthermore, the real goal of HIV behavioral prevention programs is presumably to distribute useful information to the community at large, making increased prevention behavior and reductions in HIV incidence quite difficult to attribute or directly link to the prevention program itself.

Given these potential limitations excessive pessimism towards the potential for behavioral change may be unwarranted. Returning to the difficulty in measuring reductions in HIV incidence, the lack of significant effects may stem from the inability to obtain funding for very large sample sizes and constructing study designs that enable researchers to see the benefits of behavioral interventions in the context of RCTs. In fact, many of the same studies that did not find an effect on reducing HIV incidence still found effects for other outcomes that change more frequently within a population than HIV status changes. Reductions in risky behavior and in incidences of other sexually transmitted illnesses (STIs) were found in several RCTs, many of which are the same studies that found no effect on HIV incidence (Branson et al. 1998; Jewkes et al. 2008; Kamali et al. 2003; Kamb et al. 1998). Furthermore, in select populations with both extremely high HIV incidence and high individual risk of contracting HIV, a handful of RCTs of

behavioral interventions have found significant reductions in new HIV incidence. For example, one study of men who have sex with men in the United States found lower HIV incidence, as well as less unprotected sex with HIV positive partners and partners with unknown HIV status (Koblin et al. 2004). Another RCT of female sex workers in Mexico also found reductions in cumulative STI incidence (HIV, syphilis, gonorrhea and chlamydia), as well as reductions in reported unprotected sex (Patterson et al. 2008).

Behavioral change for HIV prevention in many sub-Saharan African countries also involves changing deeply rooted cultural attitudes towards relationships, sexuality and sexual practices (Maticka-Tyndale 2012). Given the depth and complicated cultural processes involved in wide scale behavioral change as a response to HIV/AIDS risk, measurement of actual behavioral change may be an incomplete assessment of the full range of changes occurring in response to HIV/AIDS. In reality, it is possible that shifts in attitudes and beliefs towards HIV/AIDS and its prevention may be occurring much more broadly than behavioral change, providing a more positive outlook on the success of programs and policies aimed at reducing HIV risk. Furthermore, changes in attitudes and beliefs can be seen as a precursor to behavioral changes. Several studies have made a clear connection between beliefs and behavior, finding that beliefs moderate behavior (Riley and Baah-Odoom 2012; Rimal et al. 2009) . Therefore, changes in beliefs and attitudes towards HIV/AIDS could possibly be seen as an unmeasured benefit of many HIV prevention programs.

If we assume that changing beliefs and attitudes are a prerequisite to behavioral change, then even when there is not a measurable difference in sexual behavior directly after a prevention program, there may still be positive effects that could accumulate over time in the form of broader cultural changes in beliefs surrounding sexual practices. In particular, attitudes towards a

woman's right to protect against HIV risk may be an important step in increasing women's agency when it comes to protection against HIV, as well as in prevention behavior that may not be measurable in terms of direct sexual behavior. This may be particularly true if prevention programs influence women's own attitudes about their ability and right to take steps to protect themselves against HIV risk. For example, Schatz (2005) found that women in Malawi have found ways to protect themselves through culturally appropriate forms, such as discussing the dangers of HIV/AIDS with their husbands, confronting mistresses and using social networks for advice. Furthermore, Smith and Watkins (2005) point out that many of these types of behaviors are not picked up on in studies evaluating behavioral change because they are not behaviors that are as easily linked to direct sexual behavior or HIV incidence rates. Furthermore, Smith and Watkins (2005) link less worry about HIV infection over time in Malawi to changes that Malawians have made in their HIV prevention behavior.

As part of the Malawi Longitudinal Study of Families and Health (MLSFH), a behavioral intervention program was conducted from 2006 to 2008. The program, called the Malawi Incentives Project, involved conditional cash transfers to incentivize respondents to reduce risky sexual behavior after counseling participants on safe sexual practices. The goal of this study is to compare HIV negative respondents who were part of the MLSFH incentives project to those who were not offered participation in the incentives project in order to assess differences in attitudes towards condom use for HIV prevention, personal HIV risk perception and worry, as well as attitudes towards a woman's right to protect herself against HIV risk.

Data and Methods

The Malawi Incentives Project (also referred to as the sex diaries project) was administered to a subsample of the Malawi Longitudinal Study of Families and Health (MLSFH). The MLSFH is a longitudinal study in Malawi that began in 1998 and was repeated in five subsequent waves: 2001, 2004, 2006, 2008 and 2010. In 1998, the MLSFH randomly selected households from which to interview ever-married women and their husbands in three rural regions of Malawi: Rumphi in the north, Mchinji in the central region and Balaka in the south. In the 2004 wave of the MLSFH, an additional sample of adolescent men and women between 14 and 24 years of age were added to refresh the original sample. After the 2006 wave of the MLSFH, participants in the Malawi Incentives Project were selected randomly from those who were both interviewed in 2006 and agreed to an HIV test in 2006. The majority of the 2006 sample, 92 percent, agreed to an HIV test. The incentives project also oversampled HIV sero-discordant couples. Of those who were offered participation in the incentives project, 93 percent accepted.

One or two months after the MLSFH 2006 survey the incentives participants were offered financial incentives to maintain their HIV status for approximately one year (until the third round of incentives interviews). The incentives were offered randomly in various amounts between zero incentive to approximately four month's average wages at the time of the survey (zero to $16 US dollars for each individual). The incentives interviews were conducted four times in total and consisted of counseling on how to protect against HIV along with an in-depth survey interview referred to as a sexual diary. The sexual diary consisted of information about the respondent's sexual behavior in the ten days prior to interview. The four incentives interviews/sexual diaries were collected in the following four time periods: April and May of

2007, July through October of 2007, March through August of 2008 and a second time in March through August of 2008, approximately 2 weeks after HIV testing and incentive distribution was completed in the third round (Kohler and Thornton 2012) .

The subsample of the MLSFH data used in this analysis is restricted to those who participated in the 2008 survey, were tested for HIV in 2006, and tested HIV negative in 2006. The oversampled sero-discordant couples from the incentives project were excluded from the analysis as well.[1] Using the 2008 data, I then compare the outcomes for those who participated in the incentives project and those who did not. Participation in the incentives program is defined as participating in at least one of the four interviews (approximately 88 percent participated in all four, 9 percent in three, 3 percent in two and less than one percent in only one). In order to ensure comparability, comparisons were made between the incentives project participants and non-participants. These are discussed in detail below.

A categorical variable was constructed to indicate whether or not respondents participated in the incentives program according to amount of incentive received (did not participate, participated with zero financial incentive, or participated with a financial incentive). I separate sex diaries participants according to those who received a financial incentive and those who got zero incentive in order to get a "pure participation effect." Essentially, if the incentives had an effect it could be confounding the outcomes. Furthermore, the effect of participation plus the effect of the incentive might both be operating and potentially cancelling each other out. Previous work using the MLSFH sex diaries survey found little effect of the incentives and even a slight negative effect of money received, meaning a decrease in protective behavior (Kohler and Thornton 2012) . This gives some indication that the incentives effect could be working

[1] In total there were 8 sero-discordant couples / 16 individuals who were dropped.
[2] The polychoric correlation values between questions 1 and 2 above is 0.342, between questions 1 and 3 above is 0.3477, and between questions 2 and 3 above is 0.914.
[3] Post-estimation tests for multicollinearity in models including both region and religion produced variance inflation

against the participation effect, justifying the necessity to separate participation according to receipt of incentives.

The outcomes analyzed address three general concepts: belief in a woman's right to protect against HIV risk, whether participants believe it is acceptable to use condoms with a spouse to protect against HIV/AIDS, and HIV risk perception and concern. To ease interpretation of the measure for attitudes towards a woman's right to protect against HIV risk principal components analysis (PCA) or principal components factoring was used to construct a composite variable made up of three separate questions: (1) Do you think it is proper for a wife to leave her husband if she thinks he might be infected with HIV?, (2) Does a woman has the right to refuse unprotected sex with her husband when she thinks her husband may have HIV/AIDS?, and (3) Does a woman has the right to refuse unprotected sex with her husband when she thinks she may have HIV/AIDS. The constructed variable from PCA for belief in a woman's right to protect against HIV risk is essentially a set of weighted linear combinations of the three variables above based on the correlation between the variables. Since all three variables are binary I use a tetrachoric correlation matrix based on the frequency of cases in each combination of responses (cross-classified proportions) to assess correlation for use in factor analysis (Joreskog 1994; Joreskog 2004) .[2] The eigenvalue for the PCA is 2.126 and the factor loadings are 0.580 for question (1), 0.945 for question (2), and 0.947 for question (3) above. Kaiser criterion suggests retention of factors with eigenvalues equal to or higher than one (Jae-on and Mueller 1978) . A higher factor loading (weight and correlation between each variable and the factor) indicates the variable is more relevant in defining the factor. The factor is generated using regression based predicted values of varimax rotated factor loadings. To give a comparable

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measure for the relatedness of the three questions used in the construction of the factor, the Cronbach's alpha value is 0.662, which is considered an acceptable level for the creation of a composite score or factor. The remaining outcome measures are dichotomous and measure (1) whether or not the respondent believes there is a chance/likelihood of becoming infected with HIV/AIDS in the future, (2) whether or not the respondent is worried a lot that he/she might catch HIV/AIDS, and (3) whether the respondent believes it is acceptable to use a condom with a spouse to protect against HIV/AIDS (in general and/or if the spouse is suspected or known to have HIV/AIDS).

To analyze the belief in a woman's right to protect against HIV risk, a continuous factor, OLS regression is used. To analyze the dichotomous outcomes (condom use acceptability with a spouse, high HIV worry, and whether or not there is a chance of becoming HIV positive in the future) a series of logistic regression models are estimated. A second set of OLS and logistic regressions are also estimated which include interaction terms between sex diaries participation and all other variables in the models in order to allow the affect of sex diaries participation to vary according to these characteristics. The interaction coefficients indicate which variables differentially affect the outcomes for sex diaries participants, giving more nuanced information about who is more likely to be influenced to change their attitudes and beliefs as a result of sex diary participation.

All regression results shown control for the following: age in continuous years, sex of the respondent, region of residence, marital status, and education. Region of residence is a three category variable indicating residence in the north (Rumphi), the south (Balaka) or the central region (Mchinji). Marital status categories include currently married, divorced, widowed or never married. Education is measured as no formal education, some/any primary school, and

some secondary school or higher. The effect of religion was also explored but is excluded from the analysis presented here because of a high association between region and religion.[3] The northern and central regions of Malawi are both approximately 90% Christian, 1% Muslim, and 9% other/none, while the southern region is approximately 72% Muslim, 25% Christian, and 3% other/none. In models including religion instead of region the substantive results remain the same. Region is preferred as a control variable because of regional variations in the number of participants in the sex diaries survey (discussed in detail below), dictating the need to control for region in comparisons between participants and non-participants.

In order to make a valid comparison between the incentives program participants and the non-participants, a pre-requisite is that the two samples must be comparable, meaning that the incentives program participant selection must be random, or at least non-random in knowable and correctable ways. Table 1 shows descriptive characteristics separately for sex diaries participants and non-participants and tests of the significance of any differences observed between the two groups. Theoretically both groups should look fairly similar, with minimal statistically significant differences on observable characteristics. This is not entirely the case, with significant differences in the number of sex diaries participants from the southern region of Malawi (Balaka). Sex diaries participants also appear to vary slightly according to marital status and religion, which is consistent with regional variations in marriage patterns and religion in Malawi (Kohler et al. 2014) Considering that all of the characteristics described are common to Balaka, the reason for much of the difference was most likely because the survey team was presumable able to spend more time collecting the sex diaries interviews in Balaka than in other regions, resulting in a sample that over represents Balaka.

[3] Post-estimation tests for multicollinearity in models including both region and religion produced variance inflation factors (VIF) of 3.18 and 3.42 for region categories, and 2.68 and 1.04 for religious categories. VIF > 2.5 is generally thought to be problematic.

In order to confirm that the sample differences were due to oversampling in Balaka, I first looked at descriptive statistics for each region separately (table 2). Most of the significant differences by religion and marital status disappear, although the percentage of married respondents in Mchinji and Rumphi is still slightly higher in the sex diaries sample. Overall, this evidence validates the idea that regional sampling differences are driving the differences in sample characteristics but to confirm this I also ran a series of logistic regressions predicting sex diaries participation (model 3). First, I examine the effect of each variable individually on the prediction of sex diaries participation (model 1), then controlling for region plus each of the other covariates individually (models 2-6), and finally controlling for all characteristics simultaneously (model 7). When included individually (model 1) region, marital status, education and religion all significantly predict sex diaries participation. Among these variables when controlling for region as well (models 2-6), only marital status retains significance in prediction sex diaries participation, meaning that when controlling for region, the only other significant difference between sex diaries participants and non-participants is marital status, which remains true with the inclusion of all control variables simultaneously. Overall, this leads to the conclusion that controlling for region and marital status is necessary in the main analysis in order to isolate the effect of sex diaries participation and alleviate concerns of biased results due to sample differences.

Even though controlling for these observable characteristics in the analysis is obviously important, it is not necessarily sufficient. Considering that we cannot know whether bias also exists due to unobservable characteristics, I also confirm that there are no differences in the outcomes of interest between the sex diaries participants and non-participants in 2006, prior to the collection of the sex diaries survey (table 4, panel A). In 2006, prior to the sex diaries

program, there are no statistically significant differences between sex diaries participants and non-participants on any outcomes except for the question, "Do you think it is acceptable to use a condom with spouse to protect against HIV/AIDS?" Most of the outcomes become significantly different between sex diaries participants and non-participants after the program, as observed in 2008 (table 4, Panel B).[4] This indicates that there are significant differences on most outcomes, which emerge after participation in the sex diaries program. In the next section I describe the main analysis, which includes regression models controlling for region, marital status and other key characteristics, as well as regression models interacting sex diaries participation with these control variables.

Results

Table 5 reports OLS and logistic regression coefficients for all outcomes. In model 1 we see that sex diaries participants who received a financial incentive are more likely to believe that a woman has the right to protect against HIV risk as compared to non-sex diaries participants. Sex diaries participants who did not receive an incentive are not more or less likely than non-sex diaries participants to believe that a woman has the right to make choices that are protective against HIV risk. Men are also significantly less likely than women to agree that women have a right to protect against HIV risk.[5] Model 2 does not show any significant difference between sex

[4] In response to the questions "Do you think a woman has the right to refuse unprotected sex with her husband when she (a) thinks her husband may have HIV/AIDS or (b) thinks she may have HIV/AIDS?" the mean percentage of respondents replying "yes" varies between survey years in an unexpected way. The overall percentage goes down in 2008 relative to 2006. Unfortunately, these questions were asked in a different sequence in the two survey years and I believe this to be the reason for the inconsistency in the level (in 2006 asked immediately following a 24 question section on religion, in 2008 asked immediately following a section on expectations which included many questions about HIV/AIDS transmission and mortality). None the less, there is still a real difference in sex diaries participants versus non-participants, regardless of this change in the level reporting "yes" across survey years.

[5] Significant coefficients for region and marital status are not interpreted because of sample variation along these dimensions.

diaries participants and non-participants in the reported likelihood of becoming HIV positive in the future. This is consistent with the descriptive results found in table 4. Although the percent reporting "no likelihood" is lower for sex diaries participants in table 4, panel B, and the point estimates in model 2 of table 5 are in the direction suggesting that participants are less likely to report "no likelihood" of future infection, none of these results are significantly different for participants as compared to non-participants. In model 3 of table 5 we find that sex diaries participants are approximately 24% less likely[6] to be very worried about catching HIV, at least among those who received an incentive to participate. Model 4 indicates that sex diaries participants who received a financial incentive are also 36% more likely[7] to believe it is acceptable to use a condom with a spouse to protect against HIV. In the descriptive results there was a significant difference between sex diaries participants and non-participants in 2006 on this outcome that was presumably accounted for by the variation in region and/or marital status between participants and non-participants. To ensure that the effect of sex diaries participation on attitudes towards condom use with a spouse is not biased in 2008, a logit model for this outcome based on the 2006 report was also conducted (results not shown). The effect of sex diaries participation was not statistically significant in this model (for those with an incentive, b = 0.297, p = 0.10; for those without an incentive b = 0.131, p = 0.34), giving more confidence in the significant result for the difference between participants and non-participants in 2008 on this outcome.

Table 6 reports OLS and logistic regression coefficients for all outcomes once again, this time including interactions between sex diaries participation and each covariate. The inclusion of interactions in table 6 allows for the possibility that the effect of sex diaries participation may

[6] $\text{Odds Ratio} = e^{-0.279} = 0.76$
[7] $\text{Odds Ratio} = e^{0.307} = 1.36$

vary according to the individual characteristics controlled for in the models. For example, female participants might be more affected by the program in a way that would make them more likely to agree that a woman has a right to protect against HIV risk as compared to men in the program. The collective significance of a potential difference in the effect of participation versus non-participation is assessed with an F-test of the joint effects of the interaction coefficients (coefficients only, not constant) at the bottom of table 6 (second page of table 6, continued on next page). By controlling for characteristics of participants and non-participants more precisely (centering results around within group means and allowing the effect to differ across all characteristics for sex diaries participants versus non-participants), the significance of the results for sex diaries participation changes and we also gain more precise information about the source of changes in attitudes as a result of sex diaries participation. In model (1) we find that sex diaries participants, both with and without incentives, are more likely than non-participants to agree that a woman has a right to take protective measures against HIV risk. In fact, those without a financial incentive, in addition to those with a financial incentive, are now more likely to agree that women have the right to take precautions against HIV risk. Furthermore the size of the effect of sex diaries participation on agreement that women have the right to protect themselves against HIV is much larger than in the previous model from table 5.[8] The significance of the coefficients give some evidence of this difference, although the F-test of the joint effect of sex diaries participation on the constant and coefficients tests the overall significance of main effect and the interaction effects combined for sex diaries participation, confirming the significance of sex diaries participation on the outcome. Furthermore, in F-tests for the significances of sex diaries participation and interactions with each covariate individually,

[8] The summation of first order effects for sex diaries participation with second order effects for the interactions with sex diaries participation are 0.158 for sex diaries participants with a financial incentive and 0.653 for sex diaries participants with no financial incentive.

all variables in the model were also significant, indicating that the effect of sex diaries participation on the outcome varies according to these characteristics.[9]

The results for reported future likelihood of HIV infection remain non-significantly different for participants and non-participants. Again, this is not surprising considering the lack of significant difference between participants and non-participants in the descriptive results from table 4. The effect of sex diaries participation on the level of worry that respondents have about future HIV infection is no longer significant in this model, meaning that allowing for the differential effect of sex-diaries participation according to individual characteristics explains the lower likelihood of reporting no future chance of HIV infection among sex diaries participants. Due to the variation between sex diaries participants and non-participants in the number of respondents by region and marital status, this model is most likely more trustworthy than the results in model 5 that control for these variables, but do not control for them while allowing the effect of participation to differ by region, marital status and the other covariates. In model 4 of table 6, the results for condom use acceptability are still significant overall (chi-squared for joint effect of sex diaries participation on constant and coefficients = 32.86, p = 0.025), although the interactions with sex diaries participation and the covariates are not significant.

Discussion

Overall, these results suggest that attitudes towards a woman's right to be proactive in making sexual behavior choices in order to protect herself from HIV risk are affected by participation in the Malawi Incentive Project, or the sex diaries project. Considering that effects

[9] Table 6, model 1 F-test values and p-values for joint significance of sex diaries participation and interactions with each variable individually are as follows: age F-test = 5.24, p=0.003; gender F-test = 3.70, p=0.005; Region F-test = 2.73, p = 0.012; marital status F-test = 2.84, p = 0.004; education F-test = 4.52, p = 0.000.

of sex diaries participation on attitudes towards a woman's right to protect against HIV risk are significantly more likely to occur for women (see table 5), this suggests that one of the unmeasured consequences of HIV prevention programs may be increasing women's beliefs in their own agency and right to adopt protective measures against HIV risk. This is very interesting evidence of potential changes in gender norms that could be occurring as a result of HIV prevention needs and HIV prevention programs. It is also consistent with some previous related research on changing gender norms and female empowerment as it relates to HIV prevention (Schatz 2005; Smith and Watkins 2005). Sex diaries participation is also suggestive of less worry about becoming HIV positive and greater acceptability of condom use with a spouse to protect against HIV, although these results largely lose significance in models controlling for other covariates and also allowing the effect of sex diaries participation to vary by these characteristics.

Receiving a financial incentive in the sex diaries program seems to increase reported program effects. It is not entirely clear whether this reflects a real effect or not. Those receiving an incentive could be more likely to report socially desirable responses to questions. However, participation in the sex diaries interviews is slightly higher among those who receive an incentive (meaning those receiving an incentive are slightly more likely to participate in a greater number of the four possible sex diaries interviews, mean number of interviews = 3.89 with incentive and = 3.81 without incentive, $t = 2.59$, $p = 0.01$). This may indicate that receipt of an incentive motivates participants to be more enthusiastic about participation and more willing to get more out of participation. Either way, the results for the effect of participation on attitudes towards a woman's right to protect against HIV risk are significant for those who both receive and do not receive an incentive. In fact, the effect of participation on attitudes towards a woman's right to

protect against HIV risk is even larger for the no incentive group in the last model. This can be thought of as a "pure participation" effect and is encouraging evidence of a real effect.

A limitation of this study is the potential overlap of incentive and control group, which could suppress the ability of researchers to see a positive change even if it is there. In particular, sex diaries participants and non-participants are from the same villages and most likely share information, particularly if they find information about HIV prevention important. However, as with randomized control trials with difficulty in measuring program effects due to overlap of intervention and control, if we were able to separate out program effects from network information sharing effects then program effects would be even stronger than they appear to be in the results of the current study. Future research continuing to monitor not only program effects, but changes in attitudes over time in general may give further insight into how attitudes towards HIV, HIV risk and HIV prevention are changing more broadly in HIV endemic communities.

Conclusion

In conclusion, although many potential positive effects of behavioral interventions and education programs in response to the HIV/AIDS epidemic in sub-Saharan Africa are difficult to measure, I find unmeasured, indirect effects of programs on attitudes towards HIV prevention behavior, HIV risk beliefs and even on female empowerment in terms of making decisions that will more likely increase women's ability to protect themselves against HIV risk. Although some may consider changes in attitudes and beliefs to be only precursors to behavioral change and reductions in HIV incidence, changes in attitudes and beliefs are certainly important in their own right. This may be especially true when thought of in terms of sharing information and beliefs

with members of broader social networks, how new behaviors become normative in a community over time, or the ways in which ideas are transmitted to new generations. The long term effects of changing attitudes and beliefs, although most likely quite difficult to gauge quantitatively, are probably significant and worth taking into consideration when evaluating the impact of HIV prevention programs.

Table 1. Descriptive Statistics among 2008 Respondents, separated by Participation in Sexual Diaries Surveys

	Sexual Diaries Participant		Not Sexual Diaries Participant		Difference		
	Mean	Std Dev	Mean	Std Dev	Means	t-test	p-value
Male	0.44	*0.50*	0.44	*0.50*	0.00	-0.03	0.98
Age	38.17	*13.36*	*37.13*	*13.33*	-1.04	-1.78	0.08
Marital Status:							
Married	0.89	*0.32*	*0.83*	*0.38*	-0.06	-3.61	0.00
Divorced	0.03	*0.18*	0.06	*0.24*	0.03	2.78	0.01
Widowed	0.02	*0.15*	0.04	*0.19*	0.02	1.93	0.05
Never Married	0.06	*0.23*	*0.07*	*0.25*	0.01	1.34	0.18
Region:							
Mchinji (center)	0.28	*0.45*	0.39	*0.49*	0.11	5.34	0.00
Balaka (south)	0.41	*0.49*	0.23	*0.42*	-0.18	-9.08	0.00
Rumphi (north)	0.31	*0.46*	0.38	*0.49*	0.07	3.33	0.00
Education:							
No Education	0.24	*0.43*	0.18	*0.38*	-0.06	-3.25	0.00
Primary	0.64	*0.48*	*0.67*	*0.47*	0.03	1.37	0.17
Secondary or more	0.12	*0.33*	0.15	*0.36*	0.03	1.92	0.06
Religion:							
Christian	0.63	0.48	0.74	*0.44*	0.11	5.27	0.00
Muslim	0.29	0.45	0.17	*0.38*	-0.12	-6.43	0.00
Other/None	0.08	0.27	0.09	*0.29*	0.01	0.85	0.40
Observations	941		1,164				

Table 2. 2008 Descriptive statistics by region, according to sex diaries participation

	Sexual Diaries		Not Sexual Diaries		Difference		
	Mean	Std Dev	Mean	Std Dev	Means	t-test	p-value
Panel A: Balaka (south):							
Male	0.41	*0.49*	0.40	*0.49*	0.00	-0.07	0.95
Age	39.57	*14.40*	37.55	*14.69*	-2.02	-1.74	0.08
Marital Status:							
Married	0.85	*0.35*	0.81	*0.39*	-0.04	-1.34	0.18
Divorced	0.05	*0.23*	0.07	*0.25*	0.01	0.70	0.48
Widowed	0.03	*0.18*	0.07	*0.25*	0.03	2.01	0.04
Never Married	0.06	*0.23*	0.05	*0.22*	-0.01	-0.45	0.65
Education:							
No Education	0.44	*0.50*	0.43	*0.50*	-0.01	-0.28	0.78
Primary	0.53	*0.50*	0.53	*0.50*	0.00	0.06	0.95
Secondary or more	0.04	*0.19*	0.05	*0.21*	0.01	0.57	0.57
Religion:							
Christian	0.27	*0.44*	0.22	*0.42*	-0.05	-1.42	0.16
Muslim	0.70	*0.46*	0.74	*0.44*	0.04	1.18	0.24
Other/None	0.03	*0.17*	0.04	*0.19*	0.01	0.45	0.65
Observations	*382*		*263*				
Panel B: Mchiji (central):							
Male	0.46	*0.50*	0.44	*0.50*	-0.02	-0.47	0.64
Age	*36.14*	*11.78*	37.10	*13.15*	0.97	0.99	0.32
Marital Status:							
Married	0.92	*0.27*	0.86	*0.34*	-0.06	-2.46	0.01
Divorced	0.02	*0.12*	0.05	*0.22*	0.04	2.52	0.01
Widowed	0.01	*0.09*	0.02	*0.15*	0.01	1.45	0.15
Never Married	0.05	*0.22*	*0.06*	*0.24*	0.01	0.46	0.64
Education:							
No Education	0.18	*0.38*	0.20	*0.40*	0.02	0.65	0.52
Primary	0.71	*0.46*	0.72	*0.45*	0.01	0.42	0.67
Secondary or more	0.11	*0.32*	0.08	*0.27*	-0.03	-1.55	0.12
Religion:							
Christian	0.91	*0.29*	0.89	*0.31*	-0.02	-0.79	0.43
Muslim	0.01	*0.11*	0.01	*0.09*	0.00	-0.34	0.73
Other/None	0.08	*0.27*	0.10	*0.30*	0.02	0.94	0.35
Observations	*264*		*455*				
Panel C: Rumphi (north):							
Male	0.46	*0.50*	0.45	*0.50*	-0.01	-0.19	0.85
Age	*38.17*	*13.09*	36.90	*12.69*	-1.27	-1.31	0.19
Marital Status:							
Married	0.89	*0.31*	0.81	*0.39*	-0.09	-3.22	0.00
Divorced	0.02	*0.15*	0.06	*0.24*	0.04	2.46	0.01
Widowed	0.03	*0.16*	0.04	*0.20*	0.01	0.96	0.34
Never Married	0.05	*0.23*	*0.09*	*0.29*	0.04	1.79	0.07
Education:							
No Education	0.03	*0.17*	0.02	*0.12*	-0.01	-1.36	0.17
Primary	0.73	*0.45*	0.70	*0.46*	-0.03	-0.92	0.36
Secondary or more	0.24	*0.43*	0.29	*0.45*	0.05	1.39	0.16
Religion:							
Christian	0.85	*0.36*	0.89	*0.32*	0.03	1.39	0.17
Muslim	0.01	*0.08*	0.00	*0.07*	0.00	-0.42	0.68
Other/None	0.14	*0.35*	0.11	*0.31*	-0.03	-1.32	0.19
Observations	*295*		*446*				

Table 3. Logistic Regressions predicting participation in sex diaries (odds ratios)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Region (Balaka):							
Balaka	2.503**	2.484**	2.508**	2.623**	2.489**	2.835**	3.055**
	(0.279)	(0.277)	(0.280)	(0.296)	(0.287)	(0.471)	(0.517)
Rumphi	1.140	1.137	1.140	1.169	1.156	1.143	1.173
	(0.123)	(0.123)	(0.123)	(0.127)	(0.129)	(0.123)	(0.134)
Age	1.006+	1.004					1.005
	(0.003)	(0.003)					(0.004)
Male	1.002		1.039				0.988
	(0.089)		(0.094)				(0.097)
Marital Status (married):							
Divorced	0.530**			0.475**			0.469**
	(0.116)			(0.106)			(0.106)
Widowed	0.580*			0.486**			0.448**
	(0.151)			(0.129)			(0.122)
Never married	0.744			0.755			0.827
	(0.137)			(0.142)			(0.171)
Education (none):							
Primary	0.725**				0.991		0.990
	(0.080)				(0.121)		(0.129)
Secondary	0.612**				0.924		0.978
	(0.094)				(0.160)		(0.190)
Religion (christian):							
Muslim	1.958**					0.845	0.799
	(0.210)					(0.147)	(0.142)
Other	1.033					1.014	0.978
	(0.166)					(0.165)	(0.160)
Constant		0.496**	0.570**	0.611**	0.588**	0.578**	0.513**
		(0.072)	(0.050)	(0.048)	(0.074)	(0.046)	(0.106)
Observations	2,105	2,105	2,105	2,103	2,105	2,104	2,102
Pseudo R-squared		0.0285	0.0280	0.0349	0.0280	0.0284	0.0363
Chi-squared		82.36	80.93	101.0	81.03	82.14	104.9

Notes: Odds Ratios in column 1 are bivariate logits for differences between samples in each variable independently. Reference categories in parentheses. s.s.: ** p<0.01, * p<0.05, + p<0.1.

Table 4. Differences betwee sex diaries participants and non-participants in outcomes of interest as observed before (2006) and after (2008) sex diaries program

	Sexual Diaries		Not Sexual Diaries		Difference		
	Mean	Std Dev	Mean	Std Dev	Means	t-test	p-value
Panel A: 2006							
Do you think it is proper for a wife to leave her husband if she thinks he might be infected with HIV?	0.19	*0.39*	0.20	*0.40*	0.01	0.75	0.45
N	*(803)*		*(932)*				
Do you think a woman has the right to refuse unprotected sex with her husband when she:							
Thinks her husband may bave HIV/AIDS?	0.67	*0.47*	0.66	*0.47*	-0.01	-0.31	0.75
N	*(801)*		*(930)*				
Thinks she may have HIV/AIDS?	0.69	*0.46*	0.68	*0.47*	-0.02	-0.81	0.42
N	*(803)*						
Women's right to protect against HIV (factor using three variables above)	0.65	*0.42*	0.64	*0.43*	-0.01	-0.41	0.68
N	*(801)*		*(928)*				
Reported no likelihood of future HIV infection	0.48	*0.50*	0.51	*0.50*	0.03	1.23	0.22
N	*(762)*		*(903)*				
Are you very worried that you might catch HIV/AIDS?	0.15	*0.36*	0.16	*0.37*	0.01	0.57	0.57
N	*(805)*		*(935)*				
Do you think it is acceptable to use a condom with spouse to protect against HIV/AIDS?	0.80	*0.40*	0.75	*0.44*	-0.06	-2.75	0.01
N	*(805)*		*(932)*				
Panel B: 2008							
Do you think it is proper for a wife to leave her husband if she thinks he might be infected with HIV?	0.28	*0.45*	0.22	*0.42*	-0.06	-2.96	0.00
N	*(901)*		*(1,127)*				
Do you think a woman has the right to refuse unprotected sex with her husband when she:							
Thinks her husband may bave HIV/AIDS?	0.52	*0.50*	0.46	*0.50*	-0.06	-2.55	0.01
N	*(901)*		*(1,126)*				
Thinks she may have HIV/AIDS?	0.57	*0.50*	0.50	*0.50*	-0.07	-3.04	0.00
N	*(901)*		*(1,126)*				
Women's right to protect against HIV (factor using three variables above)	0.56	*0.46*	0.49	*0.45*	-0.07	-3.60	0.00
N	*(896)*		*(1,123)*				
Reported no likelihood of future HIV infection	0.25	*0.44*	0.28	*0.45*	0.03	1.51	0.13
N	*(887)*		*(1,110)*				
Are you very worried that you might catch HIV/AIDS?	0.23	*0.42*	0.28	*0.45*	0.06	2.83	0.00
N	*(905)*		*(1,123)*				
Do you think it is acceptable to use a condom with spouse to protect against HIV/AIDS?	0.78	*0.41*	0.74	*0.44*	-0.04	-2.25	0.02
N	*(901)*		*(1,118)*				

Table 5. OLS and logit models predicting key outcomes

	Outcomes			
	(1)	(2)	(3)	(4)
	Women's Right to Protect Against HIV	Reported no likelihood of future HIV infection	Are you very Worried you might catch HIV?	Condom use Acceptable with Spouse to Protect against HIV?
Sexdiaries participant (non-participant):				
with incentive	0.047*	-0.112	-0.279*	0.307*
	(0.023)	(0.122)	(0.127)	(0.130)
no incentive	0.015	-0.139	-0.143	-0.206
	(0.029)	(0.155)	(0.158)	(0.150)
Age	-0.001	0.025**	-0.004	-0.014**
	(0.001)	(0.004)	(0.005)	(0.004)
Male	-0.070**	0.471**	-0.373**	-0.198+
	(0.021)	(0.113)	(0.118)	(0.116)
Region (Balaka):				
Mchinji	0.225**	-0.014	0.385*	1.099**
	(0.026)	(0.142)	(0.160)	(0.147)
Rumphi	0.062*	0.433**	1.534**	0.682**
	(0.025)	(0.130)	(0.139)	(0.129)
Marital Status (married):				
divorced	0.028	0.158	0.211	-0.074
	(0.046)	(0.242)	(0.237)	(0.250)
widowed	-0.029	0.980**	-0.755*	0.031
	(0.056)	(0.263)	(0.355)	(0.306)
never married	0.103*	0.509*	0.118	0.774*
	(0.045)	(0.228)	(0.236)	(0.310)
Education (none):				
primary	-0.044	-0.034	0.284	-0.041
	(0.028)	(0.152)	(0.175)	(0.155)
secondary	-0.015	0.019	0.343	0.065
	(0.042)	(0.222)	(0.237)	(0.234)
F statistic	12.02			
Adjusted R-squared	0.0567			
Pseudo R-squared		0.0466	0.0929	0.0505
LL Chi-squared		108.6	215.5	113.3
Observations	2,017	1,995	2,026	2,017

Notes: Standard errors in parentheses; Reference categories in parentheses. ** p<0.01, * p<0.05, + p<0.1

Table 6. OLS and logit models predicting key outcomes with interactions for sex diaries participation

	(1) Women's Right to Protect Against HIV	(2) Reported no likelihood of future HIV infection	(3) Are you very Worried you might catch HIV?	(4) Condom use Acceptable with Spouse to Protect against HIV?
Sexdiaries participant (effect on constant):				
With incentive	0.245*	-0.687	-1.152+	-0.174
	(0.101)	(0.563)	(0.638)	(0.562)
NO incentive	0.410**	-0.818	-0.944	0.107
	(0.136)	(0.770)	(0.814)	(0.708)
Interactions with Sexdiaries participation:				
Age*Sexdiaries participant with incentive	-0.006**	0.011	0.006	-0.005
	(0.002)	(0.010)	(0.011)	(0.011)
Age*Sexdiaries participant NO incentive	-0.010**	0.016	0.014	-0.015
	(0.003)	(0.014)	(0.015)	(0.014)
Male*Sexdiaries participant with incentive	-0.012	-0.321	0.383	-0.138
	(0.049)	(0.258)	(0.274)	(0.277)
Male*Sexdiaries participant NO incentive	0.110+	0.186	0.111	0.336
	(0.062)	(0.340)	(0.347)	(0.328)
Region Interactions:				
Balaka*Sexdiaries participant with incentive	0.014	0.000	0.506	0.405
	(0.060)	(0.329)	(0.405)	(0.361)
Balaka*Sexdiaries participant NO incentive	-0.014	0.038	0.289	0.107
	(0.073)	(0.424)	(0.451)	(0.398)
Rumphi*Sexdiaries participant with incentive	-0.062	-0.196	0.510	-0.467
	(0.058)	(0.310)	(0.367)	(0.316)
Rumphi*Sexdiaries participant NO incentive	-0.021	0.325	-0.091	-0.348
	(0.074)	(0.407)	(0.415)	(0.373)
Marital Status Interactions (married):				
Divorced*Sexdiaries participant with incentive	-0.162	-1.030	-0.070	-0.619
	(0.114)	(0.714)	(0.621)	(0.622)
Divorced*Sexdiaries participant NO incentive	0.336*	-1.061	-0.440	0.000
	(0.161)	(1.134)	(0.898)	(0.000)
Widowed*Sexdiaries participant with incentive	0.056	0.359	-1.010	-0.800
	(0.144)	(0.690)	(1.147)	(0.818)
Widowed*Sexdiaries participant NO incentive	0.185	-0.976	0.000	-1.939*
	(0.159)	(0.806)	(0.000)	(0.814)
Never married*Sexdiaries participant with incentive	-0.024	0.880+	-0.053	0.302
	(0.105)	(0.532)	(0.574)	(0.856)
Never married*Sexdiaries participant NO incentive	-0.186	0.734	0.454	0.640
	(0.141)	(0.743)	(0.724)	(1.177)
Education Interactions (no educ):				
Primary*Sexdiaries participant with incentive	0.092	0.298	0.131	1.049**
	(0.063)	(0.348)	(0.407)	(0.363)
Primary*Sexdiaries participant NO incentive	-0.084	-0.195	0.280	0.291
	(0.080)	(0.446)	(0.486)	(0.433)
Secondary*Sexdiaries participant with incentive	0.017	0.937+	0.166	1.182*
	(0.095)	(0.498)	(0.546)	(0.552)
Secondary*Sexdiaries participant NO incentive	-0.073	-0.128	0.250	0.054
	(0.134)	(0.737)	(0.735)	(0.714)
Observations	2,017	1,995	2,016	2,009

Notes: Standard errors in parentheses; Reference categories in parentheses. ** p<0.01, * p<0.05, + p<0.1

Table 6 (continued). First order effects and summary statistics

	(1) Women's Right to Protect Against HIV	(2) Reported no likelihood of future HIV infection	(3) Are you very Worried you might catch HIV?	(4) Condom use Acceptable with Spouse to Protect against HIV?
First order effects:				
Age	0.003*	0.021**	-0.008	-0.012*
	(0.001)	(0.006)	(0.006)	(0.006)
Male	-0.079**	0.538**	-0.488**	-0.184
	(0.029)	(0.151)	(0.156)	(0.153)
Region (Balaka):				
Balaka	0.225**	-0.024	0.225	0.973**
	(0.036)	(0.196)	(0.215)	(0.202)
Rumphi	0.082**	0.450**	1.455**	0.869**
	(0.032)	(0.165)	(0.172)	(0.165)
Marital Status (married):				
divorced	0.028	0.392	0.264	-0.081
	(0.055)	(0.276)	(0.278)	(0.288)
widowed	-0.081	1.073**	-0.406	0.588
	(0.069)	(0.328)	(0.397)	(0.437)
never married	0.138*	0.223	0.062	0.698+
	(0.057)	(0.295)	(0.297)	(0.362)
Education (none):				
primary	-0.063	-0.101	0.200	-0.411+
	(0.040)	(0.211)	(0.238)	(0.216)
secondary	-0.015	-0.214	0.257	-0.350
	(0.057)	(0.299)	(0.313)	(0.310)
F statistic	6.004			
Adjusted R-squared	0.0672			
Pseudo R-squared		0.0537	0.0957	0.0613
LL Chi-squared		125.0	221.5	137.2
Observations	2,017	1,995	2,016	2,009
Chi2 test for joint effects of sexdiaries participation on (F test for OLS regression in model 1):				
Constant only	5.98	2.13	3.84	0.15
	[0.003]	[0.345]	[0.147]	[0.926]
Coefficients only, not constant	2.25	15.74	8.55	22.78
	[0.002]	[0.611]	[0.953]	[0.1567]
Constant and coefficients	2.24	16.69	12.6	32.86
	[0.001]	[0.673]	[0.858]	[0.025]

Notes: Standard errors in parentheses; Reference categories in parentheses. Numbers in brackets [] represent probability > chi2 or F. ** p<0.01, * p<0.05, + p<0.1

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