Positive Shifts: HIV and Changes in Contraceptive Practices among Young Women in Malawi

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Abstract

A number of clinic-based studies have examined changes in condom and hormonal contraceptive use following HIV testing. However, clinic populations are subject to a number of limitations that may affect the validity of these findings. We use eight waves of data from the Tsogolo la Thanzi study in rural Malawi to examine changes in young women's use of condoms, modern contraceptives, and abstinence following positive and negative HIV tests, with a consideration for women's prior perceived HIV status. Fixed effects models show that following a surprise HIV positive result, women increase their condom use. Following a HIV negative result (whether a surprise or a confirmation of prior perception), women reduce their use of modern contraceptives, and following a surprise negative result increase their use of abstinence. We reflect on the implications of these findings for the integration of HIV and family planning programs and the expansion of HIV testing in high prevalence settings.

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Introduction

HIV testing has been expanding throughout the generalized HIV epidemics of sub-Saharan Africa for over a decade. Among other implications, testing may alter the contraceptive practices of those who learn their HIV status. Whether and how people who get tested change their condom and contraceptive use is a key determinant of future HIV transmission. Condom use reduces both the horizontal and vertical transmission of HIV. Likewise, the use of modern effective contraceptives greatly reduces vertical transmission, while potentially increasing the risk of horizontal transmission (Polis and Curtis 2013).

Existing studies on the topic are predominately clinic-based, which was highly appropriate for the way HIV testing was initially offered in communities. Along with the recent expansion of testing, however, the way in which testing is offered and the populations getting tested are beginning to shift. While testing used to be limited to those who were already suffering from advanced stages of the disease (i.e., at TB clinics), or self-selected to attend Voluntary Counseling and Testing (VCT) clinics, increasingly it is offered under an opt-out model at routine healthcare visits, or through youth clubs, places of employment, and in homes (Bassett et al. 2007; Grabbe et al. 2010; Maheswaran et al. 2012; Wettstein et al. 2012; WHO 2012).

In this paper, we use panel data from a population-based study of young women in southern Malawi to examine the effects of receiving an HIV test on subsequent contraceptive practices, including condom use, modern contraceptives, and abstinence. This paper moves beyond existing studies in several important ways. First, we examine the implications of positive and negative HIV tests, both of which can influence reproductive behavior and HIV transmission. Second, we consider the role of women's prior perceptions of their HIV status and explore whether testing "surprises" have greater behavioral implications than tests that simply confirm perceptions. Third, we examine these questions within a population-based sample in which HIV testing was randomly

offered to subsets of respondents, a sample whose responses to testing more accuratelty reflect how today's testing protocols may influence reproductive patterns. Fourth, we consider the role of abstinence, which is a reliable form of protection against pregnancy and both vertical and horizontal transmission of HIV, but has rarely been considered in studies of HIV testing and contraceptive practices. Finally, we consider the relative importance of respondents' own HIV status and that of their partners.

Background

HIV testing and contraceptive practices

Studies from across sub-Saharan Africa have generally found that condom use increases following a positive HIV test (Allen et al. 1992; Allen et al. 1993; Allen et al. 2003; Sherr et al. 2007; VHCTSG 2000). The increase in condom use may be due to post-test counseling recommendations, which often emphasize the importance of using condoms, even among seroconcordant HIV positive couples (Hayford and Agadjanian 2010). Because HIV programs are not well-integrated with family planning programs in sub-Saharan Africa (see Askew and Berer 2003), counselors are more likely to advise condom use to prevent HIV transmission than to recommend more effective (hormonal) contraceptive methods that could help avert unwanted pregnancies and the vertical transmission of HIV.

Nonetheless, condoms are often viewed unfavorably by married couples (Chimbiri 2007; Tavory and Swidler 2009), so women in stable relationships may prefer to employ other contraceptive methods if they are primarily concerned with avoiding pregnancy.

There is limited research on the effects of HIV testing on hormonal contraceptive use. Some studies suggest that an HIV positive test might increase use. Hoffman and colleagues (2008) found that married women who tested positive significantly increased their contraceptive use after HIV testing. Similarly, Balkus and colleagues (2007) reported high initiation of hormonal contraception

among HIV positive women who had recently given birth. Both of these studies are limited by their lack of a comparison HIV negative group.

We emphasize the importance of considering the effect of an HIV negative test result in addition to an HIV positive one because even in the generalized epidemics of sub-Saharan Africa the former is the most common result, it often comes as a surprise in contexts where people overestimate their likelihood of infection (Anglewicz and Kohler 2009), and people who are negative represent the population at risk for future infection.

Mechanisms influencing contraceptive practices following an HIV test

HIV testing might affect contraceptive practices via several mechanisms. Among women who are consistently partnered, HIV testing could affect condom use, the use of other contraceptives, and abstinence by altering fertility preferences, concerns about vertical or horizontal transmission, or coital frequency (and thus perceived and actual risk of pregnancy). Additionally, an HIV test could affect relationship stability and therefore lead to changes in contraceptive practices.

Changes in fertility preferences

Most evidence points to a positive HIV test prompting a reduction in the desire for future children (Cooper et al. 2007; Hoffman et al. 2008; Taulo et al. 2009; Yeatman 2009), which suggests contraceptive use would increase. Other studies argue that changes in fertility preferences in response to HIV testing vary over the life course, such that older women and those with children may be more likely to reduce their fertility desires compared to younger, nulliparous women (Hayford et al. 2012; Yeatman and Trinitapoli 2013).

Another area of literature moves away from just looking at HIV testing and instead examines how women's perceptions of their status influence fertility desires. Hayford and colleagues' (2012) found that among ever-married women in Mozambique a perception that one is HIV positive was associated with either a desire to stop or speed up childbearing, defined as a "now or never" strategy

(p. 191). This is consistent with findings from Malawi that young women who perceived themselves to be at risk for HIV infection in the near future wanted to speed up their childbearing compared to those who were confident they could remain HIV negative (Trinitapoli and Yeatman 2011). Together, these findings suggest that an HIV positive test result might lead to reduction in contraceptive use among young women who might feel a need to quickly have children while they are still healthy. In contrast, a negative HIV test result could lead to an increase in contraceptive use by reducing uncertainty about one's HIV status, and thus reducing the pressure to have children quickly. Alternatively, women who test negative might also want to have a child sooner because they are certain they are healthy. Among an older sample of reproductive age women in Malawi, Yeatman (2009) found that women who were surprised to test negative had buoyed fertility preferences, likely because their preferences had been depressed by their pre-testing perception that they were infected.

Of course, changes in fertility preferences associated with one's HIV status do not necessarily translate into changes in contraceptive use. Another study from Malawi found reduced fertility desires among couples in which both partners were positive, but no difference in their contraceptive use (Dube et al 2012).

Other potential mechanisms

Women who test HIV positive might experience heightened concern about transmitting the virus to their future children. For example, Cooper and colleagues' (2007) research from South Africa found that some women who tested positive desired to avoid pregnancy, in part because of the fear of vertical transmission. This desire to avoid pregnancy might spark increases in condom and contraceptive use or abstinence. For women in relationships who test HIV positive, concerns about both horizontal and vertical transmission might be expressed through reductions in coital frequency. Coital frequency could also decline if an HIV positive test result prompts a relationship to dissolve. For instance, Allen and colleagues (1993) found that women who tested HIV positive had sex less

often and were more likely to be single following the test compared to women who tested negative. Other studies have found that individuals manage the risk of infection from their partners by ending relationships in which they suspect their partner might be HIV positive (Reniers 2008; Schatz 2005). Relationship instability following HIV testing might thus lead to short- or long-term abstinence (elective or otherwise) or a reduction in condoms or other contraceptives. Another way that contraceptive and condom use might decrease following a negative test is by women relaxing their concerns about vertical and horizontal transmission. This may be particularly relevant for women who previously perceived themselves as at a high risk of infection or HIV positive.

Women in relationships who test positive are likely to be encouraged by HTC counselors to employ perfect condom use to protect their partners from (re)infection (Church et al. 2014). Concerns about horizontal transmission may be greater if an HIV positive woman's partner is negative, and health care providers may be hesitant to advise discordant couples to use contraceptive methods other than condoms (e.g., Crankshaw et al. 2014). This may contribute to an increase in condom use, and for some women, a switch from hormonal contraceptives to condoms. Women in relationships who test HIV negative but whose partner tests positive may be particularly motivated to use condoms. Research among couples in Zambia found a significant increase in condom use after VCT among HIV discordant couples but little change in condom use among HIV negative and concordant couples (Allen et al. 2003). Thus, a woman's perception of her partner's status is likely to be an important determinant of her contraceptive practices following HIV testing.

Methods

Data

The study uses data from Tsogolo la Thanzi (TLT)[1], a panel study of young adults living in and

[1] Tsogolo la Thanzi is a research project designed by Jenny Trinitapoli and Sara Yeatman and funded by grants R01-HD058366 and R01-HD077873 from the National Institute of Child Health and Human Development. Details are available online at: http://projects.pop.psu.edu/tlt.

around the town of Balaka in southern Malawi. TLT was designed to examine how young adults navigate transitions to marriage and childbearing while managing their high risk of HIV infection. The TLT sample was drawn from a simple random sample using a complete household listing of people living within 7 km radius of Balaka town center. Our study uses data from the 1,505 women between the ages of 15-25 who participated in the TLT baseline interview (97% response rate). TLT interviewed women 8 times, with each interview spaced approximately 4 months apart. Interviews took place at the TLT research center in private rooms.

Dependent variables

Our dependent variables are condom use, modern contraceptive use, and abstinence. Condom use is measured at the last three sexual encounters with up to three current partners. Based on this measure, we model the predictors of two forms of condom use: (i) any condom use during the last three sexual encounters and (ii) consistent condom use – using condoms at each of the last three sexual encounters with each reported partner. We focus on modern contraceptive use because of its greater efficacy at preventing unwanted conceptions compared to traditional methods. Contraceptive use is measured as any hormonal method (injectable, pill, implant), IUD, or sterilization[2] (respondent or her partner)[3] used by women in ongoing relationships. Women are coded as abstinent if they do not report any ongoing sexual partnerships.

Independent variables

The design of TLT included the randomized offer of HIV testing and counseling to respondents. At enrollment, respondents were randomly assigned to one of three groups: the first group was offered HIV testing at each wave, the second group was offered testing at Waves 4 and 8 and the final group

[2] Two respondents had been sterilized prior to Wave 1 but remain in the sample because they are still eligible to alter their condom use or practice abstinence after being tested for HIV.
[3] Male sterilization is rare in Malawi. The 2010 Malawi DHS reported that 0.8% of men 15-49 were sterilized compared to 7.5% of women in the same age range (MDHS 2011).

was offered testing at Wave 8. After respondents tested positive, they were not re-tested[4]. Following the completion of the survey, TLT respondents were offered HIV testing and counseling based on their experimental category[5]. Testing and counseling at TLT was done by TLT interviewers, all of whom had completed the Malawi Ministry of Health standard training to become HTC counselors. Thus, in theory, the guidance offered in counseling should have been identical to that offered in local VCT centers and antenatal clinics that offer testing. We acknowledge, however, that the TLT structure afforded counselors more time with their clients than did local testing clinics.

As discussed above, this study examines perceptions of HIV status in addition to the actual HIV test result. TLT measured perceptions of HIV status through an interactive probabilistic technique that assessed respondents' perceived likelihood of HIV infection. In short, an interviewer places 10 beans on a table and asks the respondent to indicate with beans the likelihood that s/he is HIV positive (see Delavande and Kohler 2009 and Trinitapoli and Yeatman 2011 for detailed descriptions of the technique and its validity in rural Malawi). Valid responses span from 0 to 10, where 0 represents certain negative and 10 represents certain positive.

We combine perceived status with HIV test results to generate four key independent variables: (1) Respondents who report some likelihood of infection prior to testing (1-10 beans) and subsequently test HIV negative at their first TLT test are classified as **surprised HIV negative**. We limit respondents to one surprise HIV negative test during the study because we anticipate that any effect of a surprise negative test will be strongest at the first such test. (2) Respondents who report no likelihood of infection (0 beans) prior to testing and subsequently test negative are considered **confirmed HIV negative.** (3) Respondents who indicate some likelihood that they are HIV positive prior to testing (<10 beans) and subsequently test positive, and respondents who are

[4] With the exception of Wave 8: Since testing was offered to all respondents at Wave 8, those who had tested positive previously were again offered testing in order to avoid the inadvertent disclosure of their status to the research team.
[5] Instructions to offer testing or not were indicated on survey coversheets, so interviewers were not aware of experimental categories.

documented to seroconvert by Wave 7, are classified as **surprised HIV positive**[6]. (4) Respondents who indicate they are certain that they are HIV positive before testing at TLT (10 beans) and test positive are considered **confirmed HIV positive.** All key independent variables are lagged so that the HIV test result from one wave is tested for an effect on condoms, contraceptive use, and abstinence at the subsequent wave.

We measure a number of time-varying mechanisms that may influence condom use, contraceptive use, and abstinence. We measure fertility preferences using a dichotomous indicator of whether a woman reports wanting a child now or whether she would like to postpone a birth by two or more years. We measure relationship status with two dichotomous indicators: whether women are married or living with a partner versus in a dating or more casual relationship; and whether women are in more than one ongoing relationship. Coital frequency is an ordinal variable ranging from "we just had sex once" to "[we had sex] 4 or more times per week". We include a dichotomous measure of current school enrollment because being enrolled in school is often associated with a desire to delay a pregnancy that could jeopardize one's academic future (Frye 2012). We include an indicator of interview wave to control for increases in contraceptive or condom use or decreases in abstinence that may have occurred as a result of maturation. Pregnancy is measured by self-report and included because of the obvious negative relationship between being pregnant and the use of contraception to prevent pregnancy. We also control for a birth that occurred between interviews because contraceptive use might increase following a birth regardless of HIV testing. Finally, we include an indicator of a woman's perception of the likelihood that her partner is HIV positive using a Likert scale ranging from "no likelihood" to "I know he is". Because practicing abstinence precludes being in a sexual relationship, models predicting a change in abstinence only include controls for fertility preferences and school enrollment.

[6] It is possible for a respondent to be classified as surprised HIV negative and surprised HIV positive if she seroconverted during the study.

Analytic Strategy

We pool all person-waves of data from the women in the TLT sample and use fixed effects logistic regression models to test for changes in condom use, modern contraceptive use, and abstinence following an HIV test. We classify all waves following a positive HIV test result as positive and all waves following an HIV test as negative until seroconversion. Hausman tests indicated that the data violate the assumption that individual-level error is not correlated with observed covariates, therefore, random effects models were not appropriate (Hausman 1978). Fixed effects models account for the structure of the panel data and the lack of independence of multiple observations (up to 8) from the same individual. A weakness of fixed effects models is that they use data inefficiently by excluding cases in which there is no change in the dependent variable. This means that our sample of respondents drops significantly when women do not change their contraceptive practices following HIV testing. However, because fixed effects models control for any observed or unobserved time-invariant variables that exist across respondents and may influence our outcome variables (Allison 1994), we believe their strengths outweigh their weaknesses.

We present a series of models investigating each dependent variable. The first model includes HIV status and perceptions (confirmed positive, surprised positive, confirmed negative, surprised negative) and wave effects. These models measure the main effects of an HIV test on changes in modern contraceptive use, condoms, and abstinence. The second model investigating each dependent variable includes the mechanisms that might mediate the relationship between HIV testing and the outcome. The series of models predicting changes in condom use include a third model that adds perception of partner's HIV status because step-wise modeling revealed that it had an important effect on the relationship between testing and condom use. In the series of models predicting changes in contraceptive use and abstinence, perception of partner's status is added in with the other mechanisms in Model 2.

Results

Table 1 includes descriptive statistics measured at Wave 1 for our sample of young Malawian women. The mean number of waves contributed is 7. The average age of respondents is 19.5. 59% of the women in the sample are in an ongoing sexual partnership at Wave 1 and almost half (49%) are married. The average number of years of education is 7.7 years, or just below completed primary, and 39% are enrolled in school. Approximately 14% of women report they would like to have a child as soon as possible and 10% are currently pregnant. Among sexually active respondents the modal frequency of intercourse is 1 to 3 times per week. Almost two thirds of respondents (61%) believe they are definitely HIV negative (0 beans) whereas only 1% believes they are definitely positive (10 beans). During the course of the study, 5% of women were surprised to test HIV positive and for 1% of respondents their positive test result confirmed their perception that they were positive. Comparatively, 22% of respondents were surprised to learn they were HIV negative whereas 29% of respondents received a confirmatory negative test result at some point during the study. 56% of women in ongoing sexual relationships believe that there is no likelihood their primary partner is infected with HIV.

Table 2 presents odds ratios from fixed effects logistic regression models predicting some condom use (Panel 1) and consistent condom use (Panel 2) at the last three sexual encounters. The first three models examine the predictors of any recent condom use. A surprise HIV positive test significantly increases the odds that a respondent uses condoms. Although they are a small group (n=19), women who know they are positive before the test (confirmed positive), experience no similar increase in the odds of using condoms after an HIV test. When potential mechanisms are added in Model 2, the relationship between a surprise positive test and any condom use remains significant. These results show several factors that significantly reduce the odds of using condoms: being enrolled in school ($p<0.05$), being married ($p<0.01$), being pregnant ($p<0.01$), desiring to have

a child as soon as possible ($p<0.05$), and having a birth since the last survey wave ($p<0.05$). There is a strong positive relationship between having two or more sexual partners and using condoms ($p<0.01$). Additionally, having sex more frequently is associated with significantly higher odds of condom use ($p<0.01$). Finally, an increase in the perceived likelihood that one's partner is infected (Model 3) is significantly associated with an increase in the likelihood of using condoms. The inclusion of this variable weakens the relationship between a woman's surprise HIV test result and any condom use, which in Model 3 is only statistically significant at the $p<0.10$ level.

Models 4-6 examine the predictors of a change in condom use from no condom use or some condom use to consistent use at the last three sexual encounters. Similar to the results for any condom use, Model 4 shows that women who are surprised to test HIV positive experience a significant increase in their odds of using condoms at every sexual encounter. Model 5 includes mechanisms that may influence changes in condom use. Most of the added variables have similar relationships as those identified in the models predicting any condom use, with one notable exception. Being involved with more than one sexual partner – a strong predictor of any condom use – is not significantly associated with a change in consistent condom use. The effect of a surprise HIV positive result remains significant despite the inclusion of potential mechanisms which might be on the pathway between the test result and a change in condom use. Model 6 adds perception of partner's HIV status. An increase in the perceived likelihood that one's partner is infected has a positive relationship with consistent condom use. Indeed, the inclusion of this variable in the model weakens the effect of the woman's surprised HIV positive test result so that it is no longer statistically significant.

Table 3 provides results for models predicting the use of modern contraceptives. Model 1 shows that women who are surprised to test negative are significantly less likely to use modern contraceptives after HIV testing. Additionally, women who thought they were negative (reported 0

beans) and subsequently tested HIV negative (confirmed negative), also have reduced odds of using modern contraception, although this finding is only significant at the $p<0.10$ level. Several mechanisms (Model 2) are significantly associated with contraceptive use. First, we see a strong time trend where modern contraceptive use increases across survey waves. Women who are enrolled in school, are pregnant, or recently had a new birth are significantly less likely to use modern contraceptives after HIV testing. Being married or living with a partner significantly increases the odds that respondents will start using effective contraception following HIV testing. Additionally, higher coital frequency is associated with significantly higher odds that women will increase their use of modern contraceptives. In contrast to the condom variables, the perceived likelihood that a woman's partner is HIV positive is not associated with contraceptive use. After including the mechanisms in Model 2, the association between both a surprise and a confirmatory negative HIV test and a lower likelihood of using contraceptives is no longer significant. This suggests that the mechanisms added in Model 2, such as desired timing of next child, getting married (or divorced), and coital frequency, are on the causal pathway linking a negative test result with reductions in modern contraceptive use.

Table 4 includes results from models predicting changes in abstinence among women after HIV testing. Model 1 shows that receiving a surprise negative test result is associated with a significant increase in the odds of practicing abstinence ($p<0.05$). A confirmatory HIV negative test result does not have the same effect and actually trends in the opposite direction (not significant). After adding the mechanisms in Model 2, the significant association between a surprise negative text and abstinence remains.

Discussion

This study found that young Malawian women often changed their contraceptive practices following HIV testing. Women who were surprised to learn that they were HIV positive were significantly

more likely to start using condoms and to employ consistent condom use after receiving their test result. Importantly all women who were tested for HIV were more likely to use condoms after testing, but only those who were surprised to test positive showed significant increases. These results suggest that the TLT HTC counseling efforts were effective at encouraging condom use by women who received testing, but at the same time hints that these messages may be the most influential for women who tested positive but did not think they were positive going into the test. Our results among a population-based sample of young women are generally consistent with studies of HIV testing and counseling that have found some secondary preventative effect (reduced risk behaviors among people who test positive) but no primary preventative effect (reduced risk behaviors among people who test negative) (Corbett et. al. 2007; Sherr et al. 2007; Weinhardt et al. 1999).

Our study also examined how changes in a woman's perception of her partner's HIV status affected her contraceptive practices. We found that just as a respondent's HIV positive test was associated with increased condom use, so was an increase in the perception that her partner was HIV positive. This suggests that both partners' statuses influence the likelihood of condom use within relationships.

We found that following an HIV negative test women were less likely to use modern contraceptives. This relationship was particularly strong among women who were surprised to learn that they were negative. These same women were more likely to be abstinent in the period following their test as well, which may explain their lower contraceptive use. Supplemental models found that women who received a surprise negative test were less likely to be married after their test, and women whose negative test confirmed their perception that they were HIV negative were significantly more likely to want to speed up their childbearing following a test (not shown). These findings taken together suggest potentially divergent mechanisms linking an HIV test to reduced modern contraceptive use—those surprised by their negative result may end the relationship they

thought had put them at risk, and those for whom the test served as confirmation of their negative status may choose to have a child sooner while they are still healthy.

An important aspect of our study is the inclusion of a random sample of young unmarried women who move into and out of sexual relationships during the course of the study. Such a sample is likely to better approximate the types of women who will be tested for HIV through newer and alternative means, such as home-based testing or testing in schools, compared to traditional, higher-risk samples of women seeking testing, such as those who voluntarily visit testing clinics. And yet, our study is limited by the small sample of women who felt certain that they were HIV positive prior to the test (n=19). This limits our ability to draw conclusions about this group and to incorporate interaction effects examining the potentially different roles of mechanisms for women receiving a surprise or confirmatory HIV test result.

Our study is one of the first to measure the effect of an HIV test result in tandem with perceptions of HIV status prior to testing, which we have shown are associated with important differences in post-test contraceptive practices. Including only information about women's test results would provide more statistical power to our results, but would likely result in some loss of nuance, given the significant differences we found in women's contraceptive practices by their status and prior perception of status. Researchers and policymakers interested in the effects of HIV testing on contraceptive practices and on other sexual or nonsexual outcomes should bear in mind that for many, especially under expanding models of opt-out testing, a test result offers little new information from which to expect a behavior change. Our evidence suggests that individuals whose test result confirms their belief that they are HIV positive might be less likely to increase their use of condoms, despite the importance of condoms for reducing transmission. However, the strong relationship between a woman's perception that her partner is positive and increases in condom use in our study suggests that testing and counseling couples together may be an effective strategy to

increase condom use among those who test positive. Additionally, our results show that an HIV negative test can have real consequences for contraceptive behavior. On the one hand, our findings suggest that the lack of change in condom use and the reduction in modern contraceptive use following an HIV negative test may be driven by changes in fertility preferences or reduced sexual exposure associated with the test result. To the extent that a negative test leads to reduced contraceptive use through a desire to get pregnant, as long as the decision is made with knowledge of a woman's own and her partner's status, it has little implication for vertical transmission of HIV. However, to the extent that a woman's own status may influence her behavior, but she has incomplete knowledge of her partner's status, reducing contraceptive use to have a child sooner could put a woman at risk of both horizontal and vertical transmission if her partner is positive. Our results emphasize the need to expand couple-based testing and counseling services and further integrate family planning with HTC in sub-Saharan Africa to enable women and their partners – whether they test negative or positive – to safely fulfill their reproductive goals.

References

Allen, Susan, Jeffrey Tice, Philippe Van de Perre, Antoine Serufilira, Esther Hudes, Francois Nsengumuremyi, Joseph Bogaerts, Christina Lindan, and Stephen Hulley. 1992. "Effect of Serotesting with Counselling on Condom Use and Seroconversion among HIV Discordant Couples in Africa." *British Medical Journal* 304: 1605-1609.

Allen, Susan, Antoine Serufilira, Valerie Gruber, Susan Kegeles, Philippe Van de Perre, Michel Carael, and Thomas J. Coates. 1993. "Pregnancy and Contraception Use among Urban Rwandan Women after HIV Testing and Counseling." *American Journal of Public Health* 83: 705-710.

Allen, Susan, Jareen Meinzen-Derr, Michele Kautzman, Isaac Zulu, Stanley Trask, Ulgen Fideli, Rosemary Musonda, Francis Kasolo, Feng Gao, and Alan Haworth. 2003. "Sexual Behavior of HIV Discordant Couples after HIV Counseling and Testing." *AIDS* 17: 733-740.

Allison, Paul D. 1994. "Using Panel Data to Estimate the Effects of Events." *Sociological Methods & Research* 23(2): 174-199.

Anglewicz, Philip and Hans-Peter Kohler. 2009. "Overestimating HIV Infection: The Construction and Accuracy of Subjective Probabilities of HIV Infection in Rural Malawi." *Demographic Research* 20(6): 65-96.

Askew, Ian and Marge Berer. 2003. "The Contribution of Sexual and Reproductive Health Services to the Fight Against HIV/AIDS: A Review." *Reproductive Health Matters* 11(22): 51-73.

Balkus, Jennifer, Rose Bosire, Grace John-Stewart, Dorothy Mbori-Ngacha, Melissa A. Schiff, Dalton Wamalwa, Christine Gichuhi, Elizabeth Obimbo, Grace Wariua, and Carey Farquhar. 2007. "High Uptake of Postpartum Hormonal Contraception Among HIV-1-Seropositive Women in Kenya." *Sexually Transmitted Diseases* 34(1): 25-29.

Bassett, Ingrid V., Janet Giddy, Jacques Nkera, Bingxia Wang, Elena Losina, Zhigang Lu, Kenneth A. Freedberg, and Rochelle P. Walensky. "Routine Voluntary HIV Testing in Durban, South Africa: The Experience From an Outpatient Department." *JAIDS Journal of Acquired Immune Deficiency Syndromes* 46(2): 181-186.

Chimbiri, Agnes M. 2007. "The Condom is an 'Intruder' in Marriage: Evidence from Rural Malawi." *Social Science & Medicine* 64: 1102-1115.

Church, Kathryn, Alison Wringe, Phelele Fakudze, Joshua Kikuvi, Zelda Nhlabatsi, Rachel Masuku, Integra Initiative, Susannah H. Mayhew. 2014. "Reliance on Condoms for Contraceptive Protection among HIV Care and Treatment Clients: A Mixed Methods Study on Contraceptive Choice and Motivation within a Generalised Epidemic." *Sexually Transmitted Infections* Published Online First 12 April 2014. doi:10.1136/sextrans-2013-051339

Cooper, Diane, Jane Harries, Landon Myer, Phyllis Orner, and Hillary Bracken. 2007. "'Life is still going on': Reproductive Intentions among HIV-positive Women and Men in South Africa." *Social Science & Medicine* 65: 274-283.

Corbett, Elizabeth L., Beauty Makamure, Yin Bun Cheung, Ethel Dauya, Ronnie Matambo, Tsitsi Bandason, Shungu S. Munyati, Peter Mason, Anthony Butterworth, and Richard J. Hayes. 2007. "HIV Incidence During a Cluster-Randomized Trial of Two Strategies Providing Voluntary Counselling and Testing at the Workplace, Zimbabwe." *AIDS* 21(4): 483-489.

Crankshaw, Tamaryn L., Deborah Mindry, Chantal Munthree, Thabo Letsoalo, and Pranitha Maharaj. 2014. "Challenges with Couples, Serodiscordance and HIV Disclosure: Healthcare Provider Perspectives on Delivering Safer Conception Services for HIV-affected Couples, South Africa." *Journal of the International AIDS Society* 17: 18832.

Delavande, Adeline and Hans-Peter Kohler. 2009. "Subjective Expectations in the Context of HIV/AIDS in Malawi." *Demographic Research* 20: 817-874.

Dube, Albert L.N., Angela Baschieri, John Cleland, Sian Floyd, Anna Molesworth, Fiona Parrott, Neil French, and Judith R. Glynn. 2012. "Fertility Intentions and Use of Contraception among Monogamous Couples in Northern Malawi in the Context of HIV Testing: A Cross-Sectional Analysis." *PLoS ONE* 7(12): e51861.

Frye, Margaret. 2012. "Bright Futures in Malawi's New Dawn: Educational Aspirations as Assertions of Identity. *American Journal of Sociology* 117(6): 1565-1624.

Grabbe, Kristina L., Nick Menzies, Miriam Taegtmeyer, Gideon Emukule, Patrick Angala, Irene Mwega, Geraldine Musango, and Elizabeth Marum. 2010 "Increasing Access to HIV Counseling and Testing through Mobile Services in Kenya: Strategies, Utilization, and Cost-effectiveness." *JAIDS Journal of Acquired Immune Deficiency Syndromes* 54(3): 317-323.

Hausman, J. A. 1978. "Specification Tests in Econometrics." *Econometrica* 46(6): 1251-1271.

Hayford, Sarah R. and Victor Agadjanian. 2010. "Providers' Views Concerning Family Planning Service Delivery to HIV-positive Women in Mozambique." *Studies in Family Planning* 41(4): 281-300.

Hayford, Sarah R., Victor Agadjanian, and Luciana Luz. 2012. "Now or Never: Perceived HIV Status and Fertility Intentions in Rural Mozambique." *Studies in Family Planning* 43(3): 191-199.

Hoffman, Irving F., Francis E.A. Martinson, Kimberly A. Powers, David A. Chilongozi, Emmie D. Msiska, Emma I. Kachipapa, Chimwemwe D. Mghande, Mina C. Hosseinipour, Harriet C. Chanza, Rob Stephenson, and Amy O. Tsui. 2008. "The Year-Long Effect of HIV-Positive Test Results on Pregnancy Intentions, Contraceptive Use, and Pregnancy Incidence among Malawian Women." *JAIDS Journal of Acquired Immune Deficiency Syndromes* 47(4): 477-483.

Maheswaran, Hendramoorthy, Hilary Thulare, Debbi Stanistreet, Frank Tanser, and Marie-Louise Newell. 2012. "Starting a Home and Mobile HIV Testing Service in a Rural Area of South Africa." *JAIDS Journal of Acquired Immune Deficiency Syndromes* 59(3): e43-e46.

(MDHS) National Statistical Office (NSO) and ICF Macro. 2011 *Malawi Demographic and Health Survey 2010*. Zomba, Malwai and Calverton, Maryland, USA: NSO and ICF Macro.

Polis, Chelsea B. and Kathryn M. Curtis. 2013. "Use of Hormonal Contraceptives and HIV Acquisition in Women: A Systematic Review of the Epidemiological Evidence." *The Lancet Infectious Diseases* 13: 797-808.

Reniers, Georges. 2008. "Marital Strategies for Regulating Exposure to HIV." *Demography* 45(2): 417-438.

Schatz, Enid. 2005. "'Take your mat and go!': Rural Malawian Women's Strategies in the HIV/AIDS Era." *Culture, Health & Sexuality* 7(5): 479-492.

Sherr, Lorraine, Ben Lopman, Memory Kakowa, Sabada Dube, Godwin Chawira, Constance Nyamukapa, Nicole Oberzaucher, Ide Cremin, and Simon Gregson. 2007. "Voluntary Counselling and Testing: Uptake, Impact on Sexual Behaviour, and HIV Incidence in a Rural Zimbabwean Cohort." *AIDS* 21: 851-860.

Taulo, Frank, Mark Berry, Amy Tsui, Bonus Makanani, George Kafulafula, Qing Li, Chiwawa Nkhoma, Johnstone J. Kumwenda, Newton Kumwenda, Taha E. Taha. 2009. "Fertility Intentions of HIV-1 Infected and Uninfected Women in Malawi: A Longitudinal Study." *AIDS and Behavior* 13: S20-S27.

Tavory, Iddo and Ann Swidler. 2009. "Condom Semiotics: Meaning and Condom Use in Rural Malawi." *American Sociological Review* 74: 171-189.

Trinitapoli, Jenny and Sara Yeatman. 2011. "Uncertainty and Fertility in a Generalized AIDS Epidemic." *American Sociological Review* 76: 935-954.

The Voluntary HIV-1 Counseling and Testing Study Group (VHCTSG). 2000. "Efficacy of Voluntary HIV-1 Counseling and Testing in Individuals and Couples in Kenya, Tanzania, and Trinidad: A Randomized Trial." *Lancet* 356(9,224): 103–112.

Weinhardt, Lance S., Michael P. Carey, Blair T. Johnson, and Nicole L. Bickham. 1999. "Effects of HIV Counseling and Testing on Sexual Risk Behavior: A Meta-Analytic Review of Published Research, 1985-1997." *American Journal of Public Health* 89(9): 1397-1405.

Wettstein, Celina, Catrina Mugglin, Matthias Egger, Nello Blaser, Luisa Salazar, Janne Estill, Nicole Bender, Mary-Ann Davies, Gilles Wandeler, and Olivia Keiser. 2012. "Missed Opportunities to Prevent Mother-to-Child-Transmission in Sub-Saharan Africa: Systematic Review and Meta-Analysis. *AIDS* 26(18): 2361–2373.

World Health Organization (WHO). 2012. "Service Delivery Approaches to HIV Testing and Counseling (HTC): A Strategic HTC Policy Framework." Geneva, Switzerland: World Health Organization. www.who.int

Yeatman, Sara. 2009. "HIV Infection and Fertility Preferences in Rural Malawi." *Studies in Family Planning* 40(4): 261-276.

Yeatman, Sara. 2009. "The Impact of HIV Status and Perceived Status on Fertility Desires in Rural Malawi." *AIDS and Behavior* 13: S12-S19.

Yeatman, Sara and Jenny Trinitapoli. 2013. "'I Will Give Birth But Not Too Much': HIV-Positive Childbearing in Rural Malawi." Pp. 93-109 in *Women, Motherhood and Living with HIV/AIDS: A Cross-Cultural Perspective*, edited by Pranee Liamputtong. Dordrecht, Netherlands: Springer Science+Business Media.

Table 1. Descriptive Statistics from Women aged 15-25 at Wave 1, TLT 2009-201

Variables		% or mean, SD	n
HIV positive test			
	Surprised	4.6	69
	Confirmed	1.3	19
HIV negative test			
	Surprised	22.2	334
	Confirmed	28.8	434
Perception of HIV status			
	Certain negative (0 beans)	61.3	922
	Some likelihood (1-9 beans)	37.4	561
	Certain positive (10 beans)	1.3	19
Total number of survey waves		7.0, 1.9	
Age		19.5, 3.3	1505
Enrolled in school		39.3	592
Years of education		7.7, 2.8	1495
Ongoing sexual relationship		58.6	882
>1 ongoing sexual partnership		0.5	8
Married/living with partner		48.8	734
Currently pregnant		9.5	143
Wants a child in <2 years		13.8	205
Coital frequency			
	Not having sex	30.3	456
	We just had sex once	6.7	101
	<2 times per month	9.2	139
	A couple of times per month	16.4	246
	1-3 times per week	29.8	449
	4+ times per week	7.6	114
Likelihood that partner is HIV positive			
	No likelihood	56.0	494
	Low	32.2	284
	Medium	9.8	86
	High	1.5	13
	I know he is	0.6	5

Table 2. Odds Ratios from Fixed Effects Logistic Regression Models Predicting Condom Use after HIV Testing

	Any condom use			Consistent condom use		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Surprised HIV positive	2.46 **	2.66 **	1.81 +	2.50 *	2.43 *	1.62
Confirmed HIV positive	1.63	1.77	1.31	1.19	1.18	0.81
Surprised HIV negative	1.33	1.30	1.39	1.27	1.18	1.22
Confirmed HIV negative	1.25	1.34	1.37	1.00	1.06	1.08
Wave 1	1.00	1.00	1.00	1.00	1.00	1.00
Wave 2	0.81	1.25	1.18	1.29	1.50 +	1.42
Wave 3	0.69 *	1.15	1.08	1.29	1.65 *	1.54 +
Wave 4	0.78	1.34	1.22	1.35 +	1.79 *	1.65 *
Wave 5	0.62 **	1.04	0.96	1.29	1.72 *	1.61 +
Wave 6	0.66 *	1.18	1.05	1.19	1.67 +	1.53
Wave 7	0.57 **	0.98	0.90	1.29	1.77 *	1.65 +
Wave 8	0.64 *	1.09	0.97	1.58 *	2.25 **	2.01 **
Enrolled in school		0.61 *	0.61 *		0.91	0.92
Married/living with partner		0.23 **	0.23 **		0.20 **	0.20 **
Currently pregnant		0.18 **	0.18 **		0.13 **	0.13 **
Wants a child ASAP		0.71 *	0.71 *		0.70 *	0.69 *
Had a recent birth		0.60 *	0.56 **		0.57 *	0.53 *
>1 ongoing partnership		5.13 **	4.75 **		0.33	0.31
Coital frequency		1.38 **	1.35 **		1.34 **	1.31 **
Partner's likelihood of infection			1.43 **			1.45 **
Log Likelihood	-1310.19	-1188.40	-1163.26	-1028.32	-932.34	-910.36
Chi2	16.61	236.39	286.68	18.16	198.11	242.05
Pseudo R2	0.01	0.09	0.11	0.01	0.10	0.12
N	3710	3675	3675	2943	2922	2922

** p<0.01, * p<0.05, + p<0.10

Table 3. Odds Ratios from Fixed Effects Logistic Regression Models Predicting Modern Contraceptive Use after HIV Testing

	Model 1	Model 2
Surprised HIV positive	0.69	0.71
Confirmed HIV positive	0.50	0.33
Surprised HIV negative	0.69 *	0.89
Confirmed HIV negative	0.78 +	0.98
Wave 1	1.00	1.00
Wave 2	1.05	4.03 **
Wave 3	1.41 **	4.75 **
Wave 4	1.44 **	4.76 **
Wave 5	1.83 **	5.09 **
Wave 6	2.29 **	6.04 **
Wave 7	2.51 **	5.73 **
Wave 8	2.37 **	4.30 **
Enrolled in school		0.32 **
Married/living with partner		3.90 **
Currently pregnant		0.00 **
Wants a child ASAP		0.24 **
Had a recent birth		0.25 **
>1 ongoing partnership		1.29
Coital frequency		1.37 **
Partner's likelihood of infection		1.05
Log Likelihood	-1992.26	-1381.31
Chi2	85.00	1280.93
Pseudo R2	0.02	0.32
N	4944	4909

** $p<0.01$, + $p<0.10$

Table 4. Odds Ratios from Fixed Effects Logistic Regression Models Predicting Abstinence after HIV Testing

	Model 1	Model 2
Surprised HIV positive	1.67	1.62
Confirmed HIV positive	1.95	1.62
Surprised HIV negative	1.44 *	1.47 *
Confirmed HIV negative	0.82	0.84
Wave 1	1.00	1.00
Wave 2	0.83	0.48 **
Wave 3	0.84	0.49 **
Wave 4	0.63 **	0.37 **
Wave 5	0.40 **	0.24 **
Wave 6	0.27 **	0.16 **
Wave 7	0.22 **	0.13 **
Wave 8	0.15 **	0.09 **
Enrolled in school		2.59 **
Wants a child ASAP		0.59 **
Log Likelihood	-1454.44	-1381.31
Chi2	291.61	1280.93
Pseudo R2	0.09	0.32
N	4086	4909

** $p<0.01$, * $p<0.05$