HIV Testing, Behavior Change, and the Transition to Adulthood in Malawi

KATHLEEN BEEGLE, MICHELLE POULIN, and GIL SHAPIRA
World Bank

For young women and men, decisions about school attendance, sexual and marital partnerships, and fertility shape one's life course and have long-term implications on well-being. Such decisions typically involve a trade-off between short-term and long-term utility in the face of much uncertainty. The AIDS epidemic in much of sub-Saharan Africa further complicates the framework within which these kinds of trade-offs are considered. First, these decisions directly affect exposure to risk of HIV infection. Young people are well aware that some avenues toward adulthood (e.g., leave school, marry soon after, have a child soon after) lead to different risk of exposure to HIV infection than others (Poulin 2007; Clark, Poulin, and Kohler 2009). Second, young people may face these pivotal decisions with uncertainty about their current HIV status and expected life horizon.

Throughout sub-Saharan Africa, young people are coming of age at a time when AIDS policy emphasizes HIV counseling and testing. International and local public health communities view HIV testing and the counseling that accompanies it as the gateway to treatment. But even for those who test negative, it is also hoped that testing will result in preventive behaviors that slow the spread of the epidemic.[1] There has been a rapid expansion of voluntary counseling and testing (VCT) coverage in Malawi, achieved through outreach and mobilization initiatives such as Malawi's annual "Testing Week" and an increased supply of such services (Angotti 2010; Angotti, Dionne, and Gaydosh 2011). Data from the 2004 Malawi Demographic and Health Survey (MDHS) show that only 15% of men had been tested during the previous

The views expressed here do not necessarily reflect those of the World Bank or its member countries. The authors are grateful for comments from anonymous reviewers, Sarah Baird, Erick Gong, Rachel Heath, Jennifer Johnson-Hanks, Susan Watkins, and participants at the 2012 Mini-Conference on Marriage and HIV in San Francisco, CA, and at the PopPov Conference on Population, Reproductive Health, and Economic Development in Accra, Ghana. Contact the corresponding author, Kathleen Beegle, at kbeegle@worldbank.org.

[1] For example, the government of Malawi's (2003) National HIV/AIDS Policy report strongly promotes testing as a general prevention policy through a reduction in risky behaviors, as well as through improvement in access to treatment and mother-to-child transmission prevention.

Electronically published April 8, 2015

year, whereas data from the from MDHS 2010 show that 51% of men had ever been tested and 31% of men reported having been tested in the past 12 months (NSO and ICF Macro 2011). Women were more likely to have been tested in the past 12 months (72% tested). This partly reflects the introduction of testing through ante-natal surveillance sites in the early years of the epidemic.

In this article we use the Marriage Transitions in Malawi (MTM) data set, a panel study of initially never-married young women and men in central Malawi, to evaluate how, if at all, VCT influences behaviors of young people. The survey introduced a testing opportunity for a random set of respondents during the second year of the 3-year panel. We examine behaviors closely linked with the transition to adulthood and HIV risk. In particular, we estimate the intent-to-treat effect of the VCT intervention on school attendance, marriage, fertility, and reported sexual behavior in the year after the test.

Testing may alter these behaviors in several ways. Consider its potential effect on sexual behavior. If a man discovers he is negative, for example, he could commit to maintaining his status by carefully choosing partners, by choosing monogamy, by using condoms, or perhaps by seeking circumcision. A positive result might lead to a decision to engage in risky sexual behavior as incentives to protect against infection might no longer exist. But, this same man could be concerned about infecting others and therefore opt for safer behaviors.

Taking a broader view, removing uncertainty about one's status may affect expectations of young people about their life expectancy as well as opportunities that will be available to them in the future. In turn, it may alter present or near-term decisions with long-term implications, such as investments in human capital through staying in school, selection of partners, and timing of marriage and fertility. Beliefs about one's own HIV status can also translate into beliefs about the survival of (yet to be born) children, since the virus can be transmitted from mothers to their newborns. Therefore, learning one's status might affect the desired number and timing of births. Trinitapoli and Yeatman (2011), for example, find that compared to those who express certainty that they are HIV negative, those who are uncertain about their HIV status are likely to desire accelerated childbearing.

These mechanisms presume that individuals update their beliefs about their own status after learning their test result. Behavioral responses to a test therefore may depend on the extent to which one's beliefs about one's infection status changed. For example, an unmarried, 18-year-old woman who believes her likelihood of current infection to be low may be less likely to change her behavior after a negative test result compared to a young woman who believed her likelihood to be high but learns she is not infected.

VCT has the potential to affect behaviors beyond the impact of a revealed test result. A VCT intervention includes pre- and posttest counseling by trained and certified counselors. During these sessions, counselors not only provide information about how to avoid infection but also encourage deliberate decision making with respect to sexual and reproductive health (Angotti 2010). Although our data show that almost all respondents were aware of correct ways to avoid infection (see also Watkins 2004), the interactions with the counselors could have motivated them to behave in certain ways, especially those that would reduce the risk of contracting HIV.

We begin our analysis by examining the overall effect of VCT on selected behaviors of young men and women. We then proceed to examine the effects of VCT by prior beliefs, employing empirical strategies similar to Boozer and Philipson (2000) and Gong (2015). The results of both analyses show a negligible effect of VCT on the considered behaviors, with modest effects for men suggesting a slower transition to adulthood. We then examine heterogeneous effects of VCT by household wealth. We choose to focus on wealth because our data, as well as other studies, show a very strong correlation between wealth and the behaviors that our study focuses on. Wealth affects not only the set of possible choices available to young adults, but it can also influence expectations about opportunities and well-being in the future. The results of this analysis indicate that the VCT offer is associated with lower marriage rates and initiation of fertility among poorer young women who report some likelihood of being infected and wealthier young men. This is ex post analysis that was not included in the experimental design. Therefore, while informative, the results should be cautiously interpreted.

Evidence on Testing

There are a handful of studies purposively designed to examine the impact of testing on risky sexual behaviors.[2] Delavande and Kohler (2012), in investigating this phenomenon with a sample of adults in Malawi, exploit a random assignment in vouchers for cash to be redeemed upon retrieval of one's test result from temporary VCT sites. They examine the effect of testing on a range of risky behaviors and show that selectivity into testing is important for inferring the impact of testing. Learning one is HIV-positive results in fewer partners and more condom use up to 2 years later. Using the same voucher experiment as Delavande and Kohler, Thornton (2008) finds that individuals

[2] Gersovitz (2011) discusses studies that explore the implications of testing with nonrandom testing. See also Potts et al. (2008).

who receive a positive test result are more likely to purchase condoms 2 months later. However, she does not find a significant effect for those who learned a negative test result. She also does not find that beliefs about one's status before testing matter in terms of impact of testing.

Other studies have also considered the role of beliefs about own infection and the updating of beliefs after learning a test result. Using data from Nairobi, Kenya, and Dar es Salaam, Tanzania, Gong (2015) finds that individuals who learn that they are positive (and did not think so before that test) are more likely to engage in risky sexual behavior after being tested—what he describes as an "unintended consequence of testing" (33).[3] In San Francisco, a very different setting but among the earliest empirical studies on the topic, Boozer and Philipson (2000) find that among unmarried individuals, testing induces a change in behavior only if the tested person was surprised by the test result. Like the Gong study, this finding stresses the importance of prior states of uncertainty, or prior beliefs, in learning the results of a test.

Baird et al. (2014) report results of an experiment similar to the one described in this article.[4] Their sample was of adolescent girls in one district in southern Malawi who were randomly offered VCT in 2009. The randomization was across communities (52 getting VCT and 36 with no VCT). The sample was reinterviewed 10 months later. Baird and colleagues found that learning a positive test result led to an increase in the likelihood of contracting Herpes Simplex Virus, with a higher likelihood of contraction for those surprised by the test result. Among those who tested negative, achievement test scores were improved, a finding they interpret to be that those with longer perceived life horizons have greater incentive to invest in human capital.

In this study, we evaluate the effect of testing on outcomes for both young women and men. We examine the effect of VCT on sexual behavior but also on a range of other interrelated outcomes specific to the transition from adolescence to adulthood. Focusing on this period during the life cycle is of specific policy relevance because of the emphasis on youth as a targeted HIV at-risk population throughout sub-Saharan Africa (Poulin, Dovel, and Watkins 2014).

[3] The characteristics of Gong's sample are different from those of the Malawi sample used by Delavande and Kohler and Thornton in several dimensions that could potentially explain the opposite results. Individuals in his sample are less likely to be married and reside in urban areas with higher HIV prevalence than the largely rural areas where the Malawi data were collected. Gong's sample consists of people who were seeking HIV-related services, not a random sample of the population. Two-thirds of the baseline sample attrite by follow-up 6 months later.

[4] Although the age ranges are almost the same between Baird et al. (2014) and ours (women age 13–22 and 14–21, respectively), there are notable differences. The women in their sample are more likely to be in school (75% compared to 43%) and less likely to be married (9% compared to 21%). Our sample is closer to national statistics from the MDHS 2010. Ninety percent of young women in the Baird et al. (2014) study report no chance of being infected with HIV, compared to 71% in our sample.

Setting and Data

The potential for VCT to affect behaviors related to the transition into adulthood is important when considering the social and economic environments facing young people in a poor country like Malawi. Education levels remain very low. According to the MDHS from 2010, 16% of young men age 25–29 had completed secondary school, and fewer than 5% had attended postsecondary school; among women in this age group, 8% had completed secondary school and less than 3% had attended school beyond the secondary level (NSO and ICF Macro 2011). Poverty remains high. There are few opportunities for nonfarming employment and secondary education, age at first marriage remains young, and nearly everyone marries at least once. Median ages at first marriage for respondents age 25–49 are 17.8 for women and 22.5 for men.

Malawi has a generalized HIV epidemic; prevalence among the 15–49-year-old population is estimated to be 10.6% (NSO and ICF Macro 2011) with a steep age gradient. The HIV prevalence among 15–17-year-old young women is 3.4%, while that of 18–19-year-olds is 5.7%. The prevalence is 1.3% among 15–19-year-old men but increases to 4.6% among 23–24-year-olds and 6.9% for those 25–29. Prevalence rates among never-married women and men (our study sample at baseline) are about half of the rates among those ever married. Prevalence rates are much higher in urban Malawi than in rural areas like our study site.

This study uses data from the MTM project, a panel survey conducted in 60 rural and semiurban communities in the Salima district of central Malawi. The project was designed to understand socioeconomic patterns of young adults as they transition into adulthood and with an emphasis on HIV/AIDS. The connection between the two is motivated largely by the search for a spouse. This search is associated with an assessment of potential partners, leading to changes in partners or in unprotected sex to ensure the potential spouse is fertile (Clark et al. 2009; Poulin and Beegle 2014). In some countries in south and eastern Africa, the rate of new infections rises during this search process (Glynn et al. 2003; Magruder 2011).

The study consists of 1,183 initially never-married young women and men and was designed to follow them into marriage.[5] Three annual household surveys were conducted (2007, 2008, 2009), with two Partnership Interview surveys conducted midway between the annual surveys.[6] The data contain

[5] Sixty enumeration areas were randomly selected from a sample of 215 areas stratified by distance to main trading centers. The sampling frame for respondents within the enumeration areas was stratified by age for men and women. More information on the sample design is available at http://www.sites.google.com/site/mtmalawiproject/mtmbackground.

[6] In between the three main summer rounds from 2007 to 2009, the MTM study included an interim survey round for a two-thirds of the sample randomly selected and then interviewed with a

detailed information on partnering behavior as well as socioeconomic conditions, including asset ownership and family background. Since this age group is highly mobile, the MTM study made additional efforts to track sample respondents who relocated after the baseline round in 2007 (Beegle and Poulin 2013). This is especially important since marriage itself often results in moving to a new village or town. Tracking proved important for ensuring recontact rates; more than one-quarter of respondents moved during the course of the panel.

For this analysis, we include respondents interviewed during all three annual household surveys. This sample consists of 1,009 respondents, 529 women and 480 men. In the 2008 round, a random sample of respondents was offered an HIV test.[7] Of the 1,009 respondents, 531 (53%) were randomly offered VCT. The test was administered by trained and certified VCT counselors in the privacy of each respondent's residence. The test result was offered immediately. Ninety-three percent of those offered a test consented to it; of these, only five respondents opted to not learn their status.[8] There are only minimal differences between those who refused the test and those who accepted: men with no schooling were less likely to accept the test; women from wealthier households were more likely to accept the test. Both men and women who had been tested in the past were more likely to accept the offer of a test. Of those tested, less than 1% of the men (2 out of 237) and 2% of the women (4 out of 274) were HIV positive.

In table 1 we report sample characteristics at the 2008 round, by gender and by whether respondents were offered an HIV test. The results reflect the randomization process, whereby the principal investigators generated a random number program in Stata for selection. The variables are well balanced across the control and treatment groups. Variable-by-variable individual tests reported in the table cannot reject that the means are the same for the two groups for almost all the variables.

Women in the sample range in age from 14 to 21 (by design), with a mean age of 17. Nearly all women have some schooling, and 32% have attended

modified questionnaire. These Partnership Interviews focused on significant life events over the 6 months prior, especially on changes in sexual and partnership behavior. We do not use this round for this analysis for two reasons. First, the roughly 5–6 months between summer 2008 and the interim round in 2009 may be too short for the behavior changes we examine. Second, we want to examine results for the complete sample.

[7] Of the 174 respondents who are not in either round 2 or 3, three-quarters were not found, and the rest refused to participate. Those lost to attrition have comparable sociodemographic characteristics as the tracked sample (results not reported).

[8] For comparison, note that Trinitapoli and Yeatman (2011) had an acceptance rate of 80% for a sample of young adults in southern Malawi in 2009. MDHS 2010 had testing rates of about 90% for women and 83% for men (15–24). Baird et al. (2014) tested 98% of their sample of adolescent women.

TABLE 1

SAMPLE CHARACTERISTICS BY GENDER AND TREATMENT

	Young Women				Young Men			
	All (N = 529)	Control (N = 233)	Treatment (N = 296)	Difference (t-Test)	All (N = 480)	Control (N = 245)	Treatment (N = 235)	Difference (t-Test)
Age	16.68	16.72	16.65	.07	20.34	20.47	20.21	.26
	(1.63)	(1.68)	(1.59)	(.14)	(1.83)	(1.92)	(1.74)	(.17)
Schooling:								
None	.02	.02	.01	.01	.03	.04	.03	.004
Primary	.66	.69	.64	.06	.62	.62	.63	−.01
Secondary	.32	.28	.35	−.07	.31	.29	.33	−.03
Tribe:								
Chewa	.63	.63	.63	−.01	.65	.67	.63	.04
Yao	.19	.18	.20	−.01	.19	.19	.19	.001
Ngoni	.09	.10	.09	.01	.08	.08	.08	−.004
Wealth:								
2nd quartile	.24	.27	.22	.05	.27	.26	.28	−.02
3rd quartile	.26	.26	.27	−.01	.25	.24	.26	−.02
4th quartile	.24	.22	.26	−.05	.22	.24	.21	.03
Married	.21	.21	.20	.01	.16	.15	.17	−.02
In school	.43	.42	.44	−.02	.24	.22	.26	−.03
Sexually active	.44	.47	.42	.05	.59	.61	.58	.03
Ever had sex	.59	.62	.57	.05	.85	.88	.82	.06*
Ever pregnant	.15	.16	.14	.02	.16	.14	.19	−.04
Tested before	.40	.45	.37	.09	.53	.52	.53	−.01
Reports no likelihood of being infected	.71	.71	.71	.00	.92	.95	.90	.05**

Note. Outcomes in Marriage Transitions in Malawi 2008 round. With the exception of age, all covariates are binary indicators. Standard deviations in parentheses. Treatment refers to being offered a test. Control indicates no test offer.

* Significant at 10% level.

** Significant at 5% level.

secondary school. At the time of the testing offer in 2008, 43% were still attending school. Fifty-nine percent of women reported ever having sex, and 44% reported having had sex in the 12 months before the 2008 interview. Fifteen percent reported ever being pregnant and 21% were married.

The average age of the men in the sample is 20, ranging from 14 to 26.[9] Thirty-one percent of men have attended at least some secondary school, and 62% have attended some primary school. At the time of the 2008 interview, 24% of men were attending school. The lower percentage of men attending school reflects the older ages relative to the women. The men were also more likely than women to have ever had sex and to report being currently sexually active. Eighty-five percent reported ever having sex, and 59% reported being sexually active. Sixteen percent of men reported ever having impregnated a woman. The same proportion of men was married. Because of the widespread availability of VCT in Malawi, it is not surprising that just under half of the sample had been tested before the testing offered by the MTM VCT team. Men were more likely to have been tested than women (53% vs. 40%).

As discussed above, those tested, and especially when recently tested, may respond differently to an additional test than would those tested for the first time in their lives. Table 2 shows the traits of men and women in 2008 by their prior testing status. Those with a prior testing experience were on average older, had higher education, and were more likely to be married, sexually active, and to have ever been pregnant (for women) or to report having impregnated a woman (for men). In each interview round, respondents reported on the likelihood they were infected with HIV. Respondents chose one of four categories: no likelihood, low likelihood, medium likelihood, and high likelihood. Table 3 shows these stated beliefs in 2008, just before the testing offer. The table reports the beliefs overall and by some specific traits. Generally this sample reported low levels of beliefs about their own infectivity; very few reported a medium or high likelihood that they were HIV infected, so that most fall within the "no likelihood" or "low likelihood" categories.[10] There are notable gender differences in the reporting of low likelihood. While 28% of young women assigned at least some likelihood to being infected, only 8% of men reported the same. Some variation also exists across social and demographic groups. *T*-tests confirm that respondents were significantly more likely

[9] Because of the later age of marriage for men, the MTM project purposefully aimed for the sample of young men to be older than that of young women.

[10] This distribution likely reflects the young age of the respondents, although the same question posed to adults in rural Malawi yielded a similarly lopsided distribution, albeit with slightly greater percentages falling into the medium and high likelihood categories (Smith and Watkins 2005).

TABLE 2
SAMPLE CHARACTERISTICS BY TESTING BEFORE 2008 ROUND

	Young Women			Young Men		
	Not Tested (N = 316)	Tested (N = 213)	Difference (t-Test)	Not Tested (N = 228)	Tested (N = 252)	Difference (t-Test)
Age	17.35	18.16	−.82***	21.09	21.56	−.47***
Schooling:						
Primary	.71	.58	.13***	.69	.56	.13***
Secondary	.27	.39	−.12***	.26	.36	−.10**
Tribe:						
Chewa	.63	.63	.00	.68	.62	.06
Yao	.21	.17	.04	.17	.2	−.03
Ngoni	.08	.12	−.04	.07	.08	−.01
Wealth:						
2nd quartile	.25	.22	.03	.28	.26	.02
3rd quartile	.25	.29	−.04	.26	.25	.01
4th quartile	.22	.27	−.04	.18	.26	−.08**
In school	.50	.33	.17***	.25	.23	.01
Married	.12	.33	−.21***	.11	.19	−.08**
Sexually active	.33	.6	−.27***	.54	.64	−.10**
Ever had sex	.48	.75	−.27***	.83	.86	−.03
Ever pregnant	.04	.30	−.26***	.11	.22	−.11***

Note. Outcomes in Marriage Transitions in Malawi 2008 round.
** Significant at 5% level.
*** Significant at 1% level.

to assign at least some likelihood to being infected if they ever had sex, were currently sexually active, or were ever pregnant. Young women were more likely to assign no likelihood if they were attending school and less likely to do so if they were married. Men were more likely to assign no likelihood of being infected if they had been tested for HIV before the interview. The analysis that follows examines the differential results of a test offer by these self-reported likelihoods.

Estimated Causal Effects

To examine the impact of testing on subsequent behaviors, we study the intent-to-treat effect on six outcomes that capture key events experienced by young people in the transition from adolescence to adulthood. We focus on school attendance, marriage, fertility, and sexual behaviors as measured in 2009, a year after the VCT offer. Specifically, the six outcome indicators used in the analysis are (i) *stay in school*:[11] an indicator for whether a respondent is attending school in 2009, conditional on being in school in 2008 (respondents

[11] Because reentry into primary or secondary school after leaving school is rarely observed in our sample, we examine school enrollment conditional on being enrolled in the baseline, in 2007.

TABLE 3
LIKELIHOOD OF BEING HIV INFECTED IN 2008

	Young Women				Young Men			
	No	Low	Medium	High	No	Low	Medium	High
All	.71	.25	.02	.01	.92	.05	.02	.00
Schooling:								
Primary	.72	.25	.02	.01	.92	.05	.03	.00
Secondary	.70	.27	.02	.01	.95	.05	.00	.00
Tribe:								
Chewa	.73	.25	.02	.00	.92	.06	.02	.00
Yao	.71	.28	.00	.01	.94	.01	.02	.02
Wealth:								
2nd quartile	.74	.26	.01	.00	.89	.09	.02	.01
3rd quartile	.74	.23	.03	.00	.98	.02	.01	.00
4th quartile	.67	.31	.02	.01	.90	.08	.03	.00
In school	.78	.21	.00	.01	.94	.05	.01	.00
Married	.63	.34	.02	.01	.92	.05	.01	.01
Sexually active	.64	.32	.03	.01	.89	.08	.02	.01
Ever had sex	.65	.31	.03	.01	.91	.06	.02	.00
Ever pregnant	.62	.33	.05	.00	.86	.08	.04	.03
Tested before	.68	.28	.03	.01	.94	.03	.02	.01

Note. Share of respondents for each trait reported by the four categories to answer the question "In your opinion, what is the likelihood (chance) that you are infected with HIV/AIDS now?"

who report the highest grade level of secondary school as the highest grade attended by 2008 are excluded);[12] (ii) *got married*: married in 2009 conditional on having not being married in 2008; (iii) *first pregnancy*: pregnancy between 2008 and 2009 conditional on no pregnancy before the VCT intervention (for men, this is an indicator for ever impregnating a sexual partner); (iv) *number of pregnancies*: cumulative number of pregnancies (for men, it includes pregnancies for all partners); (v) *sexually active and not yet married*: reporting having had sex in the 12 months before the 2009 interview, excluding respondents who are married in 2008; and (vi) *multiple partners*: an indicator for reporting more than one sexual partner in the past year.

Given the random allocation of testing offers and the balance between the treatment and control groups, differences in outcomes' means between groups can be attributed to the VCT intervention and interpreted as intent-to-treat effects. Therefore, we present our results in terms of mean-comparison tests.[13]

[12] There are very high barriers to continuation from secondary to tertiary education in Malawi.

[13] Age is highly correlated with most of the outcomes that we focus on. Therefore, although the average age in the treatment and control groups is overall balanced, the age composition of the groups might influence the results when we do the subgroup analysis or restrict the sample for some of our outcomes. To verify that this is not driving our results, we performed an additional analysis of the full set of results presented in the article by regressions with age fixed effects. This analysis resulted in treatment effects that are similar to those presented here.

As discussed above, the effect of learning one's HIV status may depend on the individual's beliefs about his or her own HIV status before the test offer. In a manner similar to the empirical approaches employed by Boozer and Philipson (2000) and Gong (2015), we explore how the testing effect varies by these beliefs. We analyze separately the effects on the group that assigned no likelihood to being HIV infected in 2008 from those on the group that assigned any likelihood. We combine the low, medium, and high likelihood categories because less than 3% of respondents chose the medium or high categories. We observe very few men who express any likelihood of being infected, so we perform this subgroup analysis for our sample of young women only.

Table 4 presents results of the main specification for young women. Each column presents results for an estimation of one of the six outcomes of interest. We do not find a statistically significant effect of VCT on any of the outcomes. Moreover, the differences between the study groups are small in magnitude. These findings—a lack of impact of VCT—are similar to the outcomes for the sample of women in Baird et al. (2014; with the caveat in n. 4 on sample comparability).

Table 4 also presents results for young men.[14] As for the young women, we observe little response to the test offer. All the outcomes indicate a slower transition to adulthood among the group who received the VCT offer. However, for four out the six outcomes, the difference between the groups is not statistically significant. Men who are not married when tested are 7 percentage points less likely to be married a year after receiving VCT offer. Men who report having never impregnated a woman before getting tested are 8 percentage points less likely to impregnate a woman in the following year. Both of these effects are significant at the 10% level. These findings' lack of significance for most outcomes leads us to conclude that there are negligible effects for young men.

There are several reasons why offering an HIV test for young people might have little or no impact on behaviors. In settings such as Malawi where testing is now common, a new test might only provide marginal information, reflecting risk of exposure since the previous test and not since first sex. In addition, young people have had short durations of exposure to risk of HIV infection. In our data this is reflected in the results of the HIV tests, where only a handful of respondents were found to be HIV infected. It is also reflected in the low levels of likelihood that respondents assigned to being infected before taking the test. Consequently, for many of the respondents it is likely that learning

[14] The sample sizes for the schooling outcomes conditional on 2008 enrollment are smaller since the sampled men are older and, therefore, less likely overall to be in school in 2008.

TABLE 4
EFFECT OF VOLUNTARY COUNSELING AND TESTING ON OUTCOMES IN 2009

	Stay in School[a]	Got Married[b]	First Pregnancy[c]	No. of Pregnancies	Sexually Active[d]	Multiple Partners[e]
			Young Women			
Control	.624	.234	.379	.502	.402	.009
Test offer	.723	.191	.341	.446	.447	.024
Difference	−.099	.043	.038	.056	−.045	−.015
	(.065)	(.040)	(.046)	(.053)	(.049)	(.011)
Sample size:						
Control	93	184	195	233	184	233
Test offer	119	236	255	296	235	296
			Young Men			
Control	.683	.181	.290	.434	.575	.142
Test offer	.731	.113	.213	.386	.521	.094
Difference	−.048	.068*	.078*	.048	.054	.047
	(.096)	(.035)	(.043)	(.057)	(.050)	(.029)
Sample size:						
Control	41	193	193	226	193	226
Test offer	52	212	207	254	211	254

Note. Mean outcomes as measured in the 2009 round. Standard errors of the difference in means in parentheses.
[a] Excluding respondents in the fourth year of secondary school.
[b] Conditional on not being married in the 2008 round.
[c] Conditional on no pregnancies by the 2008 round.
[d] Reports having sex in the 12 months before interview, excluding respondents who report being married in 2008.
[e] Reports more than one sexual partner in the 12 months before interview.
* Significant at 10% level.

test results did not provide new information that would alter behaviors. Third, learning a negative test result, as most of our respondents did, provides information only about current HIV status. As these youth reside in a setting with a generalized epidemic, they might still perceive high risk of infection associated with different behaviors and high uncertainty for future status.

Table 5 presents the results of our second specification, interacting testing with prior beliefs for young women. This is an ex post analysis, as the randomization was not designed in regard to prior beliefs. We find that reported likelihood of being HIV positive does not change the results above. For those who assigned at least some likelihood to being infected with HIV, only one of the six outcomes is significant at the 10% level: the testing offer resulted in a decrease of 13 percentage points of marriage for those who were not married in 2008 when they reported a likelihood of being positive. Among those who report no likelihood of being infected, we find that a test offer yields a positive effect on remaining in school in subsequent rounds (significant at the 10% level). Yet we find no significant effect on fertility and sexual behaviors,

TABLE 5
EFFECT OF VOLUNTARY COUNSELING AND TESTING BY PRIOR BELIEFS, YOUNG WOMEN

	Stay in School[a]	Got Married[b]	First Pregnancy[c]	No. of Pregnancies	Sexually Active[d]	Multiple Partners[e]
Likelihood:						
Control	.706	.292	.463	.591	.542	0
Test offer	.643	.159	.418	.588	.516	.012
Difference	.063	.133*	.045	.003	.026	−.012
	(.148)	(.079)	(.091)	(.101)	(.097)	(.013)
No likelihood:						
Control	.605	.215	.348	.464	.356	.012
Test offer	.747	.202	.314	.389	.422	.028
Difference	−.142*	.013	.034	.075	−.066	−.016
	(.072)	(.047)	(.052)	(.061)	(.056)	(.015)
Sample size:						
Likelihood:						
Control	17	65	54	66	65	66
Test offer	28	98	67	85	98	85
No likelihood:						
Control	76	65	141	166	65	166
Test offer	91	98	188	211	98	211

Note. Mean outcomes as measured in the 2009 round. "Likelihood" represents whether respondent assigned any likelihood to being infected with HIV in the 2008 round. Standard errors of the difference in means in parentheses.
[a] Excluding respondents in the fourth year of secondary school.
[b] Conditional on not being married in the 2008 round.
[c] Conditional on no pregnancies by the 2008 round.
[d] Reports having sex in the 12 months before interview, excluding respondents who report being married in 2008.
[e] Reports more than one sexual partner in the 12 months before interview.
* Significant at 10% level.

regardless of the level of prior beliefs. We conclude that there is basically no impact of testing for those who reported any likelihood (mostly low) of being infected or for those who reported no likelihood.

Wealth Effects

Wealth is closely linked with the behaviors considered in this article. Wealth can determine which choices are available to young men and women. Paying for secondary school fees, for example, is often not feasible for poor households. Wealth can also affect the relative valuation of different choices. Consider a woman's decision to marry and leave the household. The higher the level of consumption she receives in her current household, the less attractive any marital offer is. In addition, wealth can affect perceptions about opportunities and well-being in the future. This might influence choices that involve trade-offs between current and future utilities. For instance, a young person's decision about whether to engage in risky sex may be influenced by his or her present valuation of expected utility flows in the future.

Our data show that household wealth and the outcomes of interest for this article are strongly correlated. In table 6 we report results for different outcomes measured in the 2009 round on respondents' age and an indicator for household wealth above the median in the baseline survey. Household wealth is defined by an asset index using principal component analysis. Wealth is associated with a slower transition to adulthood. Relative to their poorer counterparts, young men and women of higher wealth are significantly more likely to report attending school in the end line survey. They are also less likely to be married, to ever be pregnant, or to report ever having sex. The wealthier young women are also less likely to report being sexually active.

These trends observed in our data are consistent with findings in other studies. In a similar setting in southern Malawi, cash transfers that increase income have been shown to significantly delay school exit, marriage, and fertility onset of young women in Malawi and to reduce the prevalence of sexually transmitted diseases (Baird, McIntosh, and Özler 2011; Baird et al. 2012). In addition, several studies suggest that variation in income is linked to engaging in transactional sex—sexual relationships that are primarily motivated by material support to the female partner from the man (e.g., Robinson and Yeh 2011; Kohler and Thornton 2012; Burke, Gong, and Jones 2014).

TABLE 6
CORRELATION BETWEEN WEALTH AND TRANSITION BEHAVIOR

	In School	Married	Ever Pregnant	No. of Pregnancies	Sexually Active[a]	Multiple Partners[b]	Ever Had Sex
				Young Women			
High wealth	.254***	−.22***	−.134***	−.17***	−.14***	.003	−.13***
	(.038)	(.041)	(.042)	(.052)	(.043)	(.011)	(.039)
Age	−.06***	.032**	.052***	.062***	.028**	.002	.038***
	(.012)	(.013)	(.013)	(.016)	(.013)	(.004)	(.012)
N	524	524	524	524	523	524	524
R^2	.114	.062	.044	.044	.025	.001	.035
				Young Men			
High wealth	.119***	−.12***	−.156***	−.24***	−.082*	−.027	−.06***
	(.033)	(.040)	(.042)	(.054)	(.045)	(.030)	(.024)
Age	−.05***	.048***	.055***	.063***	.028**	−.011	.024***
	(.009)	(.011)	(.012)	(.015)	(.012)	(.008)	(.007)
N	472	472	472	472	471	472	472
R^2	.095	.057	.071	.073	.018	.006	.041

Note. Mean outcomes as measured in the 2009 round. "High wealth" indicates that household wealth index in 2007 is above median. Standard errors of the difference in means in parentheses.
[a] Reports having sex in the 12 months before interview, excluding respondents who report being married in 2008.
[b] Reports more than one sexual partner in the 12 months before interview.
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

Given this background, we could expect that one's response to VCT may differ depending on household wealth. To that end, we complement our study with an ex post analysis of heterogeneous effects of testing by a household's wealth. The original randomization in the test offer was a simple randomization with no regard to wealth status at baseline.

To explore heterogeneity in response to testing by a household's wealth, we perform the mean-comparison tests separately for individuals whose household wealth index in the baseline is below or above the median. Finally, we also explore heterogeneity in response to testing by both wealth and prior beliefs. When splitting the sample by both wealth and prior belief categories, we note that there are smaller cell sizes and less power to detect impacts.

In table 7, we present the effects of VCT on the two wealth groups. Overall, we find negligible effects for young women. Among those from poorer households who were attending school in 2008, the likelihood of attending school in 2009 increases by 19 percentage points after receiving a VCT offer. This effect is statistically significant at the 10% level. The coefficients for the marital and fertility outcomes are negative but not statistically significant. The effects of the testing offer are not statistically significant on any of the outcomes for young women of higher wealth.

Table 8 presents the results of a test offer across four groups of young women: women of lower wealth and some likelihood reported, women of lower wealth who assign no likelihood to being infected, women of higher wealth who assign some likelihood, and women of higher wealth who assign no likelihood. Among women who are poorer and report some likelihood of being infected, the test offer reduces the likelihood of getting married by 30 percentage points. The likelihood of having ever been pregnant a year after the test is also reduced by 32 percentage points. Both of these effects are significant at the 5% level. Among the richer young women who assign some likelihood of being infected, one test out of six appears significant at the 10% level. Those who were never pregnant by the time of the VCT offer were 20 percentage points more likely to ever be pregnant a year later. The test offer does not affect these outcomes for those who assign no likelihood to being infected, regardless of wealth status.

Table 7 also presents results for the model interacting the test offer with a household's wealth for young men. We observe more impacts of testing for wealthier men, but not across all outcomes. The testing offer has statistically significant effects on marital and fertility outcomes for young men of higher wealth. For these men, a test offer results in a 10 percentage point decrease in the likelihood of getting married conditional on not being married at the time of the test. In addition, the testing offer resulted in a decrease of 12 percentage points in the likelihood of ever impregnating a sexual partner and a

TABLE 7

EFFECT OF VOLUNTARY COUNSELING AND TESTING BY WEALTH

	Stay in School[a]	Got Married[b]	First Pregnancy[c]	No. of Pregnancies	Sexually Active[d]	Multiple Partners[e]
	Young Women					
Low wealth:						
Control	.457	.326	.475	.590	.477	.008
Test offer	.644	.265	.400	.518	.461	.022
Difference	−.187*	.061	.075	.072	.016	−.014
	(.111)	(.067)	(.068)	(.078)	(.073)	(.015)
High wealth:						
Control	.724	.155	.280	.410	.340	.009
Test offer	.767	.138	.301	.394	.442	.026
Difference	−.043	.016	−.022	.016	−.102	−.017
	(.077)	(.047)	(.061)	(.070)	(.066)	(.017)
Sample size:						
Low wealth:						
Control	35	86	101	122	86	122
Test offer	45	102	115	137	102	137
High wealth:						
Control	58	97	93	110	97	110
Test offer	73	130	136	155	129	155
	Young Men					
Low wealth:						
Control	.765	.196	.337	.509	.588	.155
Test offer	.733	.175	.320	.534	.563	.107
Difference	.031	.021	.017	−.026	.026	.048
	(.158)	(.055)	(.067)	(.088)	(.071)	(.043)
High wealth:						
Control	.609	.167	.242	.358	.556	.119
Test offer	.735	.064	.124	.216	.486	.086
Difference	−.127	.102**	.118**	.142**	.060	.033
	(.127)	(.044)	(.054)	(.065)	(.071)	(.020)
Sample size:						
Low wealth:						
Control	17	102	101	116	102	116
Test offer	15	97	97	131	96	131
High wealth:						
Control	23	90	91	109	90	109
Test offer	34	109	105	116	109	116

Note. Mean outcomes as measured in the 2009 round. "High (low) wealth" indicates that household wealth index in 2007 is above (below) median. Standard errors of the difference in means in parentheses.

[a] Excluding respondents in the fourth year of secondary school.

[b] Conditional on not being married in the 2008 round.

[c] Conditional on no pregnancies by the 2008 round.

[d] Reports having sex in the 12 months before interview, excluding respondents who report being married in 2008.

[e] Reports more than one sexual partner in the 12 months before interview.

* Significant at 10% level.

** Significant at 5% level.

TABLE 8

EFFECT OF VOLUNTARY COUNSELING AND TESTING BY PRIOR BELIEFS AND WEALTH, YOUNG WOMEN

	Stay in School[a]	Got Married[b]	First Pregnancy[c]	No. of Pregnancies	Sexually Active[d]	Multiple Partners[e]
Low wealth/likelihood:						
Control	.667	.471	.708	.833	.647	0
Test offer	.667	.172	.387	.61	.414	0
Difference	0	.299**	.321**	.223	.233	0
	(.327)	(.133)	(.131)	(.147)	(.152)	0
High wealth/likelihood:						
Control	.714	.194	.267	.389	.484	0
Test offer	.6	.156	.471	.595	.613	.024
Difference	.114	.037	−.204*	−.206	−.129	−.024
	(.182)	(.097)	(.120)	(.135)	(.127)	(.026)
Low wealth/no likelihood:						
Control	.438	.29	.403	.511	.435	.011
Test offer	.636	.301	.405	.479	.479	.031
Difference	−.198	−.011	−.002	.032	−.044	−.02
	(.123)	(.077)	(.078)	(.091)	(.084)	(.021)
High wealth/no likelihood:						
Control	.727	.138	.286	.411	.277	.014
Test offer	.81	.133	.245	.319	.388	.027
Difference	−0.083	.006	.041	.92	−.111	−.013
	(.084)	(.055)	(.071)	(.081)	(.076)	(.022)
Sample size:						
Low wealth/likelihood:						
Control	3	17	24	30	17	30
Test offer	12	29	31	41	29	41
High wealth/no likelihood:						
Control	14	31	30	36	31	36
Test offer	15	32	34	42	31	42
Low wealth/no likelihood:						
Control	32	69	77	92	69	92
Test offer	33	73	84	96	73	96
High wealth/no likelihood:						
Control	44	65	63	73	65	73
Test offer	58	98	102	113	98	113

Note. Mean outcomes as measured in the 2009 round. "Likelihood" represents whether respondent assigned any likelihood to being infected with HIV in the 2008 round. "High (low) wealth" indicates that household wealth index in 2007 is above (below) median. Standard errors of the difference in means in parentheses.

[a] Excluding respondents in the fourth year of secondary school.

[b] Conditional on not being married in the 2008 round.

[c] Conditional on no pregnancies by the 2008 round.

[d] Reports having sex in the 12 months before interview, excluding respondents who report being married in 2008.

[e] Reports more than one sexual partner in the 12 months before interview.

* Significant at 10% level.

** Significant at 5% level.

reduction of 0.14 in the total number of pregnancies. Additional analysis of wealth quartiles (more flexibility but smaller cells) shows that these impacts are concentrated among the wealthiest quartile. The VCT offer did not result in a statistically significant effect on any outcome for the poorer young men—results are both statistically insignificant and small in size.

Discussion

The international community concerned with the AIDS epidemic in Africa views HIV testing as a critical policy prescription needed to combat the disease. This view has led to a huge investment in making HIV tests widely accessible in most African countries. Testing people is a critical entry point into treatment, which can lower infectiousness and, thus, serve to mitigate the spread of the disease. But testing and the counseling that accompanies it are also supported as a means to affect behaviors to reduce transmission rates. It is this latter relationship we study here. We explore the response to HIV testing on sexual behavior and the timing of important life events among young people in Malawi. By looking at a random sample of men and women, we contribute to a small but growing body of studies that randomize testing and explore behavior change in response to VCT.

We find little response to an HIV test among our outcomes. We see no impact of the VCT intervention on any of the behaviors by young women. The results for men suggest some slowdown in the transition toward adulthood in response to the VCT intervention as measured by marriage and impregnating a sexual partner. Despite a generalized epidemic, these results are consistent with the high rates of prior testing, the low rates of infectivity among young adults, and the low levels of reported likelihood of infection—characteristics of many settings in sub-Saharan Africa where testing is touted as a means to change behaviors. The majority of young men and women report there is no or little chance they are infected. As such, a test does not offer new information, although it does provide confirmation about one's prior beliefs.

We do look for heterogeneity in response to a test through a set of ex post analysis looking at prior beliefs and wealth. These are ex post in the sense that the original study was a randomization without regard to these traits. The wealth effects differ for women and men. The poorer young women, who assigned some likelihood to being infected before receiving the VCT offer, are less likely to transition into marriage or fertility a year after the intervention. Among the young men, it is the wealthier ones who are less likely to be married or to father children a year after the VCT offer. This heterogeneity by socioeconomic status can result from the different set of opportunities richer and poorer young adults face and the different expectations they have about their futures. It could also be

that testing influences decisions similarly, but because of the different propensities to engage in the different behaviors, independent of testing, we can only observe significant changes in behaviors for some groups.

References

Angotti, Nicole. 2010. "Working Outside the Box: How HIV Counselors in Sub-Saharan Africa Adapt Western Testing Norms." *Social Science and Medicine* 71, no. 5: 986–93.

Angotti, Nicole, Kim Yi Dionne, and Lauren Gaydosh. 2011. "An Offer You Can't Refuse? Provider-Initiated HIV Testing in Antenatal Clinics in Rural Malawi." *Health Policy and Planning* 26, no. 4:307–15.

Baird, Sarah, Erick Gong, Craig McIntosh, and Berk Özler. 2014. "The Heterogeneous Effects of HIV Testing." *Journal of Health Economics* 37:98–112.

Baird, Sarah, Craig McIntosh, and Berk Özler. 2011. "Cash or Condition? Evidence from a Cash Transfer Experiment." *Quarterly Journal of Economics* 126, no. 4:1709–53.

Baird, Sarah J., Richard S. Garfein, Craig T. McIntosh, and Berk Özler. 2012. "Effect of a Cash Transfer Programme for Schooling on Prevalence of HIV and Herpes Simplex Type 2 in Malawi: A Cluster Randomised Trial." *Lancet* 379, no. 9823: 1320–29.

Beegle, Kathleen, and Michelle Poulin. 2013. "Migration and the Transition to Adulthood in Contemporary Malawi." *Annals of the American Academy of Political and Social Science* 648, no. 1:38–51.

Boozer, Michael, and Tomas Philipson. 2000. "The Impact of Public Testing for Human Immunodeficiency Virus." *Journal of Human Resources* 35, no. 3:419–46.

Burke, Marshall, Erick Gong, and Kelly Jones. 2014. "Income Shocks and HIV in Africa." *Economic Journal* (forthcoming).

Clark, Shelley, Michelle Poulin, and Hans-Peter Kohler. 2009. "Marriage Aspirations and HIV/AIDS in Rural Malawi." *Journal of Marriage and the Family* 71:396–416.

Delavande, Adeline, and Hans-Peter Kohler. 2012. "The Impact of HIV Testing on Subjective Expectations and Risky Behaviors in Malawi." *Demography* 49, no. 3: 1011–36.

Gersovitz, Mark. 2011. "HIV Testing: Principles and Practice." *World Bank Research Observer* 26, no. 1:1–41.

Glynn, Judith R., Michel Caraël, Anne Buvé, Rosemary M. Musonda, Maina Kahindo, and Study Group on the Heterogeneity of HIV Epidemics in African Cities. 2003. "HIV Risk in Relation to Marriage in Areas with High Prevalence of HIV Infection." *Journal of Acquired Immune Deficiency Syndromes* 33, no. 4:526–35.

Gong, Erick. 2015. "HIV Testing and Risky Sexual Behavior." *Economic Journal* 125, no. 582:32–60.

Government of Malawi. 2003. "National HIV/AIDS Policy: A Call to Action." Government of Malawi, Lilongwe.

Kohler, Hans-Peter, and Rebecca L. Thornton. 2012. "Conditional Cash Transfers and HIV/AIDS Prevention: Unconditionally Promising?" *World Bank Economic Review* 26, no. 2:165–90.

Magruder, Jeremy. 2011. "Marital Shopping and Epidemic AIDS." *Demography* 14, no. 4:1401–28.

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

Potts, Malcolm, Daniel T. Halperin, Douglas Kirby, Ann Swidler, Elliot Marseille, Jeffrey D. Klausner, Norman Hearst, Richard G. Wamai, James G. Kahn, and Julia Walsh. 2008. "Reassessing HIV Prevention." *Science* 320:749–50.

Poulin, Michelle. 2007. "Sex, Money, and Premarital Partnerships in Southern Malawi." *Social Science and Medicine* 65, no. 11:2383–93.

Poulin, Michelle, and Kathleen Beegle. 2014. "Out-of-Wedlock Fertility and the Timing of First Marriage in Malawi." Photocopy, World Bank, Washington, DC.

Poulin, Michelle, Kate Dovel, and Susan Watkins. 2014. "AIDS: Wealthy Men and the 'Vulnerable Women' Client Category." Photocopy, World Bank, Washington, DC.

Robinson, James, and Ethan Yeh. 2011. "Transactional Sex as a Response to Risk in Western Kenya." *American Economic Journal: Applied Economics* 3, no. 1:35–64.

Smith, Kirsten P., and Susan Cotts Watkins. 2005. "Perceptions of Risk and Strategies for Prevention: Responses to HIV/AIDS in Rural Malawi." *Social Science and Medicine* 60, no. 3:649–60.

Thornton, Rebecca. 2008. "The Demand for and Impact of Learning HIV Status: Evidence from a Field Experiment." *American Economics Review* 98, no. 5:1829–63.

Trinitapoli, Jenny, and Sara Yeatman. 2011. "Uncertainty and Fertility in a Generalized AIDS Epidemic." *American Sociological Review* 76, no. 6:935–54.

Watkins, Susan. 2004. "Navigating the AIDS Epidemic in Rural Malawi." *Population and Development Review* 30, no. 4:673–705.