Changes in HIV/AIDS Knowledge and Testing Behavior in Africa: How Much and for Whom?

Peter Glick and David Sahn

African Development and Poverty Reduction: The Macro-Micro Linkage

Forum Paper 2004

13 - 15 October 2004
Lord Charles Hotel, Somerset West, South Africa

Development Policy Research Unit
Trade and Industrial Policy Strategies
Cornell University

Sponsors

Changes in HIV/AIDS Knowledge And Testing Behavior In Africa: How Much and for Whom?

By

Peter Glick
Cornell University
pjg4@cornell.edu

and

David Sahn
Cornell University
david.sahn@cornell.edu

Paper prepared for the conference
"African Development and Poverty Reduction: The Macro-Micro Linkage"
Cape Town, South Africa
October 2004

1. INTRODUCTION

AIDS has had its most devastating impacts in Africa and the prevalence of the disease continues to rise in most African countries. With a feasible vaccine still years away, reduction in risk behaviors remains the only way to reverse the epidemic. An obvious prerequisite for behavior change is that people have an understanding of the disease and how infection can be averted. Several studies have looked at the determinants of HIV risk behaviors in Africa (Filmer 1998, Blanc 2000), but analysis of the factors determining knowledge of means of HIV prevention is less common.[1]

Further, the studies that have been carried out to date have been cross sectional analyses.[2] In this paper in contrast we consider the all important issue of changes over time in HIV prevention knowledge as well as in HIV testing behavior and attitudes toward testing. We do this by taking advantage of the fact that there are now a number of African countries in which more than one round of Demographic and Health Surveys (DHSs) with comparable HIV-related information has been carried out. We examine changes in these outcomes in Burkina Faso, Kenya, Tanzania, Uganda, and Zambia over periods of 3 to 6 years during the mid to late 90s and early 00s, as dictated by the survey years. In addition we ask how changes in knowledge and testing behavior are distributed across the distributions of schooling and household income as well as by gender and rural vs. urban location. We address this question descriptively and econometrically, the latter by estimating and comparing statistically HIV knowledge 'returns' to schooling, wealth, and age in early and later survey years.

The question is important for policy. For example, if the impact of schooling on the probability of knowing that condoms can prevent infection is found to have risen over time, this would indicate that public information campaigns have been more successful at reaching the

[1] Gersovitz (2001), Gwatkin and Deveshwar-Bahl (2001) Glick, Randriamamonjy and Sahn (2004) do consider HIV knowledge, though the first two are descriptive studies.
[2] Gersovitz (2001) is a partial exception in that he uses artificial cohort analysis from repeated cross sections to assess changes in some behaviors over time.

better educated, or else at providing information that is more easily processed by them. It would signal a need to better target or tailor messages to those with less schooling. Similar considerations would apply to findings of an increasing gradient with respect to wealth, or to increasing or persistent rural-urban and gender gaps in HIV/AIDS knowledge.

This remainder of this paper is organized as follows. The next section discusses theoretical considerations that help to frame the analysis of the impacts of factors such as education and income on HIV knowledge and testing, and how these impacts may change over time as HIV knowledge spreads and public education efforts are intensified. Section 3 described the DHS data we use. Section 4 presents results, starting with descriptive patterns and trends, followed by model results and comparisons of impacts of key regressors across location (rural/urban), gender, and over time. Section 5 draws together the findings and concludes with a discussion of implications for policy.

II. CONCEPTUAL FRAMEWORK

As indicated, in addition to simply ascertaining from descriptive analysis whether and how HIV/AIDS knowledge have changed over time, we are interesting in determining whether the distribution of this knowledge has been constant across the distributions of income and of schooling in the population or instead whether prevention knowledge has increased more for some subpopulations than others. In other words, have the (presumably positive) 'returns' to schooling and wealth increased, decreased, or remained unchanged? Similarly, we are interested in whether and how the effects of these characteristics on testing behavior and attitudes have changed over time.

First, we note that there is a fairly long list of reasons to expect those who are better schooled or wealthier to have attained more awareness of HIV and how it can be prevented. Educated people are more likely to have access to many sources of health and HIV-related information: they are more likely to read the newspaper, or to visit private or public health services where HIV-related information is dispensed. If information comes through channels they already use, the marginal costs of obtaining HIV/AIDS information will be low for them. Education may also make it easier for someone to process and understand the information to which they have access. In other words, education and health information may be complementary inputs in the production of health knowledge. Further, as Becker (1993) has pointed out, those with more schooling have already made larger investments in the future. Since their future stream of earnings, hence consumption and utility, is higher, they have greater incentive to protect their health and insure their longevity by gathering or being attentive to information about HIV prevention. Greater investment in education may be a reflection of a lower discount rate, which again would incline those with an education to seek information and change behaviors to insure their longevity. Finally, at least in younger cohorts, those who went to or stayed in school may have been exposed to school-based HIV/AIDS programs.

Observed correlations of wealth or income and HIV knowledge may occur through the association of wealth with education. But even controlling for education, level of income should be correlated with access to HIV/AIDS information through, for example, ownership of a TV or radio or more frequent use of health care practitioners. Furthermore, the rate of time preference may be higher for poorer people (perhaps because their poverty lowers their life expectancy; see Lawrence 1991). If as a result the poor discount future consumption more heavily than the well-off, they would be expected to invest less time or money in gathering health information. We would expect also that healthiness is a normal good, hence the demand for information about health generally and HIV/AIDS specifically to rise with income. Finally, in Africa, higher income is typically associated with having a larger number of sexual partners (Filmer 1998, Carael, 1995). Therefore high-income individuals, all things equal, are engaged in more risky behavior and may have greater potential benefits to both learning about HIV prevention and testing.[3] With respect to testing, we would expect the costs associated with getting tested, which can include non-trivial transportation costs in environments where local voluntary testing and counseling (VCT) services are rare, to discourage poorer individuals from using this service.

The foregoing explains why HIV knowledge, and possibly testing as well, should be increasing in the level of education and income. These patterns (at least with respect to knowledge; testing outcomes have received less attention) are indeed typically found in empirical studies (Davidson R. Gwatkin et. al. 2001; Glick, Randriamamonjy and Sahn, 2004). More difficult is to derive predictions about how these differences in prevention knowledge (and in testing behavior and attitudes) across the schooling and income distributions may change over time. Consider first that the policy and social environment with respect to HIV/AIDS can change quickly, even over the 3-6 year periods separating survey rounds in our samples. As elsewhere in Africa, mobilization efforts and public information campaigns were expanding in each of our study countries, if to a greater or lesser degree. The flow of information about the disease through social networks would likely also have increased, in part through a multiplier effect of public education efforts. These developments would make it easier—less costly—for people to acquire information about the disease. However, particularly for public mobilization efforts, the educated and uneducated may be differentially affected. As suggested already, information that is disseminated through health centers, schools, print media, television and possibly even radio are more likely to reach a better educated audience. This would lead to a strengthening of the association of HIV knowledge and education over time. If instead mobilization occurs through such mechanisms as community outreach programs and information sessions held at public

[3] The word 'may' is important, since people who have long engaged in high risk behavior may feel strongly that they have already been infected, hence (unless they are altruistic and seek to prevent infecting others) see little benefit to testing or learning more about HIV prevention.

gatherings such as weekly village markets, the cost of access to information may fall the most for less educated (and poorer) individuals.[4]

Level of education may determine not only access or exposure to the growing supply of HIV information, but also the effect of this information on actual HIV knowledge and attitudes toward testing. If as suggested above schooling makes it easier to process health-related information, the two are complements in the production of HIV knowledge.[5] However, these inputs may instead be substitutes, if the messages are specially tailored to be understood by those without much formal education. For this reason as well, it is not possible to predict the nature of changes over time in the returns to schooling on HIV/AIDS knowledge (and behavior). Turning this around, however, estimates of how these returns have changed allow us to infer something about the nature of the spread of information about HIV, and implicitly about policies. For example, if an increase in mean HIV knowledge is accompanied by an increase in the impacts of education on knowledge, we can infer that mobilization policies during the period have either not been directed at channels that are accessed by those with little schooling, or the messages have not been effectively designed to be understood by them.

The impact of income or wealth on HIV knowledge may also shift over time, again depending on how information is disseminated at the margin. If this occurs primarily through channels normally accessed by the well-off, the cost of information falls more for them than the poor. To the extent that the new information comes through public policy, the benefits of this public spending are 'captured' (in the sense of Lanjouw and Ravallion 1999) by the well-off. If instead dissemination programs are set up to target the poor though the modalities noted above, they potentially will reduce income or wealth differentials in HIV/AIDS knowledge. With regard to testing, if VCT services are set up in areas or facilities more accessible to the economically

[4] Or, information eventually may become so widely disseminated that the cost of information is essentially driven to zero for everyone, which would eliminate any advantage in information access to being educated.
[5] This is Dewalque's (2002) interpretation of the rising effect over time of schooling on HIV risk reduction behaviors in Uganda in a rural sample over the decade of the 90s.

advantaged, we would expect a rising impact of wealth on testing over time. On the other hand, the wealthy may initially have access to testing through private health services, in which case an expansion of (subsidized or free) public testing services can disproportionately increase testing by the less well-off.

Note that cross-sectional rural-urban differences in the effects of schooling and wealth can be interpreted in broadly similar terms. Access to HIV/AIDS information is presumably scarcer, hence costlier, in rural areas. Where it is available, it may be transmitted through channels used disproportionately by better educated as well as wealthier rural residents, such as health centers, newspapers, or radio. In urban areas information is probably more generally accessible: less educated urban residents usually have greater access to health services than their rural counterparts, are probably more likely to know someone or someplace with a TV or radio, and may be exposed to more information simply because social networks are denser in cities and towns. This would tend to reduce the advantage to having more schooling or income in urban as compared with rural areas.

Finally, an important pattern in the data, discussed in more detail below, is that knowledge is greater for men than women. Although differential schooling may explain some of this difference, men and women are also likely to differ in terms of how easy it is to obtain information about HIV/AIDS. Women probably have more exposure to the health care system through their use of child and maternity related services, but their social networks may be limited in terms of breadth relative to men: they may be less likely to regularly travel away from home to urban areas, for example, and less likely to frequent certain places (such as bars) where HIV/AIDS discussions occur. Media campaigns may affect women disproportionately by providing sources of information that are alternatives to those to which they lack access relative to men. Still, as in the previous cases, it is more difficult to form priors than to interpret results in light of plausible conceptual frameworks. With regard to gender and testing probabilities, women may be more fearful of testing than men (discussed further below) but also may be more likely to be exposed to opportunities to be tested through their use of reproductive health services.

III. DEMOGRAPHIC AND HEALTH SURVEYS

The Demographic and Health Survey (DHS) program has conducted over 70 nationally representative household surveys in more than 50 countries since 1984. The program is funded by USAID and implemented by Macro International, Inc. In this study, we use 10 of the surveys – two each from Burkina Faso, Kenya, Tanzania, Uganda, and Zambia. In addition to standard household information, the DHS traditionally collects information on women of reproductive age (15-49), focusing on reproductive histories, health, and the nutritional status of young children. More recently (since the early 1990s) special modules have been included on sexual knowledge and behavior that include questions related to HIV/AIDS. In the first wave of DHS surveys (DHS I), co-resident husbands of women successfully interviewed in the individual survey were generally also interviewed in half of the sample clusters. This practice was changed in the later waves (DHS II and III) to have a nationally representative sample of men, by interviewing all men aged 15-49 living in every third or fourth household. For our sample we are able to report results for men as well as women for all countries except for Uganda, which is restricted to women.

A great benefit of the DHS is that the questionnaires are standardized both across countries and over time, though some differences exist. This allows us to use a common set of independent variables and dependent variables, facilitating comparisons across countries, gender, region, and time. Our selection of countries was determined in part by the fact that each of these countries had two survey rounds at least a few years apart with the appropriate HIV/AIDS module. As shown in Table 1, the period between surveys ranges from three years in Tanzania to six years in Burkina Faso. The chronological year of the last survey ranges from 1999 to 2003. In addition, these countries capture at least some regional representation (if weighted toward East

Africa) as well as variation in HIV prevalence and policy response. We include a Southern African country (Zambia) with exceptionally high prevalence (estimated to be 22% in 2001); the East African countries of Uganda (estimated prevalence of 5% in 2001, down sharply from a decade before), Kenya (7% in 2003) and Tanzania (8% in 1999), and the West African nation of Burkina Faso, where prevalence was 6% in 1999 but rising.[6] There are variations in terms of policy as well. In particular, Uganda's aggressive stance against the epidemic is well known and contrasts for example with less organized mobilization in neighboring Tanzania.

The analysis considers first, knowledge about means of HIV prevention. We consider (separately) whether an individual knows that the risk of infection can be reduced by the use of condoms, by having only one partner, and by abstinence. For each, respondents in the survey are asked whether or not they think the action or behavior can prevent transmission of the virus that causes AIDS. We also consider questions about testing: whether the respondent says they have had an HIV test, and if not, whether they would like to be tested. In a subsequent paper we will focus on changes in behavior as reported in the DHS. For now we note that HIV knowledge and attitude questions (which describe all our dependent variables other than actual testing experience) are less likely to be subject to well known problems of mis- or under-reporting than are questions about sexual behaviors.

IV. EMPIRICAL APPROACH

For each of the binary dependent variables we estimate cluster fixed effects reduced form probits with an index function of the following form (for observation *i*):

$$y_i = \beta X_i + \sum_{j=1}^{n-1} \alpha_i d_j + \varepsilon_i$$

where β is a vector of parameter estimates, *Xi* is a vector of characteristics of *i*. The d_j are a series of dummy indicators of the survey cluster (or community) and the α_j are the community fixed

[6] Prevalence estimates are taken from UNAIDS reports, various years. We report data for the closest year available to the second DHS round used in each country.

effects. These terms are included to control for the likely correlation of individual factors such as schooling or wealth with unobserved community level characteristics that also influence knowledge or testing. The community fixed effects specification eliminates bias in the estimates of included regressors caused by any unobserved community level factors that enter linearly in the index function.[7]

The covariates we include are standard but we try to restrict the list to variables that can reasonably be regarded as exogenous to our outcome variables. Thus we exclude, for example, 'daily radio listening', since this both this and HIV knowledge may be jointly determined by unobservable preferences or abilities. To provide flexibility, years of education and age are each entered in quadratic form. The DHS does not contain information on consumption expenditures or household income. Instead we represent the level of household resources with an asset index derived using factor analysis.[8] This variable has been found to be a good proxy for the economic status of the household (Sahn and Stifel 2003). We also include a dummy variable to capture whether the individual respondent reported being in a stable relationship with a spouse or a cohabitating partner. The expected impacts of this variable on knowledge of prevention as well as on testing are ambiguous. Individuals with regular partners may be less likely to desire testing or to seek HIV prevention knowledge if they believe are in a monogamous sexual relationship with low risk of becoming infected. This would imply less knowledge and lower preference for testing among these individuals relative to those who are single. On the other hand, many who are single may not be in any sexual relationship, reducing the need hence desire for HIV prevention information or testing. Finally, we include years of partner's schooling. Since partners may exchange information, one's partner's education may be a determinant of a one's own HIV knowledge.

---

[7] The results will not be unbiased if the unobservables enter non-linearly, that is, if they interact with included individual level covariates—for example, if the response to the presence of a local program to dispense HIV information depends on wealth or education. As the earlier discussion makes clear, this process cannot be ruled out and this should be kept in mind in evaluating the estimates.
[8] See Sahn and Stifel (2003) for a discussion of the method used to create this index.

With regard to presentation, given the number of estimations it would be very cumbersome to show all our probit results. Instead we calculate marginal effects (the change in the probability of a 'successful' outcome from a unit change in the independent variable) for selected covariates—schooling, age, and the asset index. We also present results of statistical tests comparing these marginal effects across area (rural and urban), gender, and survey rounds.

V. RESULTS

V.1 Patterns and Trends in HIV Prevention Knowledge and Testing

HIV prevention knowledge

Table 1 shows the means of the binary prevention knowledge outcomes for each country and survey year by gender and location. It also shows, in the first pair of columns, the share of respondents indicating that they had heard of HIV/AIDS. With the exception of rural Burkina Faso, virtually everyone in each subsample is aware of the disease, even in the earlier survey years. Even for rural Burkina the numbers are high—95% of men and 85% of women in 1999 said they had heard of HIV/AIDS. Clearly, for the great majority of the population covered by these surveys, a lack of basic awareness of AIDS is not relevant as a constraint to knowing about prevention.

It is clear that prevention knowledge has been increasing in all countries, in some cases dramatically so. For example, the share of rural women age 15-45 who know that condoms can prevent HIV infection increased from 0.17 to 0.50 in Uganda between 1995 and 2001. The share of urban Tanzanian women reporting that abstinence can prevent HIV transmission increased from 0.18 to 0.35 in just 3 years, from 1996 to 1999. Other changes have been less dramatic, and there is no clear pattern across either countries or type of prevention knowledge in the magnitudes of the changes, but still the overall picture is one of substantial improvements in knowledge.

With regard to levels rather than changes and considering the most recent year for each country, knowledge of methods of prevention (particularly with respect to condom use) seems highest in Uganda and Zambia (though this is based on comparisons for women since data on men are not available for Uganda) and lowest in Burkina Faso. This ranking makes sense. Uganda has had perhaps the longest history of the disease as well as most extensive policies of AIDS education and Zambia has the highest prevalence; both should have led to greater awareness. Tanzania's and Kenya's mobilization efforts have been less aggressive than those of Uganda. Burkina Faso is at an earlier stage of the epidemic. Note there is a general pattern across countries that individuals are more likely to recognize that condoms are a means of AIDS prevention than they are to know that limiting oneself to one partner or having no partners can prevent infection.[9]

It is important to note that despite substantial improvements over time, a large share of the adult population in each country remains unclear about HIV prevention, even though they have heard of the disease. Even in Uganda in 2001 only about half of women (rural or urban) were able to identify having a single partner as a means of reducing the risk of infection. Only half of women in rural areas of Uganda, half of rural Tanzanian women, and less than half of rural Kenyan women know that condoms can prevent infection.[10]

Among other patterns, prevention knowledge is higher in urban areas than in rural areas, except for the partial exception of Kenya for two of the indicators. Additional calculations, not shown, indicate that proportional rural-urban differences (meaning, the share of rural residents with knowledge of a prevention method relative to the urban share) have generally fallen between

---

[9] The low numbers for abstinence (having no partners) are somewhat surprising: if you know that a condom can prevent AIDS, you should also know that not having sexual relations can prevent AIDS. It may be that, despite careful wording of the question in the DHS (which refers to ways that 'a person' not specifically the respondent, can prevent infection), respondents personalize the question, and do not consider abstinence a viable means of prevention because it is not a practical option for them.

[10] Uganda is a very interesting example because the country has famously managed to turn the tide on the epidemic. Incidence and prevalence are thought to have begun falling before 1995, the year of our first survey—yet as seen in the table in that year for no prevention knowledge method or location did more than 50% of women respond correctly. However, prevalence fell in part due to mortality among those with AIDS and likely also among delayed or reduced sexual activity specifically among the young (see Parkhurst 2002; Konde Lule 1995), both of which are not incompatible with the population means from the DHS.

survey rounds, though not dramatically. There clearly is also a gender gap: men generally are better informed than women about means of HIV prevention. There is no evident pattern of change in these gender gaps (again, measured in proportional terms) except for Tanzania, where the male advantage has declined for most indicators in urban as well as rural areas. Both the locational and gender differences in HIV knowledge can be interpreted in terms of differences in the accessibility or cost of information as suggested earlier. Information is more readily available in urban centers; women may be less able to access or process information by virtue of having less schooling and also, possibly, have social networks that provide less AIDS related information than do men's. It is noteworthy that the gender gap in knowledge is almost always larger, sometimes sizably so, in rural areas. This may be because publicly provided HIV/AIDS information disproportionately impacts women (who lack either the schooling or information networks men have), and this information is more readily available in urban areas.

In Table 2 we look at the prevention knowledge indicators and changes in them disaggregated by age category. Several other studies (e.g., Dietrich et al, 1998, Glick, Randriamamonjy and Sahn 2004) have shown that HIV/AIDS knowledge varies by age, often taking an inverted U-shape, reflecting either true age effects or cohort effects or both. The first row for each subsample in the table shows the share identifying the given prevention measure in the later survey year for each country. Below this in italics is the proportional change for the indicator over the earlier survey, specifically, the year 2 share over the year 1 share for that age group. We are able to pick out some general patterns with respect to age. The ability to identify these prevention measures tends to be lowest among the oldest group, those aged 36-45. This is especially clear for condom use. The 'one partner' figures further suggest a quadratic effect of age, with knowledge highest among 26-35 year olds. For 'abstaining' there is less of a gradient. These patterns will be clarified in the multivariate analysis below.

Comparisons across age groups in *changes* in knowledge are of interest as they provide a sense of whether messages have been disproportionately targeting (or been effective with) the young. In fact, an examination of the proportional change indicators in the table suggests that, though there is some variation, prevention knowledge by and large has increased by a similar degree across the age distribution. However, the figures do give a strong sense of the magnitude of the overall improvements in knowledge, already remarked upon.[11]

Testing and the desire to be tested

We turn now to the trends in HIV testing and the desire to be tested, shown in Table 3. There clearly has been an increase in the number of people who have had an HIV test, as governments have increased the availability of voluntary counseling and testing services (some people may have been tested at maternity clinics or been subject to mandatory testing by employers or other institutions). With some exceptions, however, the numbers tested still remain very low. The exceptions are urban Uganda, where 23% of women reported testing in 2001, and more strikingly, urban Kenya, where in both the 2003 *and* 1998 surveys over one fourth of the female and male samples reported having been tested. The earlier year figures frankly seem implausibly high to us given the limited availability of VCT in Kenya at that time, at least of publicly provided services.[12] Elsewhere, the low numbers reflect the continued lack of testing services, especially in rural areas, as well as a possible reluctance to use services that are available (see Glick 2004). With the exception of Kenya, men are typically more likely to be tested than women, and rates of testing are typically twice as high or more in urban areas than

[11] Note the comparisons of change across age groups is not a cohort analysis: we are not considering how knowledge has changed among say, individuals who were 15-25 in the first year. This could be accomplished by constructing synthetic cohorts. What the comparisons that we report do show is whether, for example, 15-25 year olds know more now than 15-25 years olds new before, and how this change compares with other age groups.

[12] Our concern is not so much with misreporting by respondents but with whether those interviewed are truly representative of the urban population.

rural areas. The latter pattern is not surprising since VCT services have been slow to penetrate into rural areas.[13]

The one indicator that does not seem to have changed over time is the share of respondents who say they want to be tested for HIV. The middle columns of Table 3 show the share of such individuals conditional on not having been tested. If instead we construct an unconditional indicator of the 'total demand' for testing that also includes those who have been tested (though as we note below it is far from clear that saying one wants to test is equivalent to actually testing) the shares are slightly higher (last two columns) but usually not very much so, because of the generally low numbers who have been tested. For the same reason, changes over time in this indicator are similar to that for the conditional indicator, which is to say, very small.

That said, the share desiring testing is quite high in all countries and years for which we have data—usually between 60-75 percent for those not tested. This may be considered quite a favorable indicator for HIV prevention prospects, but some caution is called for. Saying one would like to test and actually going through with it are two different things, as suggested by the findings of a few studies that have collected information on both in settings where VCT was readily available (see Fylkesnes and Siziya 2004 and the discussion in Glick 2004). In addition, it seems slightly odd that a larger share of people say they want to get tested than know about most of the means of prevention. It is also surprising that unlike with the knowledge indicators, there are essentially no gaps between rural and urban areas in desire to test using either the conditional or unconditional testing demand measures.

[13] With respect to the gender gap in testing experience, one can hypothesize more speculatively that the implicit costs of testing are higher for women. They probably have more to lose in terms of the stability of their partnerships from testing, especially if testing positive (and if observed or discovered by their spouses) or from stigma generally. If they are less mobile, it may be harder for them to find ways to test discretely (Glick 2004). The fact that the reported desire to be tested is similar for men and women while actual testing behavior differs lends some credence to this idea.

V.2 Determinants of HIV prevention knowledge and testing

We turn to the estimated impacts of education, age and household assets on our outcome variables based on our probit model results. As discussed above, we show marginal effects, that is, the derivatives of the predicted probability with respect to the variable.[14] Given the non-linearity of the quadratic specifications of the index function (as well as of the probit model itself) we calculate schooling and age marginal effects each at two points: 4 and 8 years for schooling, and 20 and 40 years for age. All other covariates are set to their mean values for the calculations. The variances of the marginal effects were calculated using the delta method. To save space we report these results only for the most recent survey from each country; subsequent tables will analyze changes in impacts over time.

Education has positive and statistically significant impacts on the three HIV knowledge outcomes almost if not quite totally across the board (Table 4)—in all countries, in rural and urban areas, and for women and (where data are available) men. The magnitudes are fairly large for condom knowledge, especially in Uganda and Tanzania. For example, for women with four years of education in rural Tanzania the effect of an additional year is 0.043 implying that primary school completion raises the probability of knowing about condoms as a means of prevention by about 22 percentage points over women with no schooling. Elsewhere and for other knowledge outcomes the impacts of schooling tend to be more modest. We do not observe any consistent pattern with respect to changes in the gradient between lower and higher levels of schooling (4 years, representing completed primary school, and 8 years, representing primary plus two years of secondary education in most of the countries). This reflects the varying patterns in the probit model coefficients on years of schooling and its square.

Nor does any pattern emerge with respect to rural and urban differences, despite our (tentative) expectation that education would make more of a difference in rural areas. In only a few cases are rural-urban differences statistically significant (denoted in the table using bold type

[14] The complete set of probit results can be obtained from the authors.

for larger effect of the pair) and these do not always indicate a larger effect in rural areas. Even in the same country (Uganda) schooling can have a larger impact in rural areas for one outcome (condom knowledge) but a larger effect in urban areas for another (knowing that having just 1 partner reduces risk).

Education also has positive and generally significant impacts on the probability of having been tested, consistent with expectations. These impacts are more likely to be significant in urban areas, but this may be because in most rural settings few respondents have been tested so there is relatively little variation in the dependent variable. Among the majority that has not been tested, the stated desire to be tested also tends to increase with level of schooling.

Table 5 calculates differences in male and female schooling marginal effects and their standard errors. We do not find many significant gender differences in schooling impacts, though there is a suggestion for rural Tanzania that the impacts are larger for women.

In Table 6 we turn to the effects of assets. The marginal effects are evaluated at the mean values of the asset index (and the other covariates). As expected, there is an overall pattern of better HIV prevention knowledge among those in wealthier households, though not all of the estimates are statistically significant and a few are actually negative, though insignificant. The table also reports tests of rural-urban differences in the effects of wealth. Although not many of the gaps are significant, the point estimates overall tend to be larger for rural areas. This is consistent with the existence of larger wealth related differentials in access to HIV/AIDS information in rural areas than in urban areas. As Table 7 shows there are few significant gender differences in the effects of assets on prevention knowledge.

In a few cases there are significant (positive) effects of assets on testing probabilities (Table 6). What is unexpected are a number of negative impacts on the desire to be tested conditional on not having been tested. This is the case, for example, for women in Uganda in both rural and urban areas and women in rural areas of Kenya. One might surmise that these results reflect the conditioning on the non-tested sample: perhaps the well-off who want testing have already been tested. However, in some of these cases the impact of assets on actual testing probabilities is itself negative, if insignificant, ruling out this interpretation as a general explanation. Together with other unexpected findings for the desire to test noted in the descriptive analysis above, this result leads to some uncertainty as to how to interpret the desire to test indicator.

Marginal effects of age, evaluated at 20 years and 40 years, are shown in Table 8. These impacts are almost always larger at 20 years than 40 years (by which point they often turn negative). An inverse U-shape in knowledge by age level is suggested by the knowledge of condoms and of 'having one partner' estimates, consistent with the descriptive data presented earlier. They suggest that HIV information is reaching—or being better understood by—those who are relatively young. This is usually considered a favorable outcome as this group is more likely to be potentially at high risk by virtue of being relatively highly sexually active and not in stable partnerships. Note, however, that our estimates may not be capturing only a true age effect but also a cohort effect, since individuals in different age categories at the time of the second survey were first exposed to information at different periods of the epidemic.

Finally, we briefly mention the estimates for our controls for being married or cohabitating and the schooling of the partner (results are suppressed to save space). First, the years of schooling of the partner has almost universally positive, and generally significant, effects on each prevention knowledge outcome, as well as on the probability of testing and of desire to be tested. This finding is interesting though difficult to interpret. It may indicate that partners share knowledge about HIV so that someone with an educated partner has an additional source of HIV prevention information. Alternatively there is a plausible assortative mating story: individuals who are more interested in leaning about HIV also prefer well-educated partners.

The effects of the dummy indicator for being in a partnership depend on the outcome being considered, but in a fairly logical way. Individuals in such a relationship are usually more likely than those who are single to know that having just one partner can reduce HIV risk. In contrast, individuals in partnerships are usually *less* likely than single people to report that abstinence can prevent HIV transmission. For condoms, the effects of being in a partnership are negative in some case and positive in others. There is no effect of the indicator on either of the testing outcomes. The opposing patterns for 'one partner' and abstinence knowledge suggest that people are more apt to remember options that are relevant for them—keeping to one's partner for those in steady relationships, not having sex for those who are single.[15]

Changes over time in the effects of schooling and wealth

We now consider changes in the effects of education and wealth on HIV prevention knowledge and testing. Table 9 reports the differences in marginal effects of schooling between surveys, again evaluated at 4 and 8 years of school. As a crude indicator of whether and how the gradients of prevention knowledge with respect to education have changed, we note that out of 100 paired year to year comparisons (defined by subsample, outcome variable, and use of 4 or 8 years of schooling), 26 of the differences are significant, and of these, most (18) are positively signed. Alternatively, if we group the 4 and 8 year results together and consider a change in the effect of education to occur for a subsample if a significant change for an outcome is found at either point, we have 21 changes out of 50 cases, with 14 increasing and 7 decreasing.

This suggests that the effects of schooling on knowledge are stable over time in at least a slight majority of cases, but with a tendency on balance for the impacts to increase. Country-specific examination is more informative. For Uganda in particular, the knowledge returns to schooling appear to have risen between survey years. This is consistent with the study of de Walque (2002), who found no robust relation between education and seropositivity for 1990 in data from rural Masaka District in Uganda but a negative association among young individuals in

[15] On the other hand, they could mean that the survey was not able to adequately depersonalize the question (see note 9), so respondents assumed the questions referred to prevention options relevant to their situations.

2000, following a decade of prevention campaigns.[16] Increases in the knowledge/education gradient are seen as well, though not as consistently, in Kenya and Zambia. The results for Tanzania and Burkina Faso are more mixed and if anything point to declining marginal schooling effects on knowledge between surveys. For the probability of having been tested or wanting to test, we see little change in education impacts over time.

We repeat the exercise for the asset index marginal effects in Table 10. Fewer significant changes emerge here—only 7 of the 50 paired differences are significant—and those that are significant are evenly split between increases (4) and decreases (3) in the effect of wealth on prevention knowledge. For condom knowledge, the marginal impact of wealth increased for urban men in Tanzania and rural men in Kenya while it decreased for rural men in Burkina Faso. For abstinence knowledge, there were three cases of a significant change—positive for rural women in Uganda and for rural women and men in Zambia. In no case did the effect of wealth on testing probabilities change over time, and the same is true with only one exception (rural men in Kenya) for the desire to be tested.

Thus there are some changes in the impacts of schooling and (to a lesser extent) wealth but no consistent pattern for the sample of countries as a whole, but this is not necessarily surprising in light of the conceptual discussion above. As noted, if public (or private) sources of information about the disease operate mainly through channels that are accessed by the educated, or if the reduction in the costs of acquiring information is neutral with respect to education but the educated are better at processing HIV information, the distribution of HIV knowledge will skew toward this group even as mean levels of knowledge rise (i.e., the returns to schooling will rise). If instead public campaigns work though channels accessible to the poorly educated and/or tailor the message to be understood by them, knowledge among the less educated may rise more (the returns to schooling fall). Based on our estimates, this last case seems to be the least common.

[16] De Walque argues that the reason was that the information provided in these campaigns was more easily absorbed by the educated, not that the uneducated in the study villages lacked access to the information.

More typically, growth in knowledge has either been 'distributionally neutral' in regards to both schooling and wealth, or as in the case of Uganda has tended to be greater among those with more schooling. In these cases, whatever AIDS information campaigns have been put in place over time have failed to reduce and may have increased the initial relative disadvantage of the poorly educated.

VI. CONCLUSIONS

Examination of repeated rounds of Demographic and Health Surveys from five African countries reveals that knowledge of HIV prevention has been strongly increasing over time. While this is encouraging, some aspects of the data are troubling. Even where prevention knowledge is relatively high—as in urban areas of Uganda or Kenya—a substantial minority of individuals do not know that using condoms or having just one partner can reduce the risk of infection. In many cases not even half of adults can identify specific means of prevention. Though they are falling, rural-urban gaps in prevention knowledge are large. In addition, women are disadvantaged relative to men, and these gender disparities have not changed over time. It is not surprising that HIV knowledge is greater among urban residents, given the higher density of social networks and of channels for public messages about the disease in urban environments. Obviously more needs to be done to get these messages to rural inhabitants. With respect to gender differences, it is frequently pointed out that women are disadvantaged in relationships with respect to their ability to negotiate safe sex practices. Their lower levels of knowledge of these practices, revealed by the DHS data, obviously deepens even further their vulnerability to the disease. Strategies are needed that can rectify these gender discrepancies while continuing to increase overall levels of knowledge.

In proportional terms the largest increases among the outcomes considered have been in the shares of men and women who report having been tested for HIV. These increases have usually been from a very small base, however. Other than in Uganda and Kenya, the numbers tested remain quite low, especially in rural areas.

Multivariate analysis highlights the positive impacts on prevention knowledge of schooling and household wealth. These results confirm findings in earlier studies, but in this study we have also considered whether the importance of these factors has changed over time. In some cases, but not the majority, they have, especially for education. The picture is mixed, but where the effects of schooling on knowledge have changed they have tended to increase. This was seen fairly clearly for Uganda. In these cases, the distribution of prevention knowledge has become more skewed toward the well educated even as mean levels of prevention knowledge have risen. In other cases the growth in knowledge has been 'distributionally neutral' – i.e., not changing the initial disparities between the uneducated and educated, or the poor and the wealthy. In fewer cases have returns to schooling or wealth actually fallen.

Thus in most cases those who are poor or lack schooling remain at a constant or increasing disadvantage with respect to HIV knowledge. To reach these groups, and ultimately to reduce their vulnerability to infection, policies must be reoriented. As to how to do this, the DHS data unfortunately do not permit us to evaluate efficacy of specific HIV education interventions. However, from our results we can infer that existing programs have not been effective in one or two ways, or both: in reaching the poor and less educated; and in tailoring messages that these groups can easily understand. This suggests some directions for change, for example, disseminating more information through community health workers in rural areas, church organizations and community leaders, in addition to standard mass media channels such as newspapers or television.

References

Blanc, A.K., 2000." The relationship between sexual behavior and level of education in developing countries." Report prepared for UNAIDS.

Becker, G. 1993. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, 3rd Edition, The University of Chicago Press.

Cohen, B., Trussell, J., 1996. "Preventing and Mitigating AIDS in Sub-Saharan Africa." National Academy Press, Washington, D.C. 1996.

de Walque, Damien. 2002 "How Does the Impact of an HIV/AIDS Information Campaign Vary with Educational Attainment? Evidence from Rural Uganda." University of Chicago

Emily Lawrence, 1991. "Poverty and the Rate of Time Preference: Evidence from Panel Data, Journal of Political Economy; 99 [3]: 54-77.

Filmer, D., 1998. "The socioeconomic correlates of sexual behavior: A summary of results from an analysis of DHS data."

Fylkesnes, K. and S.A. Siziya 2004. A randomised trial on acceptability of voluntary HIV counselling and testing. Tropical Medicine & International vol. 9, iss. 5, pp. 566-572(7)

Gersovitz, M., 2000. "The African HIV epidemic as seen through the Demographic and Health Surveys." Report for the CSAE Conference, Oxford University, 4/9-10/00.

Glick, P. 2004. "Scaling up HIV voluntary counseling and testing in Africa: what can evaluation studies tell us about potential prevention impacts? Draft. Cornell University

Glick, P., Randriamamonjy, J., and D. Sahn 2004. "Determinants of HIV Knowledge and Behavior in Madagascar: An analysis using DHS data". Draft. Cornell University

Gwatkin, D.R., Deveshwar-Bahl, 2001. "Inequalities in knowledge of HIV/AIDS prevention: An overview of socio-economic and gender differentials in developing countries." World Bank. Study for the Population Services International.

Konde-Lule, J.K., Tumwesigye, M.N., Lubanga, R.G. 1997. "Trends in Attitudes and Behaviour Relevant to AIDS in the Ugandan Community". *East African Medical Journal 74(7:406-410*

Lanjouw, Peter, and Martin Ravallion. 1999. "Benefit Incidence, Public Spending Reforms, and the Timing of Program Capture." *The World Bank Economic Review* 13:257-73.

Parkhurst, J. O. 2002. "The Ugandan success story? Evidence and claims of HIV-1 prevention," *Lancet*, 360: 78-80

Sahn, D., Stifel, D., 2001. "Exploring alternative measures of welfare in the absence of expenditure data." Cornell University Food and Nutrition Policy Program Working Paper N. xx. Ithaca , NY.

Table 1 - Share of sample with HIV/AIDS awareness and knowledge of means of HIV/AIDS Prevention

	Heard of HIV/AIDS		Knows that __ can prevent infection: Condom		Abstain		Have 1 partner	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Burkina Faso (1992/93, 1998/99)								
Urban								
Female	0.97	0.99	0.38	0.58	0.04	0.12	0.48	0.48
Male	0.98	1.00	0.61	0.78	0.05	0.18	0.58	0.48
Rural								
Female	0.81	0.85	0.08	0.13	0.02	0.05	0.35	0.41
Male	0.92	0.95	0.28	0.48	0.04	0.10	0.50	0.52
Kenya (1998, 2003)								
Urban								
Female	100	99	0.52	0.50	0.32	0.47	0.36	0.54
Male	100	100	0.56	0.64	0.33	0.52	0.39	0.58
Rural								
Female	99	98	0.33	0.38	0.26	0.41	0.28	0.60
Male	99	99	0.46	0.54	0.28	0.55	0.33	0.61
Tanzania (1996,1999)								
Urban								
Female	1.00	1.00	0.55	0.73	0.18	0.35	0.31	0.57
Male	1.00	1.00	0.64	0.82	0.32	0.39	0.32	0.55
Rural								
Female	0.96	0.96	0.33	0.49	0.13	0.25	0.22	0.43
Male	0.99	0.99	0.51	0.67	0.19	0.28	0.23	0.45
Uganda (1995,2001)								
Urban								
Female	1.00	1.00	0.46	0.78	0.38	0.64	0.43	0.46
Male	1.00	1.00	--	--	--	--	--	--
Rural								
Female	0.99	1.00	0.17	0.50	0.33	0.47	0.49	0.50
Male	1.00	1.00	--	--	--	--	--	--
Zambia (1996, 2001/02)								
Urban								
Female	1.00	1.00	0.50	0.63	0.32	0.53	--	--
Male	1.00	1.00	0.57	0.67	0.41	0.59	--	--
Rural								
Female	0.99	0.99	0.28	0.39	0.25	0.38	--	--
Male	0.99	0.98	0.41	0.58	0.36	0.49	--	--

Source: DHS, indicated years.

Table 2 - Share of sample with knowledge of means of HIV/AIDS Prevention by Age Group

	Knows that __ can prevent infection:								
	Condom			**Abstain**			**Have 1 partner**		
	Age Group			Age Group			Age Group		
	15-25	26-35	36-45	15-25	26-35	36-45	15-25	26-35	36-45
Burkina Faso (92/93, 98/99)									
Urban									
Female	0.63	0.59	0.45	0.13	0.09	0.13	0.39	0.58	0.57
	1.60	*1.39*	*1.67*	*3.02*	*2.85*	*4.33*	*0.90*	*1.07*	*1.16*
Male	0.83	0.82	0.72	0.18	0.21	0.17	0.42	0.49	0.55
Rural									
Female	0.14	0.17	0.10	0.06	0.03	0.04	0.35	0.47	0.44
	1.42	*1.72*	*1.91*	*3.33*	*2.43*	*2.53*	*1.06*	*1.23*	*1.26*
Male	0.47	0.58	0.49	0.12	0.10	0.09	0.31	0.62	0.69
Kenya (98,03)									
Urban									
Female	0.52	0.52	0.45	0.50	0.44	0.45	0.42	0.64	0.62
	1.01	*0.94*	*0.89*	*1.52*	*1.50*	*1.33*	*1.39*	*1.52*	*1.52*
Male	0.68	0.64	0.59	0.59	0.55	0.42	0.44	0.67	0.66
	1.03	*1.14*	*1.26*	*1.76*	*1.88*	*1.17*	*1.29*	*1.50*	*1.74*
Rural									
Female	0.39	0.42	0.32	0.48	0.34	0.38	0.69	0.70	0.68
	1.17	*1.09*	*1.23*	*1.67*	*1.45*	*1.47*	*3.02*	*2.20*	*2.23*
Male	0.55	0.58	0.51	0.61	0.53	0.47	0.44	0.71	0.77
	1.04	*1.23*	*1.43*	*1.95*	*2.00*	*1.83*	*2.18*	*1.66*	*1.80*
Tanzania (96, 99)									
Urban									
Female	0.68	0.80	0.72	0.41	0.30	0.34	0.43	0.68	0.67
	1.30	*1.26*	*1.43*	*2.41*	*1.58*	*1.68*	*1.78*	*1.85*	*1.86*
Male	0.79	0.88	0.85	0.39	0.37	0.40	0.45	0.65	0.57
	1.19	*1.22*	*1.49*	*1.53*	*1.00*	*1.06*	*1.60*	*2.12*	*1.39*
Rural									
Female	0.46	0.59	0.43	0.25	0.23	0.28	0.38	0.46	0.47
	1.41	*1.56*	*1.56*	*1.99*	*1.86*	*1.79*	*2.05*	*1.97*	*1.88*
Male	0.65	0.79	0.66	0.27	0.25	0.30	0.30	0.52	0.55
	1.24	*1.42*	*1.29*	*1.51*	*1.31*	*1.48*	*1.56*	*2.31*	*2.04*
Uganda (95, 00)									
Urban									
Female	0.81	0.78	0.71	0.64	0.63	0.64	0.43	0.50	0.47
	1.77	*1.60*	*1.86*	*1.61*	*1.77*	*1.59*	*1.07*	*1.08*	*1.06*
Rural									
Female	0.54	0.52	0.41	0.47	0.45	0.48	0.43	0.56	0.52
	2.64	*2.95*	*3.29*	*1.38*	*1.46*	*1.39*	*0.94*	*1.06*	*1.03*
Zambia (96, 01/02)									
Urban									
Female	0.64	0.65	0.56	0.57	0.48	0.52	--	--	--
	1.30	*1.14*	*1.32*	*1.62*	*1.76*	*1.55*	--	--	--
Male	0.71	0.72	0.59	0.61	0.56	0.62	--	--	--
	1.15	*1.24*	*1.17*	*1.41*	*1.20*	*1.86*	--	--	--
Rural									
Female	0.38	0.43	0.36	0.38	0.36	0.39	--	--	--
	1.33	*1.31*	*1.55*	*1.38*	*1.70*	*1.55*	--	--	--
Male	0.62	0.61	0.57	0.48	0.47	0.50	--	--	--
	1.31	*1.64*	*1.44*	*1.12*	*1.68*	*1.87*	--	--	--

Notes:
Shows share by age group for later (year 2) survey. Figures in italics show the ratio of this to the year 1 share.

Table 3 - Share of Sample reporting having been tested for HIV and wanting to be tested

	Have been Tested		Want to be tested[a]		Have been or want to be tested	
	Year 1	Year 2	Year 1	Year 2	Year 1	Year 2
Burkina Faso (1992/93, 1998/99)						
Urban						
Female	--	--	--	--	--	--
Male	--	--	--	--	--	--
Rural						
Female	--	--	--	--	--	--
Male	--	--	--	--	--	--
Kenya (1998, 2003)						
Urban						
Female	0.28	0.27	0.55	0.64	0.68	0.74
Male	0.29	0.26	0.66	0.66	0.76	0.75
Rural						
Female	0.13	0.13	0.68	0.67	0.72	0.72
Male	0.15	0.14	0.68	0.71	0.72	0.75
Tanzania (1996,1999)						
Urban						
Female	0.07	0.13	0.72	0.70	0.74	0.73
Male	0.17	0.19	0.69	0.70	0.74	0.75
Rural						
Female	0.03	0.04	0.67	0.68	0.68	0.69
Male	0.09	0.10	0.74	0.72	0.77	0.75
Uganda (1995,2001)						
Urban						
Female	0.16	0.23	0.62	0.61	0.68	0.70
Male	--	--				
Rural						
Female	0.04	0.06	0.71	0.72	0.72	0.73
Male	--	--				
Zambia (1996, 2001/02)						
Urban						
Female	--	0.14	--	0.71	--	0.75
Male	--	0.17	--	0.67	--	0.72
Rural						
Female	--	0.06	--	0.77	--	0.79
Male	--	0.12	--	0.77	--	0.80

[a] Share of non-tested indicating a desire to be tested
Source: DHS, indicated years.

Table 4 - Marginal effects of education, Year 2

Sample/Outcome	Knows that __ can prevent infection: Condom		Abstinence		Have 1 partner		Tested		Want to be tested[a]	
	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years
Burkina Faso										
Women										
Rural	0.011 **	0.022 **	0.001	0.003 *	0.009	0.001				
Urban	0.021 **	0.018 **	-0.001	0.003 **	-0.002	0.006 **				
Men										
Rural	-0.001	**0.031** **	**0.011** *	**0.011** **	-0.001	0.005 *				
Urban	**0.016** **	0.013 **	-0.002	0.003	-0.013	0.001				
Kenya										
Women										
Rural	0.022 **	0.017 **	0.011 **	0.019 **	0.009 *	0.015 **	0.008 **	0.013 **	0.007	-0.004
Urban	0.024 **	0.014 **	0.005	0.015 **	**0.029** **	0.018 **	0.002	0.014 **	0.005	-0.013 **
Men										
Rural	0.013 *	0.013 **	0.030 **	0.029 **	0.032 **	0.020 **	0.012 **	0.013 **	0.019 **	-0.002
Urban	**0.046** **	**0.032** **	0.036 **	0.039 **	0.019 *	0.017 **	-0.012	0.003	0.013	0.001
Tanzania										
Women										
Rural	0.043 **	0.023 *	0.007 *	0.012	0.017 **	0.016	0.008 **	0.007	0.011 **	-0.002
Urban	0.041 **	0.013 *	**-0.018** *	0.003	0.021 **	-0.001	0.005	0.012	0.009 **	0.007 **
Men										
Rural	0.020 **	0.014 **	0.006	0.004	0.004	0.008 **	0.002	0.003 *	0.014	0.009
Urban	0.035 **	0.016 **	-0.007	0.004	0.017	0.015 **	0.002	0.008	-0.001	0.004
Uganda										
Women										
Rural	0.039 **	**0.046** **	0.016 **	0.019 **	0.018 **	0.016 **	0.009 **	0.023 **	**0.010** **	0.001
Urban	0.030 **	0.022 **	0.015 **	0.026 **	0.017 **	**0.034** **	0.012 **	0.023 **	-0.007	0.006
Men										
Rural										
Urban										
Zambia										
Women										
Rural	0.010 **	0.018 **	-0.004	0.006 *			0.004 **	0.005 **	0.009 **	0.003 **
Urban	0.011 *	0.015 **	-0.002	0.009 *			0.005 *	0.006 **	0.007	0.002
Men										
Rural	0.020 **	0.016 **	-0.007	0.008 **			0.007	0.007 *	0.014 *	0.005
Urban	0.023	0.013	0.015	0.021 **			-0.010	-0.001	0.013	0.005

Note: based on probit estimates. Standard errors calculated using the delta method.
Shows effect of an additional year of schooling on the probability of the outcome variable, evaluated at 4 and 8 years of schooling.
**' denotes significance at the 5% level. '*' denotes significance at the 10% level.
Bold face indicates that the rural (urban) value is significantly larger than the urban (rural) value at 10% or better.
[a] Share of those not tested indicating a desire to be tested

Table 5 - Gender differences in marginal effects of education, Year 2

Sample/ Outcome:	Knows that __ can prevent infection: Condom		Abstinence		Have 1 partner		Tested		Want to be tested	
	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years
Burkina Faso										
Rural	-0.012	0.009	0.010 *	0.008 *	-0.010	0.004				
Urban	-0.005	-0.005	-0.001	0.000	-0.011	-0.005				
Kenya										
Rural	-0.009	-0.004	0.019 **	0.010 *	0.023 **	0.005	0.003	0.000	0.012	0.002
Urban	0.023 *	0.018 **	0.031 **	0.024 **	-0.010	-0.001	-0.014	-0.011	0.009	0.014
Tanzania										
Rural	-0.023 **	-0.008	-0.001	-0.008	-0.012 *	-0.008	-0.006	-0.004	0.003	0.010
Urban	-0.006	0.003	0.011	0.002	-0.004	0.016	-0.003	-0.005	-0.010	-0.003
Uganda										
Rural										
Urban										
Zambia										
Rural	0.010	-0.002	-0.003	0.002			0.003	0.002	0.004	0.002
Urban	0.012	-0.002	0.018	0.011			-0.015	-0.007	0.006	0.003

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows differences in marginal effects (male minus female) of an additional year of schooling on the probability of the outcome variable, evaluated at 4 and 8 years of schooling.

**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Table 6 - Marginal effects of Assets, Year 2

	Knows that __ can prevent infection:				
Sample/Outcome:	Condom	Abstinence	Have 1 Partner	Tested	Want to be tested[a]
Burkina Faso					
Women					
Rural	**0.060** **	0.002	0.056 **		
Urban	0.009	0.007	0.011		
Men					
Rural	0.098 **	0.017	0.047		
Urban	0.006	0.028 **	-0.010		
Kenya					
Women					
Rural	0.031	0.009	0.042	0.000	-0.057 *
Urban	-0.019	-0.002	0.037	0.004	-0.003
Men					
Rural	0.085 **	0.053	0.005	0.062 **	-0.002
Urban	0.020	0.075 **	0.036	0.036	0.061
Tanzania					
Women					
Rural	**0.073** **	0.046	0.011	0.009	0.015
Urban	-0.012	0.006	-0.003	-0.004	-0.033 **
Men					
Rural	**0.094** **	**0.102** **	0.068 **	**0.054** **	-0.022
Urban	-0.007	-0.003	0.021	0.000	-0.011
Uganda					
Women					
Rural	**0.036**	0.005	**0.034** *	-0.001	-0.051 **
Urban	-0.004	0.012	0.000	0.007	-0.027 **
Men					
Rural					
Urban					
Zambia					
Women					
Rural	-0.015	**0.119** **		0.002	0.020
Urban	**0.039** **	0.024		0.017	-0.018
Men					
Rural	**0.137** **	**0.094** *		**0.183** **	0.046
Urban	0.004	-0.037		-0.034	**-0.079** *

Note: based on probit estimates. Standard errors calculated using the delta method.
'**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Bold face indicates that the rural (urban) value is significantly larger than the urban (rural) value at 10% level.
[a] Share of those not tested indicating a desire to be tested

Table 7 - Gender differences in marginal effects of Assets, Year 2

	Knows that __ can prevent infection:				
Sample/Outcome:	**Condom**	**Abstinence**	**Have 1 partner**	**Tested**	**Want to be tested**
Burkina Faso					
Rural	0.038	0.015	-0.009		
Urban	-0.003	0.021	-0.021		
Kenya					
Rural	0.054	0.044	-0.037	0.062 *	0.055
Urban	0.038	0.077 *	-0.001	0.032	0.064
Tanzania					
Rural	0.021	0.056 **	0.056	0.045 *	-0.037
Urban	0.005	-0.009	0.025	0.004	0.022
Uganda					
Rural					
Urban					
Zambia					
Rural	0.152 **	-0.025		0.180 *	0.026
Urban	-0.035	-0.061		-0.051	-0.061

Note: based on probit estimates. Standard errors calculated using the delta method.
Shows differences in marginal effects (male minus female).
**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Table 8 - Marginal effects of age, Year 2

Sample/Outcome	Knows that __ can prevent infection: Condom		Abstinence		Have 1 partner		Tested		Want to be tested[a]	
	20 Years	40 Years	20 Years	40 Years	20 Years	40 Years	20 Years	40 Years	20 Years	40 Years
Burkina Faso										
Women										
Rural	0.005 **	-0.007	-0.003 **	0.001	0.011 **	-0.004 *				
Urban	0.004	-0.016 **	-0.004 **	0.007	0.022 **	-0.002				
Men										
Rural	**0.016** **	**-0.014** **	0.004	0.002	**0.031** **	0.000				
Urban	0.002	-0.004	0.000	-0.002	0.002	-0.004				
Kenya										
Women										
Rural	-0.001	-0.008 **	-0.001	0.007 **	0.012 **	-0.002	-0.005 *	-0.005	-0.001	-0.011 **
Urban	0.001	-0.008 *	0.008	0.004	0.014 **	-0.002	0.001	-0.010	-0.004	-0.005
Men										
Rural	0.010 **	-0.009 **	-0.001	-0.003	0.023 **	0.000	0.010 **	-0.006	0.001	-0.001
Urban	0.007	-0.006 **	-0.008	-0.004	0.012 *	-0.001	0.012 *	-0.003	-0.010	**-0.008** **
Tanzania										
Women										
Rural	0.024 **	-0.019 **	0.001	0.008 **	0.007 *	0.000	0.002 *	0.000	-0.001	-0.008 **
Urban	0.023 **	-0.011	-0.006	0.001	**0.031** **	-0.004	0.006	-0.004	-0.003	-0.007 *
Men										
Rural	0.018 **	-0.009 **	0.005	0.003 **	0.018 **	0.003 *	0.006	-0.001	0.007 *	-0.001
Urban	0.012 **	-0.003	0.000	0.005	0.017 **	0.003	0.009	-0.001	-0.005	0.002
Uganda										f
Women										
Rural	**0.005** *	-0.011 **	0.006 **	0.005 *	0.014 **	-0.004 **	0.000	-0.001	-0.005 *	-0.004 **
Urban	-0.002	-0.007 **	0.006 *	0.002	0.010 **	-0.006	**0.010** *	-0.014	-0.013 **	-0.004
Men										
Rural										
Urban										
Zambia										
Women										
Rural	0.010 **	-0.009 **	0.003	0.003 *			0.001	-0.001	0.001	-0.004 **
Urban	0.009 **	-0.012 **	0.002	0.004			-0.001	-0.002	-0.001	-0.004 *
Men										
Rural	0.004	-0.009 **	0.005	0.003			0.009 **	0.004	-0.007	-0.003
Urban	0.008	-0.010 **	0.007	-0.003			0.007	0.005	-0.011	0.001

Note: based on probit estimates. Standard errors calculated using the delta method.
Shows effect of an additional year on the probability of the outcome variable, evaluated at 20 and 40 years of age.
**' denotes significance at the 5% level. '*' denotes significance at the 10% level.
Bold face indicates that the rural (urban) value is larger than the urban (rural) value at the 10% level or better.
[a] Share of those not tested indicating a desire to be tested

Table 9 - Differences in marginal effects of education, Year 2 - Year 1

Sample/Outcome:	Knows that __ can prevent infection: Condom		Abstinence		Having 1 Partner		Tested		Want to be tested	
	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years	4 Years	8 Years
Burkina Faso										
Women										
Rural	-0.001	0.007	0.003	0.006	0.008	-0.010				
Urban	0.001	-0.002	0.001	0.005 **	-0.005	-0.006 *				
Men										
Rural	-0.006	0.003	0.010	-0.008	-0.007	-0.003				
Urban	-0.010	-0.001	0.007	0.004	-0.017 *	-0.011 **				
Kenya										
Women										
Rural	-0.002	-0.003	0.002	0.011 *	-0.001	-0.007	0.002	-0.003	-0.002	0.000
Urban	-0.005	-0.008	0.007	0.014 *	0.017	0.003	-0.005	0.000	-0.001	-0.017
Men										
Rural	-0.028 **	-0.011	0.032 **	0.021 **	0.009	-0.010	-0.003	-0.004	0.024 **	0.007
Urban	0.056 **	0.032 **	0.021	0.025 **	0.015	0.003	-0.035	-0.016	0.034	0.031
Tanzania										
Women										
Rural	0.009 *	-0.012	-0.002	0.003	0.008	0.007	0.003	0.002	0.002	-0.009
Urban	0.008	-0.016 *	-0.029 **	-0.009	0.004	-0.018	0.001	0.008	0.006	0.004
Men										
Rural	-0.008	-0.012 **	0.009	-0.004	-0.005	-0.007 *	0.005	-0.002	-0.005	-0.004
Urban	0.019	0.001	-0.007	0.000	0.004	0.000	0.010	0.007	-0.008	0.008
Uganda										
Women										
Rural	0.019 **	0.004	0.013 **	0.010	0.002	-0.012	0.003	0.020 **	0.002	0.000
Urban	-0.001	-0.007	0.014 *	0.021 **	0.014 *	0.023 **	-0.005	-0.003	-0.023 **	0.003
Men										
Rural										
Urban										
Zambia										
Women										
Rural	0.004	0.005 **	-0.005	0.003						
Urban	0.001	0.003	0.001	0.012 **						
Men										
Rural	0.001	-0.002	-0.015	0.001						
Urban	0.010	0.000	0.030	0.031 **						

Note: based on probit estimates. Standard errors calculated using the delta method.

Shows differences in marginal effects (Year 2 minus Year 1) of an additional year of schooling on the probability of the outcome variable, evaluated at 4 and 8 years of schooling.
**' denotes significance at the 5% level. '*' denotes significance at the 10% level.

Table 10 - Differences in marginal effects of assets, Year 2 - Year 1

Sample/Outcome:	Knows that __ can prevent infection: Condom	Abstinence	Having 1 Partner	Tested	Want to be tested
Burkina Faso					
Women					
Rural	0.013	-0.020	-0.007		
Urban	0.008	0.002	-0.002		
Men					
Rural	-0.158 **	0.029	-0.062		
Urban	0.001	0.012	-0.057 *		
Kenya					
Women					
Rural	-0.026	-0.036	0.007	-0.006	-0.027
Urban	0.037	-0.002	0.017	-0.020	0.052
Men					
Rural	0.115 **	-0.030	0.059	0.042	0.013
Urban	0.060	0.017	-0.036	0.035	0.110 *
Tanzania					
Women					
Rural	0.015	0.057 **	-0.042	-0.008	0.007
Urban	-0.014	0.007	-0.028	-0.013	-0.018
Men					
Rural	0.075	0.089 **	0.046	0.002	0.069
Urban	-0.051 **	-0.016	-0.011	-0.036	0.042
Uganda					
Women					
Rural	-0.005	0.005	0.044	-0.020	0.030
Urban	-0.014	0.033 **	-0.015	0.013	0.019
Men					
Rural					
Urban					
Zambia					
Women					
Rural	-0.027	0.064			
Urban	0.020	0.011			
Men					
Rural	0.111	0.063			
Urban	-0.011	-0.076			

Note: based on probit estimates. Standard errors calculated using the delta method.
Shows differences in marginal effects (Year 2 minus Year 1).
**' denotes significance at the 5% level. '*' denotes significance at the 10% level.