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Do HIV-AIDS Teacher Training Programs Work in Africa? Evidence from the Cameroon*

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Abstract

We assess the impact on student knowledge, attitudes and behavior of a typical HIV-AIDS teacher training program, funded by the African Development Bank and implemented with technical assistance from UNESCO in the Cameroon. Applying an identification strategy based on instrumental variables that controls for teacher self-selection into the training program, we find that exposure to a trained teacher increases the apprehension of 12 to 13 year olds concerning HIV-AIDS, by rendering them less likely to be willing to buy from an HIV-positive shopkeeper, and more likely to wish to remain sexually abstinent during adolescence. No effect is found either on their knowledge or on their behavior. For 16 to 17 year olds, on the other hand, exposure to a trained teacher increases the likelihood that students are willing to discuss HIV-AIDS issues within their families. More importantly, older students who are exposed to a trained teacher are 29% more likely to have used a condom during their last sexual intercourse, and are 27% more likely to have carried out an HIV test.

Key words: teacher training, HIV-AIDS, Cameroon.
JEL: I18, C21.

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1 Introduction

Are teachers who have benefited from HIV-AIDS teacher training programs more likely to significantly affect the knowledge, attitudes and behavior of their students, when compared to teachers who have not? In this paper, we provide instrumental variables estimates that suggest that, at least in the Cameroonian case, the answer to this question is a qualified "yes".

While this is not the same thing as saying that such programs are the most efficient means of preventing the spread of HIV-AIDS amongst African youth, and while our statistical evidence cannot isolate the specific mechanisms whereby teacher skills are improved and result in greater AIDS awareness amongst students, our results do suggest that teacher training programs, alongside other policy interventions, may indeed be an effective manner of fighting the HIV-AIDS pandemic among younger cohorts of students in subsaharan Africa.

In the Cameroon, the prevalence of HIV-AIDS is 7.9% among women in the $20-24$ year age bracket, with the corresponding figure being 2.5% for men (Demographic and Health Survey, 2004). Little is known concerning younger age categories, though HIV-AIDS is thought to be spreading amongst adolescents as well. In policy terms, it is therefore not surprizing that the $15-24$ year age category has been singled out as the main priority of the Cameroonian government in its national HIV-AIDS strategy, of which the teacher training program evaluated here is an element.

Teacher training programs dealing with HIV-AIDS are becoming common place in subsaharan Africa, as documented, among others, by Ramos and Siamatowe (2006). Unfortunately, as noted in a recent survey by Gallanta and Maticka-Tyndale (2004), impact evaluations of HIV-AIDS teacher training programs in subsaharan Africa are few and far between, with most available work suffering from a number of serious methodological flaws. In particular, and to the best of our knowledge, none of the available evaluations adequately control for self-selection into the teacher training programs by the teachers themselves, leading to the possibility, even when the treatment and control groups of students or schools are properly constructed, to biased estimates of the impact of such programs.

The rest of this paper is organized as follows. In section 2 we describe the operation of the teacher training program, and note how neither the choice of eligible schools nor of the participating teachers was random. While the first problem can be dealt with basing one's analysis on within-school variation in the knowledge, attitudes and behavior of the students, the second calls for an identification strategy based on instrumental variables.

In section 3 we present our survey design, which considers students in two age categories —12-13 year olds and 15-17 year olds. We justify the sample size used (at least for the

older age category) on the basis of power calculations that we carried out using pre-existing Cameroonian household data, and identify our main response variables. The latter correspond to the knowledge, attitudes and behavior (henceforth referred to as "KAB variables") of the students with respect to HIV-AIDS related issues. In the empirical portion of the paper, we will focus on nine such variables, three for each category of KAB variables, for each age group. We conclude the description of our data by reporting linear probability model regressions results, based on intra-school variation, that highlight the principal structural determinants of the KAB of students. Student KAB appear to be the result of a complex interaction amongst student characteristics (with gender, age and religion being the most important), household characteristics (with the most important role being played by household wealth, the employment status of the household head and the presence of a TV in the household), and the characteristics of the teacher within whose class the student was interviewed (with an interesting opposition between teacher age and teacher experience).

In section 4 we present our identification strategy, and highlight the likely endogeneity of the traiing status of teachers. This is because it is probable that teacher-specific unobservables determine both teacher training status and the KAB of the students under their tutelage. We also show that the likely effect of the endogeneity teacher training status will be that OLS-based estimates of the impact of teacher training on the KAB of students will be biased downwards, thereby underestimating the positive impact (if there is indeed one) of teacher training on our response variables. Our identification strategy is based on isolating teacher characteristics that affect their decision to participate in the training program, but which should not have any direct impact on the KAB of students. We consider two such characteristics: (i) whether the teacher knows an HIV-positive colleague, and (ii) whether the teacher knows an HIV-positive student. We argue that these exclusions restrictions will generate plausibly exogenous variation in the treatment status of teachers, (i) as long as we control for school-specific unobservables (which we do by including school-specific effects in all of our structural equations), and (ii) as long as we control for a measure of the time devoted by teachers to HIV-AIDS-related topics in class. This latter covariate, alongside the rich set of teacher, student and parental characteristics that we include in our specifications, should ensure that there are no teacher-specific unobservables that could be correlated with the training decision, and that remain in the structural equation.

In section 5 we present our results. We begin by reporting our reduced forms, and show that our proposed exclusion restrictions do indeed provide identification: both variables are statistically significant individually at the usual levels of confidence and, as one would expect, increase the likelihood of a teacher participating in the training program. We then present our IV results for nine response variables for the two age categories. For the younger age

category, our results indicate that student knowledge is *not* improved and student behavior is *not* affected by having a teacher who has followed the training program. Their attitudes, in contrast, show a marked tendency towards *less* tolerance, perhaps because of the fear induced by having a teacher who is particularly aware of HIV-AIDS related issues: students with a trained teacher are less likely to be willing to buy from an HIV-positive shopkeeper, and they are more likely to wish to remain sexually abstinent during adolescence. Intuitively, it would appear that having a trained teacher "scares" the younger cohort of students.

For the older age category, teacher training displays more constructive effects on students. Though the "fear" effect appears in the form of students with a trained teacher being more likely to consider abstinence as the main manner of avoiding infection, students in this age category have markeddly different attitudes. In particular, students with a trained teacher are significantly more likely to be willing to discuss HIV-AIDS-related issues with family members, and they are marginally more likely to be willing to meet with HIV-positive individuals. The main impact of having a trained teacher manifests itself in their behavior. First, students with a trained teacher are more likely (by almost 29%) to have used a condom during their last sexual intercourse. Second, they are more likely to have carried out an HIV test. We conclude this section by examining the potential direction of bias if our exclusion restrictions are false.

Section 6 concludes, and presents some thoughts on the implications of our results for the role that can be played by teacher training as a means of fighting HIV-AIDS in the Cameroon.

2 The program

2.1 Teacher training

The Cameroonian government, with the support of UNESCO, is currently in the process of introducing a *teaching module* devoted to HIV-AIDS into its school curriculum. The goal is to effectively educate schoolchildren concerning HIV-AIDS, by including information in the curriculum concerning prevention, transmission mechanisms, as well as other issues linked to HIV-AIDS. The official name of this new component of the Cameroonian school curriculum is "Education à la vie familiale, en matière de population et au VIH/SIDA", with "EVF /EMP/VIH et SIDA" being the most commonly-used acronym.

During the 2006-2007 academic year, roughly 2,000 teachers of French, English (the two official languages in the Cameroon), civic education, history and geography, life sciences (biology) and physical education participated in teacher training sessions on the HIV-AIDS

teaching module in the five Cameroonian provinces of Adamaoua, Nord, Extrème Nord, Sud, and Centre.

The choice of schools from which the potentially participating teachers were drawn was not random. Given that the program was funded by the African Development Bank (AfDB), participating schools were drawn from towns in which the AfDB had contributed to the construction or renovation, within the town's health center, of a unit explicitly devoted to HIV-AIDS prevention, information and testing. Another criterion used in program deployment was to focus on towns where there were at least two secondary schools, so as to inflate the number of schools which could potentially participate in the program, while keeping costs within predetermined bounds.

Three options were envisaged by authorities in terms of HIV-AIDS education in the schools, and this choice ultimately determined, at least in part, the identity of the teachers who ended up participating. The first option was to introduce the "EVF/EMP/VIH et SIDA" module as a subject in its own right, with the same status as English, French or mathematics. The second option was to introduce the module within a given discipline ("discipline d'accueil"), with the third option being to do so within several different disciplines. Ultimately, the third option was chosen, with the disciplines within which the module would be tought being (i) languages, (ii) civic education, (iii) history and geography, (iv) physical education and (v) life sciences.

As with the choice of schools, the choice of participating teachers within a given school was not random, either. In each participating school, nine teachers drawn from the five eligible disciplines were selected to participate in the training program. This choice may have been a function of the discretionary power of the school's director (and this is highly likely in the Cameroonian context), and may also have been driven by economic motives: the daily *per diem* granted to participants amounted to $100. For teachers who participated in the full three day program, participation was therefore roughly equivalent to their monthly wage.

Within each province, training took place at 3 to 5 HIV-AIDS "focal points" of the Ministry of Secondary Education. More often than not, these corresponded to the equivalent of teacher training colleges ("Ecole Nationale des Instituteurs de l'Enseignement - ENIEG"), which are well attuned to this type of activity in that they have traditionally been associated with HIV-AIDS information campaigns in Cameroonian schools. The trainers, often, were inspectors ("inspecteurs pédagogiques nationaux") of the teacher's discipline, who had themselves been trained by UNESCO-provided external experts. Together, these external experts and the trainers formulated a pedagogical guide that served as a reference manual for the trainees. By and large, the content of teacher training was based on the logic model,

in which trained teacher are tought (in theory) how to modify intermediate indicators so as to ultimately change student behavior. The intermediate student mediating factors focused on by the teacher training included knowledge, perceived risk, perceived severity, personal values and attitudes, perceived peer behavior and norms, self-efficacy and skills, motivation and intentions. Though it is difficult to pinpoint a particular psychological theory underlying the training, it is safe to say that it was based, at least in part, on the protective motivation, behavior change for intervention, theory of reasoned action, social learning and psychological determinants of behavior approaches.

Table 1 details the distribution of teachers, as well as their students, by training status of the teacher, as well as by the intensity of training (2, 3 or more than 3 days). Roughly one quarter of the teachers in the schools we surveyed participated in the training program, and this corresponded to roughly one quarter of the students we surveyed having a trained teacher.

It is important to stress at the outset that the purpose of this paper is *not* to evaluate the impact of the introduction of the new HIV-AIDS teaching module into the school curriculum. Rather, exploiting the fact that, at the time of our December 2007-January 2008 survey work, one quarter of the children in our sample had been exposed to three months of teaching by teachers who had followed the teacher training program, but who had not yet introduced the formal teaching module into the classroom, our purpose is to evaluate the impact of teacher training *per se*. None of the students considered here had, as yet, been exposed to the new school curriculum, which was put to the test during the second semester of the 2007-8 school year.

3 Data

3.1 Survey design

This impact evaluation focuses on secondary schools, with our surveys covering "general" secondary schools (as opposed to those dispensing specific programs, such as vocational training). In each school, we surveyed four classes: one $6^{ème}$ and one $5^{ème}$ class (students are in the 12-13 year age bracket) and one 2^{nde} and one $1^{ère}$ class (students are in the 15-17 year age bracket).[1]

[1] In the Cameroon, as in the old French school system, the numbering of classes work *backwards*. Note that students are assigned to various classes within the school on a sequential basis: there may therefore be a small bias in terms of non randomness in that certain classes may be composed of students with more motivated parents. Our random selection of classes within each school should, however, mitigate this potential problem.

Power calculations for the 15-17 age category, based on the 2004 Cameroon DHS, the 2001 Cameroon MICS and the 2000 ECAM II (Enquête Camerounaise Auprès des Ménages — basically a Cameroonian LSMS) indicated that a sample of roughly 2,400 students, dstributed over 110 schools, would be appropriate. Such a sample is of sufficient size, for example, to detect a 5% change in condom use, at the 95% level of confidence. In each school, between 10 and 12 pupils per class (divided equally between boys and girls) were randomly selected, as were the specific classes to be surveyed.

Our survey design for the lower age category could not be based on explicit power calculations, given the lack of information concerning HIV-AIDS-related issues for 12-13 year olds in existing statistics. As such, we applied the same sampling scheme to the lower age category as to the older students.

3.2 Key response variables

Specific questionnaires were prepared for the two age brackets. For the younger students, the questionnaire focuses on the so-called KAB themes (i.e. Knowledge, Attitudes and Behavior), with a particular emphasis on the first two themes. Specific questions involve knowledge concerning transmission mechanisms and protection, attitudes towards infected persons and stigmatisation. For the 15-17 year age bracket, a slightly different questionnaire was administered, given that more emphasis is placed on sexual behavior. While collecting information on the KAB themes, we also collected information on each student's family background. We also administered a separate questionnaires to all teachers, whether they followed the teacher training program or not.

For the 12-13 year olds, the key response variables, divided by KAB theme, include:

- *knowledge*: student knows that HIV causes AIDS, knows that mosquito bites do not transmit HIV, knows that having a STD increases the likelihood of infection;
- *attitudes*: student would care for a relative who has HIV-AIDS, would buy food from a shopkeeper who has HIV-AIDS, and declares that she/he will remain sexually abstinent during adolescence;
- *behavior*: student declares that he/she has never had sex, that he/she has had more than one partner, and that he/she used a condom the last time he/she had sex.

For the 15-17 year olds, the response variables are similar; with minor variations; in particular, we consider whether the student has contracted a sexually-transmitted disease during the last 12 months; and whether she/he has subjected him/herself to an HIV-AIDS test during the last 12 months.

Tables 2 to 7 provide descriptive statistics concerning the KAB variables, by age category. These tables also include simple univariate tests of differences in means between students whose teacher was trained and those whose teacher was not.

3.3 Descriptive statistics

Table 8 provides descriptive statistics on student and parental characteristics, while Table 9 does so for teachers. Tables 10 to 12 provide linear probability estimates of the determinants of selected measures of student knowledge, attitudes and behavior. In order to examine the relationship between household wealth and the KAB variables, we constructed a household wealth index as in Filmer and Pritchett (2001), by using the first principal component of twenty asset variables.[2] This allows us to control for a plethora of household characteristics in a particularly parsimonious manner. All specifications include school-specific fixed effects, and are therefore based on within-school variation. The purpose of these estimates is to highlight the main determinants of student KAB, before turning to the impact of teacher training *per se*.

3.3.1 Knowledge

We begin by considering the knowledge (see the upper portion of Table 10) of the younger age cohort. Males are more likely to know that mosquito bites do not transmit, as are older students, and students who attend a technical class. Muslim students are less likely to know that mosquitos do not transmit, as well as being less likely to know that having a STD increases the risk of contamination. This contrasts with what is known in Senegal, for example, where the Muslim confraternities were instrumental in promoting HIV-AIDS awareness. Having a working parent reduces the likelihood that the student knows that HIV causes AIDS, which is slightly puzzling. Similarly, students from wealthier households are less likely to know that HIV causes AIDS. Having a TV in the household significantly increases the likelihood that the student knows that mosquitos do not transmit HIV-AIDS:

[2]The "assets" or characteristics in question are virtually identical to those used by Filmer and Pritchett (2001), with the exception of land owned. More explicitly, the characteristics are: the household has an iron, a radio, a television, a stove, a scooter, a freezer, a car; there is a water tap within the house, the household gets its water from an outside source, or a community pump; the toilet flushes, latrines correspond to a hole in the ground, or the household uses some other form of toilet; the household is connected to the electricity grid; the number of rooms in the house, the household uses gas for cooking, uses coal for cooking, the house is of high quality (concrete floor, concrete walls, zinc roof), the house is of low quality (sand or dirt floor, earthen or thatched walls, thatched roof), household owns its lodging. In the case of Filmer and Pritchett (2001), the first principal component explains 25.6% of the variance in their 21 variables. In our case, the corresponding number is 21% for a total of twenty variables. The key assumption is that household long-run wealth is what causes the most common variation in asset variables. The mean value of the index is zero by construction.

this is a first indication of the importance of this source of information for student KAB variables. Having a male teacher increases the likelihood that the student knows that HIV causes AIDS, as does the fact that the student was interviewed in the context of a biology class. This last effect may correspond to a "framing" issue in terms of student responses to the survey.

For the older age cohort (the results are reported in the lower portion of Table 10), the student being in a technical class increases her/his likelihood of knowing that HIV causes AIDS. No other student characteristics are statistically significant at the usual levels of confidence. At least one of the parents being able to read or write increases the likelihood that the student thinks that abstinence is the main way of avoiding contamination, as does (marginally) the fact that the household head is gainfully employed. Similarly, students from wealthier households are more likely to believe that abstinence is the main way of avoiding contamination. In contrast to the younger age category, having a male teacher appears to decrease student knowledge, at least as far as knowing that someone who is apparently in good health can be HIV positive. Teachers with greater educational attainment are associated with students who know that there is a difference between contraception and protection from infection, while having a more experienced teacher is associated with a greater likelihood of believing that abstinence is the main way of avoiding contamination; teacher age works (in a statistically significant manner) in the opposite direction.

3.3.2 Attitudes

Within the younger age category, as is apparent from the results reported in the upper part of Table 11, male students appear to have more tolerant attitudes towards HIV positive individuals: they are significantly more likely to be willing to buy from a shopkeeper who is HIV positive, as are older students. In contrast, Muslim students appear to be less tolerant (they are significantly less likely to be willing to buy from such a shopkeeper). Males are also less likely to be confident of remaining sexually abstinent during their adolescence than are females, *ceteris paribus*. Students from relatively wealthier backgrounds also appear to be more tolerant. The likelihood of being willing to buy from an HIV positive shopkeeper is a significantly increasing function of student family wealth. In terms of the characteristics of their teachers, students with older teachers are more willing than their peers with younger teachers to take care of an HIV positive family member, students with male teachers are significantly less likely to do so, whereas the effect of teacher experience works in the opposite direction: it also reduces the likelihood that the student is willing to buy from an HIV positive shopkeeper. Students interviewed in the context of a class in which the teacher was male are also more likely to be confident of remaining abstinent during adolescence.

For the older age category, as shown in the lower portion of Table 11, male students are less willing to discuss HIV-AIDs with family members than are female students, while older pupils are more likely to be willing to meet and assist people living with HIV-AIDS. Muslim students, in contrast, are less willing to discuss the topic within their households, and students from the Haoussa ethnic group are less likely to be concerned as to whether the blade in a barbershop is of the single-use variety. Students who have a parent who can read or write are more likely to be willing to meet and assist individuals living with HIV-AIDS, and students from households in which the head is employed are more likely to be concerned about the sterilization of blades in barbershops. Students from wealthier households are more likely to be willing to have a conversation within the family on HIV-AIDS topics, as are students who come from a household that possesses a TV. Once again, teacher age and experience have opposite effects on attitudes. The likelihood of a student being willing to meet and assist people living with HIV-AIDS is an increasing function of teacher experience, and a decreasing function of teacher age. Similarly, teacher experience increases the likelihood of the student being willing to discuss HIV-AIDS-related topics within the household, with teacher age having the opposite effect (though it is not statistically significant at the usual levels of confidence).

3.3.3 Behavior

Turning to the behavior results for the younger age category presented in Table 12, males, older pupils, and those attending a technical class are less likely never to have had sexual intercourse. The first two categories of students are also more likely to have had more than one sexual partner. Males are significantly less likely to have used a condom if they have had sexual intercourse, and older students are significantly more likely to have done so. Parental characteristics do not appear to have any statistically significant impact on the sexual behavior of the younger age category, with the exception of the student coming from a household where the mother is present: if the mother is absent, the student is significantly less likely to have used a condom if she/he has had sexual intercourse. The characteristics of the teacher giving the class in which the students were interviewed also appear to have very little to do with student behavior. The exceptions are teacher educational attainment, which significantly increases the likelihood of the student using a condom, and the teacher being male, which significantly reduces the likelihood of the student having had more than one sexual partner.

For the older students (see the lower portion of Table 12), student age significantly increases the likelihood that she/he used a condom during her/his last sexual intercourse, and also significantly increased the likelihood that the student carried out an HIV test.

Haoussa students were significantly less likely to get tested, as were student attending a technical class. Having a TV in the household appears to have important impacts on the behavior of the older age category. First, students from such household are significantly more likely not to have contracted a STD during the past 12 months. Second, they are significantly more likely to have carried out an HIV test. The same is true for students hailing from households were the head works. Finally, teacher age and experience again work in opposite directions in terms of sexual behavior, with teacher age decreasing the likelihood of condom use, and teacher experience increasing it (as does teacher educational attainment). The opposite pattern emerges in terms of the student contracting a STD (again, with teacher educational attainment significantly reducing this probability).

The upshot of these descriptive results is that student knowledge, attitudes and behavior appear to be the result of a complex interaction amongst student characteristics (with gender, age and religion being the most important), household characteristics (with the most important role being played by household wealth, the employment status of the household head, the literacy status of the parents and the presence of a TV in the household), and the characteristics of the teacher within whose class the student was interviewed (with an interesting opposition between teacher age and teacher experience).

4 Identification strategy

Let i index students, j index teachers and k index schools, and let N represent sample size. Our basic empirical specification is given by:

$$y_{ijk} = x_{ijk}\alpha + d_{jk}\beta + u_{ijk}, \tag{1}$$

where y_{ijk} represents our $N \times 1$ response variable (student knowledge, attitudes or behavior), x_{ijk} represents an $N \times K_x$ matrix of student-, teacher- and school-specific control variables, d_{jk} is an $N \times 1$ dummy variable representing teacher j's "treatment status", with:

$$d_{jk} = \begin{cases} 1 \text{ if the teacher participated in the HIV-AIDS teacher training program} \\ 0 \text{ otherwise} \end{cases} \tag{2}$$

and u_{ijk} is a disturbance term. Our purpose is to consistently estimate the parameter β, the impact of a teacher participating in the HIV-AIDS training on the response variable of choice.

There are several potential sources of inconsistency that may afflict the estimation of

equation (1). To see why, consider the following decomposition of the disturbance term u_{ijk}:

$$u_{ijk} = \lambda_k + \mu_{jk}\sigma + \varepsilon_{ijk}, \tag{3}$$

where μ_{jk} is a teacher-specific, λ_k is a school-specific disturbance term, and where the parameter σ will be defined further below.

First, student KAB variables, even after controlling for the observable covariates x_{ijk}, may differ amongst schools because of unobservable school-specific characteristics. Examples include previous HIV-AIDS training programs in the school, a principal who is particularly concerned with raising awareness concerning HIV-AIDS in his or her school, or community-based information campaigns in the neighborhood that affect all students in a given school. Such unobservables can be accounted for by including school-specific effects, which we allow for in all of the specifications presented below.

Second, and more seriously, whether or not a teacher participates in the training program (d_{jk}) may be correlated with unobserved teacher characteristics (μ_{jk}). For example, teachers in a class in which, on average, students have particularly poor knowledge concerning HIV-AIDS may be more likely to participate in the training program. If this is the case, then:

$$E[d'_{jk}\mu_{jk} \big| \, x_{ijk}, \lambda_k] \neq 0, \tag{4}$$

yielding an inconsistent estimate of β. Formally-speaking, we can write this in terms of a latent index model which underlies the "treatment status" of teachers:

$$d^*_{jk} = z_{jk}\pi - \mu_{jk}, \tag{5}$$

where:

$$d_{jk} = \mathbf{1}[d^*_{jk} > 0], \tag{6}$$

where $\mathbf{1}[.]$ is an indicator function that is equal to 1 when the inequality in square brackets is true, and 0 otherwise, and where the key role played by the matrix z_{jk} of teacher-specific characteristics will be discussed in what follows. In this framework, it is readily apparent that simple least-squares estimates of β derived from equation (1), even when controlling for school-specific effects λ_k, will be biased when $\sigma \neq 0$ which, in turn, is highly likely. Another way of putting this is that there are probably unobserved teacher characteristics that affect both student responses and the likelihood of the teacher undertaking the training. The specification given by (3), (5) and (6), known as a common factor model, underlines this dependence and zeroes in on the mostly likely potential source of bias.

In order to get an idea of the likely direction of bias that might arise in estimating

equation (1) by OLS, note that the estimated coefficient will be given by:

$$\beta_{OLS} = \frac{\text{cov}\left[M_x d_{jk}, M_x y_{ijk}\right]}{\text{var}\left[M_x d_{jk}\right]} = \beta + \sigma \frac{\text{var}\left[\mu_{jk}\right]}{\text{var}\left[d_{jk}\right] + \text{var}\left[P_x d_{jk}\right]}, \tag{7}$$

where $P_x = x\left(x'x\right)^{-1}x'$ is the $N \times N$ idempotent projection matrix associated with x_{ijk} and $M_x = I_N - P_x$ is its orthogonal complement (with I_N being the $N-$dimensional identity matrix).

In the context of this teacher training program, it is highly likely that a teacher facing students with particularly poor KAB results will be more likely to undertake training. If this positive correlation holds for *unobservables* that determine student KAB as well, it will be the case that $\sigma < 0$. As such, and considering a situation in which the true impact of teacher training on our response variables is positive ($\beta > 0$), estimating (1) by OLS is likely to result in a downward bias in β_{OLS}, with the magnitude of this bias being increasing in the relative importance of the variance in teacher-level unobservables var$[\mu_{jk}]$. Note however that adding covariates x_{ijk} to the specification, as long as they are correlated with the teacher training decision, reduces the magnitude of the bias, given that it increases var$[P_x d_{jk}]$, where $P_x d_{jk}$ is the value of teacher training predicted by a regression of d_{jk} on x_{ijk}.

Note that estimating (1) with teacher-specific fixed effects would solve the problem, but would also throw the baby out with the bathwater in that the impact of teacher-level variables such as d_{jk} could then no longer be identified in that estimation would be wholly based on within-teacher variation.[3] Teacher-specific random effects are not feasible either, because the likely endogeneity of the training status variable implies that it will be correlated with the random effects.

Our identification strategy is therefore predicated on isolating elements of z_{jk} that do not have a *direct* impact on the response variable y_{ijk}, and which are therefore excluded from x_{ijk}. In other words, our identification strategy is based on the existence of instrumental variables, whose only impact on the response variable operates *indirectly* through their effect on the likelihood of a teacher receiving training.

We consider two such excluded instruments: (i) whether the teacher knows of any students who are HIV positive and (ii) whether the teacher knows of any colleagues who are HIV positive.

This identification strategy hinges, of course, on the inclusion of the appropriate matrix of covariates x_{ijk}. For the exclusion restrictions to be valid, the excluded instruments must not be correlated with unobservables that also affect the students' response variables. This

[3] An alternative would be Hausman and Taylor (1981) type estimation, but it is very difficult to think of student or household-level characteristics that can be plausibly argued to be orthogonal with respect to μ_{jk}.

might not be the case, for example, if teachers who devote a particular amount of effort in class to HIV-related topics (and therefore improve their students' KAB) are also more likely to undertake training. The validity of our exclusion restrictions therefore depends upon our being able to control for this sort of heterogeneity. We do this by including a variable that represents the number of minutes that the teacher devotes to HIV-related topics in class.[4] Of course, there might still be "quality" issues in terms of the intervention by the teacher on HIV related topics that are not controlled for by this covariate, but we minimize the likelihood of this by including a rich vector of teacher characteristics, including their education, their years of experience, their age, as well as the discipline they teach. Note also that we include school-specific fixed effects in all specifications, so unobserved school-specific heterogeneity that might simultaneously affect the training participation decision and the students' KAB for a given teacher is also controlled for.

5 Results

5.1 First stage reduced forms

We begin by presenting the first stage reduced form that corresponds to the latent index model given by equations (5) and (6), in order to see whether our proposed exclusion restrictions do in fact provide a modicum of identification. The specification includes school-specific effects, and standard errors are clustered at the teacher level. As should be obvious from the results presented in Table 13, both excluded IVs are statistically significant determinants of whether or not a teacher participates in the training program, while controlling for observed teacher characteristics and school-specific effects. A teacher knowing an HIV positive colleague increases the probability of taking up training by 22%, while knowing an HIV positive student increases this likelihood by 33%.

Amongst the teacher-specific covariates included in the first stage reduced form, the age, sex and educational attainment of the teacher have no impact on their likelihood of attending training. On the other hand, more experienced teachers are more likely to attend training, with each additional year of experience increasing this probability by 1.4%. Biology or life science teachers are 17% more likely to take up training than teachers in the other four disciplines, which squares well with one's *a priori* expectations.[5] Overall, the statistically

[4] Unfortunately, we do not know precisely what teachers devoted their average of 13 minutes per week of HIV-AIDS related teaching to. On the other hand, note that this variable is often statistically insignificant in the estimated structural equations, so the issue may be moot from an econometric standpoint.

[5] The first stage reduced forms differ for each response variable because the precise sample over which the 2SLS specification is estimated varies both by response variable and by age category of students, though they are all very similar to the results presented in Table 13. In the right-hand column of Table 14 we

significant determinants of teacher participation in training are reasonable.[6]

5.2 Instrumental variables results

IV estimates of the impact of teacher training on the various KAB variables are presented in the first column of Table 14. There are two particularly interesting findings in this table, given that the results for the two age categories of students are not at all the same.

First, the impact of having a trained teacher for the 12-13 year olds, essentially, is to increase apprehension concerning HIV-AIDS. In particular, younger students with a trained teacher are less likely to be willing to buy from an HIV positive shopkeeper. Moreover, they are more likely to wish to remain abstinent during adolescence. There is no impact of having a trained teacher on the knowledge of the younger students (this remains true whatever response variable we consider, including those not presented in Table 14), and no impact on their behavior.

Second, and on a more constructive and positive note, there is a big impact of teacher training on the attitudes and behavior of 16-17 year olds, as shown in the lower portion of Table 14. First, while in terms of knowledge there is a similar effect to that for the younger students in that having a trained teacher increases the likelihood of the student believing that abstinence is the main way of avoiding infection, students with a trained treacher are also marginally more likely to be willing to assist people who are HIV-positive, and they are significantly more likely to discuss HIV-AIDS issues within their family. Second, the older age category of students with a trained teacher are 29% more likely to have used a condom during their last sexual intercourse (recall that these are linear probability specifications, so that coefficients can be directly interpreted as an approximation of the marginal impact at the sample mean), and are 27% more likely to have carried out an HIV test.[7]

present partial$-F$ and partial R^2 statistics for the reduced form for each of our response variables. Using the standard rules of thumb (Stock, Wright, and Yogo 2002), there may be a weak instruments problem for the younger age category, while the partial $F-$statistics are all above the usual cutoff for the older age category. On the other hand, both exclusion restrictions were individually significant in all of the reduced forms for the younger age category. On the lack of reliability of the standard rules of thumb, see the excellent presentation by Cruz and Moreira (2005).

[6] One puzzle that emerges in the first stage reduced forms is the difference in the partial $F-$statistics. For the first stage reduced forms that correspond to teachers of the younger age category of students, the partial $F-$statistics are relatively low (approximatel equal to 2), while they are relatively large (around 20) for teachers of the older age category of students. Note however that the two exclusions remain statistically significant in most specifications. Extensive experimentation with different specifications did not change this result. The upshot is that identification by our exclusion restrictions is much stronger for teachers of students falling into the older age category, which may indicate a greater concern with HIV-AIDS related issues on their part.

[7] The IV results are also available disaggregated by the sex of the student and the sex of the teacher. In the interests of brevity we do not include these results in the paper but they are, of course, available upon

The second column of Table 14 presents the corresponding results from estimating the equation by OLS, without correcting for the endogeneity of teacher training. Recall from equation (7) that we argued that OLS estimates of the impact of teacher training should be biased downward when the "true" coefficient is positive (and therefore upward biased when the true coefficient is negative). Taking the case of condom use for the older age category yields exactly the pattern predicted by equation (7). Using OLS, the estimated impact of teacher training is to increase condom use by 13.1% but with a standard error that renders the point estimate statistically indistinguishable from zero at the usual levels of confidence. Moving to the IV estimates more than doubles the point estimate (and less than doubles the associated standard error). Conversely, if we consider the likelihood of the student in the younger age category being willing to buy from a shopkeeper who is HIV-positive, the OLS-based estimate yields a point estimate that, though negative, is measured so imprecisely as to be insignificant at the usual levels of confidence; moving to the IV results yields a point estimate that is almost six times larger in absolute value terms, and which is measured much more precisely.

Notice also that, taking a 5% critical value, the test of the overidentifying restrictions never rejects and that, out of 18 test statistics, only two (for the mosquito not transmitting HIV-AIDS and for worrying about the sterility of razor blades at the barber shop) are the $p-$values associated with the test below the 0.10 threshold. For the 16 other test statistics, the $p-$values are never below the 0.3 level.

How sensitive are our results to the validity of our exclusion restrictions? So as to organize our thoughts, assume that our exclusion restrictions are false, and that the structural equation is actually given by:

$$y_{ijk} = x_{ijk}\alpha + d_{jk}\beta + \lambda_k + \mu_{jk}\sigma + z_{jk}\phi + \varepsilon_{ijk}, \tag{8}$$

where the vector of parameters ϕ represents the degree of violation of the exclusion restrictions.[8] In the context of this teacher training program, and if the time that the teacher devotes to HIV-AIDS related topics in class does not adequately control for teacher-specific unobservables that affect student KAB variables, it is reasonable to assume that each element of ϕ is positive: teachers who know HIV-positive colleagues or students are likely to have unobservables that improve the KAB results of their students. If, for illustrative

request.

[8] If we use both teacher characteristics as excluded instruments, ϕ is a 2×1 vector, with each element corresponding to the degree of violation of the exclusion restriction for each excluded instrument.

purposes, we were to estimate (8) using a single exclusion restriction, we would obtain:

$$\beta_{IV} = \frac{\text{cov}\left[M_x z_{jk}, M_x y_{ijk}\right]}{\text{cov}\left[M_x z_{jk}, M_x d_{jk}\right]} = \beta + \frac{\text{var}\left[M_x z_{jk}\right]}{\text{cov}\left[M_x z_{jk}, M_x d_{jk}\right]}\phi, \tag{9}$$

where $\frac{\text{var}\left[M_x z_{jk}\right]}{\text{cov}\left[M_x z_{jk}, M_x d_{jk}\right]}$ is readily seen to be the inverse of the coefficient associated with z_{jk} of a regression of training status d_{jk} on z_{jk} and x_{ijk}. If the marginal effect of knowing an HIV-positive student or colleague, conditional on x_{ihc}, is to increase the likelihood of training (which means that $\frac{\text{var}[M_x z_c]}{\text{cov}[M_x z_c, M_x w_c]} > 0$), it follows that β_{IV} will be biased upwards, leading potentially (for the case in which the true β is positive) to an overstatement of the beneficial impact of teacher training on outcomes. Equation (9) is clear: in order to minimize potential bias stemming from a violation of our exclusion restriction, (i) knowing an HIV-positive colleague or student must be a strong predictor of training status (so that $\frac{\text{var}\left[M_x z_{jk}\right]}{\text{cov}\left[M_x z_{jk}, M_x d_{jk}\right]}$ is small), whereas (ii) we must minimize the potential size of ϕ by including a rich set of covariates x_{ijk} in the structural equation. The first condition appears to be satisfied by our first-stage reduced forms presented in column (1) of Table .13. We have attempted to satisfy the second condition by including a rich set of student, parental, and teacher characteristics amongst the covariates x_{ijk}, as well as by basing our estimates on within-school variation.

6 Concluding remarks

Should governments be investing in HIV-AIDS teacher training programs in subsaharan Africa, such as the one considered in this paper, and as they are currently doing? Though it is well known that targeted interventions amongst high-risk populations (such as sex workers) are effective in reducing the spread of HIV-AIDS, interventions in large, relatively low risk populations are often seen as being impractical and prohibitively costly. On the other hand, it would appear to be especially important to consider interventions in such populations, in that significant increases in HIV infection will necessarily come, in the future, from the lower risk general population. Given the near-universality of schooling in relatively rich African countries such as the Cameroon, such programs would appear to be a particularly cost-effective manner of reaching an important segment of the general population. Moreover, for the Cameroonian case, in which pprevalence rates are significantly higher than in most of francophone West Africa, it would appear to be extremely important to implement any intervention that can contribute to maintaining prevalence below the threshold of 5%.

Though we do not have quantitative evidence (for example, in terms of QALYs saved) on

the effectiveness of alternative interventions in the Cameroon, such as blood screening, the use of the mass media, the social marketing of condoms, the treatment of STDs, the peer education of sex workers, voluntary counselling and testing, prevention activities among intravenous drug users or the prevention of mother-to-child transmission, our empirical results suggest that teacher training can have a significant impact on the behavior of 16 to 17 year olds. More empirical evidence, allowing one to establish cost-effectiveness comparisons with alternative approaches, would therefore appear to be a key ingredient so as to be able to ascertain whether teacher-training programs, such as the one considered in this paper, should be extended to the bulk of the Cameroonian schooling system.

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	Teacher trained					
	yes	days			no	total
		2	3	> 3		
12-13 year olds:						
Number of teachers	52	15	28	9	173	225
Number of students	625	162	329	81	2076	2701
boys	327	85	171	71	1056	1383
girls	298	77	158	63	1020	1318
16-17 year olds:						
Number of teachers	48	18	20	10	157	205
Number of students	566	213	238	119	1888	2454
boys	301	107	125	69	997	1298
girls	264	105	113	46	889	1153

Table 1: Distribution of teachers, 12-13 year olds and 16-17 year olds by training status and duration of training of teacher.

	mean	N	Teacher trained − teacher not trained [$p-$value]
Thinks that someone apparently in good health can be HIV positive			
overall	0.710	2614	−0.049 [0.208]
boys	0.729	1341	−0.040 [0.367]
girls	0.699	1492	−0.062 [0.218]
Thinks one dies directly as a result of being HIV positive			
overall	0.046	2659	−0.018 [0.176]
boys	0.043	1365	−0.009 [0.595]
girls	0.040	1294	−0.029 [0.052]
Thinks that sexual abstinence allows one to avoid getting HIV-AIDS			
overall	0.843	2583	−0.038 [0.234]
boys	0.842	1331	−0.005 [0.859]
girls	0.847	1252	−0.074 [0.115]
Thinks using a condom is means of protection against HIV-AIDS			
overall	0.888	2607	0.009 [0.663]
boys	0.879	1333	0.003 [0.895]
girls	0.897	1274	0.016 [0.513]
Thinks having a STD increases the risk of contraction HIV-AIDS			
overall	0.540	2647	−0.010 [0.797]
boys	0.530	1358	−0.013 [0.795]
girls	0.549	1289	−0.007 [0.870]

Table 2: Selected descriptive statistics —knowledge: 12-13 year olds. Standard errors adjusted for clustering at the class level.

	mean	N	Teacher trained − teacher not trained [$p-$value]
Willing to take care of an HIV positive family member			
overall	0.853	2693	−0.038 [0.105]
boys	0.841	1379	−0.033 [0.295]
girls	0.865	1314	−0.042 [0.157]
Willing to buy from a shopkeeper who is HIV positive			
overall	0.462	2665	0.010 [0.774]
boys	0.498	1361	−0.010 [0.794]
girls	0.424	1304	0.034 [0.464]
Thinks it's OK to use a condom before marriage if abstinence not possible			
overall	0.838	2701	0.014 [0.578]
boys	0.848	1383	0.057 [0.019]
girls	0.827	1318	−0.030 [0.389]
Thinks it's difficult to remain abstinent			
overall	0.387	2682	0.002 [0.948]
boys	0.422	1372	0.033 [0.491]
girls	0.350	1310	−0.030 [0.477]
Is confident or remaining HIV negative			
overall	0.622	2667	0.008 [0.862]
boys	0.644	1368	0.013 [0.797]
girls	0.599	1299	0.001 [0.982]
Wishes to remain a virgin during adolescence			
overall	0.697	1749	−0.019 [0.660]
boys	0.666	809	−0.003 [0.938]
girls	0.724	940	−0.032 [0.563]

Table 3: Selected descriptive statistics —attitudes: 12-13 year olds. Standard errors adjusted for clustering at the class level.

	mean	N	Teacher trained − teacher not trained [$p-$value]
Has never had sexual intercourse			
overall	0.657	2674	−0.004 [0.937]
boys	0.592	1366	−0.001 [0.983]
girls	0.724	1308	−0.002 [0.966]
Has had sexual intercourse with more than one partner			
overall	0.146	2674	0.025 [0.396]
boys	0.204	1366	0.029 [0.471]
girls	0.086	1308	0.015 [0.570]
Has used a condom if he/she has had sexual intercourse			
overall	0.628	635	−0.000 [0.883]
boys	0.586	435	−0.010 [0.790]
girls	0.720	200	0.024 [0.777]

Table 4: Selected descriptive statistics —behavior: 12-13 year olds. Standard errors adjusted for clustering at the class level.

	mean	N	Teacher trained − teacher not trained [$p-$value]
Thinks that someone apparently in good health can be HIV positive			
overall	0.928	2426	0.021 [0.225]
boys	0.925	1283	−0.004 [0.860]
girls	0.930	1141	0.050 [0.008]
Thinks that sexual abstinence is the main way allowing to avoid HIV-AIDS			
overall	0.548	2382	0.059 [0.138]
boys	0.553	1260	0.060 [0.150]
girls	0.544	1120	0.059 [0.256]
Thinks that using a condom is the main way allowing to avoid HIV-AIDS			
overall	0.251	2382	−0.048 [0.121]
boys	0.254	1260	−0.060 [0.065]
girls	0.247	1120	−0.032 [0.439]
Thinks using a condom is means of protection against HIV-AIDS			
overall	0.911	2422	−0.010 [0.452]
boys	0.921	1282	−0.020 [0.185]
girls	0.898	1138	0.000 [0.991]
Thinks having a difference contraceptive method and protective method against HIV-AIDS			
overall	0.644	2428	0.010 [0.769]
boys	0.622	1277	−0.000 [0.909]
girls	0.668	1149	0.025 [0.542]

Table 5: Selected descriptive statistics —knowledge: 16-17 year olds. Standard errors adjusted for clustering at the class level.

	mean	N	Teacher trained − teacher not trained [$p-$value]
Talks about HIV-AIDS as disease that could happen in your family			
overall	0.911	2451	0.011 [0.563]
boys	0.907	1297	0.033 [0.150]
girls	0.916	1152	−0.000 [0.696]
Ready to meet and assist people living with AIDS in your village/Neighborhood			
overall	0.901	2449	0.019 [0.358]
boys	0.898	1295	0.070 [0.000]
girls	0.904	1152	−0.030 [0.265]
Has a discussion on HIV-AIDS within your family			
overall	0.735	2450	−0.061 [0.029]
boys	0.696	1297	−0.079 [0.033]
girls	0.778	1151	−0.041 [0.265]
Knows a place for testing of HIV-AIDS			
overall	0.887	2447	0.034 [0.116]
boys	0.888	1294	0.045 [0.085]
girls	0.885	1151	0.021 [0.512]
Make sure that the blade used is unique or that the mower is sterilized?			
overall	0.640	2230	0.017 [0.637]
boys	0.636	1267	−0.020 [0.469]
girls	0.645	961	0.079 [0.148]

Table 6: Selected descriptive statistics —attitudes: 16-17 year olds. Standard errors adjusted for clustering at the class level.

	mean	N	Teacher trained − teacher not trained [$p-$value]
Pregnant girls	0.025	1087	−0.029 [0.000]
Used a condom during last sexual intercourse			
overall	0.789	1186	−0.048 [0.156]
boys	0.776	695	−0.058 [0.139]
girls	0.806	491	−0.028 [0.566]
Contracted a STD during the past 12 months			
overall	0.102	1396	−0.015 [0.562]
boys	0.114	804	−0.027 [0.344]
girls	0.086	592	−0.001 [0.960]
Number of partners			
overall	2.19	1279	0.047 [0.850]
boys	2.54	738	−0.222 [0.420]
girls	1.71	539	0.380 [0.355]
Carried out an HIV test			
overall	0.314	2451	0.102 [0.000]
boys	0.299	1297	0.064 [0.031]
girls	0.332	1152	0.148 [0.000]

Table 7: Selected descriptive statistics —behavior: 16-17 year olds. Standard errors adjusted for clustering at the school level.

	12-13 year olds			16-17 year olds		
	mean	std.		mean	std.	
		total	within class		total	within class
Student characteristics						
Male	0.512	0.499	0.486	0.529	0.499	0.480
Age	13.52	2.050	1.669	18.17	2.010	1.653
Education (years)	5.937	0.241	0.179	10.20	0.545	0.477
Attended school last year	0.989	0.099	0.094	0.983	0.137	0.132
Is single	0.992	0.083	0.079	0.979	0.142	0.128
Lives in an urban area	0.593	0.491	0.052	0.566	0.495	0.115
Attends a:						
general college	0.856	0.350	0.092			
technical college	0.144	0.031	0.023			
Attends a:						
literary class				0.593	0.491	0.233
scientific class				0.266	0.442	0.217
technical class				0.139	0.346	0.125
Parental characteristics						
Household wealth index	0.002	2.037	1.526	0.000	2.065	1.036
Household size	8.059	4.239	3.778	7.641	4.347	3.917
Mother lives in household	0.813	0.389	0.345	0.734	0.462	0.404
Mother <35 years of age	0.356	0.479	0.448	0.157	0.364	0.342
Household head married	0.747	0.434	0.390	0.736	0.440	0.403
Education (highest of 2 parents)	7.824	5.720	5.136	9.578	5.270	4.600
Head worked last 7 days	0.857	0.349	0.319	0.774	0.437	0.404
Ethnic group:						
Beti/Bassa/Mbam	0.577	0.494	0.322	0.585	0.492	0.305
Arab choa/Peulh	0.152	0.359	0.235	0.153	0.360	0.223
Religion:						
Catholic	0.554	0.497	0.418	0.533	0.498	0.433
Protestant	0.218	0.413	0.379	0.266	0.442	0.399
Muslim	0.147	0.354	0.264	0.121	0.326	0.258

Table 8: Student characteristics.

	mean	std.	
		total	within school
Male	0.775	0.417	0.277
Age	35.61	7.873	4.855
Educational attainment	15.62	1.960	1.194
Experience	8.812	7.151	4.855
Married	0.543	0.498	0.334
Number of classes tought	4.901	2.774	1.692
Total students	270.3	171.0	89.08
Class size	61.83	25.94	12.35
School has an infirmary	0.439	0.494	0.214
Minutes devoted to teaching HIV-AIDS topics	13.277	16.970	9.245

Table 9: Teacher characteristics.

	12-13 year olds			16-17 year olds		
	Response variable			Response variable		
	HIV causes AIDS	Mosquito does not transmit	STD increases risk	Someone apparently in good health can be HIV+	Abstinence is main way of avoiding HIV-AIDS	Thinks there is a difference between contra-ception and protection
Student characteristics						
Male	0.027	0.058	−0.008	0.006	0.024	−0.025
	(0.024)	(0.024)	(0.021)	(0.012)	(0.025)	(0.023)
Age	−0.004	0.012	0.000	0.001	0.001	0.008
	(0.007)	(0.006)	(0.007)	(0.002)	(0.006)	(0.005)
Technical class	0.254	0.098	−0.247	0.074	0.116	−0.067
	(0.072)	(0.042)	(0.100)	(0.028)	(0.072)	(0.147)
Muslim	−0.008	−0.098	−0.100	−0.002	0.000	0.014
	(0.037)	(0.040)	(0.039)	(0.026)	(0.047)	(0.045)
Haoussa	−0.037	0.033	−0.020	0.010	−0.052	−0.069
	(0.046)	(0.049)	(0.053)	(0.028)	(0.047)	(0.043)
Parental characteristics						
Parent can read/write	0.039	−0.047	0.055	0.054	0.104	−0.017
	(0.045)	(0.052)	(0.053)	(0.037)	(0.047)	(0.045)
Hh. head works	−0.093	−0.030	0.052	−0.003	0.047	−0.041
	(0.033)	(0.028)	(0.029)	(0.013)	(0.025)	(0.026)
Hh. wealth index	−0.013	0.004	0.003	0.007	0.013	0.000
	(0.006)	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)
Mother lives in hh.	−0.022	−0.003	0.014	0.003	−0.012	0.010
	(0.042)	(0.041)	(0.014)	(0.022)	(0.032)	(0.038)
Hh. has a TV	−0.000	0.067	0.013	0.004	−0.025	0.032
	(0.028)	(0.030)	(0.034)	(0.017)	(0.028)	(0.027)
Teacher characteristics						
Age	−0.003	0.005	0.002	−0.008	−0.021	−0.010
	(0.003)	(0.002)	(0.004)	(0.003)	(0.007)	(0.009)
Male	0.058	0.038	0.008	−0.032	0.042	0.050
	(0.027)	(0.031)	(0.046)	(0.017)	(0.071)	(0.076)
Education	−0.003	0.023	0.018	−0.002	0.017	0.040
	(0.012)	(0.008)	(0.013)	(0.009)	(0.018)	(0.016)
Years of experience	−0.004	−0.009	−0.000	0.008	0.023	0.007
	(0.003)	(0.003)	(0.005)	(0.003)	(0.008)	(0.008)
Biology teacher	0.146	0.068	0.034	0.021	0.008	0.049
	(0.037)	(0.042)	(0.065)	(0.028)	(0.043)	(0.049)
N	2204	2240	2192	2064	2023	2067
R^2	0.034	0.029	0.016	0.028	0.020	0.018
σ	0.270	0.219	0.160	0.147	0.165	0.121

Table 10: Determinants of student knowledge: school-specific fixed effects included in all specifications, standard error clustered at the teacher level in parentheses.

	12-13 year olds			16-17 year olds		
	Response variable			Response variable		
	Willing to take care of an HIV positive family member	Willing to buy from a shopkeeper who is HIV+	Confident not to have sex during adole -scence	Ready to meet and assist people living with HIV-AIDS	Discusses HIV-AIDS with family members	Worries whether razor is single use at barber-shop
Student characteristics						
Male	−0.026 (0.015)	0.031 (0.007)	−0.080 (0.024)	−0.003 (0.015)	−0.071 (0.023)	−0.001 (0.031)
Age	0.009 (0.005)	0.031 (0.007)	−0.004 (0.007)	0.010 (0.003)	0.001 (0.005)	0.001 (0.006)
Technical class	−0.026 (0.044)	−0.084 (0.057)	−0.071 (0.112)	0.004 (0.036)	0.092 (0.051)	0.032 (0.117)
Muslim	0.005 (0.036)	−0.098 (0.044)	0.026 (0.050)	0.005 (0.030)	−0.075 (0.036)	0.058 (0.047)
Haoussa	−0.043 (0.040)	−0.005 (0.047)	−0.070 (0.045)	0.033 (0.032)	0.017 (0.038)	−0.092 (0.037)
Parental characteristics						
Parent can read/write	0.027 (0.056)	0.017 (0.017)	0.068 (0.061)	0.085 (0.036)	0.012 (0.044)	−0.086 (0.049)
Hh. head works	−0.025 (0.021)	−0.040 (0.030)	−0.045 (0.030)	−0.009 (0.014)	−0.020 (0.023)	0.053 (0.026)
Hh. wealth index	0.008 (0.005)	0.014 (0.007)	0.004 (0.007)	−0.000 (0.004)	0.013 (0.006)	0.008 (0.006)
Mother lives in hh.	−0.018 (0.027)	−0.044 (0.039)	−0.007 (0.048)	0.035 (0.025)	0.019 (0.040)	−0.013 (0.039)
Hh. has a TV	−0.008 (0.024)	−0.022 (0.031)	0.025 (0.034)	0.027 (0.020)	0.058 (0.027)	0.027 (0.029)
Teacher characteristics						
Age	0.008 (0.002)	0.004 (0.003)	0.008 (0.004)	−0.006 (0.003)	−0.007 (0.005)	−0.012 (0.008)
Male	−0.087 (0.018)	−0.074 (0.036)	−0.075 (0.048)	−0.009 (0.028)	−0.036 (0.042)	0.141 (0.060)
Education	0.007 (0.004)	0.002 (0.009)	0.010 (0.010)	0.008 (0.009)	0.031 (0.017)	−0.006 (0.012)
Years of experience	−0.008 (0.002)	−0.012 (0.004)	−0.004 (0.004)	0.008 (0.004)	0.012 (0.006)	0.017 (0.010)
Biology teacher	0.040 (0.045)	−0.072 (0.049)	0.053 (0.049)	0.025 (0.040)	0.051 (0.035)	−0.038 (0.047)
N	2236	2209	1511	2087	2087	1884
R^2	0.019	0.032	0.027	0.022	0.031	0.019
σ	0.120	0.144	0.286	0.096	0.122	0.140

Table 11: Determinants of student attitudes: school-specific fixed effects included in all specifications, standard error clustered at the teacher level in parentheses.

	12-13 year olds			16-17 year olds		
	Response variable			Response variable		
	Has never had sexual inter -course	Has sex with more than one partner	Used a condom if he/she has had sexual inter -course	Used a condom during last sexual inter -course	Contracted a STD during the past 12 months	Carried out an HIV test
Student characteristics						
Male	−0.130	0.103	−0.194	0.008	0.025	−0.027
	(0.020)	(0.017)	(0.052)	(0.026)	(0.022)	(0.020)
Age	−0.069	0.049	0.052	0.019	0.005	0.024
	(0.006)	(0.005)	(0.014)	(0.007)	(0.005)	(0.005)
Technical class	−0.141	0.100	0.004	0.145	−0.169	−0.038
	(0.070)	(0.061)	(0.125)	(0.090)	(0.061)	(0.034)
Muslim	0.035	−0.011	0.101	0.072	−0.006	0.043
	(0.030)	(0.030)	(0.094)	(0.066)	(0.031)	(0.039)
Haoussa	0.027	−0.023	−0.081	0.095	0.030	−0.099
	(0.027)	(0.028)	(0.079)	(0.058)	(0.043)	(0.040)
Parental characteristics						
Parent can read/write	−0.031	−0.024	−0.048	0.136	0.037	0.048
	(0.039)	(0.040)	(0.093)	(0.071)	(0.036)	(0.044)
Hh. head works	0.000	−0.027	−0.012	0.036	0.004	0.068
	(0.025)	(0.020)	(0.056)	(0.028)	(0.019)	(0.022)
Hh. wealth index	−0.005	0.006	0.034	0.012	0.006	−0.000
	(0.005)	(0.004)	(0.019)	(0.009)	(0.005)	(0.006)
Mother lives in hh.	0.012	−0.041	0.209	−0.034	−0.015	0.069
	(0.033)	(0.031)	(0.077)	(0.049)	(0.031)	(0.033)
Hh. has a TV	−0.023	0.007	−0.023	−0.025	−0.042	0.057
	(0.024)	(0.021)	(0.057)	(0.043)	(0.020)	(0.025)
Teacher characteristics						
Age	0.004	−0.001	0.004	−0.027	0.009	−0.000
	(0.005)	(0.002)	(0.005)	(0.007)	(0.004)	(0.006)
Male	0.035	−0.097	0.026	0.052	−0.059	0.073
	(0.041)	(0.029)	(0.043)	(0.062)	(0.031)	(0.054)
Education	0.013	−0.008	0.026	0.031	−0.017	0.003
	(0.011)	(0.004)	(0.011)	(0.014)	(0.008)	(0.010)
Years of experience	0.000	0.001	−0.001	0.030	−0.008	0.008
	(0.005)	(0.002)	(0.006)	(0.008)	(0.004)	(0.007)
Biology teacher	0.046	0.058	−0.062	0.033	0.034	0.006
	(0.063)	(0.034)	(0.067)	(0.046)	(0.037)	(0.042)
N	2220	2220	520	1310	1168	2088
R^2	0.126	0.103	0.123	0.035	0.048	0.041
σ	0.378	0.166	0.414	0.249	0.195	0.146

Table 12: Determinants of student behavior: school-specific fixed effects included in all specifications, standard error clustered at the teacher level in parentheses.

Dependent variable	Linear probability model = 1 if teacher is trained, 0 otherwise
Exclusion restrictions	
Teacher knows HIV positive colleague	0.220 (0.085)
Teacher knows HIV positive student	0.335 (0.114)
Time spent discussing HIV/AIDS	0.001 (0.001)
Teacher characteristics:	
Age	0.000 (0.005)
Sex	0.022 (0.066)
Educational attainment	−0.005 (0.014)
Years experience	0.014 (0.006)
Teacher teaches biology	0.170 (0.075)
Student characteristics included	yes
Parental characteristics included	yes
N	4,342
R^2 or pseudo$-R^2$	0.155
σ	0.694

Table 13: First stage reduced form: the determinants of the teacher training decision; school-specific fixed effects included in all specifications (standard errors clustered at the teacher level in parentheses).

	IV estimate of impact of teacher training	OLS estimate of impact of teacher training	Test of the OID restrictions [$p-$value]	Weak IV diagnostics: partial R^2, partial F of reduced form
12-13 year olds: Response variables				
Knowledge:				
HIV causes AIDS	-0.078 (0.148)	0.048 (0.067)	0.421 [0.516]	0.063, 2.18
Mosquito does not transmit AIDS	0.042 (0.213)	0.011 (0.049)	3.306 [0.069]	0.062, 2.12
STDs increase risk	-0.351 (0.302)	-0.052 (0.067)	0.852 [0.356]	0.045, 3.07
Attitudes:				
Willing to take care of HIV+ family member	-0.125 (0.135)	-0.079 (0.031)	0.286 [0.592]	0.063, 1.14
Willing to buy from shopkeeper who is HIV+	-0.402 (0.177)	-0.071 (0.061)	0.117 [0.731]	0.058, 1.94
Will remain abstinent during adolescence	0.349 (0.167)	0.084 (0.067)	0.067 [0.795]	0.059, 2.05
Behavior:				
Has never had sexual intercourse	-0.250 (0.211)	0.041 (0.059)	0.000 [0.986]	0.062, 2.11
Has sex with more than one partner	0.453 (0.309)	-0.016 (0.030)	0.374 [0.541]	0.062, 2.11
Used a condom if had sexual intercourse	-0.395 (0.298)	-0.061 (0.082)	0.557 [0.455]	0.056, 1.97
16-17 year olds: Response variables				
Knowledge:				
Person apparently in good health can be HIV+	0.084 (0.073)	0.046 (0.028)	0.001 [0.972]	0.119, 18.29
Abstinence main way to avoid contamination	0.288 (0.132)	0.053 (0.079)	0.105 [0.745]	0.116, 18.24
Contraception is different from prevention	0.607 (0.457)	0.054 (0.085)	0.081 [0.776]	0.117, 17.62
Attitudes:				
Ready to meet and assist HIV+ individuals	0.124 (0.069)	-0.003 (0.015)	0.585 [0.444]	0.116, 18.11
Discusses HIV-AIDS with family members	0.359 (0.120)	0.140 (0.070)	0.001 [0.980]	0.116, 18.20
Worries that blade is single-use at barbershop	0.130 (0.138)	0.101 (0.073)	3.074 [0.079]	0.129, 20.22
Behavior:				
Use a condom durant last sexual intercourse	0.289 (0.116)	0.131 (0.068)	1.001 [0.317]	0.168, 20.43
Contracted a STD during the past 12 months	0.185 (0.146)	0.011 (0.044)	0.502 [0.478]	0.155, 16.68
Carried out an HIV test	0.273 (0.145)	0.000 (0.065)	0.270 [0.603]	0.116, 18.17

Table 14: The impact of teacher training on KAB: school-specific fixed effects included in all specifications, standard error clustered at the teacher level in parentheses.