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Sexual Behavior and STI/HIV Status Among Adolescents in Rural Malawi: An Evaluation of the Effect of Interview Mode on Reporting

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Abstract

This study investigates the reporting of premarital sex in rural southern Malawi. It summarizes the results of an interview-mode experiment conducted with unmarried young women aged 15–21 in which respondents were randomly assigned to either an audio computer-assisted self-interview (ACASI) or a conventional face-to-face (FTF) interview. In addition, biomarkers were collected for HIV and three STIs: gonorrhea, chlamydia, and trichomoniasis. Prior to collecting the biomarkers, nurses conducted a short face-to-face interview in which they repeated questions about sexual behavior. The study builds on earlier research among adolescents in Kenya where we first investigated the feasibility and effectiveness of ACASI. In both Malawi and Kenya, the mode of interviewing and questions about types of sexual partners affect the reporting of sexual activity. Yet the results are not always in accordance with expectations. Reporting for “ever had sex” and “sex with a boyfriend” is higher in the FTF mode. When we ask about other partners as well as multiple lifetime partners, however, the reporting is consistently higher with ACASI, in many cases significantly so. The FTF mode produced more consistent reporting of sexual activity between the main interview and a subsequent interview. The association between infection status and reporting of sexual behavior is stronger in the FTF mode, although in both modes a number of young women who denied ever having sex test positive for STIs/HIV.

Our understanding of the dynamics of HIV transmission in developing countries is compromised by unreliable data on sexual behavior. Epidemiological studies in Africa have observed little association between self-reported risky sexual behavior and HIV status. Indeed, a large multisite study of factors determining HIV prevalence in four African cities revealed considerable numbers of women who were HIV-positive yet reported never having had sex or having had only one sexual partner and few episodes of sexual intercourse (Buvé et al. 2001; Glynn et al. 2001).

The inconsistency between reported sexual behavior and HIV incidence has prompted some epidemiologists to question the conventional explanation for the African AIDS pandemic. Arguing that preconceived notions of African sexuality have unduly influenced researchers, several epidemiologists suggest that parenteral transmission via medical injections with

contaminated needles, rather than risky sexual behavior, is primarily responsible for the spread of HIV (Brewer et al. 2003; Gisselquist and Potterat 2003; Gisselquist et al. 2003).¹ Some anthropologists also have been critical of the standard interpretations of the African pandemic. In a recent critique of explanations for trends in HIV in Uganda, Allen (2006: 14) argues that “much of what has been claimed [about sexual activity] is based on little more than speculation, and is sometimes affected by very misleading assumptions about a homogeneous African sexuality.” He, too, faults AIDS researchers for focusing on high-risk behavior and neglecting nonsexual transmission.

Surprisingly, some of the epidemiologists who challenge conventional wisdom on the transmission of HIV in Africa are not similarly skeptical about the survey data on sexual behavior used to buttress their arguments. As Gisselquist and Potterat (2003: 171) assert regarding the behavioral studies they review: “the care with which these [surveys] ... have been performed, the familiarity of investigators with local conditions, their experience in the conduct of such studies and the consistency of response make summary dismissal of such results untenable.” The willingness of these researchers to accept survey data of questionable validity has serious implications for interpretations of the etiology of HIV transmission.

On the other hand, researchers who rely on survey data are more suspicious of the information they collect on sexual behavior (see, for example, Dare and Cleland 1994; Cleland et al. 2004). Many researchers have examined the reliability and validity of survey data from developing countries (Blanc and Rutenberg 1990; Lagarde et al. 1995; Blanc and Way 1998; Eggleston et al. 2000; Curtis and Sutherland 2004; Gregson et al. 2004; Nnko et al. 2004; Zaba et al. 2004). Many acknowledge that reporting of sexual behavior is problematic, and a few have investigated the ways in which the data-collection process may be flawed, or have explored techniques to improve it (see Rumakom et al. 1999; Gregson et al. 2002; Plummer et al. 2004; Potdar and Koenig 2005).

This study represents one effort to investigate the reporting of sexual behavior in a developing-country survey. It summarizes the results from an interview-mode experiment conducted among unmarried adolescents in a rural district of southern Malawi. Data concerning sexual behavior obtained from audio computer-assisted self-interviewing (ACASI), a technique designed to collect data on sensitive issues, are compared with data obtained from conventional face-to-face (FTF) interviews. The study builds on earlier research conducted in two districts in Kenya where we first investigated whether the use of ACASI is feasible in developing countries and whether it provides more accurate information than interviewer-administered and self-administered questionnaires (Mensch et al. 2003; Hewett et al. 2004a; Hewett et al. 2004b). Although ACASI was found to elicit higher reporting of many sensitive behaviors in Kenya, some anomalies emerged, raising questions about the effectiveness of computerized interviewing in reducing measurement error in developing-country surveys.

Whereas our Kenya study was limited to comparisons of reporting between interview modes, here we are able to draw on the use of biomarkers for STIs to investigate the strength of the association between STI/HIV status and respondents’ reporting of risky sexual behavior, as well as on interviews—conducted by nurses prior to the collection of biomarkers—in which questions on sexual behavior were repeated. Although we are aware of the limitations and difficulties of using biomarkers to measure the association between behavior and infection (Catania et al. 1990; Fishbein and Pequegnat 2000; Fenton et al. 2001; Boerma and Weir

¹This suggestion has generated a considerable amount of attention from epidemiologists. In a recent article, French and her colleagues (2006) produce simulations revealing that unrealistic assumptions about unsafe medical injections would be required to produce the current HIV pandemic in Africa, whereas plausible average partner-change rates are compatible with the current pandemic. See also Hayes and White (2006).

2005), we believe that if they are collected in tandem with an experimental assignment to interview mode, they can provide important supplementary data for evaluating interviewer-mode effects.

The computerized administration of questionnaires, developed in part to address concerns about the influence of interviewers on survey participants' responses, is presumed to improve the quality of the data by making the interview more private and standardized. With ACASI, software is designed so that the respondent hears both the question and the response categories through headphones. The respondent answers each question by pressing a number on a keypad or computer keyboard. The advantage of ACASI over FTF interviews is that neither the investigator nor anyone else in the area where the interview is being conducted hears the question or response, presumably reducing social desirability bias. Moreover, unlike self-administered interviewing, which requires that the respondent be literate and competent to fill out a questionnaire, ACASI can be used without the respondent's having to read the questions on the computer screen. Moreover, the researcher does not have to be concerned with differences in the characteristics or interviewing styles of the interviewers (Tourangeau et al. 2000).

ACASI has been used successfully in surveys conducted in the United States, including the National Survey of Family Growth, the National Survey of Adolescent Males, and the National Longitudinal Study of Adolescent Health. Data have been collected on injection-drug use, abortion, same-gender sex, and violent behavior, with significantly higher levels of these sensitive and illegal behaviors reported than in face-to-face interviews and paper-and-pencil self-administered questionnaires, although ethnic differences in the degree of comfort with the computer have been observed (Tourangeau and Smith 1996; Turner et al. 1997; Fu et al. 1998; Turner et al. 1998; Hewitt 2002). ACASI has also been used successfully in specialized surveys of homosexual men, injecting drug users, and women at high risk of HIV exposure (Des Jarlais et al. 1999; Gross et al. 2000; Metzger et al. 2000). Randomized assignment of respondents either to ACASI or to face-to-face interviews revealed greater reporting of HIV-risk behaviors among ACASI respondents (Des Jarlais et al. 1999; Metzger et al. 2000); greater differences were observed among HIV-positive than HIV-negative respondents (Macalino et al. 2002).

A commentary in *Science*, which summarized the results of an experiment conducted in the United States comparing ACASI with self-administered questionnaires, argued that ACASI may be especially suited to collecting data in developing countries, "where overcrowded living conditions typically prevail, where literacy is relatively low, and where some of the behaviors in question may be particularly pronounced" (Bloom 1998: 847). In the past ten years, a number of studies have investigated the use of ACASI in developing countries. The results from these studies are not as definitive, however, as the results from the interview-mode experiments conducted in the United States.

One of the first experiments undertaken outside the United States was conducted at a college in Thailand; it compared self-administered questionnaires and ACASI. Substantial differences by interview mode were found, with ACASI producing more reports of sexual activity, particularly from females, although the sample was too small for these differences to be statistically significant. The use of automated skip patterns with ACASI was found to reduce measurement error (Rumakom et al. 1999). A more recent randomized experiment in Thailand was conducted among a sample of approximately 1,200 students aged 15–21. The study compared palm-top-assisted self-interviewing (PASI) with ACASI, self-administered, and face-to-face interviewing and found that PASI was comparable to ACASI and self-administered questionnaires and superior to the face-to-face method with regard to self-reports of the most sensitive sexual behaviors. Moreover, the association between the reporting of tobacco

smoking and the presence of a biomarker for nicotine metabolites in the urine was stronger in PASI and ACASI than in face-to-face interviews (van Griensven et al. 2006).

A study undertaken in Mexico assessed differences in the reporting of induced abortion by women aged 15–55 who were randomly assigned to one of four interview methods: ACASI using a touch screen, face-to-face interviews, self-administered interviews, and a random-response technique. For the random-response technique, a woman was asked to put her hand in a bag that contained two folded sheets of paper, one asking whether she was born in April and the other asking whether she had ever had an abortion. The interviewer did not know which sheet the woman chose. The methods were tested with three populations: hospital patients in Mexico City, illiterate women in rural areas, and a household sample in Mexico City. For all three populations, the highest reported rate of abortion was found with the random-response technique, followed by the self-administered questionnaire. Reporting among those assigned to ACASI and face-to-face interviews was lower (Lara et al. 2004).²

Two experimental studies with random assignment have been conducted more recently in Asia: one in Pune, India, among unmarried male college students and slum dwellers and another in Vietnam among a large house-hold-based sample of adolescents in a suburb of Hanoi. In India, reporting of sensitive sexual behaviors was generally higher among college students assigned to ACASI, compared with those assigned to face-to-face or self-administered questionnaires. The results for slum youth were much less consistent, leading the authors to question the efficacy of computerized interviewing among the less educated (Potdar and Koenig 2005). In Vietnam, the reporting of sensitive behavior was significantly higher among young men, but not among young women (Le et al. 2006).

Our research in Kenya employed an experimental design to investigate whether ACASI produced more valid reporting of sexual activity and related behaviors than FTF or self-administered interviews among more than 6,000 unmarried adolescents aged 15–21 in two districts. The results for girls from our first district, Nyeri, were inconsistent with expectations. In response to the initial “ever had sex” question, those interviewed with the computer were less likely to report that they had had sex, compared with those interviewed face to face. Boys interviewed by means of ACASI were also less likely to report having had sex, but that finding was expected because we assumed that boys exaggerate in FTF interviews. For our second district, Kisumu, we altered the skip pattern of the questionnaire. Regardless of the response to the first question, respondents were asked a subsequent series of questions about sexual partners and coerced sex. For most of these additional questions, which ask about more highly stigmatized behavior, reporting was higher among both boys and girls with ACASI (Mensch et al. 2003).

A more focused analysis of consistency in the reporting of sexual behavior among adolescent girls in Kisumu revealed that ACASI respondents were much more likely to provide discrepant answers than were those interviewed face to face. For example, only three of 181 young women questioned face to face who reported never having had sex in response to the first question on sexual behavior indicated that they had had sex in response to questions about various types of partners and about coerced sex.³ In contrast, among the ACASI group, 83 of 174 who reported never having had sex subsequently reported having had sex in answer to the partner and coerced-sex questions. Based solely on the initial question of age at first sex, 48 percent of the interviewer-administered group reported having had sex, compared with 43 percent of the ACASI group. When we recomputed the proportion ever having had sex based on all of

²Random-response techniques may prove useful for estimating the prevalence of a particular behavior; however, they cannot be used for analyses of the determinants and consequences of the behavior because the data cannot be linked to individual information.

³Respondents were asked about sexual partnerships even if they responded “no” to the initial question about ever having had sex.

the sexual behavior questions, the interviewer-administered group barely changed (49 percent), whereas the ACASI group increased to 68 percent. We concluded that ACASI produced a more diverse picture of adolescent sexual activity than FTF interviews. We also concluded that the consistency in the interview mode was suspect, particularly in light of the much lower levels of reporting, relative to ACASI, for types of sexual partners and coerced sexual activity (Hewett et al. 2004b).

Data and Methods

The ACASI experiment described here was an ancillary study to the 2004 wave of the Malawi Diffusion and Ideational Change Project (MDICP), a panel survey of ever-married women of childbearing age and their husbands to which an adolescent sample was added. The MDICP project assesses behavioral responses to perceived and actual HIV/AIDS risk, with a focus on the role of social interactions in mediating information flows.⁴ The first MDICP survey was conducted in 1998 in rural areas of three Malawi districts, one in each administrative region of the country: Rumphi in the North, Mchinji in the Center, and Balaka in the South. Although the MDICP was not designed to be representative of rural Malawi, the sample characteristics are similar to those of the rural areas of the 1996 Malawi Knowledge, Attitudes and Practices in Health Survey (Watkins et al. 2003). Subsequent rounds were conducted in 2001, 2004, 2006, and 2008. For the third wave of data collection, approximately 1,500 males and females aged 15–24, both unmarried and married, were added to the MDICP study population; participants were also tested for HIV, chlamydia, and gonorrhea, and women were also tested for trichomoniasis.

The data for the ancillary study come from interviews conducted in June and July of 2004 among a supplementary sample of 501⁵ unmarried female adolescents aged 15–21⁶ in rural areas of Balaka District. Balaka was selected because it is located in the region of the country with the highest documented rates of HIV infection (UNAIDS 2004), teenage pregnancy, and risky sexual behavior, including early sexual initiation (National Statistical Office [Malawi] and ORC Macro 2001).

The adolescents in our sample resided in villages contiguous to trading centers near the villages included in the main MDICP project. Trading centers in rural Malawi consist of small, centralized market areas and are situated along major roadways. The villages adjacent to trading centers are more densely populated than remote rural villages and were chosen because of the greater likelihood of finding adolescents, who are typically more mobile than the adult population. Despite our efforts, however, of the 707 adolescents in our household listing, we managed to interview only 501 successfully, for a response rate of 71 percent. We have no way of knowing whether those who were interviewed differed markedly from those who were not, because household information was not systematically included in the listing form; the MDICP household form was used only for determining eligibility.

Study Design

Respondents were randomly assigned to a face-to-face interview or a combination FTF/ACASI interview. The questionnaire for the experimental substudy was the same as that for the adolescent survey in the MDICP study. The 12 sections of the questionnaire were divided by topic. For ACASI respondents, all sections except for the sexual behavior questions and a small set of sensitive questions from the HIV/AIDS section were administered face to face by an

⁴For additional project information, see <<http://www.malawi.pop.upenn.edu>>.

⁵The 501 adolescents were surveyed in addition to the approximately 1,500 young people added to the third wave of the MDICP.

⁶A small number of respondents who were interviewed were aged 14 or 22, outside the designated age range; we retained them in the analysis because of the small sample size.

interviewer; otherwise the interviews were equivalent. To further minimize the effect of interviewer characteristics, all interviewers were female and trained in both interviewing methods; respondents were randomly assigned both to an interviewer and to an interview mode.

After an introduction common to both interview modes that reiterated the confidentiality of the interview and the purpose of collecting sensitive information, the sexual behavior section began by asking “How old were you when you first had sex?” This question also provided a response option for “never had sex.” Irrespective of the reply, the survey continued with a series of yes/no questions about sex with different types of sex partners, specifically “Have you ever had sex with an expected spouse (person the respondent expected to marry)? Boyfriend? Friend or acquaintance? Relative? Teacher? Employer? Stranger?” If a respondent indicated that she had had sex with a particular partner, she was asked the age at which she had first had sex with that partner. Additional questions were asked regarding the respondent’s total number of lifetime sexual partners, and whether she had had sex in the past 12 months.

If respondents provided an age at first sex or identified any sex partners, they were subsequently asked additional questions about their two most recent relationships, including the frequency of sex, duration of the relationship, marital status and educational level of the partner, and condom use; the last included ever use, use at last sex, and frequency of use. Our analyses excluded all these questions because in order to be asked them, respondents had to report having had sex. If reporting biases exist according to interview mode, and if they are correlated with behavior, the selective observation on this secondary set of questions might distort the comparisons by interview mode if, for example, respondents who are more confident and open about their behavior during an interview are also better able to negotiate condom use with their partners. This possibility restricts our analyses to questions that were asked of the full sample of young women.

After being interviewed, respondents were asked whether they would be willing to be tested for HIV and STIs. Consent was requested separately for testing, and parental permission was obtained for those younger than 18. Data collection for STIs typically occurred within one week of the survey and was conducted by trained nurses. Prior to collection of the biomarkers, respondents were interviewed by the nurses, and a series of questions was repeated about their sexual behavior, including age at first sex, number of sex partners, sexual activity in the past 12 months, relationship to current or most recent sexual partner, condom use at last sex, concurrency of partners, and whether respondents had ever been tested for HIV. These questions enabled us to do test–retest comparisons of the consistency of responses by interview mode.

Respondents provided vaginal swabs for gonorrhea, chlamydia, and trichomoniasis. Collected specimens were analyzed by Roche Polymerase Chain Reaction (PCR) tests. HIV status was determined by use of the OraSure® ELISA test on oral samples; positive samples were retested using the OraSure Western Blot test. The biomarkers were analyzed at Lilongwe Central Hospital by a laboratory supervised by the University of North Carolina, Chapel Hill. To preserve confidentiality, each specimen was given a unique biomarker identification number; this number was also recorded on a Polaroid® photograph by the nurse collecting the specimen and given to the respondent. No personal identifiers were included on the specimens.

Of the 501 respondents in our sample, 399 (80 percent) provided at least one biomarker, and 376 provided biomarkers for all four tests.⁷ Because the testing rate was not as high as expected

⁷For the most part, respondents were receptive to being tested; however, in a number of villages in Balaka where the ACASI study was conducted, the response was not enthusiastic, and nurses were occasionally referred to as “bloodsuckers” (Anglewicz et al. 2005). For more information on the STI/HIV testing procedures and the communities’ reactions, see Bignami-Van Assche et al. (2004), Anglewicz et al. (2005), and Thornton et al. (2005).

in the ACASI sample or in the main MDICP sample, respondents who had not been tested originally were contacted again for HIV testing in November, approximately four to five months after their initial interview. An additional 22 respondents were tested for HIV after recontact. In total, 421 respondents (84 percent) provided one or more biomarkers. This proportion is comparable to the proportion of female adolescents who were tested in the larger MDICP sample, for which 83 percent provided STI samples and 90 percent provided HIV samples (Thornton et al. 2005). Respondents who tested positive for any of the STIs were treated at the site at no cost.⁸ Respondents who tested positive for HIV were referred to the nearest district hospital for care and treatment options.

ACASI Technology and Design

A customized ACASI program was developed using Microsoft Visual Basic and Access software. Respondents used audio headphones connected to a notebook computer and listened to the questions and associated response options. A female voice was used, and a choice of languages was offered; 18 percent of ACASI respondents listened to the questions in Chiyao and 82 percent in Chichewa.⁹ Respondents answered the questions via an external minikeypad with several color-coded keys: a red key to replay the question, a green key to go on to the next question, and a yellow key to skip a question. For dichotomous questions, respondents were instructed to press 1 for yes and 2 for no. For questions requiring a numeric response (for example, age), they entered the number. During the ACASI interview, the computer remained closed and was kept in a carrying case. The decision to rely entirely on audio mode was based on a concern about the level of literacy of the target population and the desire to provide greater privacy for the respondent, especially because computers are novel in rural Africa and attract attention. Prior to the ACASI main survey, each respondent completed three “practice” questions to evaluate her understanding of the interview process, for example, “Are you a male or a female?” For each practice question, the correct answers were previously entered by the interviewer to serve as a check against the respondent’s entry. Respondents were not able to proceed to the main interview until they were able to answer all three practice questions correctly.¹⁰

Results

As noted above, for the sections of the survey that contained sensitive questions, simple randomization was used to assign respondents to one of the two interview modes, FTF or ACASI. Table 1 compares respondents for each mode by individual and household characteristics. The differences in the size of the two samples are due to assignment of a slightly larger proportion of respondents to the FTF (52 percent) than to the ACASI interview (48 percent), and to a higher response rate for the FTF group (74 percent versus 67 percent in ACASI).¹¹ Because of the simple random sampling procedure and the relatively small overall sample, the two groups may differ in ways that could affect the distribution of reporting of sensitive behavior. As observed in Table 1, those in the ACASI group are more likely to be Muslim and religiously observant, less likely to live with both parents, and more likely to be born again or to have made *tauba*, although only the last difference was statistically significant. All analyses that follow are adjusted for the individual and household characteristics listed in Table 1.

⁸They were given azithromycin for chlamydia, metronidazole for trichomoniasis, ciprofloxacin for gonorrhea if they were not pregnant, and azithromycin for gonorrhea if they were pregnant (Bignami-Van Assche et al. 2004).

⁹Although more than half of the ACASI respondents were Yao and the survey instrument was available in both languages, a much smaller proportion chose to be interviewed in the Yao language. Unlike Chichewa, which is the written and spoken national language, Chiyao is primarily oral and may not lend itself as well to structured interviewing.

¹⁰For a review of ACASI and its use among adolescents in rural Africa, see Hewett et al. (2004a).

¹¹The lower response rate for ACASI is largely accounted for by six interviews that were only partially completed and that could not be used in the analysis and by six cases in which the sex of the adolescent was incorrectly coded in the household listing as female.

Reporting of Premarital Sex by Interview Mode

To assess differences in reporting of premarital sexual behavior by interview mode, in Table 2 we present predicted percentages derived from logistic regression models that control for the background characteristics and adjust the standard errors for clustering within study villages. Because the study design, sample age group, and questionnaires were similar in our previous experiment conducted in Kenya, we provide the results for a selection of questions where direct comparisons between the two studies can be made.

In the first row of Table 2, a respondent is considered to have “ever had sex” if she provided an age when asked, “How old were you the first time that you had sex?”¹² The next set of outcomes is based on questions regarding sex with particular types of partners. Two different composite measures follow. The first is coded 1 if the respondent answers “yes” to any of the individual partner questions. The second composite measure, which is our most inclusive indicator of premarital sex, is coded 1 if the respondent provides an age in reply to the initial “age at first sex” question or if the respondent answers “yes” to any of the individual partner questions. Finally, for comparative purposes, we present a measure of multiple lifetime partners. On the right side of the table, we present the results from our Kenya study, which, like the experiment in Malawi, was limited to unmarried adolescents aged 15–21. In Kenya, however, the lead question was “Have you ever had sexual intercourse?” rather than “How old were you the first time that you had sex?”

The boldface notation indicates which mode produces the higher percentage of reports for each behavior. Although a large difference by interview mode is observed for the initial question of ever had sex, the difference is not in the expected direction. In Malawi, nearly half the FTF sample report having had sex, compared with slightly more than one-third of the ACASI sample. In Kenya, the difference between the two groups is not as large, but it is in the same direction; 48 percent of the FTF group report ever having had sex, compared with 43 percent in the ACASI group. Although the similarity of these results across the two countries is compelling, we do not have a ready explanation for them. A discussion of this issue is presented after the results from the partner questions and composite indicators are described.

Aside from the response to the question on sex with a boyfriend, which follows the pattern observed for age at first sex, the results for the series of partner questions are more consistent with expectations: specifically, ACASI produces higher reporting than the FTF interview mode. For the Malawi sample, the difference between modes is statistically significant for sex with a friend or acquaintance. For Kenya, girls interviewed with ACASI are significantly more likely to report having had sex with a friend, family member, or stranger. For both samples, ACASI respondents are significantly and substantially more likely to report having had more than one sex partner. These results suggest that ACASI is eliciting higher reporting of the most stigmatizing sexual behavior.

Using various partner questions, we generated a composite indicator of whether the respondent ever had premarital sex. As Table 2 shows, these indicators suggest different sexual experiences according to interview mode. For instance, comparing the initial “ever had sex” reporting with the two composite measures in the FTF mode, the proportion changes minimally from 48 to 47 to 48 percent. The results for ACASI, however, are notably different. Although only 35 percent of ACASI respondents report ever having had premarital sex based on the initial question, the proportion increases to 51 percent with the first composite measure and increases to 58 percent with the second composite measure. This latter percentage is significantly higher

¹²No “don’t know” option was provided in either mode of administration for this question, nor did any script ask the respondent to estimate her age at first sex if she could not remember it. Because of the age range of our sample, the respondent was expected to remember her age at first sex. Only one value was missing for this question.

than the proportion reporting having ever had sex in the interview-administered mode (48 percent). We observed a similar pattern in Kenya. When the partner-specific questions were considered, the proportion reporting “ever had sex” remained around 48 percent in the FTF group, but increased markedly in the ACASI group, from 43 percent to 61 percent and to 68 percent for the most inclusive measure.

Differences in reporting of the composition of sexual partners are further illustrated in Figure 1. Whereas only one-fourth (18 percent plus 7 percent) of FTF respondents report having had sex with someone other than a boyfriend or expected spouse, 42 percent (23 percent plus 19 percent) of ACASI respondents report having had sex with such a partner.

Although the ACASI respondents presented a more diverse picture of their premarital sexual behavior than did FTF respondents, their responses were more inconsistent than those of the FTF respondents between the initial ever had sex question and the questions about specific partners: 52 respondents (35 percent) indicated they had never had sex, but then responded “yes” to questions about having had sex with a particular partner, and 17 (22 percent) of those who indicated they had had sex in the response to the initial question subsequently did not indicate having sex with any of the specific partners mentioned in the questions. Only four respondents in the FTF interviews were inconsistent.

The question arises whether this inconsistency between the response to the initial question on sex and the more detailed follow-up questions is more common among certain adolescents than others. Research on survey responses, which focuses primarily on adolescents, indicates that inconsistency tends to vary by sex, education, cognitive ability, and race. Analyses of reported sexual activity in nationally representative longitudinal surveys of adolescents in the United States indicate that black males tend to be the most inconsistent and white females the most consistent (Lauritsen and Swicegood 1997; Upchurch et al. 2002). Multivariate analyses of inconsistent reporting of sexual behavior and drug use indicate that racial differences persist after controlling for other socioeconomic characteristics (Fendrich and Vaughn 1994; Lauritsen and Swicegood 1997; Upchurch et al. 2002). Some analysts suggest that minorities may have less trust in the interview process or feel more threatened by it (Mensch and Kandel 1988; Fendrich and Vaughn 1994). For both sexual behavior and substance use, inconsistent reporting is higher among those with lower levels of schooling, lower scores on cognitive tests, and lower grade point averages (Bachman and O’Malley 1989; Fendrich and Vaughn 1994; Upchurch et al. 2002).

We investigated the covariates of inconsistent reporting between the first question on age at first sex and subsequent questions on particular types of partners, although this investigation was implemented only for the ACASI group because so few FTF respondents provided discrepant answers. The results from logistic regression models using the demographic and household variables in Table 1 (not shown) reveal no systematic associations with inconsistent reporting. None of the expected demographic variables—age, years of education, current school enrollment, ethnicity, religion, or religiosity—was significant. The only variables that appeared to have an effect were the household-structure variables, although it is not clear why; having older male peers in the household raised the likelihood of an inconsistent response, whereas having older female peers lowered that likelihood. In some models, the greater the number of people in the household, the lower the likelihood of an inconsistent response.

In an earlier study based on our Kenya data, we speculated about the inconsistency between responses to the initial “ever had sex” question and the subsequent partner questions in ACASI and recommended that more research be conducted (see Mensch et al. 2003; Hewett et al. 2004b). Because the same pattern is observed here, it is worth reviewing and expanding on the possible explanations, which fall into two groups:

1. ACASI responses are inconsistent because:
 - a. respondents may compartmentalize specific sexual behaviors and not regard sex with certain partners as the type of behavior that is being asked about when they are queried about their age at first sex;¹³ or
 - b. without the personal interaction with an interviewer, ACASI respondents may be less focused and less motivated to provide consistent responses, potentially losing concentration over the course of the survey.
2. FTF interviews are more consistent than we expected because:
 - a. although they were trained not to do so, interviewers in the FTF group may have decided to skip the sex-partner questions if the respondent indicated in her response to the initial question that she had never had sex;
 - b. contrary to protocol, the FTF interviewer may have returned to the initial ever had sex question and changed the answer if the respondent subsequently responded affirmatively to a sex-partner question; or
 - c. respondents may be more focused and motivated to provide consistent answers and unwilling to contradict previous responses when answering an interviewer face to face.

Unfortunately, in the absence of further data collection, we cannot privilege one of these explanations over another. Not only might we benefit from in-depth interviews with respondents about the interviewing process in both the FTF and ACASI modes,¹⁴ we also would be aided by a better understanding of how an interviewer conducts an interview, perhaps by taping a subset of interviews or doing a better job of debriefing interviewers in the field. As Watkins and her colleagues (2003) suggest, interviewer motivations and autonomy¹⁵ may often trump training and study protocols in survey research.

Consistency Between Reporting in Nurses' Interview and Main Interview

Prior to the collection of STI/HIV biomarkers, the nurses again asked respondents several questions about their sexual behavior in a face-to-face interview. These questions were a subset of those asked in the main interview and were similarly worded. The data allow for an FTF/FTF and ACASI/FTF comparison of responses between the main and nurses' interviews. If our assumption about the reporting of premarital sex in a computerized interview is correct, a higher percentage of ACASI respondents reporting sexual activity in the main interview would deny having had sex in the subsequent FTF interview. Of course, respondents may feel less timid or more comfortable about reporting their sexual behavior to a health professional, such as a nurse. In this case, more accurate reporting might be expected from the nurses' interview.

Table 3a compares whether an age was provided in response to the question "How old were you the first time you had sex?" in the nurses' and the main interviews.¹⁶ As the table shows, a higher proportion of inconsistent responses (off-diagonal, shown in bold) are given in ACASI than in the FTF mode (28 percent versus 13 percent). We expected that compared with those interviewed in the FTF mode, a higher proportion of those who answered "yes" in the main interview in ACASI would subsequently deny having had sex in the nurses' interview.

¹³The ACASI program allowed respondents to return only to the previous question, preventing them from returning to the lead question in order to change their response.

¹⁴In a subsequent survey of Malawian adolescents in 2007, where sensitive questions were asked using ACASI, we asked respondents about their attitudes toward and anxieties about computerized interviewing.

¹⁵Interviewer autonomy is exercised when the interviewer deliberately chooses to ignore the survey protocol.

¹⁶Respondents could have become sexually active between the time of the main interview and the nurses' interview, although, typically, only one week elapsed between the two.

Although the proportion is larger (8.2 percent versus 6.5 percent), the difference is smaller than we anticipated. Moreover, among those who reported in the main interview that they had not had sex, a much higher proportion of ACASI than FTF respondents reported that they had sex when interviewed by a nurse.

Table 3b compares the proportion reporting that they had had sex in answer to the question “How old were you the first time you had sex?” in the nurses’ interview with the proportion reporting that they had had at least one sexual partner in the main interview. A direct comparison of reporting of types of sexual partners is not possible because the partner questions were not asked in the nurses’ interview. The results for this comparison are more in line with expectations: a much larger proportion of ACASI respondents than FTF respondents who answered “yes” in the main interview deny ever having had sex in their responses to the nurses’ interview (18 percent versus 7 percent). Nevertheless, we find that a higher proportion of ACASI “deniers” than FTF “deniers” in the main interview report having had sex when a nurse asks the question (24 percent versus 20 percent).

We also investigated the multivariate correlates of discordant reporting between the main interview and the nurses’ interview. As with the internal ACASI analysis of inconsistency discussed above, the results from the logistic regression (not shown) indicate that the only statistically significant variable was the presence of older male peers in the household.

Association Between Reporting of Sexual Behavior and STI Status

One advantage of the Malawi study design over other survey-based ACASI experiments conducted in developing countries—including our own work in Kenya—is that biomarker data were collected from respondents. Pairing behavioral reporting and STI status enables an estimation of the association by interview mode. If ACASI produces more valid sexual behavior data, a stronger association with STIs should exist, because systematic underreporting of sexual behavior will attenuate the observed association toward zero, holding other things constant. Of course, the usefulness of this validation technique is limited because the true underlying association is unknown for this population, and our measure of sexual behavior is too crude to be a good marker of risk.¹⁷

Before investigating the association between the reporting of sexual behavior and infection status by interview mode, we present descriptive data on STI and HIV prevalence for our sample. Table 4 indicates that 2 percent of the sample test positive for trichomoniasis, 6 percent for gonorrhea, 1 percent for chlamydia, and 6 percent for HIV; only two respondents had more than one STI. Of the STI indicators, only gonorrhea is different across the two study groups, with the FTF arm having a higher proportion of infections. Because the prevalence of STIs is low and the sample size small, we combine the biomarker data into a single indicator of “any STI” and examine the association between testing positive for at least one infection and reported sexual behavior. When combined with HIV, 14 percent of the sample (16 percent in FTF and 11 percent in ACASI) test positive for one or more STIs and/or HIV.

As mentioned earlier, only 423 of 501 respondents were tested for STIs and/or HIV. Prior to linking the information on sexual behavior to the STI/HIV results, we explore whether those who provided samples are selective in ways that might bias our subsequent analyses. Nonresponse bias is a particular concern if it is associated with the mode of data collection or with demographic characteristics not distributed randomly in our sample, which are themselves associated with sexual behavior.

¹⁷In this study, we use a current-status measure of infection (rather than a measure of incidence) and a basic measure of sexual activity. Moreover, we do not incorporate additional variables that, presumably, affect the likelihood of infection, such as per-coitus condom use, overlapping partnerships, and circumcision status of partners.

Table 5 reports the results of the analysis investigating the selectivity of those who were tested. The dependent variable is zero only if respondents missed all four STI tests. We examined testing status for the full sample and separately by interview mode. We estimate two models. The first includes only the composite indicator of ever having had sex, in order to address the concern that the probability of being tested would vary according to reported sexual behavior. The second includes only the demographic characteristics of the respondent.

The first column of results in Table 5 for the full sample indicates that those who report having had premarital sex are less likely to be tested for STIs, perhaps because they are reluctant to find out whether they are infected. No variables are statistically significantly associated with being tested in the full sample. When analyzed separately by interview mode, greater variability is seen, yet only “older female peers in household” is significant in the FTF mode. These results indicate that although approximately 15 percent of our sample was not tested, we can feel reasonably confident that those who provided biomarkers do not differ in any important way from those who did not provide biomarkers.

Table 6 provides the results linking reported sexual behavior to infection status. We used the narrower measure of ever had sex, which was converted to a dichotomous variable from the age-at-first-sex question, because, as indicated above, questions concerning type of sexual partnerships were not asked in the nurses’ questionnaire. Of the respondents in the main survey who reported ever having had premarital sex, 26 percent of FTF respondents and 15 percent of ACASI respondents tested positive for an STI and/or HIV. When we examine the association between ever had sex and infection status using the data generated from the nurses’ interview, the results are not substantially different from those of the main survey: 23 percent of those in the FTF group and 14 percent in the ACASI group who reported having had premarital sex tested positive for an STI. Using the broader composite measure of premarital sex that includes responses to questions about sexual partners increases the ACASI association, but only marginally (not shown). The chi-square statistics in the table indicate that the associations between STI status and sexual behavior are stronger for those interviewed face to face.¹⁸

These results suggest that the significantly higher reporting of having had sex in the FTF interview provides a more accurate assessment of premarital sexual activity than do the ACASI responses, at least for the age-at-first-sex question. That these stronger associations carry over to the nurses’ interview is likely a function of the greater consistency in reporting between the FTF and nurses’ questionnaire (as shown in Tables 3a and 3b). Finally, in both groups, we observe a nontrivial number of “virgin” infections, namely infections found for young women who deny ever having had sex; the proportion of these infections varies little between the two interview modes.

Discussion

The experiment we describe here assesses whether interview mode affects the reporting of sexual behavior among a sample of unmarried adolescent girls aged 15–21 in a district in southern Malawi. This study builds on our earlier research in Kenya where we investigated whether ACASI provides more accurate data on sexual behavior than FTF interviews. The results for Balaka District in Malawi are similar to those observed in Kisumu District in Kenya. For both sites, the interview mode and the questions concerning different types of sexual partnerships affect respondents’ reports of their sexual activity. For the first two indicators —“ever had sex” and “had sex with a boyfriend”—the proportion responding affirmatively is greater in the FTF mode, and in Malawi, the difference between the two modes is statistically

¹⁸More rigorous bivariate probit methods that examine the influence of demographic characteristics in estimates of the association between sexual behavior and STI outcome (Hewett et al. 2008) reveal results similar to the cross-tabulations.

significant. When we ask about other, more stigmatized partners and multiple lifetime partners, however, the reporting is consistently higher with ACASI, in many cases significantly so.

What remains puzzling is why the initial questions regarding sexual activity generate higher reporting in the FTF mode than in ACASI. We had assumed that adolescent girls in sub-Saharan Africa would find great difficulty admitting to an interviewer that they have had sex outside a socially sanctioned relationship (Dare and Cleland 1994), even when the interviewer is the same sex as and relatively close in age to the respondent. Is this assumption without foundation? Or does ACASI produce its own set of anxieties among African adolescents such that it generates higher reporting only for the most stigmatized of behaviors?

What also intrigues us is the greater consistency in answers to the initial question and the subsequent partner questions in the FTF mode. Both in Kenya and in Malawi, when the partner-specific questions were included as an indicator of “ever had sex,” the proportion reporting premarital sex changed little in the FTF group but increased substantially in the ACASI group. We suggest several explanations: interviewer-imposed skips, the interviewer’s reconciling of answers, compartmentalizing specific sexual behaviors in the ACASI mode but not in the FTF mode, and the respondent’s unwillingness to provide contradictory answers when being interviewed face to face.

As in Kenya, where the interviewer-administered mode produced more consistent reporting of sexual activity between the main interview and an FTF exit interview, in Malawi the interviewer-administered mode produced more consistent reporting between the main interview and the subsequent FTF interview with a nurse than did ACASI. Although this finding is not unexpected, we did not anticipate that a greater proportion of “deniers of having had sex” in the main ACASI interview would subsequently report having had sex in the later FTF interview.

In linking respondents’ reports of their sexual behavior with their infection status, we find that the association is positive only in the FTF mode. The stronger associations suggest that the reporting of premarital sexual activity in the FTF mode is more accurate, at least with respect to the initial question about age at first sex. In the two modes of survey administration, however, a roughly equal proportion of young women deny ever having had sex, yet test positive for STIs/HIV. The sexual behavior questions available to us in this study do not capture STI risk well, and because we lack incidence data to time the onset of infection more accurately, the results of the biomarker analysis are by no means conclusive.

The conventional notion in survey research is that the more anonymous the interviewing process, the more likely the respondent is to divulge stigmatized or embarrassing information. Yet in a recent study on the “limitations of stranger-interviews,” Weinreb (2006) challenges the view that respondents in all settings are more honest with interviewers unknown to them. He argues that, in certain environments where the community is highly suspicious of both outsiders and the research process, respondents are more inclined to be honest when the interviewer is familiar to them. Weinreb did not conceive of the computer as an alien interviewer—indeed, he suggested that ACASI would produce more reports of sensitive behavior if it were “introduced to respondents by insider-interviewers” (page 1,021)—but perhaps our adolescent respondents found it alien. A computerized interview, which is a highly impersonal encounter, may generate greater suspicion than an FTF interview in settings where the technology is unfamiliar. Even so, the strangeness of the technology and the impersonal nature of a computerized interview do not answer the question as to why ACASI produces higher reporting than FTF interviews for some sensitive behaviors and not for others among adolescents in Kenya and Malawi.

The results from our methodological experiments in Africa and comparable experiments conducted by researchers in India and Vietnam emphasize the necessity of treating survey data from adolescents on sensitive behaviors with healthy skepticism. Findings from our research among older women in Brazil are less ambiguous and support the expectation that computerized interviewing produces more valid data (Hewett et al. 2008; Mensch et al. forthcoming). In our earlier study conducted in Kenya, we called for more quantitative research on interview-mode effects and for qualitative research on the interaction between interviewers and respondents as well as on attitudes toward the computer among developing-country populations. In light of the importance of behavioral data for understanding both the etiology of the AIDS pandemic and the results of clinical trials that assess the efficacy of products and technologies to reduce the transmission of sexually transmitted infections, we continue to advocate for more research in this area, particularly among adolescents and young adults.

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Figure 1.
Percentage of respondents reporting that they had ever had sex, by interview mode, according to type of sex partner, Malawi, 2004

Table 1

Percentage of study sample, by respondents' and household characteristics, according to interview mode, Malawi, 2004

Characteristic	Face-to-face interview (FTF)		Audio computer-assisted self-interview (ACASI)	
	Percent	(N)	Percent	(N)
Respondents' characteristic				
Age (years)	16.5	(265)	16.8	(226)
Years of schooling (range 0–12)	6.9	(275)	7.2	(226)
Currently enrolled in school	64.5	(271)	61.0	(226)
Ethnicity: Yao	53.0	(275)	54.9	(226)
Muslim	44.3	(275)	52.6	(226)
Attends religious services at least once per week	64.3	(264)	69.6	(214)
Born again (Christian)/made <i>tauba</i> (Muslim)	28.6	(269)	36.9 [*]	(225)
Household characteristics				
Lives with both parents	40.7	(275)	34.5	(226)
Female-headed household	47.6	(275)	45.1	(226)
Has older male peers in household ^a	22.5	(275)	21.7	(226)
Has older female peers in household ^a	25.5	(275)	23.5	(226)
Number of people slept in household previous night	5.9	(275)	6.1	(226)
Number of consumer durable items owned ^b	5.4	(266)	5.3	(225)

* Significant at $p < 0.05$.

^a Older peers are defined as being between one and five years older than the respondent.

^b Consumer durables include: furniture, television, radio, telephone, mosquito nets, solar panels, bicycle, motorcycle, car, hoe, and oxcart.

Table 2

Predicted percentage of respondents, by sexual behavior, according to interview mode and country, Malawi (2004) and Kenya (2002)

Sexual behavior	Balaka, Malawi		Kisumu, Kenya ^a	
	FTF (236)	ACAS (211)	FTF (348)	ACAS (302)
Ever had sex	47.9 ^{**}	34.8	48.3	42.8
Ever had sex with: ^b				
Boyfriend	30.9 ^{**}	21.0	45.7	40.1
Expected spouse	27.5	29.4	na	na
Friend or acquaintance	6.8	17.1 ^{**}	9.8	31.9 ^{**}
Family member	1.3	7.1	1.0	20.9 ^{**}
Stranger	2.5	3.3	3.7	13.9 ^{**}
Teacher	1.0	1.4	na	na
Employer	1.0	1.9	na	na
More than one sexual partner in lifetime	16.5	27.2 ^{**}	20.7	34.9 ^{**}
Composite: sex with any partner ^c	47.4	50.7	48.0	61.0 ^{**}
Composite: ever had sex or sex with any partner ^d	48.3	57.8 [*]	48.9	67.5 ^{**}

* Significant at $p < 0.05$

** $p < 0.01$; represents significance of interview mode variable in logistic regression, controlling for background characteristics shown in Table 1. na = Not available.

^a Sources for these figures are Hewett et al. (2004b) and Mensch et al. (2003).

^b These questions were asked in the order presented and are not all mutually exclusive; for example, a teacher may have been a boyfriend.

^c Responses for this item are not strictly comparable for Balaka and Kisumu because of different sex-partner listings and because the percentages for Kisumu include coerced sex.

Note: The higher percentage within each pair is boldfaced.

Table 3

Table 3a Percentage distribution of respondents reporting in the main interview and the nurses' interview that they had ever had sex, based on responses to the question about age at first sex, by interview mode, Malawi, 2004

Response	FTF (n = 231) Main interview		ACASI (n = 186) Main interview	
	No	Yes	No	Yes
Nurses' interview				
No	80.7	6.5	61.6	8.2
Yes	19.4	93.5	38.4	91.8
(n)	(124)	(107)	(125)	(61)

Table 3b Percentage distribution of respondents reporting that they had ever had sex, based on responses to the age-at-first-sex and type-of-partner questions in the main interview and the age-at-first-sex question in the nurses' interview, by interview mode, Malawi, 2004

Response	FTF (n = 231) Main interview		ACASI (n = 187) Main interview	
	No	Yes	No	Yes
Nurses' interview				
No	80.5	7.4	76.2	17.5
Yes	19.5	92.6	23.8	82.5
(n)	(123)	(108)	(84)	(103)

Note: Inconsistent responses are presented in boldface.

Table 4

Among the 423 respondents tested, prevalence of sexually transmitted infections, by interview mode, Malawi, 2004

Infection	FTF		ACASI		Total	
	Percent	(n)	Percent	(n)	Percent	(n)
Trichomoniasis	2	(220)	1	(181)	2	(401)
Gonorrhea	8	(214)	4	(173)	6	(387)
Chlamydia	1	(214)	1	(173)	1	(387)
HIV	6	(227)	6	(196)	6	(423)
Any sexually transmitted infection ^a	16	(207)	11	(171)	14	(378)

^aCategory is defined as testing positive for trichomoniasis, gonorrhea, chlamydia, or HIV.

Table 5

Odds ratios from logistic regression models assessing selectivity of the 423 respondents tested for any STI or HIV, Malawi, 2004

Model	Full sample Odds ratio	FTF Odds ratio	ACASI Odds ratio
Model 1 - Ever had sex	(n = 501)	(n = 275)	(n = 226)
Composite measure: Ever had sex ^a	0.69	0.75	0.61
Model 2 – Demographic characteristics	(n = 447) ^b	(n = 236) ^b	(n = 211) ^b
Interview mode: ACASI	1.02		
Respondent's age	0.90	0.78	1.04
Respondent's years of schooling	1.01	1.07	0.97
Currently enrolled in school	1.22	1.04	1.44
Ethnicity: Yao	0.88	1.12	0.62
Muslim	1.35	1.16	1.57
Attends religious services at least once per week	1.19	0.80	2.02
Born again/made <i>tauba</i>	1.00	1.00	0.91
Lives with both parents	1.05	0.83	1.66
Female-headed household	1.02	1.21	0.94
Older male peers in household	1.23	1.66	1.02
Older female peers in household	0.80	0.42 ^{**}	1.90
Number of people who slept in household previous night	1.00	1.05	1.02
Number of consumer durable items owned	0.94	0.98	0.90

^{**} Significant at $p < 0.01$.

^a Composite measured as reporting ever having had sex or having had sex with any partner.

^b Sample sizes are smaller than full sample as a result of missing values in the covariates.

Table 6
Percentage distribution of respondents, by infection status, according to whether they reported ever having had sex, based on responses to age-at-first-sex question, by interview mode, Malawi, 2004

Infected with any STI/HIV	FTF				ACASI			
	Main survey: Ever had sex ^a		Nurses' interview: Ever had sex ^a		Main survey: Ever had sex ^a		Nurses' interview: Ever had sex ^a	
	No	Yes	No	Yes	No	Yes	No	Yes
No	91.7	74.5	91.2	76.6	90.4	85.5	91.7	86.4
Yes	8.3	25.5	8.8	23.4	9.6	14.5	8.3	13.6
(n)	(109)	(98)	(91)	(107)	(114)	(55)	(72)	(88)
Chi squared	11.2***		7.5**		0.89		1.1	

** Significant at p < 0.01

*** p < 0.001.

^a Responses dichotomized from the age-at-first-sex question.