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Inconsistent sexual behavior reporting among youth affected by perinatal HIV exposure in the United States

Krystal Cantos¹, Molly F. Franke², Katherine Tassiopoulos¹, Paige L. Williams^{1,3}, Anna-Barbara Moscicki⁴, George R. Seage III^{1,*}, **Pediatric HIV/AIDS Cohort Study**

¹Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, MA

²Department of Global Health and Social Medicine, Harvard Medical School, Boston, MA

³Department of Biostatistics, Harvard T.H. Chan School of Public Health, Boston, MA

⁴University of California, Los Angeles, Los Angeles, CA

Abstract

We examined reporting agreement of oral, vaginal, and anal sex in adolescents and young adults living with perinatally-acquired HIV and those perinatally HIV-exposed and uninfected in the Pediatric HIV/AIDS Cohort Study Adolescent Master Protocol (AMP) and AMP Up studies. Agreement between fixed constructs (e.g., age at first sex) and prevalence of logical inconsistencies (e.g., reclaimed virginity status) over time were assessed. Internal consistency was also examined using an attention check question and questions regarding condom use in the prior three months. Those who reported having anal sex in adolescence had a higher proportion of inconsistent responses compared to vaginal and oral sex measures. At their most recent survey, 84% of young adults correctly answered an attention check question and 74% agreed within the survey on condom use in the prior three months. In bivariate analyses, HIV status was not associated with responding inconsistently. Increased time between surveys, male sex, and younger age at first survey were associated with multiple measures of inconsistency over time, while lower cognitive scores, having less than a high school diploma, and negatively answering post-survey acceptability questions were associated with incorrectly answering an attention check question.

INTRODUCTION

Stakeholders, including policymakers, program directors, and researchers, use data on the prevalence of sexual behavior to monitor trends, identify target populations, set program priorities and advocate for support. One inherent limitation of these data is that sexual behavior history is almost always measured through self-report, which can be subject to many forms of bias. For instance, a question's intent may be unclear and misunderstood, or the question may be subject to social-desirability bias leading respondents to answer in a manner they believe will be viewed favorably by others, even if the survey is anonymous. Failure to reliably assess self-reported sexual behaviors can lead to significant errors in research on sexual health as well as policy creation and implementation.

*Dedicated to our recently deceased co-author Dr. George R. Seage III (1957-2021).

Among adolescents, inconsistencies in self-reported sexual behaviors are well documented (1, 2). Adolescents may purposely underreport or overreport some behaviors if they believe engaging in these behaviors is socially undesirable or desirable, respectively. Cognitive demands associated with recalling past behaviors and poor comprehension of survey questions, inattentiveness, and lack of motivation may also threaten reliability of self-report.

To assess the validity of self-report, researchers have used the presence of biomarkers of vaginal exposure to semen such as the presence of sperm, prostate-specific antigen, or Y chromosome in vaginal fluids (3–5). These measures are relevant for evaluation of very recent condomless sexual intercourse in women only and may not be relevant in most epidemiological studies where long-term exposure and variety of exposures are of interest (6). Some have used corroboration of partner reports of sexual behavior (7), but partner report may be influenced by the nature of the relationship between partners and jeopardizes confidentiality. Recording sexual behaviors in daily diaries (8) shortens recall time, but it may alter the behavior itself and is burdensome, which may lead to high attrition rates and non-compliance.

Test–retest reliability, which assesses the stability of responses to questionnaires over time, is a pre-requisite for validity. Findings from several studies on self-reported sexual behavior test-retest reliability among adolescents in the United States have varied. For dichotomous items, kappa reliability estimates have ranged anywhere from 0.40 to 0.90 (9–11). Continuous outcome measures, particularly the frequency of sexual intercourse, have performed poorly (9, 12). Adolescents also retract earlier-reported behaviors, for instance, initially reporting sexual activity and subsequently reporting never having engaged in the behavior. This is a logical inconsistency given the respondent was incorrect in at least one of the two surveys (13). An analysis of two waves of the National Longitudinal Study of Adolescent Health found that 11% of adolescents reclaimed virginity status (i.e., by reporting prior sex in one survey and no prior sex in the second survey), while only 22% reported the same month and year of sexual initiation (14). Better consistency has been demonstrated when timing of sexual initiation is reported as age in years, though results from these studies in adolescents have found varying levels of consistency in self-reported age at first sexual encounter, suggesting that recall may vary across populations and survey design (15–17).

Several studies have identified factors associated with inconsistent reporting, including survey design, interview modality, and setting, as well as participant characteristics such as age, sex, race and ethnicity, living in a single-parent family, HIV status, knowledge about sexually transmitted infections and perception of peer norms (2, 16, 18, 19). Research has shown that adolescents who take a virginity pledge or become born-again Christians are more likely to retract earlier reports of sex (20). Studies generally have indicated that high-frequency sexual behaviors are reported less consistently than low-frequency sexual behaviors, because respondents who engage in a behavior frequently are less likely to remember specific instances (19). However, when adolescents report infrequent behaviors, they often retract those behaviors later on (21). For instance, if a person experienced anal sex only once a decade earlier, they may not consider themselves to be someone who has anal

sex, rendering their report an indicator of whether they currently have anal sex as opposed to actual anal sex history.

Attention check questions, which have become an increasingly popular albeit somewhat debated method, are utilized in survey research as a means to filter out careless, or even mischievous, responses (22–25). Attention check questions are often referred to as trap questions, red herrings, validation questions, verification ratings, and instructed response or instructional manipulation questions. The proportion of people who incorrectly answer an attention check can vary widely across survey groups, setting, placement within a survey, and complexity of question, but it can help identify respondents more likely to have item nonresponse, inconsistent answers, speeding, and implausible statements throughout a survey (26, 27).

Since self-report of sexual behavior may be subject to social desirability bias, which may differ by age, sex, and cultural norms, it is important to evaluate reliability in the context of research in adolescents affected by HIV. More than half of states in the US have HIV-specific criminal laws, including laws targeting non-disclosure to sexual partners. Many states criminalize behaviors, such as spitting, that pose even a low or negligible risk for HIV transmission (28). Participant knowledge of such laws, or feelings of stigma related to their diagnosis, may lead to greater inconsistency in sexual reporting compared to the wider US adolescent population.

Among youth living with perinatally-acquired HIV (PHIV) and youth living with perinatal HIV exposure but uninfected (PHEU) in the United States, we examined reporting agreement of oral, vaginal and anal sex over time. We also considered associations of inconsistent reports with several demographic, health and psychosocial measures. Understanding factors associated with inconsistent responses may help identify areas for improvement of questionnaires in this population and inform researchers and policymakers of the precision of sexual behavior prevalence estimates.

METHODS

Study participants

The Pediatric HIV/AIDS Cohort Study (PHACS) Adolescent Master Protocol (AMP) is an ongoing prospective cohort study following youth living with PHIV and PHEU. Eligibility criteria for youth with PHIV included perinatal HIV infection, age 7 to <16 years at enrollment, and engagement in medical care with available antiretroviral treatment (ART) history. Enrollment took place from March 2007 through October 2009 at 15 sites in the United States, including Puerto Rico. Youth who were PHEU, in a similar age range, and from the same clinical sites were enrolled for comparison. An audio computer-assisted self-interview (ACASI) was administered annually in the clinic to participants 10 years of age or older with parental consent to collect information on substance use and sexual behaviors. Questions related to sexual behavior included prompts to ensure that youths understood words or concepts that may have been unfamiliar to them.

Once participants living with PHIV and PHEU in the AMP study become 18 years of age, follow-up is continued through enrollment into the AMP Up study (29), in which clinic-based visits during adolescence are transitioned to a hybrid of online and in-person data collection. Enrollment for AMP Up began in May 2014 and is ongoing. Young adults living with PHIV, who were not enrolled in AMP, but with available medical record documentation since early childhood are also eligible for enrollment. At the entry visit, clinical site staff introduce participants to the online surveys, and participants complete the surveys in the clinic. For follow-up surveys completed outside the clinic, participants can access online surveys either through links provided to them from clinical site staff or through a participant website. Participants in AMP are referred to as adolescents and in AMP Up as young adults. AMP and AMP Up were approved by the institutional review boards of each site and the Harvard T.H. Chan School of Public Health. Written informed consent is obtained from all participants or from guardians for those unable to consent themselves.

Sexual reporting agreement and prevalence of logical inconsistencies

Prevalence of logical inconsistencies (e.g., reclaimed virginity status) and agreement between fixed constructs (e.g., age at first sexual encounter) over time were assessed across two different intervals. The first *within-adolescence analysis* assesses agreement over a shorter period, where all surveys were administered via ACASI in AMP. In contrast, the *adolescence to adulthood analysis* examines agreement and inconsistencies over a longer period. ACASIs were administered at first report (to youth in AMP) and online surveys with no audio component were administered at second report (to young adults in AMP Up).

Participants in AMP were asked every year about whether they ever had vaginal sex with opposite sex partners, as well as oral or anal sex with opposite- or same-sex partners (see Supplementary Tables S1 and S2 for full list of questions analyzed). All participants who reported ever having oral, vaginal, or anal sex and had at least one subsequent survey response were included in the analysis for that particular item. Participants were also asked, “in your lifetime, how many partners have you had vaginal sex with,” and we considered responses logically inconsistent if fewer partners were enumerated in a latter survey when compared to a participant’s first response. Participants were asked, “in your lifetime, when you had vaginal sex, how often did you/your partner wear a condom,” and response options were: always, sometimes, or never. If a participant’s response changed from always to never, never to always, or sometimes to either always or never in the subsequent survey, it was considered logically inconsistent.

Any young adult participant who answered the attention check question was eligible for inclusion in this agreement measure, including those who did not answer sexual behavior questions. The attention check is a question that instructs the respondent to “please select ‘usually’ from the options below,” and if the participant does not select ‘usually,’ their response is considered incorrect (see Supplementary Table S4).

For agreement measures, two random surveys in which the question was answered were selected for comparison using simple random sampling. Participants were asked to input an integer value for their own age and partner age at their first vaginal sexual encounter, as well as their own age at first anal sexual experience. We considered responses to be in agreement

if the latter report of age was within (+/-) one year of the first reported age. Participants were also asked about condom use at their first sexual encounter. We reported the simple percent agreement, Cohen's kappa coefficient (30), and prevalence-adjusted bias-adjusted kappa (PABAK). We calculated PABAK to better account for the overestimation of kappa when bias is high and underestimation of kappa when prevalence is either very high or low for a particular response option (31, 32).

In adolescents' surveys, condomless vaginal sex was determined based on two questions: the first asked if a condom was used at first vaginal sex encounter, and the second asked of those who reported condom use if condomless sex occurred even for a moment. Surveys administered to young adults, conversely, only included the first question. Thus, two separate measures were examined in the adolescence to adulthood analysis. Kappa values were calculated comparing the young adult condom use question to the first condom use question in adolescence only and to the combined questions including the follow-up question assessing only partial condom use.

We assessed within-survey agreement of condom use in the prior three months in online surveys administered to young adults. As opposed to other measures, any sexually active young adult who completed at least one survey was included in this agreement measure, and only the most recent survey was used for an individual. Participants were asked within the same survey about condom use in the previous three months, to which they could respond that they "always," "sometimes," or "never" used a condom. Additionally, two separate questions requested a time interval for most recent sexual encounter with a condom and without a condom. From these two questions we could determine if they had always, sometimes, or never used a condom in the three months prior to survey completion and compare their within-survey agreement using the Fleiss-Cohen weighted kappa. Ninety-five percent confidence intervals (95% CI) of kappa and PABAK were calculated using asymptotic variance.

Associations between factors and inconsistent reporting

Data collection—We examined the association of the following factors with inconsistent reporting. Except where indicated, these factors were measured during AMP follow-up.

Sociodemographic data: Information was obtained on age, sex, race, ethnicity, and caregiver education. The location of a participant's primary study site was used to ascertain whether the participant lived in the South as defined by US Census Region. A 4-point scale question from Monitoring the Future, an ongoing study of the behaviors, attitudes, and values of Americans from adolescence through adulthood (33), was used to determine the importance of religion to the participant and was dichotomized to contrast those who feel religion is very important in their lives compared to less or non-important.

Survey administration: The time it took participants to complete a survey and survey administration dates were obtained from ACASI in AMP and from the Datstat Illume software (34) for young adults in AMP Up.

Cognitive functioning and academic achievement: Standardized Wechsler and NIH Toolbox neuropsychological examinations (35–38) were performed and are explained in greater detail in Supplementary Table S5. We examined the following: working memory scores, which have been implicated in inattention, hyperactivity, and mind-wandering when impaired (39–42); processing speed, which is also linked to inattention as well as anxiety and a lack of motivation to complete the task at hand when impaired (43); word reading and numerical operations scores assessing phonological awareness, decoding skills, and the ability to identify and write numbers; and crystallized cognition scores, which in contrast to working memory and processing speed, represent an accumulated store of verbal knowledge and skills, and are thus more heavily influenced by education and cultural exposure. These measures were taken from the examination closest to the date of survey completion, as neuropsychological exams were only performed every two to three years to reduce participant burden.

General and mental health: Participants and their caregivers were interviewed separately by a psychologist using the Behavior Assessment System for Children- 2nd Edition (BASC-2) (44), a series of scales assessing their perceptions of the participant’s emotional and behavioral health. We included the caregiver-reported Behavioral Symptoms Index (BSI) and participant-reported Emotional Symptoms Index (ESI). BSI scales measure hyperactivity, aggression, depression, attention problems, atypicality and withdrawal. ESI scales reflect a composite of social stress, anxiety, depression, sense of inadequacy, self-esteem and self-reliance. These measures were also taken from the examination closest to the date of survey completion in AMP. Self-reported substance use was collected through the same surveys as sexual behavior history.

Psychological instrument validity indices: We also examined BASC-2 validity indices for the participant-reported emotional symptoms index, including the F, L, V, consistency, and response pattern indices. Validity indices alert researchers to the presence of questionable data. The F index is a measure of the participant’s tendency to be excessively negative about their behaviors or emotions. The L index measures the participant’s tendency to give an extremely positive picture of themselves. The V index rates a respondent’s proclivity to agree with nonsensical or highly implausible statements (such as “I drink 50 glasses of milk every day”). The consistency index flags cases in which the participant has given different responses to items that usually are answered similarly. The response pattern index detects response patterning in which a participant repeats or cycles through response options.

Post-survey questions: Optional post-survey acceptability questions were included as part of the AMP Up online surveys. Six items regarding the acceptability of the survey (e.g., “the survey instructions were explained clearly”) included response options: strongly agree, agree, disagree, and strongly disagree. An additional statement asked participants to rate the difficulty of the survey overall on a 4-point scale from very easy to very hard, and another question ascertained the location in which the survey was completed.

Statistical Methods—Bivariate associations between inconsistent reporting and these factors were examined using logistic regression. For within-adolescence analyses, we ran

separate models for two outcomes of interest: inconsistently reported age at first vaginal sex (> +/- 1 year) and reclaimed vaginal sex virginity. For adolescence to adulthood analyses we ran models for inconsistently reported age at first vaginal sex (> +/- 1 year) and reclaimed anal sex virginity. For two items measured in the young adult online survey only, we also examined associations with prior three-month within-survey inconsistency of condom use reporting and an incorrect attention check response.

RESULTS

The within-adolescence analysis assessed agreement over an average interval of 1.5 years (range: 0.2–7.6 years) among 277 participants. The mean age at first and second report was 15.9 and 17.4 years, respectively. The adolescence to adulthood analysis, assessing agreement and inconsistencies over an average interval of 3.1 years (range: 0.5–9.9 years), consisted of 250 participants with a mean age at first and second report of 17.0 and 20.1 years, respectively.

Demographic characteristics of participants are described in Table I for both the within-adolescence and adolescence to adulthood analyses. About half of participants were male, two-thirds were Black, a quarter were Hispanic, and two-thirds were living with PHIV. About one-third of participants were from the Northeast and another third from the South. At first report, most were between 14 and 19 years of age, but for adolescence to adulthood analyses, those at retest were all over the age of 18, with about half over 20 years old.

Logical inconsistencies

Agreement in ever and lifetime measures are shown in Table II. Within adolescence, of those who reported oral, vaginal, and anal sex with an opposite sex partner at first report, 14% (32/228), 12% (28/229), and 48% (51/107), later reclaimed oral, vaginal, and anal sex virginity at second report, respectively. Fifteen percent (31/211), 6% (12/217), and 54% (53/99) reclaimed oral, vaginal, and anal sex virginity as a young adult, respectively. Of those who reported same-sex oral sex at first report, 34% (21/62) and 33% (19/58) reclaimed oral sex virginity at second report in adolescence and adulthood, respectively, and 50% (5/10) and 13% (1/8) reclaimed anal sex virginity at second report in adolescence and adulthood, respectively.

For lifetime measures, 15% (26/176) and 19% (37/190) were inconsistent in reporting lifetime vaginal sex condom use and 22% (40/178) and 22% (39/176) were inconsistent in reporting lifetime number of vaginal sex partners in adolescence and adulthood, respectively. Thirty-two percent (20/63) and 37% (20/54) were inconsistent in reporting lifetime anal sex condom use and 22% (14/63) and 25% (13/51) were inconsistent in reporting lifetime number of anal sex partners in adolescence and adulthood. Additionally, 16% (88/559) of participants answered the attention check incorrectly at their most recent survey as a young adult. Twenty-four percent (21/88) of those who answered the attention check incorrectly selected “rather not answer” instead of “usually.” Excluding these responses, 12% (67/538) answered incorrectly.

Agreement in fixed constructs

Within adolescence, 78% agreed on their own age at first vaginal sexual encounter (+/- one year), 70% agreed on their first partner's age, and 65% agreed on their own age at first anal sexual encounter (Table III). Across adolescence and young adulthood, 68% agreed on their own age at first vaginal sexual experience (+/- one year) and 67% agreed on their first partner's age, while only 47% agreed on their own age at first anal sexual experience. For the within-adolescence analysis, reported age was 0.4 to 0.9 years greater on average at second report, with a 1.7 year mean interval between surveys. For the adolescence to adulthood analysis, reported age at second report was about three quarters of a year greater on average for age and partner age at first vaginal sexual encounter and almost 2 years greater for age at first anal sexual encounter compared to first report. There was an average of 3 years between surveys for the vaginal sex measures and 3.5 years between surveys for age at first anal sexual encounter.

Condom use during a participant's first vaginal sexual experience (yes/no) had fair agreement in both the within-adolescence analysis (kappa = 0.45, 95% CI: [0.33, 0.57]; PABAK = 0.46, 95% CI: [0.34, 0.58]; 73% [156/214] in agreement) and the adolescence to adulthood analysis (kappa = 0.43, 95% CI: [0.28, 0.57]; PABAK = 0.59, 95% CI: [0.48, 0.70]; 79% (166/209) in agreement). When we define partially condomless sex as condomless in the first survey as determined by the follow-up question regarding condomless sex even for a moment, adolescence to adulthood agreement drops (kappa = 0.39, 95% CI: [0.28, 0.51]; PABAK = 0.45, 95% CI: [0.32, 0.57]; 72% (151/209) in agreement) as reports of condomless sex increase in the first survey.

Within-survey agreement of condom use in the previous three months showed moderate agreement (weighted kappa = 0.72, 95% CI: [0.67, 0.78]; 74% [324/439] in agreement). While 74% agreed within the survey on condom use in the prior three months, 18% (79/439) reported more condom use, and only 8% (36/439) reported less condom use, when responding generally about always, sometimes, or never using a condom compared to selecting time intervals for the last time they had sex with and without a condom.

Associations between factors and inconsistent reporting

Table IV shows the estimated odds ratios (OR) and 95% CIs for factors associated with inconsistent reporting over time. In bivariate analyses, increasing time between survey administrations was associated with inconsistent reporting of age at first vaginal sexual encounter in both within-adolescence and adolescence to adulthood analyses and reclaimed anal sex virginity status in the latter analysis. Older age at first survey is associated with decreased odds of incorrect reporting of age at first sexual encounter or reclaimed virginity status across all inconsistency measures. Male sex was positively associated with inconsistent reporting of age at first vaginal sexual encounter as well as reclaimed vaginal sex virginity within adolescence, while Black race was associated with increased inconsistent reporting of age within adolescence only. Living in the South was associated with inconsistent reporting of age at first vaginal sexual encounter. No health, cognitive functioning, or academic achievement measures were associated with inconsistent reporting over time. Increased L and V indices, which measure a participant's tendency to give an

extremely positive picture of their life and to agree with highly implausible statements, respectively, were both associated with increased odds of reclaiming virginity status within adolescence. An increased V index was also associated with inconsistent reporting of age across adolescence to adulthood.

Estimated ORs and 95% CIs for factors associated with inconsistent reporting within one young adult survey are shown in Table V. The time it took to complete the survey, clinic versus home-based survey completion, responses to post-survey acceptability questions, cognitive functioning, and sociodemographic or health factors were not associated with inconsistent reporting of condom use in the previous three months within the same survey. Not responding to the attention check correctly was the only factor associated with increased odds of inconsistent reporting of condom use within the same survey (OR=3.19, 95% CI: [1.52, 6.69]).

Being a high school graduate and all cognitive scores, including higher working memory, processing speed, and crystallized cognition scores, were associated with decreased odds of responding incorrectly to the attention check. Compared to strongly agreeing positively with optional post-survey acceptability responses, agreeing or disagreeing were associated with increased odds of an incorrect attention check, with the exception of feelings about how long it took to complete the survey. Compared to strongly agreeing with the statement that survey instructions were explained clearly, agreeing (OR=1.97, 95% CI:[1.19, 3.28]) or disagreeing (OR=8.49, 95% CI:[2.57, 28.0]) were associated with increased odds of an incorrect attention check response. No other factors were associated with an incorrect attention check response.

DISCUSSION

We found that participants who reported having sex in adolescence had a higher proportion of inconsistent responses across surveys for anal sex compared to vaginal and oral sex measures and for same-sex partners compared to opposite-sex partners. This is the first study to our knowledge to examine reclaimed oral and anal sex virginity with both opposite- and same-sex partners. About half of those who reported anal sex in adolescence later reported not having had the sexual experience. This may support findings that retraction of earlier-reported sexual encounters is most common among adolescents for experimental behaviors initially reported as infrequent, given reports related to anal sex and same-sex anal or oral sex were much less frequent than oral and vaginal sex (13, 21). This could also be related to perceived stigma attached to these misreported behaviors (45). The proportion reclaiming vaginal sex virginity was almost identical to proportions reported in other adolescent populations (14, 20). For lifetime vaginal sex condom use and partner counts, anywhere from 14 to 22% of those who responded provided answers at the second survey that were logically inconsistent with their responses at the first survey, congruous with the results of a study using similar measures (46). For anal sex, these inconsistency percentages were slightly higher at 21 to 39 percent. Comparing these proportions between the within-adolescence and adolescence to adulthood analyses, inconsistencies did not appear to differ dramatically despite slight differences in wording of questions and administration format,

age differences, and almost twice the time interval between surveys for the adolescence to adulthood analysis.

Agreement related to first sexual encounters was reasonable, with most adolescents and young adults consistently reporting the same age and condom use at two surveys, similar to analyses in other adolescent and young adult populations (15–17). For the within-adolescence analysis, reported age was on average about half to three-quarters of a year greater at second report, while in the adolescence to adulthood analysis, average reported age at second report was three quarters of a year to two years greater for age at first sexual encounter. Agreement on condom use during an adolescent's first sexual experience was also fair. A follow-up question about whether sex was condomless even for a short time increased reports of condomless sex, corroborating previous research in youth living with PHIV (47). Condoms may be applied only for a portion of sex, or condoms may break or slip off during intercourse. Asking only if a condom was used is likely to underestimate the actual prevalence of condomless sex.

There were also two measures of reliability examined within the same survey among young adults. Inquiring about the last time a participant had sex with and without a condom compared to asking how often they used a condom (i.e., always, sometimes, never) produced a higher number of 'inconsistent' and 'never' condom use reports within a three-month recall period. Under the assumption that these behaviors are underreported (4, 6), this finding supports use of the former method to ascertain condom use in a given period. In this instance, episodic recall may reduce social desirability compared to general frequency recall because the participant is asked to dig into their memory and recall specific events, avoiding translation of a vague impression of their own condom use to fit a category (48). Additionally, 16% of participants selected an imperfect attention check response at their most recent survey as a young adult, a proportion similar to other studies that have included such a question (23, 26).

Consistent with other studies, several sociodemographic characteristics were associated with inconsistent reporting. Older age at first survey was associated with decreased odds of inconsistent report across all consistency measures, and living in the South and male sex were associated with multiple measures of inconsistency. There are a number of reasons younger age at first report may be associated with inconsistent reporting. Though surveys among participants under the age of 18 included prompts to define different terms, including body parts, it is possible that the prompts were not used or were insufficient for some young participants to understand sexual behavior questions fully. Immaturity, less care for research goals, and stronger compulsion to respond in a socially desirable manner may impact the responses of younger participants. As a means to attain adult status, some adolescents may exaggerate their sexual involvement. It is likely, therefore, that socially desirable answers change with age and developmental stage (13).

The association between living in the South and inconsistent reports may capture regional differences in beliefs about sexual norms. For instance, prior research has shown that a respondent's belief that fewer peers were engaging in sex and the belief that more peers will wait until marriage to have sex were associated with inconsistent reports (18). Among

all southern states in this cohort, sex education is required to frame sexual activity as appropriate only within marriage, while only one non-southern state requires such framing (49). This regional finding warrants further study.

HIV status was not associated with inconsistent reporting, counter to the hypothesis that stigma associated with HIV status leads to greater inconsistency in reporting. Additionally, behavioral and emotional symptoms were not associated with inconsistent reporting. Two BASC validity indices were associated with reclaimed virginity status in adolescence. The L index, which can indicate assertion of a falsely positive picture of a participant's life, was associated with increased odds of reclaiming vaginal sex virginity. This suggests that participants who reclaim virginity may be more likely to present themselves positively and therefore may alter their responses based on perceived social desirability. Additionally, the V index, which quantifies a participant's penchant to agree with highly implausible statements, was associated with increased odds of inconsistent report of age at first vaginal sexual encounter across adolescence to adulthood and reclaiming vaginal sex virginity within adolescence, indicating reports of sex may be incorrect and are correlated with other inaccurate reports. Given participants who reclaim virginity may be more likely to select nonsensical and implausible options, this could point to intentional misreporting, though it may also indicate poor comprehension or lack of attention in completing surveys.

While sociodemographic variables were associated with inconsistent reporting over time, they were not important for within-survey inconsistency as a young adult. In examining inconsistency over time, identity and beliefs about sensitive reporting, peer norms, and social desirability may be more crucial to explaining why responses change over time. Conversely, the social and demographic variables that are correlated with identity and beliefs may matter less when examining inconsistency at one point in time. Beliefs about sex and what is socially desirable are likely to remain constant and instead, cognitive abilities or general attentiveness or feelings toward completing a survey may be better markers of inconsistency in this case. Though numerous cognitive and academic achievement scores, post-survey acceptability questions and higher education were associated with an incorrect attention check, incorrectly responding to the attention check was the only factor associated with increased odds of inconsistent reporting of condom use within the same survey, suggesting the measure does indicate unreliable reporting. Additionally, reports of ever using marijuana appeared to be associated with decreased odds of an incorrect attention check response. This association may exist if those who are more likely to report honestly about drug use are also more likely to answer an attention check correctly. Sensitivity analyses restricted to those who correctly answer an attention check could allow examination of the possible effects of unreliable reporting on effect estimates.

Although this study provides a wealth of information regarding self-reported sexual behaviors, there are several limitations. First, it remains unclear whether the initial report of sexual activity, the subsequent report of virginity, or both are false. We can only speculate that measures of reclaimed virginity are capturing only some of those adolescents who are reporting incorrectly (50). Nonetheless, it is important to identify the extent to which adolescents report inconsistently as an indicator of validity of the self-reports. Second, most comparisons required a participant to report at two time periods, and it may be the case that

those who remain in the study for more than one year feel that research is more important and are more truthful in their responses. Additionally, measures such as age at first vaginal sex are examined only among those who consistently reported having ever had vaginal sex at both time points. Finally, neuropsychological measures were not always taken at the same time as survey administration since most occurred every three years. Therefore, these measures may not reflect a participant's cognitive abilities at the moment they completed the survey and may attenuate an association between cognitive scores and inconsistent report.

Even when carefully worded, sexual behavior questions can be interpreted in ways that differ from a researcher's intent. Our use of detailed descriptions of what was meant by terms such as "vaginal sex" (i.e., "by vaginal sex I mean that a boy had his penis in your vagina"), in addition to culturally normative terms to describe specific sexual behaviors, presumably helped to provide clarity in these surveys.

An additional strategy to reduce socially desirable responding would be to reframe questions so that they ask "how many times" rather than "if" a participant engaged in a particular sexual behavior, thus placing the burden of denial on the participant.

Despite the limitations, our study provides prevalence estimates of logically inconsistent sexual behavior reports and agreement measures on report of first sexual encounters among adolescents and young adults affected by HIV. We focused on a wide range of sexual behaviors not often examined, including vaginal, anal, and oral sex as well as same-sex oral and anal sex. The associations found between inconsistent reports and several demographic, health, and psychosocial measures suggest distinct mechanisms behind inconsistent reporting across surveys compared to within a given survey.

We offer several recommendations based on our findings that may reduce inconsistencies in self-reported sexual behavior. Inclusion of a follow-up question about whether sex was condomless even for a short time may produce greater reports of condomless sex, and asking about the last time a participant had sex with and without a condom, compared to asking how often they used a condom in a given time period, may produce higher inconsistent and never condom use reports. Attention check questions provide a measure for inattentiveness and/or mischievous responses that is easy to implement; we recommend placing the question near the end of the survey to avoid concerns that exposure to the question may affect responses. Although asking "how many times" rather than "if" a participant engaged in a particular sexual behavior may avoid underreporting of sensitive sexual behaviors, this advice may only apply after a certain age because social desirability bias at younger ages may favor overreporting. Further research should examine reporting reliability of anal sex and sex with same-sex partners in adolescents and young adults because participants reported about these encounters less consistently. Finally, participants should be reminded how study data will be used and that they are making an important contribution to improve the lives of other young people affected by HIV.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographic characteristics of 277 eligible participants for within-adolescence analysis and 250 eligible participants for adolescence to adulthood analysis

Variable	Within-adolescence		Adolescence to adulthood	
	Percent (N = 277)		Percent (N = 250)	
Sex at birth				
Male	49.8		47.2	
Female	50.2		52.8	
Race				
Black or African American	67.9		66.4	
White	24.9		25.6	
Other/ Multi / Unknown	7.2		8.0	
Ethnicity				
Hispanic or Latino	24.9		28.8	
Perinatal HIV Status				
PHIV ^a	62.8		67.2	
PHEU ^b	37.2		32.8	
US Region				
Northeast	34.7		39.2	
Midwest	15.2		11.2	
South	32.5		31.2	
West	11.9		11.2	
Puerto Rico	5.8		7.2	
Age, years				
	At test, % (N=1819)^c	At retest, % (N=1819)^c	At test, % (N=1742)^d	At retest, % (N=1742)^d
10–13	12.1	4.2	7.3	n/a
14–16	64.3	30.2	37.3	n/a
17–19	22.5	56.7	50.1	50.6
20–23	1.1	8.9	5.3	45.2
24+	0.0	0.0	0.0	4.1
Average time between surveys	1.5 years		3.1 years	

^aPHIV: Living with perinatally-acquired HIV

^bPHEU: Exposed to HIV perinatally, but uninfected

^cN = Total number of agreement measures assessed among 277 participants

^dN = Total number of agreement measures assessed among 250 participants

Table II

Proportion of logically inconsistent response in ever and lifetime measures across two surveys

<i>Ever had sex measures</i>	Within-adolescence		Adolescence to adulthood	
	Percent reclaiming virginity between first and second survey (proportion)	Mean time between surveys, in years (IQR) ^a	Percent reclaiming virginity between first and second survey (proportion)	Mean time between surveys, in years (IQR)
Opposite sex partner				
Oral sex	14 (32/228)	1.1 (0.9, 1.3)	15 (31/211)	3.1 (1.5, 4.4)
Vaginal sex	12 (28/229)	1.2 (0.9, 1.3)	6 (12/217)	2.9 (1.4, 4.1)
Anal sex	48 (51/107)	1.2 (0.9, 1.3)	54 (53/98)	3.6 (2.1, 4.9)
Same sex partner				
Oral sex	34 (21/62)	1.1 (1.0, 1.3)	33 (19/58)	2.9 (1.2, 4.3)
Anal sex (males only)	50 (5/10)	1.1 (1.0, 1.1)	13 (1/8)	4.3 (3.0, 5.3)
<i>Lifetime sex measures</i>	Within-adolescence		Adolescence to adulthood	
	Percent inconsistent between first and second survey (proportion)	Mean time between surveys, in years (IQR)	Percent inconsistent between first and second survey (proportion)	Mean time between surveys, in years (IQR)
Vaginal sex				
Lifetime condom use	15 (26/176)	1.8 (1.0, 2.4)	19 (37/190)	2.9 (1.3, 4.0)
Lifetime number of sex partners	22 (40/178)	1.7 (1.0, 2.3)	22 (39/176)	3.0 (1.4, 4.5)
Anal sex				
Lifetime condom use	32 (20/63)	1.6 (0.9, 2.3)	37 (20/54)	3.8 (2.2, 5.1)
Lifetime number of sex partners	22 (14/63)	1.7 (0.9, 2.2)	25 (13/51)	3.8 (2.1, 5.4)

^aIQR: Interquartile range

Table III

Participant and partner age at first sex as reported at first and second survey

	Response at first survey		Response at second survey		Percent agreement ^b	Mean time between surveys, in years (IQR)
	Mean, in years	IQR ^a	Mean, in years	IQR		
<i>Within-adolescence</i>						
Age at first vaginal sex (N=212)	14.0	(13.0, 15.0)	14.4	(14.0, 16.0)	78	1.8 (1.0, 2.3)
Partner age at first vaginal sex (N=214)	14.8	(13.0, 17.0)	15.7	(15.0, 17.0)	70	1.7 (1.0, 2.2)
Age at first anal sex (N=63)	13.9	(13.0, 16.0)	14.8	(13.0, 17.0)	65	1.7 (1.0, 2.2)
<i>Adolescence to adulthood</i>						
Age at first vaginal sex (N=208)	14.6	(14.0, 16.0)	15.3	(14.0, 16.0)	68	3.0 (1.4, 4.3)
Partner age at first vaginal sex (N=209)	15.7	(15.0, 17.0)	16.5	(15.0, 18.0)	67	3.0 (1.4, 4.0)
Age at first anal sex (N=53)	15.2	(14.0, 17.0)	17.1	(16.0, 19.0)	47	3.5 (1.6, 4.9)

^aIQR: Interquartile range^bResponses in agreement if age provided at second survey is within +/- 1 year of age provided at first survey

Table IV

Bivariate factor associations with inconsistent reporting over time

Variable ^a	Within-Adolescence				Adolescence to Adulthood				
	Reclaimed vaginal virginity status	Inconsistent age of first vaginal sex	Inconsistent age of first vaginal sex	Reclaimed anal virginity status	Inconsistent age of first vaginal sex	Inconsistent age of first vaginal sex	Reclaimed anal virginity status	Inconsistent age of first vaginal sex	
N ^b	OR ^c	95% CI ^d	N	OR	95% CI	N	OR	95% CI	
<i>Administration</i>									
Interval between surveys (years)	229	0.68	(0.28, 1.67)	212	1.93	(1.43, 2.60)	98	1.32	(1.05, 1.66)
Time to complete first survey (min)	229	0.95	(0.90, 1.01)	212	0.98	(0.95, 1.01)	98	1.00	(0.99, 1.01)
<i>Sociodemographic</i>									
Age at first survey (years)	229	0.70	(0.56, 0.88)	212	0.73	(0.60, 0.88)	98	0.72	(0.59, 0.89)
Age at second survey (years)	229	0.71	(0.58, 0.88)	212	0.98	(0.80, 1.20)	98	0.83	(0.66, 1.05)
Male	229	2.50	(1.08, 5.80)	212	2.46	(1.26, 4.80)	98	0.91	(0.41, 2.01)
Black race	219	2.43	(0.81, 7.32)	202	3.25	(1.30, 8.17)	95	2.16	(0.90, 5.17)
Caregiver high school graduate	229	0.73	(0.30, 1.81)	212	0.90	(0.44, 1.82)	98	1.03	(0.44, 2.39)
Live in the South	229	1.01	(0.44, 2.37)	212	1.86	(0.96, 3.61)	98	3.56	(1.34, 9.46)
Religion very important	212	1.29	(0.45, 3.69)	198	1.01	(0.41, 2.53)	89	1.53	(0.53, 4.39)
<i>Health</i>									
Living with HIV	229	1.05	(0.46, 2.39)	212	1.74	(0.86, 3.55)	98	1.70	(0.71, 4.07)
Behavioral symptom index (BASC)	205	1.02	(0.98, 1.05)	186	1.00	(0.97, 1.03)	78	1.00	(0.96, 1.04)
Emotional symptom index (BASC)	226	0.98	(0.94, 1.02)	208	0.97	(0.94, 1.01)	95	1.00	(0.96, 1.05)
Ever marijuana use at first survey	227	0.91	(0.41, 2.02)	210	1.03	(0.53, 1.98)	98	0.57	(0.25, 1.29)
Ever marijuana use at second survey	229	0.57	(0.26, 1.26)	212	0.93	(0.47, 1.83)	97	1.43	(0.58, 3.57)
<i>BASC validity indices^e</i>									
F index	226	1.02	(0.74, 1.40)	208	0.76	(0.51, 1.14)	95	1.29	(0.85, 1.97)
L index	225	1.14	(1.00, 1.29)	208	1.02	(0.91, 1.14)	95	1.03	(0.89, 1.18)
V index	225	1.73	(1.01, 2.96)	208	0.63	(0.24, 1.68)	95	2.28	(0.94, 5.49)
Consistency index	217	1.01	(0.93, 1.11)	204	1.03	(0.95, 1.11)	94	1.04	(0.95, 1.13)

Variable ^d	Within-Adolescence				Adolescence to Adulthood							
	N ^b	OR ^c	95% CI ^d	Inconsistent age of first vaginal sex N	OR	95% CI	Reclaimed anal virginity status N	OR	95% CI	Inconsistent age of first vaginal sex N	OR	95% CI
Response pattern index	217	1.01	(0.98, 1.04)	204	0.99	(0.97, 1.01)	94	1.02	(1.00, 1.05)	203	1.00	(0.98, 1.02)
<i>Cognitive functioning and academic achievement</i>												
Processing speed	224	1.01	(0.98, 1.03)	208	1.00	(0.97, 1.02)	94	1.02	(0.99, 1.05)	203	0.99	(0.97, 1.01)
Working memory	225	1.01	(0.98, 1.04)	209	1.00	(0.98, 1.02)	95	1.02	(0.99, 1.05)	204	0.99	(0.97, 1.01)
WIAT ^f math score	199	1.01	(0.98, 1.03)	185	1.00	(0.98, 1.01)	81	1.01	(0.99, 1.04)	181	0.99	(0.98, 1.01)
WIAT word score	199	1.00	(0.97, 1.02)	185	0.98	(0.96, 1.00)	81	1.01	(0.99, 1.04)	181	0.99	(0.97, 1.01)

^a At time closest to first survey unless otherwise stated

^b Numbers differ due to refusals and missing observations

^c OR: odds ratio

^d CI: confidence interval

^e BASC: Behavior Assessment System for Children--2nd Edition; F index: tendency to be excessively negative; L index: tendency to give an extremely positive picture of self; V index: proclivity to agree with nonsensical or highly implausible statements; Consistency index: participant provides different responses to items that usually are answered similarly; Response Pattern index: participant repeats or cycles through response options.

^f WIAT: Wechsler Individual Achievement Test, Second Edition, Abbreviated 33 is a standardized measure of academic achievement

Table V

Bivariate factor associations with inconsistent reporting within young adult survey

Variable	Within-survey condom use inconsistency, N=440			Within-survey incorrect attention check, N=559		
	Median (IQR) ^a or N (%) ^b	OR ^c	95% CI ^d	Median (IQR) or N (%)	OR	95% CI
Sociodemographic						
Age (years)	23 (21, 27)	1.00	(0.95, 1.05)	23 (21, 27)	0.98	(0.93, 1.04)
Male	155 (35)	1.03	(0.66, 1.60)	214 (38)	1.21	(0.76, 1.91)
Black race	284 (68)	1.30	(0.81, 2.10)	380 (71)	0.88	(0.53, 1.45)
High school graduate	354 (82)	0.80	(0.47, 1.36)	465 (85)	0.40	(0.23, 0.70)
Live in the South	134 (30)	1.24	(0.79, 1.96)	160 (29)	0.92	(0.56, 1.54)
Health						
Living with HIV	360 (82)	0.79	(0.46, 1.35)	466 (83)	0.88	(0.49, 1.59)
Ever marijuana use	330 (77)	1.33	(0.78, 2.30)	387 (72)	0.54	(0.33, 0.90)
Cognitive functioning						
Processing speed	103 (90, 117)	1.00	(0.99, 1.01)	101 (88, 115)	0.99	(0.97, 1.00)
Working memory	105 (97, 113)	1.00	(0.98, 1.01)	105 (94, 113)	0.96	(0.95, 0.98)
Crystallized cognition	100 (94, 106)	0.99	(0.97, 1.01)	100 (93, 108)	0.95	(0.93, 0.98)
Survey administration and post survey questions						
Time to complete survey (minutes)	40 (31, 55)	1.00	(1.00, 1.00)	39 (30, 55)	1.00	(1.00, 1.00)
Survey completion location						
Clinic	300 (90)	REF		500 (90)	REF	
Home or elsewhere	39 (10)	0.59	(0.25, 1.39)	53 (10)	0.69	(0.29, 1.67)
The survey instructions were explained clearly						
Strongly agree	203 (49)	REF		275 (50)	REF	
Agree	180(43)	1.21	(0.77, 1.91)	228 (42)	1.97	(1.19, 3.28)
Disagree	5 (1)	0.77	(0.08, 7.01)	12 (2)	8.49	(2.57, 28.0)
Strongly disagree	30 (7)	1.53	(0.67, 3.49)	31 (6)	2.47	(0.98, 3.28)
The survey questions were easy to understand						
Strongly agree	197 (47)	REF		262 (48)	REF	
Agree	180 (43)	0.99	(0.62, 1.56)	239 (44)	1.89	(1.13, 3.14)
Disagree	10 (2)	1.86	(0.51, 6.85)	14 (3)	8.36	(2.73, 25.6)
Strongly disagree	28 (7)	1.32	(0.56, 3.01)	29 (5)	2.18	(0.82, 5.81)
The survey questions were easy to answer						
Strongly agree	189 (46)	REF		252 (47)	REF	
Agree	188 (45)	1.01	(0.64, 1.60)	241 (45)	1.47	(0.88, 2.45)
Disagree	10 (2)	1.23	(0.31, 4.92)	17 (3)	6.58	(2.36, 18.4)
Strongly disagree	27 (7)	1.43	(0.60, 3.39)	29 (5)	1.93	(0.73, 5.12)
The online survey format was user friendly						
Strongly agree	197 (48)	REF		266 (49)	REF	
Agree	179 (44)	1.08	(0.68, 1.71)	232 (43)	1.93	(1.16, 3.23)
Disagree	8 (2)	0.98	(0.19, 5.01)	13 (2)	8.51	(2.57, 28.2)

Variable	Within-survey condom use inconsistency, N=440			Within-survey incorrect attention check, N=559		
	Median (IQR) ^a or N (%) ^b	OR ^c	95% CI ^d	Median (IQR) or N (%)	OR	95% CI
Strongly disagree	27 (7)	1.47	(0.62, 3.48)	30 (6)	2.13	(0.80, 5.64)
I'm fine with how long it took to complete the survey						
Strongly agree	183 (44)	REF		247 (45)	REF	
Agree	188 (45)	1.02	(0.64, 1.62)	237 (44)	1.57	(0.94, 2.63)
Disagree	15 (4)	0.43	(0.09, 1.99)	29 (5)	2.39	(0.94, 6.09)
Strongly disagree	29 (7)	1.72	(0.76, 3.90)	31 (6)	2.19	(0.87, 5.54)
The \$75 gift card is fair compensation for taking part						
Strongly agree	189 (46)	REF		257 (47)	REF	
Agree	168 (41)	1.02	(0.64, 1.63)	220 (41)	1.57	(0.94, 2.62)
Disagree	22 (5)	0.82	(0.29, 2.33)	27 (5)	2.55	(1.00, 6.53)
Strongly disagree	32 (8)	1.46	(0.66, 3.23)	39 (7)	1.88	(0.79, 4.46)
Overall, completing this set of surveys was						
Very easy	257 (59)	REF		329 (60)	REF	
Easy	156 (36)	1.37	(0.88, 2.15)	195 (36)	1.29	(0.79, 2.10)
Hard	14 (3)	2.46	(0.82, 7.38)	18 (3)	3.16	(1.13, 8.83)
Very hard	5 (1)	--	--	7 (1)	2.52	(0.48, 13.4)
Incorrect attention check response (n=342)	32 (9)	3.19	(1.52, 6.69)	--	--	--

^aIQR: Interquartile range

^bN = number of participants in a given category

^cOR: odds ratio

^dCI: confidence interval