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HIV infection and risk factors related to early sexual debut in a 2016
national cross-sectional survey of American men who have sex with men

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B.A.
University of Richmond
2015

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Rollins School of Public Health of Emory University
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Abstract

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A significant portion of HIV research aims to assess HIV risk factors in men who have sex with men (MSM), yet there is a paucity of research investigating the role of sexual debut age (SDA) in determining later HIV risk within the MSM community, especially in the US. This analysis employed data from the American Men's Internet Survey (AMIS), an annual cross-sectional representative sample of US MSM, to determine the relationship between SDA and later HIV risk, along with other potentially contributing HIV risk behaviors. The authors categorized self-reported SDA in MSM by age of oral sexual debut (OSD) with a man and age of anal sexual debut (ASD) with a man in four categories: <13, 13-14, 15-17, and 18+ years. The outcome HIV status was self-reported. After adjusting for age at time of survey, race, education level, and current household income, early age of ASD was associated with elevated HIV risk (for <13 versus 18+, adjusted odds ratio (AOR): 2.23, 95% confidence interval (CI): 1.51-2.26), as was early OSD (for OSD <13 versus 18+, OR: 2.52, 95% CI: 2.12-3.00). The AMIS sample is disproportionately older, wealthier, and more well-educated than other MSM samples, which potentially contributed bias to the study. Given the demonstrated association between SDA and HIV risk, more research is necessary to validate this relationship in more diverse populations and other contexts.

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Introduction

Despite recent advances in HIV treatment and prevention, HIV remains a growing problem worldwide, with increased risk in subpopulations including men who have sex with men (MSM) accounting for a disproportionate number of new diagnoses [1]. In the United States, MSM accounted for 82% of new HIV diagnoses in males age 13 years and older in 2015, and new HIV diagnoses increased in MSM ages 13-24 years from 2010 to 2014 [2]. Investigations into factors associated with growing HIV rates in MSM have included sexual debut age (SDA) as both a potential standalone risk factor for HIV infection, and a factor associated with several previously assessed HIV risk factors. The continued decrease in SDA in men could help explain the rising HIV diagnoses in young MSM (YMSM) [3].

Multiple studies have demonstrated associations between SDA and HIV risk factors in several populations, including non-MSM populations. Sexual debut before 13 years was associated with increased sexual risk taking, substance use, and violent victimization in a nationally representative study of U.S. high school students [4]. Early sexual debut has also been linked to less consistent contraceptive use among U.S. women [5]. One study examining a nationally representative sample of U.S. adults found that earlier sexual debut in women and men was linked with increased likelihood of having multiple sexual partners and higher likelihood of substance use at last sex [6]. Additionally, a study examining a cohort of Nordic women found higher likelihood of prior sexually transmitted infection and multiple sexual risk-taking behaviors among those with earlier sexual initiation [7]. Studies of a nationally representative sample in Nepal found associations between early SDA and a robust sexual risk profile,

including having paid for sex, having inconsistent condom use, and having a history a sexual violence [8]. Early sexual debut has also been associated with increased HIV acquisition in studies of women in sub-Saharan Africa. One cohort study of women at risk for HIV in South Africa concluded that those in the lowest quintiles of SDA had a much higher likelihood of seroconversion, an effect authors attributed to higher numbers of lifetime sexual partners [9]. While the above body of research demonstrates linkages between early debut and HIV risk factors within global non-MSM populations, it is important to note that the definition of early sexual debut varies across culture and sample population, and relatively few studies have assessed the direct relationship between HIV prevalence and SDA generally.

There is mounting evidence that sexual behavior disparities between sexual majority and sexual minority populations occur early in life and are predictive of further risk behavior later [10]. Previous research has found that sexual minorities report a lower mean SDA than their sexual majority counterparts, which, when paired with riskier sex behaviors exhibited by sexual minority populations in general, could drive increased HIV risk. Self-reported SDAs among MSM have been found to be lower than those of heterosexual males in a national study of debut age and adverse childhood events [11], as well as in a study of debut age based on sexual identity in the U.S. Youth Risk Behavior Survey (YRBS) [12]. Early sexual debut was associated with increased sexual risk taking in sexual minority youth as well [4]. Early sexual debut has also been found to differ by birth cohort, indicating that younger MSM are having sex earlier and cross-generationally, increasing their risk of HIV acquisition [13]. The same birth cohort study found a link between earlier sexual debut and increased incidence of condomless anal intercourse when controlling for birth cohort [13]. The study posited that younger MSM HIV risk factors

have also been demonstrated across multiple categories of debut age, with likelihood of higher-risk behavior increasing as debut age decreases. In a cohort of HIV-positive black MSM, those with SDA of 13 years showed increased sexual risk behavior in later years than their counterparts with sexual debut during ages 14 and over, showing a potential inverse continuous relationship [14] . The emerging link between early sexual debut and high-risk sexual behavior indicates that more robust studies across more specific populations are necessary to determine the true nature of this relationship.

HIV prevalence varies by race and ethnicity among MSM in the United States [2], and this disparity is echoed in studies regarding SDA and HIV risk factors. Despite having similar rates of condomless anal intercourse, number of sexual partners with unknown HIV-status, and other risk factors, black MSM's HIV incidence is disproportionately higher than that of white MSM, and this effect is increased among young black MSM [15]. One study of factors related to condom use at first same-sex sexual encounter among young black MSM found that reduced sexual education and sexual networks that were relatively intolerant to condoms increased condom nonuse and increased HIV risk [16]. Young MSM, including young black MSM, who can often lack social support around their sexual identity, may pursue older partners for mentorship and sexual interest, putting them at higher risk for HIV [17]. A study of HIV-positive racial/ethnic minority MSM found an increased likelihood of sexual risk taking and HIV-related risk behaviors among those with earlier sexual debut [14].

While there have been multiple studies examining HIV infection and its relation to early sexual debut in Africa and among women, few studies have investigated the relationship between early

sexual debut and actual HIV prevalence in MSM. One study in Kenya demonstrated that men with early sexual debut were more likely to have HIV than those with later debut [18]. Another study examining disparities in HIV risk between MSM sex workers and non-commercial MSM in China found that those with earlier debut had higher HIV prevalence [19]. Finally, a recent study in China demonstrated that MSM who reported earlier ages of anal same-sex sexual debut were more likely than those with later sexual debuts to have an HIV infection [20].

While there is some existing literature regarding linkages between early sexual debut and subsequent HIV risk behaviors, it is sparse, and there is a paucity of research investigating the link between early sexual debut and HIV infection prevalence specifically among U.S. MSM. This study uses a nationally representative sample of MSM from the American Men's Internet Survey (AMIS), an annual cross-sectional survey of U.S. MSM, to elucidate the link between SDA and HIV risk, in order to establish a window of SDA wherein MSM are more susceptible to HIV risk factors and HIV infection, and more adequately inform HIV prevention efforts for younger MSM.

Methods

Data were collected as part of the 2016 iteration of the American Men's Internet Survey (AMIS), an annual online survey of MSM assessing behaviors and factors related to HIV transmission. The 2016 administration, protocol, and key indicators of AMIS were virtually identical to those of the 2015 version, the full description of which has been provided elsewhere [21]. Briefly, banner advertisements on various social media and networking sites were used to recruit participants for survey administration between September 2016 and February 2017. Participants were eligible if they were U.S. residents who were 15 years of age or older and had ever had sexual contact with another male or identified as gay or bisexual. The survey collected information regarding behaviors and factors related to HIV risk, including demographics, substance use, sexual behaviors, HIV testing and status, sexually transmitted infection (STI) history, and HIV awareness.

The outcome of interest in this analysis was HIV status, which was determined by a question assessing the result of each participant's last HIV test. Those with unknown HIV status were excluded from the analysis sample. The exposures of interest were ages of both oral and anal sexual debut with a man. Age of oral sexual debut (OSD) was assessed using a fill-in-the-blank survey item ("How old were you the first time you had oral sex (mouth on the penis) with a man?"), as was age of anal sexual debut (ASD) ("How old were you the first time you had anal sex (penis in the butt) with a man?"). Both exposure variables were categorized into four age groups: <13, 13-14, 15-17, and 18+ years. The selection of these categories was informed by previous literature analyzing SDA as a risk factor for HIV and STIs.

Variables determined to be potential covariates were also assessed using self-reported data. Demographic factors included age at time of survey (15-24, 25-29, 30-39, 40+ years), race/ethnicity (non-Hispanic white, non-Hispanic black/African American, Hispanic/Latino, and multiracial), past year total household income (<$19,999, $20,000-$39,999, $40,000-$74,999, $75,000+) and education level (less than high school graduate, high school/GED, some college/technical degree, college degree and beyond). Reported ZIP codes were validated and used to determine U.S. region based on HIV surveillance regions employed by the Centers for Disease Control and Prevention (Northeast, Midwest, South, West). The few respondents in U.S. territories were excluded from this analysis. The analysis included two factors related to sexual orientation: sexual identity (heterosexual, gay, bisexual) and disclosure of sexual identity, or "outness" (disclosed, not disclosed). A significant portion of potential covariates were sexual risk behaviors, including number of male sexual partners in the past year, diagnosis with an STI in the past year (yes/no), sexual position (top, bottom, versatile), condomless anal intercourse (CAI) in the past year (yes/no), CAI with HIV-discordant partner in past year (yes/no), and types of intercourse in the past year (anal, oral, anal and oral). Indicators of healthcare access, including type of health insurance (none, private, public, other/multiple types) and visits to healthcare provider in the past year (yes/no) were included. Additionally, two substance use behaviors were included: lifetime drug injection (yes/no) and non-injection drug use in the past year (yes/no). Finally, past year homelessness, which was defined using the question "In the past 12 months were you ever homeless, that is, were you living on the street, in a shelter, in a Single Room Occupancy hotel, or in a car?" was included in the analysis (yes/no).

Descriptive statistics were calculated for each included predictor using frequencies for categorical variables and means and standard deviations for continuous variables. Distributions of OSD and ASD by HIV status were calculated. Directed acyclic graphs were used to theorize and eliminate potential pathways of causality based on implausibility of temporal relationships between current predictors and SDA. Bivariate logistic regression was then used to estimate the crude effect on HIV status of age of OSD and age of ASD separately. A backwards elimination-based model selection process was used to determine meaningfully and statistically significant confounding by covariates; those covariates whose absences caused a greater than 10% change in the effect estimate, as well as those covariates determined to be significant a priori, were retained in the final model. Odds ratios (OR) and 95% confidence intervals (95% CI) were calculated and reported.

Results

Participant Characteristics

Of the 10,166 total survey respondents, 2,008 were initially excluded due to missing or unclear

self-reported HIV status, leaving 8,158 observations (80.2%) for analysis.

Table 1 includes sociodemographic and sexual behavior characteristics of those participants with

self-reported HIV status. A majority of 3,855 (47.2%) were age 40 or older at the time of survey,

with the rest of participants' ages fairly equally distributed from 15 to 39 years. There were 771

(9.5%) participants who reported being African-American or black, and 1,021 (12.5%) who were

Hispanic or Latino; a majority (69.4%) of participants were white. Most respondents reported

involvement with post-secondary education, with 2,661 (33.0%) reporting some college or a

technical degree, and 4,591 (56.9%) reporting having completed college or further education.

Among participants who reported their past year total household income (6,778), 2,302 (33.9%)

made less than $40,000, and 4,476 (66.1%) made $40,000 or above. Furthermore, 5,720 (70.1%)

reported having condomless anal intercourse (CAI) in the past 12 months, 1,508 (18.5%)

reported CAI with a partner of discordant HIV status in the past 12 months, and the average

number of sexual partners in the past 12 months was 12.0 (SE 0.4).

Prevalence of HIV Infection

The overall prevalence of self-reported HIV infection in this study, excluding those reports that

were missing or uncertain, was 12.3% (1,001/8,158). Associations between HIV prevalence and

both sociodemographic factors and sexual behaviors are presented in Table 1. Current age,

sexual identity, race, education level, past year household income, and access to medical care

and coverage were all associated with HIV infection (p<0.05). Those who had acquired a sexually transmitted infection (STI) in the past 12 months were more likely to be HIV-positive (25.0%) than those who had not acquired an STI (10.5%) (p<0.05). Those who identified as being a "top" (exclusively participating in insertive anal sex) were less likely to be HIV-positive than those who identified as a "bottom" (exclusively receptive anal sex) or "versatile" (both types); (6.4% versus 16.1% and 12.4%, respectively) (p<0.05). Additionally, CAI in the past 12 months, CAI with a partner of discordant HIV status in the past 12 months, and lifetime drug use were all associated with HIV infection (p<0.05).

Sexual Debut Age

Table 2 includes participant SDA – both OSD and ASD – in reference to sociodemographic factors and sexual behaviors.

Among those 8,158 participants with documented HIV status, 385 were missing responses for age of ASD, and were excluded from all analyses related to ASD (N=7,773). Participants were more likely to have initiated anal sex at ages 18 and up (66.6%), with only 461 (5.9%) having participated in anal sex before age 13. Those who were younger when taking the survey were more likely to have had an earlier age of ASD, with 34.9% of those aged 15-24 having debuted at ages 15-17 versus 13.6% of those who were age 40 and above. Age of ASD was also significantly associated with race, education level, income, insurance level, CAI, drug use, CAI with discordant partners, and sexual position (p<0.05).

Among those 8,158 participants with documented HIV status, 1,757 were missing responses for age of OSD, and were excluded from all analyses related to OSD (N=6,401). While participants were still more likely to have initiated oral sex at or after 18 years, far more participants (20.7%) had their OSD before age 13, as opposed to 5.9% having had their ASD before age 13. Participants ages 40+ were more likely to have participated in oral sex before age 13 than their younger counterparts (26.8% versus 14.2% for those ages 15-17) ($p<0.05$). Age of OSD was also significantly associated with race, education level, income, insurance level, CAI, drug use, CAI with discordant partners, and sexual position ($p<0.05$).

Association Between Early Sexual Debut and HIV Status

The distributions of both oral and anal sexual debut age by HIV status can be found in Table 3.

Almost 6% had an ASD below age 13, with 7.1% of participants commencing anal sex between 13 and 14 years of age. A larger proportion of participants (20.7%) participated in oral sex before age 13 than the proportion that participated in anal sex before age 13 (5.9). There was a statistically significant association between earlier age of OSD and HIV infection, with 19.2% of those who initiated oral sex before 13 and 19.2% of those who initiated oral sex at 13 or 14 being HIV positive, versus only 8.7% of those who had their OSD at or after 18 ($p<0.05$). Logistic regression was used to evaluate the relationship between early oral and anal sexual debuts and HIV status among participants (Table 4). Univariate analyses demonstrated that early ASD was a risk factor for HIV infection, with likelihood of current HIV infection increasing as anal sexual debut age decreases (for ASD below 13, odds ratio (OR): 2.89, 95% confidence interval (CI): 2.36-3.55). This relationship remained statistically and notably significant in

multivariate models when controlling for current age, race, education level, and income (for <13 versus 18+, adjusted odds ratio (AOR): 2.23, 95% CI: 1.51-2.26). Additionally, there was a similar statistically significant, albeit slightly weaker, relationship between early OSD and likelihood of HIV infection, wherein odds of HIV infection increased as age of OSD decreased (for OSD <13 versus 18+, OR: 2.52, 95% CI: 2.12-3.00). This relationship remained viable when controlling for current age, race, education, and income (for OSD <13 versus 18+, AOR: 1.85, 95% CI: 1.51-2.26).

Discussion

The majority of studies regarding sexual debut and HIV risk have focused on HIV risk factors, rather than actual HIV prevalence. [3-7, 10-14, 16-17]. Despite multiple studies' conclusions that earlier sexual debut is linked directly with increased risk of HIV acquisition [8, 9], there have been few studies examining this association in MSM [18-20], and even fewer still of MSM in the U.S. This is the first study using a nationally representative sample of U.S. MSM to determine the association between SDA and actual HIV risk. This study's main conclusion is that there is an association between early SDA and increased HIV risk in the AMIS cohort after adjusting for current age, race, income, and education level. This relationship was seen for ages of both anal and oral sexual debut. Larger effect estimates were seen as SDA decreased in both anal and oral sexual debut. Additional conclusions from this study reinforce findings that early sexual debut is linked to several HIV risk factors in MSM, and that the inter-generational dynamics of both sexual history and sorting sex by birth cohort may contribute to heightened HIV risk.

The current findings that earlier sexual debut is associated with heightened HIV risk are supported by prior research. One study among South African women indicates that sexual debut age (SDA) is an important standalone factor influencing HIV acquisition (AOR=1.96 for SDA<15 95%CI (1.53, 2.51)) [9]. Global studies in men reinforce this relationship, with a study of men in Kenya (AOR=3.19 for SDA<16, 95%CI (1.06, 9.59)) and two studies of MSM in China using anal sexual debut [(AOR=1.82 for ASD<21 95%CI (1.00, 3.32)) and (AOR=2.88 for ASD<15 95%CI (1.01, 8.18))] demonstrating the direct link between age of debut and HIV risk [18-20]. None of these findings is quite as precise as the measures of effect found in the current study, nor do they discern between oral and anal SDA: (for ASD <13 versus 18+,

adjusted odds ratio (AOR): 2.23, 95% CI: (1.51-2.26)), (for OSD <13 versus 18+, OR: 2.52, 95% CI: (2.12-3.00))]. The relationship between SDA and HIV acquisition may be explained by the presumed higher number of lifetime sexual partners (and thus, increased chance of encountering HIV) that someone with an earlier debut might have had, due to a longer period of sexual activity [22, 23].

This analysis contributes additional evidence that SDA plays a role in the exhibition of HIV risk factors later in life, especially in MSM. Those in the study sample with lower debut age – most strongly in those with debut ages below 15 years – have higher prevalence of HIV risk behaviors such as CAI in the past year, CAI with serodiscordant partners, number of sexual partners, lifetime injecting drug use, and past homelessness. Indeed, those with SDA lower than 18 years were more likely than not to participate in all of the above risk behaviors. The effect mostly switches for those with debut ages 18 or older, for whom the proportion of those engaging in risk behaviors is significantly less than those who are not exhibiting risk behaviors. Recent studies of high school students have shown that the relationship between early debut age and risky behaviors begins occurring early, with those who debut earlier showing increased signs of sexual risk even in adolescence [4]. There is also a disparity in debut age between sexual minority and sexual majority young men, and thus heightened occurrence of HIV risk factors in sexual minority men from adolescence [12]. This study reinforces findings that earlier sexual debut is associated with increased CAI across all ages of MSM [13]. Additionally, research linking early sexual debut to higher prevalence of drug use is underscored here, with those in the current study sample who debuted earlier more likely to have injected drugs in their lifetime, or used any type

of illicit drug in the past 12 months [14]. This study contributes to prior research in a robust

way, allowing for stronger conclusions of the association between SDA and HIV risk factors.

The majority of the study sample is composed of respondents who were white, age 40 and older,

and who had their MSM sexual debuts at or after age 18. Relatively few YMSM participated in

this study, and the prevalence of HIV in older participants is necessarily higher due to increased

age and higher likelihood of more lifetime sexual partners. However, when controlling for age at

time of survey, there was still a significant link between SDA and HIV prevalence, indicating

that in older MSM populations, debut age was still a determining factor in HIV acquisition. In an

older sample such as this, the higher likelihood of MSM sexual debut after 18 years could be

explained by multiple factors, most notably the differences in historical and sociological

experiences of gay and bisexual men by birth cohort [13]. Those sampled who were age 40 or

older include a birth cohort that experienced the HIV crisis at its apex, as well as those who, due

to societal attitudes against homosexuality, could have remained closeted and refrained from

same-sex sexual behavior well into their twenties, thirties, or forties [24]. Additionally, those

who were age 40 and above and debuted earlier in their lives could have had far more sexual

partners with HIV in the LGBTQ+ community, leading to a stronger association between the

two. Studies of the birth cohort effect have also demonstrated a relationship between birth cohort

and SDA, indicating that YMSM are debuting earlier than their older counterparts and having

more sex with partners outside of their birth cohort who may be more likely to be HIV-positive,

thus increasing their risk for HIV [17]. Additional considerations regarding debut age come

when confronting the number of participants who report sexual debut at ages below 13 years.

The likelihood that a portion of these participants are survivors of sexual abuse is high, which could also be a confounding factor in the causal web that predicts future HIV status [11, 25].

A primary limitation of this study is its use of a sample that is mostly age 40 and over, white, well-educated, and relatively economically advantaged. This sample has widespread and frequent access to social media (where sampling and recruitment took place in hopes of garnering a more diverse sample), which is less common among other, more vulnerable populations of MSM. From a methodological perspective, AMIS is a thorough and groundbreaking survey, yet it does not adequately include questions related to sexual debut-associated HIV risk. Both SDA with a female sex partner (a frequent occurrence during adolescence for gay and bisexual men) and number of lifetime sexual partners (which could mediate the relationship between SDA and HIV risk) [9] are missing from the survey. Bias due to errors in recall among participants as well as social desirability bias could have affected the data. Despite these biases, the evidence demonstrated in the current analysis is significant enough to necessitate further investigations of this important relationship.

HIV research is currently focused on constructing a web of causal factors that may be assessed in order to determine where behavioral change or other types of mitigation may be best applied in order to decrease HIV transmission. Windows of susceptibility to both HIV and HIV-preventative behaviors are vital pieces of the puzzle, and such opportunities are directly dependent on sexual identity development. Targeting preventative messaging specific to queer children and adolescents at the right age, before stages of sexual development such as sexual debut, will allow for a more detailed, tailored, and hopefully successful approach to preventing

the spread of HIV before it's too late. More research is needed to clarify and add nuance to the relationship between SDA and HIV risk by exploring specific racial and ethnic communities and other contexts, both globally and in the U.S.

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Table 1. Sociodemographic and sexual behavior characteristics of MSM 2016 AMIS participants by self-reported HIV status

	Total	Negative	Positive	p-value
	n (%)	n (%)	n (%)	
Total observations	8158	7157 (87.7)	1001 (12.3)	--
Age				<0.0001
15-24 yrs	1546 (18.9)	1501 (97.1)	45 (2.9)	
25-29 yrs	1468 (18.0)	1385 (94.3)	83 (5.7)	
30-39 yrs	1289 (15.8)	1117 (86.7)	172 (13.3)	
≥40 yrs	3855 (47.2)	3154 (81.8)	701 (18.2)	
Sexual identity	7092			<0.0001
Heterosexual	50 (0.7)	47 (94.0)	3 (6.0)	
Gay	5874 (82.8)	5105 (86.9)	769 (13.1)	
Bisexual	1168 (16.5)	1102 (94.3)	66 (5.7)	
Disclosure of sexual identity	8083			0.0004
Disclosed	7737 (95.7)	6770 (87.5)	967 (12.5)	
Not disclosed	346 (4.3)	325 (93.9)	21 (6.1)	
Race/ethnicity				<0.0001
White, non-Hispanic	5660 (69.4)	5088 (89.9)	572 (10.1)	
Black/African American, non-Hispanic	771 (9.5)	542 (70.3)	229 (29.7)	
Hispanic/Latino	1021 (12.5)	900 (88.2)	121 (11.8)	
Other/Multiracial	706 (8.6)	627 (88.8)	79 (11.2)	
U.S. Region				0.0004
Northeast	1478 (18.1)	1333 (90.2)	145 (9.8)	
Midwest	1548 (19.0)	1373 (88.7)	175 (11.3)	
South	3324 (40.7)	2857 (85.9)	467 (14.1)	
West	1804 (22.1)	1590 (88.1)	214 (11.9)	
U.S. Territory	4 (0.1)	4 (100.0)	0 (0.0)	
Education	8067			<0.0001
Less than high school graduate	136 (1.7)	126 (92.6)	10 (7.4)	
High school/GED	679 (8.4)	566 (83.4)	113 (16.6)	
Some college/technical degree	2661 (33.0)	2280 (85.7)	381 (14.3)	
College graduate and beyond	4591 (56.9)	4110 (89.5)	481 (10.5)	
Past year total household income	6778			<0.0001
$0 to $19,999 annually	939 (13.8)	788 (83.9)	151 (16.1)	
$20,000 to $39,999 annually	1363 (20.1)	1164 (85.4)	199 (14.6)	
$40,000 to $74,999 annually	1940 (28.6)	1737 (89.5)	203 (10.5)	
$75,000 or more annually	2536 (37.4)	2270 (89.5)	266 (10.5)	
Health insurance	7982			<0.0001
No insurance	1268 (15.9)	1114 (87.8)	154 (12.2)	
Private insurance	5068 (63.7)	4540 (89.3)	546 (10.7)	
Public insurance	877 (11.0)	695 (79.2)	182 (20.8)	
Other/multiple insurance	751 (9.4)	635 (84.5)	116 (15.5)	
Visited healthcare provider in past 12 mo.	7126			<0.0001
Yes	6466 (90.7)	5635 (87.1)	831 (12.9)	
No	660 (9.3)	650 (98.5)	10 (1.5)	
No. of male sexual parters in past 12 mo.				
Mean (SE)	12.0 (0.4)	11.1 (0.5)	18.3 (1.5)	
Sexually transmitted infection in last 12 mo.				<0.0001
No	7141 (87.5)	6394 (89.5)	747 (10.5)	
Yes	1017 (12.5)	763 (75.0)	254 (25.0)	
Sexual position	7832			<0.0001
Top	1513 (19.3)	1416 (93.6)	87 (6.4)	
Bottom	1871 (23.9)	1570 (83.9)	301 (16.1)	
Versatile	4448 (56.8)	3898 (87.6)	550 (12.4)	
CAI in past 12 mo.				<0.0001
No	2438 (29.9)	2202 (90.3)	236 (9.7)	
Yes	5720 (70.1)	4955 (86.6)	765 (13.4)	
CAI with partner with discordant HIV status in past 12 mo.				<0.0001
No	6650 (81.5)	5988 (90.1)	662 (9.9)	
Yes	1508 (18.5)	1169 (77.5)	339 (22.5)	
Types of intercourse in past 12 mo.				
Oral only	911 (11.2)	836 (91.8)	75 (8.2)	
Anal only	98 (1.2)	68 (69.4)	30 (30.6)	
Both oral and anal	7149 (87.6)	6253 (87.5)	896 (12.5)	
Ever injected drugs	8081			<0.0001
No	7710 (95.4)	6866 (89.1)	844 (10.9)	
Yes	371 (4.6)	224 (60.4)	147 (39.6)	
Non-injection drug use in past 12 mo.	8018			<0.0001
No	5378 (67.1)	4776 (88.8)	602 (11.2)	
Yes	2640 (32.9)	2262 (85.7)	378 (14.3)	
Past year homelessness	7462			<0.0001
No	7253 (97.2)	6392 (88.1)	861 (11.9)	
Yes	209 (2.8)	166 (79.4)	43 (20.6)	

Table 1. Sociodemographic and sexual behavior characteristics of MSM 2016 AMIS participants by age of anal sexual debut (ASD) and oral sexual debut (OSD) ages

	Sexual debut age (SDA) with a male partner (years)										
	Total anal n (%)	Anal <13 yrs n (%)	Anal 13-14 yrs n (%)	Anal 15-17 yrs n (%)	Anal 18+ yrs n (%)	p-value	Total oral n (%)	Oral <13 yrs n (%)	Oral 13-14 yrs n (%)	Oral 15-17 yrs n (%)	Oral 18+ yrs n (%)	p-value
Total observations	7773	461 (5.9)	555 (7.1)	1580 (20.3)	5177 (66.6)	–	6401	1324 (20.7)	389 (6.1)	1076 (16.8)	3612 (56.4)	
Age						<0.0001						<0.0001
15-24 yrs	1472 (18.9)	44 (3.0)	124 (8.4)	514 (34.9)	790 (53.7)		1249 (19.5)	177 (14.2)	89 (7.1)	398 (31.9)	585 (46.8)	
25-29 yrs	1433 (18.4)	51 (3.6)	70 (4.9)	331 (23.1)	981 (68.5)		1174 (18.3)	150 (12.8)	51 (4.3)	235 (20.0)	738 (62.9)	
30-39 yrs	1234 (15.9)	86 (7.0)	78 (6.3)	240 (19.4)	830 (67.3)		997 (16.2)	204 (19.9)	57 (5.6)	154 (15.0)	611 (59.5)	
≥40 yrs	3634 (46.8)	280 (7.7)	283 (7.8)	495 (13.6)	2576 (70.9)		2820 (45.8)	793 (26.8)	192 (6.5)	289 (9.8)	1678 (56.8)	
Sexual identity	6796					0.07	5576					0.04
Heterosexual	28 (0.4)	1 (3.6)	2 (7.1)	3 (10.7)	22 (78.6)		42 (0.7)	4 (9.5)	4 (9.5)	5 (11.9)	29 (69.1)	
Gay	5685 (83.6)	320 (5.6)	405 (7.1)	1179 (20.7)	3781 (66.5)		4582 (82.2)	947 (20.7)	271 (5.9)	791 (17.3)	2573 (56.2)	
Bisexual	1083 (15.9)	59 (5.4)	81 (7.5)	181 (16.7)	762 (70.4)		952 (17.1)	193 (20.3)	55 (5.8)	126 (13.2)	578 (60.7)	
Disclosure of sexual identity	7711					0.02	6345					0.02
Not disclosed	296 (3.8)	12 (4.1)	18 (6.1)	44 (14.9)	222 (75.0)		295 (4.6)	44 (14.9)	13 (4.4)	46 (15.6)	192 (65.1)	
Disclosed	7415 (96.2)	443 (6.0)	532 (7.2)	1528 (20.6)	4912 (66.2)		6050 (95.4)	1265 (20.9)	373 (6.2)	1026 (17.0)	3386 (56.0)	
Race/ethnicity						<.00001						<0.0001
White, non-Hispanic	5415 (69.7)	244 (4.5)	363 (6.7)	999 (18.4)	3809 (70.3)		4413 (68.9)	887 (20.1)	246 (5.6)	654 (14.8)	2626 (59.5)	
Black/African American, non-Hispanic	718 (9.2)	89 (12.4)	50 (6.7)	181 (25.2)	398 (55.4)		615 (9.6)	160 (26.0)	40 (6.5)	119 (19.4)	296 (48.1)	
Hispanic/Latino	971 (12.5)	80 (8.2)	87 (9.0)	261 (26.9)	543 (55.9)		830 (13.0)	155 (18.7)	62 (7.5)	202 (24.3)	411 (49.5)	
Other/Multiracial	669 (8.6)	48 (7.2)	55 (8.2)	139 (20.1)	127 (63.8)		543 (8.5)	122 (22.5)	41 (7.5)	101 (18.6)	279 (51.4)	
U.S. Region						0.01						<0.0001
Northeast	1394 (17.9)	60 (4.3)	94 (6.7)	307 (22.0)	933 (66.9)		1144 (17.9)	197 (17.2)	68 (5.9)	225 (19.7)	654 (57.2)	
Midwest	1486 (19.2)	82 (5.5)	107 (7.2)	267 (18.0)	1030 (69.3)		1234 (19.3)	254 (20.6)	65 (5.3)	178 (14.4)	737 (59.7)	
South	3166 (40.7)	203 (6.4)	243 (7.7)	669 (21.1)	2051 (64.8)		2594 (40.5)	605 (23.3)	168 (6.5)	437 (16.8)	1384 (53.4)	
West	1723 (22.2)	116 (6.7)	111 (6.4)	335 (19.4)	1161 (67.4)		1425 (22.3)	268 (18.8)	88 (6.2)	234 (16.4)	835 (58.6)	
Education						<0.0001	6332					<0.0001
Less than high school graduate	120 (1.6)	14 (11.7)	17 (14.2)	68 (56.7)	21 (17.5)		110 (1.7)	33 (30.0)	13 (11.8)	50 (45.5)	14 (12.7)	
High school/GED	628 (8.2)	46 (7.3)	63 (10.0)	207 (33.0)	312 (49.7)		532 (8.4)	132 (24.8)	44 (8.3)	148 (27.8)	208 (39.1)	
Some college/technical degree	2518 (32.7)	197 (7.8)	228 (9.1)	609 (24.2)	1484 (58.9)		2066 (32.6)	525 (25.4)	159 (7.7)	412 (19.9)	970 (46.9)	
College graduate and beyond	4429 (57.6)	196 (4.4)	242 (5.5)	682 (15.4)	3309 (74.7)		3624 (57.2)	620 (17.1)	168 (4.6)	451 (12.4)	2385 (65.8)	
Past year total household income						<0.0001	5310					<0.0001
$0 to $19,999 annually	890 (13.7)	73 (8.2)	71 (8.0)	241 (27.1)	505 (56.7)		743 (14.0)	172 (23.1)	50 (6.7)	160 (21.5)	361 (48.6)	
$20,000 to $39,999 annually	1297 (20.0)	81 (6.3)	106 (8.2)	274 (21.1)	836 (64.5)		1075 (20.2)	226 (21.0)	75 (7.0)	190 (17.7)	584 (54.3)	
$40,000 to $74,999 annually	1855 (28.6)	100 (5.4)	113 (6.1)	353 (19.0)	1289 (69.5)		1516 (28.5)	300 (19.8)	73 (4.8)	240 (15.8)	903 (59.6)	
$75,000 or more annually	2447 (37.7)	125 (5.11)	161 (6.6)	405 (16.6)	1756 (71.8)		1976 (37.2)	387 (19.6)	107 (5.4)	261 (13.2)	1221 (61.8)	
Health insurance						<0.0001	6259					<0.0001
No insurance	1180 (15.5)	100 (8.5)	84 (7.1)	285 (24.2)	711 (60.3)		992 (15.8)	237 (23.9)	62 (6.3)	204 (20.6)	489 (49.3)	
Private insurance	4902 (64.4)	229 (4.7)	327 (6.7)	932 (19.0)	3414 (69.7)		4026 (64.3)	732 (18.2)	222 (5.5)	641 (15.9)	2431 (60.4)	
Public insurance	818 (10.7)	86 (10.5)	83 (10.1)	168 (20.5)	481 (58.8)		662 (10.6)	205 (32.6)	59 (8.9)	98 (14.8)	300 (45.3)	
Other/multiple insurance	713 (9.4)	40 (5.6)	52 (7.3)	136 (19.1)	485 (68.0)		579 (9.3)	132 (22.8)	36 (6.2)	86 (14.8)	325 (56.1)	
Visited healthcare provider in past 12 mo.						0.4	5600					0.16
No	630 (9.2)	33 (5.2)	44 (7.0)	143 (22.7)	410 (65.1)		530 (9.5)	94 (17.7)	29 (5.5)	104 (19.6)	303 (57.2)	
Yes	6194 (90.8)	348 (5.6)	446 (7.2)	1232 (20.0)	4168 (67.3)		5070 (90.5)	1051 (20.7)	302 (6.0)	828 (16.33)	2889 (57.0)	
No. of male sexual parters in past 12 mo.												
Mean (SD)	12.1 (33.9)	15.0 (38.7)	13.4 (38.9)	10.6 (26.2)	20.0 (68.6)		11.9 (33.0)	18.4 (59.5)	14.3 (34.8)	12.1 (24.5)	9.3 (18.2)	
Sexually transmitted infection in last 12 mo.						<0.0001						<0.0001
No	6785 (87.3)	381 (5.6)	487 (7.2)	1332 (19.6)	4585 (67.6)		5605 (87.6)	1129 (20.1)	345 (6.2)	903 (16.1)	3228 (57.6)	
Yes	988 (12.7)	80 (8.1)	68 (6.9)	248 (25.1)	592 (59.9)		796 (12.4)	195 (24.5)	44 (5.5)	173 (21.7)	384 (48.2)	
Sexual position						<0.0001	6183					0.0005
Top	1453 (19.0)	61 (4.2)	94 (6.5)	240 (16.5)	1058 (72.8)		1160 (18.8)	242 (20.9)	62 (5.3)	150 (12.9)	706 (60.9)	
Bottom	1827 (23.9)	140 (7.7)	142 (7.8)	357 (19.5)	1188 (65.0)		1508 (24.4)	332 (22.0)	98 (6.5)	256 (17.0)	822 (54.5)	
Versatile	4351 (57.0)	251 (5.8)	311 (7.2)	962 (22.1)	2827 (65.0)		3515 (56.8)	724 (20.6)	212 (6.0)	639 (18.2)	1940 (55.2)	
CAI in past 12 mo.						<0.0001	6401					0.0004
No	2205 (28.4)	119 (5.4)	144 (6.5)	387 (17.5)	1555 (70.5)		1879 (29.4)	334 (17.8)	113 (6.0)	286 (15.2)	1146 (71.0)	
Yes	5568 (71.6)	342 (6.1)	411 (7.4)	1193 (21.4)	3622 (65.1)		4522 (70.6)	990 (21.9)	276 (6.1)	790 (17.5)	2466 (54.5)	
CAI with partner with discordant HIV status in past 12 mo.						<0.0001						<0.0001
No.	6289 (80.9)	339 (5.4)	427 (6.8)	1249 (19.9)	4274 (68.0)		5204 (81.3)	1009 (19.4)	311 (6.0)	857 (16.5)	3027 (58.2)	
Yes	1484 (19.1)	122 (8.2)	128 (8.6)	331 (22.3)	903 (60.9)		1197 (18.7)	315 (26.3)	78 (6.5)	219 (18.3)	585 (48.9)	
Types of intercourse in past 12 mo.						<0.0001						<0.0001
Oral only	739 (9.5)	43 (5.8)	45 (6.1)	93 (12.6)	558 (75.5)		694 (10.8)	129 (18.6)	43 (6.2)	79 (11.4)	443 (63.8)	
Anal only	90 (1.2)	6 (6.7)	2 (2.2)	23 (25.6)	59 (65.6)		77 (1.2)	18 (23.4)	2 (2.6)	17 (22.1)	40 (51.9)	
Both oral and anal	6944 (89.3)	412 (5.9)	508 (7.3)	1464 (21.1)	4560 (65.7)		5630 (88.0)	1177 (20.9)	344 (6.1)	980 (17.4)	3129 (55.6)	
Ever injected drugs						<0.0001	6346					<0.0001
No	7351 (95.4)	415 (5.65)	506 (6.9)	1494 (20.3)	4936 (67.2)		6081 (95.8)	1206 (19.8)	352 (5.8)	1035 (17.0)	3488 (57.4)	
Yes	356 (4.6)	45 (12.6)	43 (12.1)	77 (21.6)	191 (53.6)		265 (4.2)	107 (40.4)	31 (11.7)	36 (13.6)	91 (34.3)	
Non-injection drug use in past 12 mo.						<0.0001	6294					<0.0001
No	5089 (66.5)	294 (5.8)	322 (6.3)	931 (18.3)	3542 (69.6)		4244 (67.4)	830 (19.6)	242 (5.7)	653 (15.4)	2519 (59.3)	
Yes	2566 (33.5)	157 (6.1)	226 (8.8)	625 (24.4)	1558 (60.7)		2050 (32.6)	471 (23.0)	142 (6.9)	403 (19.7)	1034 (50.4)	
Past year homelessness						<0.0001	5876					<0.0001
No	6945 (97.2)	388 (5.6)	488 (7.0)	1399 (20.1)	4670 (67.2)		5717 (97.3)	1153 (20.2)	332 (5.8)	964 (16.9)	3268 (57.2)	
Yes	194 (2.7)	23 (11.9)	27 (13.9)	53 (27.3)	91 (46.9)		159 (2.7)	57 (35.8)	21 (13.2)	27 (17.0)	54 (34.0)	

Table 3. Distributions of anal sexual debut (ASD) and oral sexual debut (OSD) age by HIV status

		HIV status			
		Total	Negative	Positive	p-value
		n (%)	*n (%)*	*n (%)*	
Age at anal sexual debut with a male partner	Total	7773	6826 (87.8)	947 (12.2)	<.0001
	<13 yrs	461 (5.9)	350 (75.9)	111 (24.1)	--
	13-14 yrs	555 (7.1)	453 (81.6)	102 (18.4)	--
	15-17 yrs	1580 (20.3)	1361 (86.1)	219 (13.9)	--
	18+ yrs	5177 (66.6)	4662 (90.1)	515 (9.9)	--
Age at oral sexual debut with a male partner	Total	6401	5628 (87.9)	773 (12.1)	<.0001
	<13 yrs	1324 (20.7)	1070 (80.8)	254 (19.2)	--
	13-14 yrs	389 (6.1)	319 (82.0)	70 (18.0)	--
	15-17 yrs	1076 (16.8)	942 (87.5)	134 (12.5)	--
	18+ yrs	3612 (56.4)	3297 (91.3)	315 (8.7)	--

Table 4. Univariate and multivariate binary logistic regression models evaluating the effect of early oral and anal sexual debut on HIV status

		Univariate models			Multivariate models*		
		OR	95% CI	p-value	OR	95% CI	p-value
Age at anal sexual debut with a male partner	**18+ yrs**	--	--	--	--	--	--
	15-17 yrs	1.42	(1.33, 1.52)	<0.0001	1.31	(1.21, 1.41)	<0.0001
	13-14 yrs	2.03	(1.77, 2.33)	<0.0001	1.71	(1.46, 1.99)	<0.0001
	<13 yrs	2.89	(2.36, 3.55)	<0.0001	2.23	(1.76, 2.82)	<0.0001
Age at oral sexual debut with a male partner	**18+ yrs**	--	--	--	--	--	--
	15-17 yrs	1.36	(1.28, 1.44)	<0.0001	1.23	(1.15, 1.31)	<0.0001
	13-14 yrs	1.85	(1.65, 2.08)	<0.0001	1.51	(1.32, 1.72)	<0.0001
	<13 yrs	2.52	(2.12, 3.00)	<0.0001	1.85	(1.51, 2.26)	<0.0001

*Mulitvariate models adjusting for age at time of survey, race, education, and income level.