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Individual and Interpersonal Factors Associated with HIV Prevention Conversations and Condomless Anal Intercourse among Non-Concordant MSM Main Partners

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An abstract of
Individual and Interpersonal Factors Associated with HIV Prevention Conversations and Condomless Anal Intercourse among Non-Concordant MSM Main Partners
A thesis submitted to the Faculty of the
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Abstract

Individual and Interpersonal Factors Associated with HIV Prevention Conversations and Condomless Anal Intercourse among Non-Concordant MSM Main Partners
By Nydia Esther Palacios Torres

Background: About 65% of new U.S. HIV infections are found in the men who have sex with men (MSM) population. Recent studies suggest that 32-68% of HIV transmission within this population occurs between main partners in a relationship. HIV transmission between non-concordant couples is particularly concerning.

Objective: Drawing from the Social Ecological Model, this study aims to: 1) describe the individual and interpersonal characteristics of MSM in non-concordant relationships, and 2) examine how factors are associated with HIV prevention conversations and condomless anal intercourse (CAI).

Methods: This study is a secondary data analysis of the 2015 American Men's Internet Survey, a quantitative, cross-sectional online study. Eight hundred and fifty six US MSM in a non-concordant relationship with a main partner were included in the study subsample. Outcome measures were HIV prevention conversations within the past 6 months and CAI within the past 12 months.

Results: Most respondents were early 30's, White, had some college education, did not use non-injection drugs, experienced low levels of stigma, had at least one ACE exposure, had a sexual agreement with their main partner, and did not use technology-based social networking sites.

HIV prevention conversation scores were low while CAI was high. No association was found between these outcome variables. Age, education, number of sexual partners in the past 12 months, and sexual agreement were significantly associated with HIV prevention conversation. Marital status, drug use, and sexual agreement were associated with CAI in the first multivariate regression while education, sexual agreement, and breaking the sexual agreement were associated with CAI in the second model. Specifically, participants in open sexual agreements without conditions or those who broke their agreement were 4 and 12 times as likely to engage in CAI, respectively.

Conclusions: Findings suggest potentially increased HIV transmission risk within and outside of the dyad. HIV prevention conversations that only include topics such as condom usage, testing, or PrEP/TasP may not mitigate HIV transmission risk. Relationship dynamics, and accompanying conversations, may play a more influential role in CAI decision-making. Adding communication elements including relationship satisfaction, sexual agreements, and commitment may strengthen HIV prevention conversation campaigns.

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List of Abbreviations

ACE	Adverse childhood events
AMIS	American Men's Internet Survey
CAI	Condomless anal intercourse
CDC	Centers for Disease Control and Prevention
HIV	Human immunodeficiency virus
JHS	Johns Hopkins University School of Public Health
MSM	Men who have sex with men
NHBS	National HIV Behavioral Surveillance
PrEP	Pre-exposure prophylaxis
PRISM Health	Programs, Research, and Innovation in Sexual Minority Health
SEM	Social ecological model
SITQ	Sex is the Question
STI	Sexually transmitted infection
TasP	Treatment as prevention

Chapter 1: Introduction

Human immunodeficiency virus (HIV) continues to be a public health problem in the United States. Since 2001, HIV diagnoses have increased annually by more than 8% (1). Men who have sex with men (MSM) in the United States have been disproportionally affected by HIV since the 1980s (1). Although MSM account for less than 10% of the U.S. male population, about 65% of new HIV infections are found in this group (2). Recent studies suggest that 32-68% of HIV transmission within MSM populations occurs between main partners in a relationship, or dyad (1, 3). HIV transmission between serodiscordant couples, where one partner is HIV-positive while the other is HIV-negative, or non-concordant couples, where one or both partners are unaware of their HIV status, is of particular concern[1]. Serodiscordant dyads that engage in condomless anal intercourse (CAI), a primary high-risk sexual behavior, are naturally at risk for infection if the HIV-positive partner has a detectable viral load and/or if the receptive partner ("bottom") is HIV-negative (4). CAI among serodiscordant dyads is high; one study found that half of participants in serodiscordant relationships engaged in this sexual behavior (5).

Since MSM main partners are a major force driving new HIV infections, research interest has shifted towards understanding the relationship between MSM dyad characteristics and HIV risk (6). One commonly studied dyad characteristic is communication. This includes perceptions of commitment, partner-provided support, communication style, and sexual agreements (4, 5, 7-15). In general, more communication between partners is positively associated with higher rates of HIV status

[1] For the purposes of this paper, "non-concordant couples" will encompass dyads where a lack of concordance is confirmed or presumed (ie. Dyads where one or both partners are unaware of their HIV status and dyads where one partner is HIV-positive while the other is HIV-negative).

disclosure and lower rates of high-risk sexual behavior, lowering HIV risk (7-14, 16, 17). Among serodiscordant couples, some studies have found that HIV risk via sexual behavior is negotiated through conversations about the HIV-positive partner's viral load and seroadaptive practices (17-21). An HIV-negative individual may choose to have CAI with their HIV-positive partner if he has an undetectable viral load, which presents very low risk of HIV transmission (18, 19). Conversely, in seroadaptive behavior, a HIV-positive individual may choose to be the receptive partner because this is also perceived to have lower risk of HIV transmission (17, 20, 21). Seroadaptive practices may lead to a greater risk of HIV infection when compared to consistent condom use but are less risky than CAI that does not incorporate these practices (22-25). These types of HIV prevention behavior result from conversations within a MSM partnership.

Therefore, promoting HIV prevention conversations between MSM dyads is considered to be one HIV prevention strategy amongst many. In fact, the Centers for Disease Control's (CDC) newest HIV prevention campaign is called "Start Talking. Stop HIV." (26). The campaign encourages MSM to engage their partners in a range of HIV prevention conversations; topics in these conversations include HIV testing, status disclosure, using condoms, participating in lower-risk sexual behavior, and adhering to medications that can prevent or treat HIV (26). Although HIV prevention conversations mitigate HIV risk, conversations between partners do not occur within a vacuum. Limited research suggests that other factors, such as experiences of depression, intimate partner violence, and sexual compulsivity, can delay or inhibit communication between partners (27).

Social Ecological Model

The Social Ecological Model (SEM) can be used as a guide to understanding how individual and interpersonal HIV risk factors impact HIV prevention conversations within the non-concordant MSM dyad. The SEM is a comprehensive framework investigating how an individual's uptake of a preventive behavior is negotiated through multiple levels of influence (28). Influence of behavior occurs on and interacts between the individual, interpersonal, organizational, community, and policy levels (28). Public health practitioners use SEM to understand how mechanisms at each level contribute to or disrupt behavior uptake in order to create thorough interventions (28).

SEM is a well-suited framework for understanding the barriers to reducing HIV transmission in the United States. Although individual behaviors are essential to spreading HIV, researchers recognize that interpersonal, community, and policy levels may influence whether certain populations have the ability to engage in preventive measures (29). For example, qualitative research indicates that a MSM youth's chosen gay family or other peers, an interpersonal influence, have the power to positively affect personal decisions such as staying in school or practicing safe sex (30). Quantitative research has also shown that SEM constructs are useful for studying HIV risk behaviors. In one Atlanta-based study, interpersonal and neighborhood level influences helped explain the disparity in HIV prevalence between black and white MSM because the individual behaviors of these groups were not significantly different (31).

For the purposes of this study, I will only focus on individual and interpersonal levels of influence on HIV prevention conversations between non-concordant dyads. Individual factors are an individual's biological or psychological traits that may affect uptake of the preventive health behavior. Interpersonal factors are social and cultural

influences that may affect an individual's engagement with a preventive health behavior. It is appropriate to focus on individual and interpersonal levels as the majority of HIV prevention conversations occur within this context; additionally, other levels, such as policy, are not applicable since this preventive behavior cannot be mandated.

Research Question

Drawing from the SEM, this study aims to focus on a gap in the literature by: 1) describing the individual and interpersonal characteristics of this population, and 2) examining individual factors and interpersonal factors associated with HIV prevention conversations and CAI among MSM in non-concordant relationships. In particular, individual characteristics to be described include sociodemographics, substance use, and psychosocial factors, including perceived or experienced stigma and adverse childhood events. Interpersonal factors will include a description of sexual agreements[2] and technology-based social network usage. Based on the literature, we hypothesized that higher levels of substance abuse, perceived or experienced stigma, and childhood adverse events, lacking dating agreements, and higher engagement in technology-based dating activity will be associated with lower HIV prevention conversation scores among non-concordant MSM dyads. Additionally, these factors, as well as lower HIV prevention conversation scores, will be associated with higher risk of CAI among MSM in non-concordant relationships.

[2] The nature of sexual agreements will be characterized by sexual agreements in place, length of agreement, how the agreement is broken (ie. sex act type), and the frequency of breaking agreements.

Chapter 2: Literature Review

Certain individual and interpersonal factors are risk factors for HIV infection in the MSM community. The mechanisms by which these factors are associated with HIV infection may be two-fold: at the level of interpersonal communication and at the level of behavior. For the purposes of this study, interpersonal communication and behavior will be operationalized with the HIV prevention conversation measure and CAI, respectively. The individual factors of interest in this study of MSM in non-concordant relationships include sociodemographic characteristics, substance use, perceptions or experiences of stigma, and experiences of childhood adverse effects. Sexual agreements among MSM and engagement with technology-based MSM social networks are two interpersonal factors associated with higher HIV risk. The following sections briefly summarize how each factor is associated with HIV risk and any recent research related to HIV prevention conversations among main partners.

Individual Factors

Sociodemographics

MSM in certain demographic groups categorized by age, race/ethnicity, and socioeconomic status (SES) are disproportionally affected by HIV. In the United States, youth between the ages of 13 to 24 represented a quarter of all new HIV infections in 2010 (32). Seventy two percent of newly diagnosed youth were MSM (32). CDC estimates that over half of HIV positive youth are unaware of their infection as well (32); an individual unaware of their HIV status can continue to unknowingly spread HIV. African American and Hispanic/Latino MSM also carry a large HIV burden. Almost half of all new HIV diagnoses in 2014 were among African Americans; of these, 57% were

African American MSM (33). Hispanics/Latinos accounted for a quarter of new overall HIV diagnoses in 2013; of these, 81% were Hispanic/Latino MSM (34). Determined by income and/or education level, SES is inversely associated with HIV prevalence, with individuals in lower SES brackets having higher rates of HIV infection (35-37). HIV prevention conversation literature includes descriptive statistics about the racial/ethnic makeup of participants, but it has not examined possible associations between sociodemographic characteristics and whether or how these conversations occur.

Substance Use

The literature suggests that MSM have a higher rate of substance use than the general population (38-40); 40% of MSM indicated some form of substance use in the past 6 months (39). Injection drug use functions as a direct mode of HIV transmission, while non-injection drugs may function as an indirect mode. Drug usage can impair judgment and lower sexual inhibitions, making individuals more susceptible to choosing high-risk sexual behavior. In fact, several studies report associations between CAI and use of alcohol, marijuana, cocaine, ecstasy, amyl nitrites (poppers), and methamphetamine among this population (41-45). Substance use is one factor amongst many that may explain increased risk of HIV transmission within the MSM community. The association between substance use among MSM dyads and HIV prevention conversations has not been explored in the literature. However, one study assessed the association between syndemic stress and HIV status disclosure among MSM dyads. Syndemic stress refers to how individual risk factors can magnify vulnerability to adverse health outcomes when occurring simultaneously; poly-drug use was one of the study's

syndemic factors (27). Higher levels of syndemic stress were linked to lower rates of HIV status disclosure before first CAI (27).

Stigma

Within the literature, the MSM community's experiences of stigma fall within two categories. First, there is stigma related to sexual orientation. MSM may experience real or perceived external homophobia, from society or health providers, or internalized homophobia (46-51). Societal homophobia and internalized homophobia has been associated with increased levels of high-risk sexual behaviors (46-48). For example, a sample of New York City and Los Angeles-based Latino MSM found that those who experienced both racism and homophobia were 92% more likely to report receptive CAI with a casual partner, a leading sexual behavior risk factor for HIV (50). A sample of black MSM recruited in New York City and Philadelphia similarly found that participants experiencing societal homophobia were at increased risk of receptive CAI (49). Internalized homophobia and health provider homophobia have been linked to decreased use of HIV preventive services, such as testing and treatment, as well (46, 47, 51). A study about MSM couples linked higher rates of internalized homophobia to decreased communication about HIV prevention strategies among the dyad (6). The combination of increased rates of high-risk sexual behaviors and decreased uptake of HIV prevention behaviors associated with homophobia means increased HIV transmission risk within the MSM community (46).

Second, there continues to be stigma against HIV-positive individuals. In particular, stigmatization of HIV-positive MSM is prevalent within the gay community (52). HIV-positive MSM may feel real or perceived stigmatization from their HIV-

negative counterparts. Examples of discriminatory views from some HIV-negative MSM include believing that HIV-positive MSM have higher levels of promiscuity and are responsible for their infection (52). HIV-positive MSM report feelings of rejection from HIV-negative MSM friends and potential sexual partners, which can lead to depression and isolation (52, 53). HIV-negative MSM who anticipate negative personal and social outcomes in the event of seroconversion also experience negative affect (53). Consequently, some MSM avoid HIV testing because of the stigma associated with a positive result (52-54). Others who are aware of their HIV-positive status may have suboptimal adherence to treatment or avoid disclosing their HIV status to potential sexual partners (52, 54). As a result, higher rates of HIV-related stigma are associated with lower rates of HIV prevention behaviors and conversation, including testing, treatment, and status disclosure (52). This can lead to increased risk of HIV transmission within the MSM community.

Experiences of Adverse Childhood Events

Adverse childhood events (ACE), which can include physical, emotional, or sexual abuse (55), may also impact HIV risk behaviors. The majority of literature focuses on the relationship between MSM with a history of childhood sexual abuse and HIV risk. Prevalence of childhood sexual abuse among MSM ranges from 15% to 50% (55, 56). Studies have consistently found that MSM with a history of childhood sexual abuse are significantly more likely to engage in casual intercourse, have CAI, and report substance use during sexual encounters (55, 57). In addition, MSM with a history of childhood sexual abuse were more likely to be HIV-positive (55, 57). One prospective cohort study found that when childhood sexual abuse overlapped with other psychosocial problems,

such as depression or drug use, it created an additive dose response that increased HIV risk behavior and seroconversion among MSM (58). The literature also suggests that childhood sexual abuse history among HIV-positive MSM is associated with high-risk sexual behavior, like CAI, allowing HIV transmission to persist (56, 59, 60). Although there is a clear link between childhood sexual abuse and HIV risk, the literature does not explore an association between ACE and HIV prevention conversations. Limited research assessing the association between syndemic stress and HIV status disclosure among MSM dyads included childhood sexual abuse as one of the syndemic factors. Higher levels of syndemic stress were linked to lower rates of HIV status disclosure before first CAI (27).

Interpersonal Factors

Sexual Agreements among MSM

Researchers have reported on "understandings", or sexual agreements, among MSM dyads since the late 1970s (10). Agreements may be verbally explicit or unspoken and implicitly understood between partners (5). Open or closed sexual agreements describe whether or not sex is allowed outside of the primary relationship (12). Couples who choose to open their relationship may include rules within their sexual agreement dictating when, where, and how sex outside of the dyad takes place (10). Research suggests that the main motivations behind engaging in sexual agreements include giving the primary relationship structure and meaning while enjoying the sexual benefits of the arrangement (10, 12). Reducing HIV transmission risk is not always a major factor behind having a sexual agreement (10); in one cross-sectional survey, about a quarter of

participants indicated preventing HIV/STIs as the primary reason for establishing a sexual agreement (12).

Prior cross-sectional studies have consistently found that about half of MSM respondents have a closed sexual agreement while the other half engage in some form of open sexual agreements (12, 14). MSM in a closed sexual agreement were, as expected, more likely to practice CAI with their partner (12). MSM within open sexual agreements had CAI with their main partners, and up to 25% reported CAI with outside partners (12, 14). CAI is a high risk sexual behavior (61); engaging in CAI with both main and outside partners may increase HIV transmission risk.

Sexual partnerships can be broken by one or both main partners in the dyad. The literature suggests that only 20-30% of MSM respondents report breaking their sexual agreement in the past year (9, 12, 14). However, 50-70% of those who have broken their agreement fail to disclose the break to their main partner (9, 12, 14). Non-disclosures of this kind may increase HIV transmission risk, especially if main partners in either open or closed relationships engage in CAI (10, 11). The literature has not engaged with whether this form of communication is associated with HIV prevention conversations, including using condoms or antiviral treatment adherence.

Engagement with Technology-based MSM Social Networks

MSM have used the internet to connect with other members of the MSM community, including potential sexual partners, since the 1990s (62). Access to social and sexual networking sites, such as Facebook and Grindr, respectively, has expanded with the shift towards smartphone usage (62). Third-party software applications, also known as “apps”, facilitate locating potential sex partners who are geographically close

by (63-65). As a result, MSM who use apps report a higher number of recent sex partners than those who do not (62, 63, 66). Some studies examining the relationship between technology-based sexual partners and risk for CAI among MSM suggest higher rates of CAI with technology-based partners (67, 68). However, other studies have found no difference in CAI rates among MSM engaging with technology-based partners versus those located by other means (66, 69). Consequently, MSM who engage with technology-based social networks may have an increased risk of HIV infection resulting from increased levels of high-risk sex behavior. Limited literature suggests that HIV-positive individuals may feel more comfortable disclosing their status to potential partners they meet online (67). However, it is unclear if this translates to safer sex practices. Additionally, literature is not available regarding how online participation is associated with HIV prevention conversations among MSM dyads.

Summary

The literature clearly demonstrates that the individual and interpersonal factors listed above are risk factors for HIV infection in the MSM community. Specifically, MSM who are African American and Hispanic/Latino, substance users, experience homophobia, have a history of childhood sexual abuse, are in an open sexual agreement, and/or utilize technology-based social networks to find sexual partners may be at increased risk of HIV infection. HIV prevention conversations may mediate HIV risk among both seroconcordant and serodiscordant MSM couples. However, limited literature exists regarding a direct association between individual and interpersonal HIV risk factors and HIV prevention conversations or if HIV prevention conversations are associated with CAI. These associations have not been explored exclusively in non-

concordant MSM relationships. Describing the individual and interpersonal factors of MSM in non-concordant relationships and examining how these factors are associated with HIV prevention conversations and CAI is particularly useful for this population because HIV transmission between partners is a concern.

Chapter 3: Methods

Study Design

This study was a secondary data analysis of the American Men's Internet Survey (AMIS), a quantitative, cross-sectional online survey study. AMIS is commonly referred to as the Sex is the Question (SITQ) Survey. Programs, Research, and Innovation in Sexual Minority (PRISM) Health, a research group located in Emory University's Rollins School of Public Health, has sponsored AMIS annually since 2012 (70). AMIS' purpose is to monitor HIV risk behavior trends among U.S. MSM every year.

Recruitment consists of banner ads on the following website/app types: general social networking, geospatial social networking, gay social networking, and gay general interest (71). Additionally, survey respondents from previous data collection cycles may also be recruited if they indicated interest in being contacted for future research (71, 72). The survey is self-administered online via SurveyGizmo after participants complete a survey eligibility screener. Consent, for participants aged 18 and over, or assent, for participants below the age of 18, is obtained prior to beginning the survey. A parental consent waiver for participants under 18 was granted by Emory University IRB (72). Survey responses are stored on a secure server at SurveyGizmo (72). No incentives are provided to participants upon completion of the survey. However, participants who are HIV-negative or who do not disclose their HIV status are eligible to receive a free HIV home test kit (72). IRB approval was obtained by PRISM Health at the start of the AMIS study (72).

Participants and Sampling

The AMIS survey population of interest are MSM residing in the U.S. or Mexico. Participant inclusion criteria includes being male at birth, at least 15 years of age, and having had sex with a man within their lifetime (72). The study uses convenience sampling to recruit participants online. The sample size goal is 10,000 complete surveys from MSM per data collection cycle (70).

The study population of interest for this data analysis was U.S. MSM in a non-concordant relationship with one main partner. In addition to the inclusion criteria described above, this subset of participants must have completed the AMIS survey during the 2015 data collection cycle (January 2015 – April 2016), indicated the U.S. as their current country of residence, and fallen into one of the following respondent categories: 1) a HIV-positive respondent with one HIV-negative main partner, 2) a HIV-positive respondent with one unknown HIV status main partner, 3) a HIV-negative respondent with one HIV-positive main partner, 4) a HIV-negative respondent with one unknown HIV status main partner, or 5) a respondent with unknown HIV status and one HIV-positive, HIV-negative, or unknown HIV status main partner. AMIS survey data from previous data collection cycles were not examined because the AMIS survey is modified slightly each year. Key study variables, such as the HIV prevention conversation scale, did not exist in previous iterations of the survey (72).

A total of 10,217 respondents completed the 2015 AMIS survey. Of those, 856 respondents (8.38%) met subsample eligibility criteria for inclusion into the current analyses. Specifically, 121 respondents were HIV-positive with one HIV-negative main partner; 19 respondents were HIV-positive with one unknown HIV status main partner; 92 respondents were HIV-negative with one HIV-positive main partner; 145 respondents

were HIV-negative with one unknown HIV status main partner; and 479 respondents had unknown HIV status and one HIV-positive, HIV-negative, or unknown HIV status main partner (n=6, n=338, and n=135, respectively)[3].

Measures

Outcome Measures

The main outcomes assessed in the AMIS survey were CAI within the past year and HIV prevention conversations within the past 6 months. CAI within the past year was a self-reported behavioral measure modified from the CDC NHBS Questionnaire (73). It was assessed with one item: "In the past 12 months, did you have anal sex without using a condom?" Answer responses included "Yes", "No", "I prefer not to answer", and "Don't know". This question was operationalized as a dichotomous measure (yes/no). Fifteen percent of respondents (1590/10217) who answered "I prefer not to answer", "Don't know", or who chose not to answer were excluded from the study[3].

HIV prevention conversation within the past 6 months was a measure created by PRISM Health (74). It consisted of one 8-item scale for HIV-positive respondents and one 8-item scale for HIV-negative or unknown HIV status respondents who have a main partner. Each item assessed the frequency of conversation in regards to various HIV prevention strategies, including condom use and medication adherence. A sample HIV prevention conversation item from the HIV-positive respondent scale was "In the last 6 months, how many times have you talked with your partner about your antiviral medication adherence?"; a sample item from the HIV- respondent scale was "In the last 6 months, how many times have you talked with your partner about his antiviral medication

[3] See Appendix A for AMIS respondents subsample selection flowchart.

adherence?"[4]. Answer options ranged from (0) "never" to (3) "5 or more times". A total score was computed by summing the responses of all 8 items. Scores ranged from 0 to 24, with higher scores indicating a higher frequency of HIV prevention conversation within the MSM dyad. Reliability for the scales presented to HIV-positive and HIV-negative/unknown HIV status respondents was adequate (Cronbach alpha=.897 and .795, respectively)[5]. Therefore, data from HIV-positive respondents and HIV-negative/unknown HIV status respondents was combined into one group. The reliability of the combined HIV prevention score was good (Cronbach alpha=.866). Finally, it should be noted that the majority of subset respondents (n=643) were unable to answer the HIV prevention conversation scale due to the survey skip pattern logic. Specifically, the HIV prevention conversation measure was hidden from HIV-negative or unknown HIV status respondents who only had one sexual partner in the past 12 months, regardless of the main partner's HIV status (n=46 and n=197, respectively). HIV-negative respondents who reported more than one sexual partner but whose main partner's HIV status was unknown did not receive this measure (n=121). Respondents with an unknown HIV status who reported more than one sexual partner but whose main partner's HIV status was either negative or unknown did not receive this measure, as well (n=279). All HIV-positive respondents were given the opportunity to answer the HIV prevention conversation measure.

Correlates of Interest

Individual Factors

[4] See Appendix B for full set of AMIS HIV prevention conversation items.
[5] A Cronbach alpha was not calculated for respondents with an unknown HIV status because only 3 of 213 respondents fell into this category.

Sociodemographics, substance use, perceptions or experiences of stigma, and experiences of adverse childhood events (ACE) were four individual factors that could impact HIV prevention conversation. It should be noted that stigma and ACE survey items were not offered for all participants to answer. Participants were randomly assigned to three groups when they began the survey; the participant's group assignment determined if stigma or ACE questions are offered.

Sociodemographics. Sociodemographics were assessed with seven items modified from the CDC NHBS Questionnaire (73): age, race/ethnicity, educational level, annual income, self-reported HIV status, number of partners in the past 12 months, and marital status. Age was a continuous item, with participants inputting their age. Race/ethnicity, educational level, annual income, and self-reported HIV status were categorical items; answer options depended on the item. Categorical variables that had several possible answers were recoded into three answer options where appropriate to facilitate analysis. A sample sociodemographic categorical item was "What is the highest level of education you completed?". Original answer options included "Never attended school (0)", "Less than high school (1)", "Some high school (2)", "High school diploma or GED (3)", "Some college, Associate's Degree, or Technical Degree (4)", "College, post graduate, or professional school (5)", "I prefer not to answer (7)", and "Don't know (9)". These were recoded to "High school diploma or GED and below (0-3)", "Some college, Associate's Degree, or Technical Degree (4)", and "College, post graduate, or professional school (5)"; respondents who selected "I prefer not to answer (7)" or "Don't know (9)" were included in the "High school diploma or GED and below (0-3)" category. Number of partners in the past 12 months and marital status were operationalized as dichotomous

variables to facilitate statistical analysis. Respondents entered number of partners when answering the question “In the past 12 months, with how many different men have you had oral or anal sex?”; those who entered “1” were recategorized as having one partner within the past 12 months while those who entered a number higher than “1” were recategorized as having more than one sexual partner in the past 12 months. Another sample sociodemographic dichotomous item was “Are you currently legally married?”; the answer responses for this question were “Yes”, “No”, “I prefer not to answer”, or “Don’t Know”. The few respondents who chose “I prefer not to answer” or “Don’t know” were recoded into the “No” category.

Substance Use. Substance use was assessed with three items. Two items were modified from the CDC NHBS Questionnaire (73). These items assessed non-injection drug use in the past year and types of substances used. Sample items included “In the past 12 months, have you used any non-injection drugs other than those prescribed to you?” and “In the past 12 months, which drugs that were not prescribed to you did you use?”. The answer responses for the first question were “Yes”, “No”, “I prefer not to answer”, and “Don’t Know”. The few respondents who chose the “I prefer not to answer” or “Don’t Know” options were recoded into the “No” category. Answer options for the second question were “Marijuana”, “Powdered cocaine (smoked or snorted)”, “Poppers (amyl nitrate)”, “X or Ecstasy”, “Painkillers (Oxycontin, Vicodin, Percocet)”, “Downers (Valium, Ativan, Xanax)”, “Crystal meth (tina, crank, ice)”, “Hallucinogens (LSD, mushrooms)”, “Special K (ketamine)”, “GHB”, “Crack Cocaine”, “Heroin (smoked or snorted), “Other”, “I prefer not to answer”, and “I don’t know”. These were recoded into three answer options to facilitate analysis: “Marijuana”, “All other drugs”, or “None”.

Respondents who chose "I prefer not to answer" or "I don't know" were recoded into the "None" category. The final measure, poly-drug use within the past 12 months, was calculated by the researcher by adding subsequent drug substance types reported per respondent. The answer responses were "One drug", "More than one drug", or "None".

Stigma and ACEs. Respondents participating in the 2015 AMIS survey were randomized to one of three groups, which were then assigned to complete one of two stigma measures or an adverse childhood event measure. Given that the sample sizes for each group were smaller than the overall N, bivariate analyses were conducted to inform decisions about whether these factors should be further considered for inclusion in regression analyses.

Perceptions or experiences of stigma were assessed using two different modules. One measure of perceptions or experiences of stigma included ten items modified from the CDC NHBS Questionnaire (73). Items assessed MSM-related discrimination, perceived community tolerance of MSM, and HIV stigma (73). Sample items included "During the past 12 months, have any of the following things happened to you because someone knew or assumes you were attracted to men: You were called names or insulted", "Most people in my area are tolerant of gays and bisexuals", and "Most people in my area would discriminate against someone with HIV"[6]. Answer options were either "Yes", "No", "I prefer not to answer", or "Don't Know", for the first sample item, or on a Likert scale ranging from (1) "Strongly Disagree" to (5) "Strongly Agree", for the second and third sample item. The few respondents who chose the "I prefer not to answer" or "Don't Know" options were recoded into the "No" or (3) "Neutral" categories, respectively. Results in previous literature demonstrated bivariate analyses between each

[6] See Appendix C for CDC stigma items

individual stigma item and the outcome of interest (47, 75). In addition, four of the ten items specifically designed to measure HIV stigma were used to develop an average HIV stigma score. Answer options for these four items were on the Likert scale mentioned above. One item was reverse coded prior to computing the total score by summing the responses of all four items and dividing by four. Scores could range from 1 to 5, with higher scores indicating higher levels of perceived HIV stigma among participants. Cronbach's alpha reliability for this score was .815, suggesting good internal consistency of scale items.

The second measure of perceptions or experiences of stigma was a 13-item scale adapted from the Center of Public Health and Human Rights at Johns Hopkins University School of Public Health (JHS) (76-79). Items assessed social and healthcare stigma. Sample items included "Have you ever felt excluded from family gathering because you have sex with men?" and "Have you ever avoided going to healthcare services because you worried someone may learn you have sex with men?"[7]. Answer options included "Yes", "No", "Doesn't Apply", "I prefer not to answer", and "Don't Know". The few respondents who chose the "Doesn't apply", "I prefer not to answer" or "Don't Know" options were recoded into the "No" category. A total score was computed by summing "Yes" responses of all 13 items. Scores ranged from 0 to 13, with higher scores indicating higher levels of stigma. Cronbach's alpha reliability for this scale using the sample subset was .773, suggesting adequate internal consistency of scale items.

Experiences of ACE were assessed with 18-items from the ACE Study (80). Items assessed eight ACE subcategory exposures: verbal abuse, physical abuse, sexual abuse, exposure to a battered mother, substance use in the household, mental illness in the

[7] See Appendix D for JHS stigma items.

household, parental separation or divorce, and exposure to an incarcerated household member. One sample item was "During the first 18 years of life, did an adult, relative, family friend, or stranger ever touch or fondle you in a sexual way?" The answer options for some questions, like the sample, were "Yes", "No", "I prefer not to answer", and "Don't Know" while others were on a Likert Scale ranging from (0) "Never" to (5) "Very Often". Item responses indicated whether or not the respondent experienced exposure to any ACE subcategories[8]. An ACE index score was computed by summing all eight ACE subcategories. Index scores ranged from 0 to 8, with higher scores indicating exposure to more types of ACE.

Interpersonal Factors

Sexual Agreements. Sexual agreements were assessed with ten items created by PRISM Health (74). Due to skip patterns based on responses to previous items, only one item was considered for inclusion in the regression analyses in order to retain our samples size. Specifically, we asked, "What is your current agreement, if any, that you and your partner have about having sex with partners outside of your relationship?" Answer options for this item include "Neither of us can have any sex with any outside partners", "We can have sex with outside partners, but with some conditions or restrictions that make it safer", "We can have sex with outside partners, without any conditions or restrictions", "We have no agreement", "I prefer not to answer", or "I don't know". The few respondents who chose "I prefer not to answer" or "I don't know" were recoded into the "We have no agreement" category. Other items were examined in bivariate analyses only. These included the length of agreement, frequency of broken agreements in the past 12 months by the participant and his partner, type of sex when breaking the agreement,

[8] See Appendix E for definitions of ACE subcategory exposure.

and condom usage when breaking the agreement. Length of agreement and type of sex when breaking agreement were operationalized as dichotomous variables. Length of agreement was assessed by asking "How long have you and your main partner had this agreement?". Answer options included "Less than three months", "Three to six months", "Six months to one year", "One to two years", "Two to three years", "Four to five years", "More than five years", "I prefer not to answer", and "Don't Know"; these were recoded into "Less than or equal to one year" or "More than one year". The few participants who chose "I prefer not to answer" or "Refuse" were recoded into the "Less than or equal to one year" option. The following item assessed type of sex when breaking agreement "During the times that you broke your agreement with your partner, which of the following did you do?". Answer options included "Receptive anal sex", "Insertive anal sex", and "Some other kind of sex". This measure was recoded into three dichotomous variables: receptive anal intercourse when breaking agreement, insertive anal intercourse when breaking agreement, and some other kind of sex when breaking agreement. For frequency of broken agreements, respondents input the number of times they and their main partner broke their agreement within the past 12 months. These responses were recoded into a dichotomous variable, with answer options including "0 times" and "1 or more times". Condom usage when breaking the agreement was measured using a Likert scale ranging from (0) "Never" to (4) "Always". Participants who chose "Prefer not to answer" or "Don't know" answer categories were recoded to the "Never" answer option.

Engagement in Technology-Based MSM Social Networks. Engagement with technology-based MSM social networks were assessed with four items modified from the CDC NHBS Questionnaire (73). Items indicated the type of internet site used to meet gay

men and the frequency of use. A sample item was “In the past 12 months, have you used any of the following kinds of internet sites to meet or socialize with gay men?” Answer options included “Social network websites”, “Dating websites directed towards gay men”, “Mobile phone apps”, “None of the above”, “I prefer not to answer”, and “Don’t know”. This measure was recoded into three dichotomous variables: past 12-months social network website usage, past 12-months dating website usage, and past 12-month mobile phone app usage. Answer options for these variables were “Yes” or “No”; participants who chose “None of the above”, “I prefer not to answer” and “Don’t Know” were recoded into the “No” option. Answer options for frequency items were on a Likert scale ranging from (0) “Never” to (8) “More than once a day”; these response categories were recoded to a Likert scale ranging from (0) “Never” to (4) “At least once a day” to simplify analysis.

Data Analysis

Descriptive analyses were conducted to examine basic demographics and study variable characteristics, as well as distributions among the variables. Bivariate analyses were conducted to examine the relationships of sociodemographics, individual factor variables, and interpersonal factor variables to our two outcomes, respectively: HIV prevention conversation scale scores with main partners in the past 6 months and CAI within the past year. The relationship between HIV prevention conversation scale scores and CAI within the past year was examined using an ANOVA as well. Specifically, for the continuous outcome variable of HIV prevention conversation scores, t-tests and ANOVAS were used for categorical variables, and Pearson correlations were used for continuous variables. For the dichotomous outcome of CAI within the past year, chi-

squares were used for categorical and t-tests were used for continuous variables. We examined the data for violations to the normality assumption and appropriately applied transformations or non-parametric tests as needed. Additionally, sensitivity analyses were conducted to understand the impact of the following on HIV prevention conversation and CAI outcomes: 1) including HIV-unknown respondents in the sample, and; 2) recategorizing "I prefer not to answer" or "Don't Know" responses as "No". HIV-unknown respondents represented more than half of the subsample and could behave differently from respondents in truly serodiscordant dyads, thereby skewing results. Recategorizing non-responses as "No" as opposed to accepting the information loss could also impact results. Sensitivity analyses indicated that neither significantly affected HIV prevention conversation or CAI results.

One linear regression model and two logistic regression models were then developed for 1) the HIV prevention conversation score outcome and 2) the CAI within the past year behavioral outcome, respectively. We utilized IBM SPSS Statistics 24 to conduct analyses. The enter (standard) method was used where all covariates were evaluated based on what each contributes to the prediction of the HIV prevention conversation or CAI outcome. We forced entry correlates of important sociodemographics (age, race/ethnicity, education level, marital status), individual variables (self-reported HIV status, number of sexual partners in the past 12 months, non-injection drug use in the past 12 months), and interpersonal variables (type of sexual agreement, use of dating technology). These variables were selected in order to account for factors that have been shown to be important correlates of HIV risk and related behaviors, either at $\leq .05$ significance at the bivariate level or from the literature, while maximizing sample size

(given that some questions were only asked among subsets of participants). Results from the bivariate analyses were used to inform exploratory regression analyses.

Chapter 4: Results

Descriptive Statistics of Participants Individual and Interpersonal Factors

A total of 856 MSM in non-concordant main partnerships were included in this secondary analysis subsample. The mean age of participants was 31.25 years (SD=14.44; Table 1). The majority of respondents identified as non-Hispanic White (n=590; 68.9%), followed by Hispanic (n=136; 15.9%), non-Hispanic Black (n=61; 7.1%), and other (n=69; 8.1%). About three quarters of respondents indicated having some college education (n=300; 35.2%) or at least a Bachelor's degree (n=340; 39.7%). About half of respondents (n=395; 46.1%) reported an annual income of less than $40,000. In addition, 56% of respondents (n=479) did not know their HIV status at the time of survey completion. Approximately two thirds of participants (n=575; 67.2%) reported having more than one sexual partner in the past 12 months. The vast majority of participants indicated they were not legally married to their main male partner (n=780; 91.1%).

About one third of participants (n=277; 32.4%) reported using non-injection drugs in the past 12 months. The primary type of non-injection drug used by participants was marijuana (n=224; 26.2% of the overall subsample). Additionally, 16% of the overall subsample (n=139) reported using more than one non-injection drug in the past 12 months. Of the 856 participants, 301 completed the CDC-developed stigma scales. The mean score for perceived community tolerance of MSM and HIV stigma was 3.47 (SD=1.05) and 3.02 (SD=.84), respectively. About one third of participants (n=267) completed the JHS sexual behavior stigma scale. The mean score for this stigma measure was 3.77 (SD=2.91). Finally, 251 participants completed experiences of ACE measures. More than three quarters of these respondents reported one or more ACE exposures

(n=196; 78.1%); the majority reported one ACE exposure (n=73; 29.1%), followed by four or more ACE exposures (n=59; 23.5%).

Six hundred and three participants (70.4%) of the overall subsample reported having a sexual agreement with their non-concordant main partner. The majority of these sexual agreements were characterized as strictly monogamous, or no sex with outside partners (n=416; 48.6% of the overall subsample), followed by sex with outside partners with conditions (n=129; 15.1% of the overall subsample), and sex with outside partners without conditions (n=58; 6.8% of the overall subsample). Approximately half of the respondents reported having a sexual agreement with their main partner for more than one year (n=283; 51.2%). Of those who had a sexual agreement, 12% of respondents (n=64) had broken their sexual agreement within the past 12 months. Almost one tenth of respondents with a sexual agreement (n=51; 9.7%) believed that their partner had broken their sexual agreement within the same time period. Approximately one third of participants who broke their agreement reported engaging in insertive anal sex (n=21; 32.8%) or some other kind of sex (n=25; 39.1%) when breaking the sexual agreement, while 53.1% of respondents (n=34) reported engaging in receptive anal sex. Respondents who engaged in anal sex when breaking their agreement reported rarely using condoms during these encounters (mean=1.49; SD=1.55).

About one third of respondents (n=258; 30.1%) reported using social networking websites, such as Facebook, or using dating websites directed towards gay men (n=281; 32.8%) over the past 12 months. More than half of respondents (n=466; 54.4%) reported using mobile phone apps, including dating or hookup apps, over the past 12 months. The

mean frequency of using social networking websites, MSM dating websites, and mobile phone apps was 2.66 (SD=1.29), 2.93 (SD=1.18), and 3.02 (1.16), respectively.

HIV Prevention Conversation Score Outcome

Two hundred and thirteen subsample MSM participants in non-concordant main partnerships (24.9%) completed the HIV prevention conversation score measure. The mean HIV prevention conversation score was 8.69 (SD=6.31; Table 1). Scores ranged from 0 to 24, with 8.5% (n=18) reporting no conversations while 3.3% (n=7) reported always having conversations within the past 6 months. Interestingly, HIV prevention conversation scores did not significantly differ by HIV status; HIV-positive respondents, HIV-negative respondents, and HIV-unknown respondents had mean HIV prevention scores of 8.63 (SD=6.74), 8.87 (5.51), and 7.33 (4.04), respectively. This is a somewhat left-skewed scale, with skewness of .640 (SE=.167) and kurtosis of -.326 (SE=.332).

Bivariate Analyses

Tables 1 and 2 present the results of the bivariate analyses. There was a statistically significant association between age (r=-.197; p=.004), perceived community tolerance (r=-.362; p=.002), HIV stigma score (r=.405; p=.001) and HIV prevention conversation with the participant's non-concordant main partner at most recent sex (Table 1). Being younger, having a lower perceived community tolerance score, and having a higher HIV stigma score were associated with a higher HIV prevention conversation score. In addition, participants with more than one sexual partner in the past 12 months had a significantly higher HIV prevention conversation score (mean=9.33; SD=6.51) than those with one sexual partner (mean=5.76; SD=4.32, p=.001). A statistically significant difference was observed in HIV prevention conversation score

among the five ACE exposure groups (F=(4,52)=3.14, p=.022). Tukey post hoc tests indicated that the mean HIV prevention conversation score for participants with 1 ACE exposure (mean=12.86; SD=7.99) is significantly higher than the mean HIV prevention conversation score for participants with 3 ACE exposures (mean=5.40; SD=4.14; p=.026). No other differences were observed between other ACE exposure groups. Finally, participants who used mobile phone apps within the past 12 months had a significantly higher HIV prevention score (mean=9.71; SD=6.43) than those who had not (mean=7.30; SD=5.91, p=.006).

Age, number of partners in the past 12 months, and mobile phone app usage in the past 12 months were associated with HIV prevention conversation at the $p<.05$ level, and were therefore included in the multivariate linear regression.

Multivariate Analyses

A multivariate linear regression was conducted using the enter method to determine the relationship between age, race/ethnicity, education level, self-reported HIV status, number of partners in the past 12 months, marital status, non-injection drug use within the past 12 months, sexual agreement type, and mobile phone app usage in the past 12 months with HIV prevention conversation. For individual level factors, age, education level, and number of partners in the past 12 months were significantly associated with HIV prevention conversation. Specifically, for each unit increase in age, HIV prevention conversation decreased by .08 points when controlling for all other variables (B=-.08; 95% CI: -.15, -.01; p=.026). Participants with at least a Bachelor's degree had a HIV prevention conversation score that is 3.05 points higher than participants with a high school diploma or less (B=3.05; 95% CI: .44, 5.66; p=.022).

Participants with some college education did not have a significantly higher HIV prevention conversation score than participants with a high school diploma or less (p=.066). On average, participants who reported having more than one sexual partner in the past 12 months had a HIV prevention conversation score that was 4.10 points higher than participants with one sexual partner in the past 12 months (B=4.10; 95% CI: 1.42, 6.78; p=.003). Race/ethnicity (p=.143; p=..472; p=.370), self-reported HIV status, (p=.177; p=.937), marital status (p=.222), and non-injection drug use within the past 12 months (p=.424) were not significantly associated with this outcome.

For interpersonal factors, results from the multivariate linear regression model indicate that sexual agreement type was significantly associated with HIV prevention conversation. Specifically, participants without a sexual agreement had a HIV prevention conversation score that was 2.83 points lower than participants with a monogamous sexual agreement (B=-2.83; 95% CI: -5.07, -.59; p=.014). Participants who either had a sexual agreement including sex with outside partners with conditions or without conditions were not significantly associated with HIV prevention conversation (p=.356 and p=.220, respectively). Additionally, mobile phone app usage was not significantly associated with HIV prevention conversation (p=.211). The total regression model accounted for 10.2% of the variance in HIV prevention conversation scores (see Table 3).

CAI Outcome

All subsample participants (n=856) completed the CAI measure. Approximately three fourths of participants (n=651; 76.1%) reported CAI in the past 12 months.

Bivariate Analyses

Results indicated that there was a statistically significant association between marital status (χ^2=5.332; df=1; p=.021), non-injection drug use in the past 12 months (χ^2=5.213; df=1; p=.022), polydrug use in the past 12 months (χ^2=7.547; df=2; p=.023), sexual agreement type (χ^2=8.012; df=3; p=.046), length of sexual agreement (χ^2=5.462; df=1; p=.019), and frequency of participant breaking the sexual agreement within the past 12 months (χ^2=15.464; df=1; p<.001) with CAI. Additionally, a t-test was conducted between HIV prevention conversation and CAI. No significant differences in HIV prevention conversation score were found among participants who had engaged in CAI in the past 12 months versus participants who had not (F=(1, 211)=.592, p=.442).

Multivariate Analyses

Two multivariate logistic regressions were conducted using the enter method. The first logistic regression examined the relationship between age, race/ethnicity, education level, self-reported HIV status, number of partners in the past 12 months, marital status, non-injection drug use within the past 12 months, sexual agreement type, and mobile phone app usage in the past 12 months with CAI. For individual level factors, marital status and non-injection drug use within the past 12 months were significantly associated with CAI. Results indicate that married participants were twice as likely as unmarried participants to report engaging in CAI (AOR=2.07; 95% CI: 1.01, 4.23; p=.048). Participants who reported non-injection drug use within the past 12 months were 1.6 times more likely than participants who did not report non-injection drug use to engage in CAI, as well (AOR=1.60; 95% CI: 1.11, 2.30; p=.012). Age (p=.713), race/ethnicity (p=.489; p=.280; p=.568), education level (p=.135; p=.411), self-reported HIV status

(p=.863; p=.281), and number of partners in the past 12 months (p=.668) were not significantly associated with CAI (see Table 3).

For interpersonal factors, results from the first multivariate logistic regression model indicate that sexual agreement type was significantly associated with CAI. In particular, participants whose sexual agreement included sex with outside partners without conditions were almost three times as likely to report CAI than participants with a monogamous sexual agreement (AOR=2.62; 95% CI: 1.04, 6.56; p=.040). Interestingly, participants whose sexual agreement included sex with outside partners with conditions (p=.420) or participants without a sexual agreement (p=.491) were not significantly related to CAI. Additionally, mobile phone app usage was not significantly associated with CAI (p=.999). The total regression model accounted for 4.5% of the variance in CAI (see Table 3). Note that the HIV prevention conversation score was initially included in the CAI logistic regression models; however, this variable was removed because it was not significant in the models and reduced the number of cases available for analysis.

The second logistic regression for CAI was more exploratory and was informed by bivariate results. Specifically, we examined the relationship between the variables listed above as well as length of sexual agreement, frequency of broken agreements by the participant within the past 12 months, and frequency of perceived broken agreements by the participant's partner within the past 12 months (which limited this regression analyses to an n of 511). For individual level factors, education was significantly associated with CAI. Specifically, participants who had completed some college were almost twice as likely as participants with a high school diploma or less to engage in CAI (AOR=1.91; 95% CI: 1.06, 3.45; p=.031). Age (p=.660), race/ethnicity (p=.694; p=.537;

p=.678), self-reported HIV status (p=.908; p=.079), number of partners in the past 12 months (p=.233), marital status (p=.182), and non-injection drug use within the past 12 months (p=.110) were not significantly associated with CAI (see Table 3).

For interpersonal factors, results from the second multivariate logistic regression were similar to the first model. Participants whose sexual agreement included sex with outside partners without conditions were almost four times as likely to report CAI than participants with a monogamous sexual agreement (AOR=3.72; 95% CI: 1.28, 10.86; p=.016). Participants whose sexual agreement included sex with outside partners with conditions were not significantly related to CAI (p=.890). Interestingly, participants who reported breaking their sexual agreement within the past 12 months were almost 12 times more likely to engage in CAI than those who had not broken their agreement (AOR=11.83; 95% CI: 2.74, 51.13; p=.001). Length of sexual agreement (p=.482), frequency of perceived broken agreements by the participant's partner within the past 12 months (p=.304), and mobile phone app usage (p=.280) were not significantly associated with CAI. The total regression model accounted for 13.2% of the variance in CAI (see Table 3).

Summary

The majority of respondents were in their early 30's, identified as non-Hispanic White, had at least some college education, did not use non-injection drugs, experienced low levels of stigma, had at least one ACE exposure, had a sexual agreement with their main partner, and did not use technology-based social networking sites. About half of respondents reported an annual income of less than $40,000 and did not know their HIV status at the time of survey completion.

Overall, HIV prevention conversation scores in this sample were low while CAI was high. Age, perceived community tolerance, HIV stigma score were significantly associated with HIV prevention conversation at the bivariate level. At the multivariate level, age, education level, number of sexual partners in the past 12 months, and sexual agreement type were significantly associated with HIV prevention conversation; the linear regression model accounted for 10.2% of variance in HIV prevention conversation. In addition, marital status, non-injection drug use, polydrug use, sexual agreement type, length of agreement, and frequency of participant breaking the sexual agreement with significantly associated with CAI at the bivariate level. Two multivariate logistic regression models were conducted for the behavioral outcome. Marital status, non-injection drug use, and sexual agreement type were associated with CAI in the first multivariate regression; this model accounted for 4.5% of the variance in CAI. Education, sexual agreement type, and participants breaking the sexual agreement were associated with CAI in the second multivariate regression; this model accounted for 13.2% of the variance in CAI.

Table 1. Participant individual characteristics and bivariate analyses examining associations with HIV prevention conversation score and condomless anal intercourse within the past 12 months

	Total sample M (SD) or N (%)	**HIV prevention conversation score past 6 months[9] M (SD) or r**	**p**	**Condomless anal intercourse within the past 12 months M (SD) or N (%)**		**P**
Socio-demographics	N=856	N=213		No N=205 (23.9%)	Yes N=651 (76.1%)	
Age (SD)	31.25 (14.44)	-.197	.004**	30.53 (14.69)	31.48 (14.37)	.410
Race/Ethnicity (%)			.191			.516
Non-Hispanic Black	61 (7.1)	6.74 (5.88)		13 (21.3)	48 (78.7)	
Non-Hispanic White	590 (68.9)	9.22 (6.33)		135 (22.9)	455 (77.1)	
Hispanic	136 (15.9)	8.68 (6.65)		38 (27.9)	98 (72.1)	
Other	69 (8.1)	9.32 (6.13)		19 (27.5)	50 (72.5)	
Education level (%)[10]	N=852	N=212	.198	N=205 (24.1%)	N=647 (75.9%)	.332
≤High school diploma	212 (24.9)	6.68 (4.74)		58 (27.4)	154 (72.6)	
Some college[11]	300 (35.2)	9.07 (5.99)		65 (21.7)	235 (78.3)	
≥Bachelor's Degree	340 (39.7)	8.95 (6.73)		82 (24.1)	258 (75.9)	
Annual income (%)[10]	N=781	N=190	.936	N=186 (23.8%)	N=595 (76.2%)	.906
≤$39,999	395 (50.6)	8.69 (6.37)		94 (23.8)	301 (76.2)	
$40,000 to $74,999	184 (23.6)	8.77 (6.43)		42 (22.8)	142 (77.2)	
≥$75,000	202 (25.9)	8.38 (6.25)		50 (24.8)	152 (75.2)	
Self-reported HIV status			.901			.901
HIV – Positive	140 (16.4)	8.63 (6.74)		34 (24.3)	106 (75.7)	
HIV –	237 (27.7)	8.87 (5.51)		59 (24.9)	178 (75.1)	

[9] HIV prevention conversation score sample size is smaller than total sample due to survey skip pattern logic.
[10] Missing values because participants have the option to skip any survey question.
[11] Some college, Associate's Degree, or Technical Degree

Negative HIV – Unknown	479 (56.0)	7.33 (4.04)		112 (23.4)	367 (76.6)	
Number of sexual partners in past 12 months			.001**			.464
1 Partner	281 (32.8)	5.76 (4.32)		63 (22.4)	218 (77.6)	
>1 Partner	575 (67.2)	9.33 (6.51)		142 (24.7)	433 (75.3)	
Legally married to male partner (%)	76 (8.9)	9.53 (6.52)	.415	10 (13.2)	66 (86.8)	.021*
Vs. No	780 (91.1)	8.54 (6.29)		195 (25.0)	585 (75.0)	
Substance use	N=856	N=213		No N=205 (23.9%)	Yes N=651 (76.1%)	
Past 12-month non-injection drug use (%)	277 (32.4)	8.79 (5.76)	.875	53 (19.1)	224 (80.9)	.022*
Vs. No	579 (67.6)	8.64 (6.57)		152 (26.3)	424 (73.7)	
Type of non-injection drug used in past 12 months (%)			.524			.070
Marijuana	224 (26.2)	9.40 (5.34)		42 (18.8)	182 (81.3)	
All other drugs[12]	53 (6.2)	7.55 (6.49)		11 (20.8)	42 (79.2)	
None	579 (67.6)	8.64 (6.57)		152 (26.3)	427 (73.7)	
Past 12-month polydrug use (%)			.096			.023*
One drug	124 (14.5)	6.59 (4.92)		29 (23.4)	95 (76.6)	
>One drug	139 (16.2)	10.18 (5.81)		21 (15.1)	118 (84.9)	
None	593 (69.3)	8.60 (6.55)		155 (26.1)	438 (73.9)	
Psychosocial characteristics						
CDC-developed stigma scales[13]	N=301	N=72		No N=67 (22.3%)	Yes N=234 (77.7%)	
Perceived community tolerance (SD)	3.47 (1.05)	-.362	.002**	3.37 (1.14)	3.50 (1.02)	.369
HIV stigma	3.02 (.84)	.405	.001**	2.88 (.84)	3.07 (.84)	.126

[12] Includes cocaine (powder or crack), amyl nitrate, ecstasy, painkillers, downers, crystal meth, hallucinogens, ketamine, GHB, and heroin.

[13] Sample size is smaller than total sample because participants were randomly assigned to one of three module groups (CDC Stigma Module 1, Johns Hopkins School of Public Health Stigma Module 2, or Adverse Childhood Events Module 3). Participants have the option to skip any survey question.

score (SD)						
JHS-developed stigma scales[13]	N=267	N=70		No N=61 (22.8%)	Yes N=206 (77.2%)	
Sexual behavior stigma score (SD)	3.77 (2.91)	-.143	.248	3.63 (2.85)	3.82 (2.93)	.669
Number of adverse childhood exposures (%)[13]	N=251	N=57	.022*	No N=62 (24.7%)	Yes N=189 (75.3%)	.563
0	55 (21.9)	8.22 (5.87)		14 (25.5)	41 (74.5)	
1	73 (29.1)	12.86 (7.99)		21 (28.8)	52 (71.2)	
2	35 (13.9)	5.89 (4.01)		6 (17.1)	29 (82.9)	
3	29 (11.6)	5.40 (4.14)		9 (31.0)	20 (69.0)	
≥4	59 (23.5)	7.93 (5.23)		12 (20.3)	189 (75.3)	

Table 2. Participant interpersonal characteristics and bivariate analyses examining associations with HIV prevention conversation score and condomless anal intercourse within the past 12 months

	Total sample M (SD) or N (%)	HIV prevention conversation score past 6 months[9] M (SD) or r	p	Condomless anal intercourse within the past 12 months M (SD) or N (%)		P
Sexual agreements among partners[10]	N=856	N=213		No N=205 (23.9%)	Yes N=651 (76.1%)	
Type of agreement (%)			.133			.046*
No sex with outside partners	416 (48.6)	9.44 (6.10)		96 (23.1)	320 (76.9)	
Sex with outside partners, with conditions	129 (15.1)	9.13 (6.38)		34 (26.4)	95 (73.6)	
Sex with outside partners, without conditions	58 (6.8)	9.74 (7.56)		6 (10.3)	52 (89.7)	
No agreement	253 (29.6)	7.27 (5.72)		69 (27.3)	184 (72.7)	
Length of agreement (%)[14]	N=553	N=127	.268	N=124	N=429	.019*
≤1 year	270 (48.8)	10.02 (7.01)		72 (26.7)	198 (73.3)	
>1 year	283 (51.2)	8.66 (6.16)		52 (18.4)	231 (81.6)	
Past 12-months participant broke sexual agreement[14] (%)	N=533	N=112	.215	N=119	N=414	<.001**
0 times	469 (88.0)	8.80 (6.40)		117(24.9)	352 (75.1)	
≥1 time	64 (12.0)	10.67 (6.67)		2 (3.1)	62 (96.9)	
Past 12-months partner broke sexual agreement[14] (%)	N=525	N=110	.064	N=118	N=407	.054
0 times	474 (90.3)	8.71 (6.15)		112(23.6)	362 (76.4)	

[14] Sample size represents participants who indicated the following sexual agreements: "no sex with outside partners"; "sex with outside partners, with conditions", or; "sex with outside partners, without conditions". Participants have the option to skip any survey question.

≥1 time	51 (9.7)	11.79 (8.15)		6 (11.8)	45 (88.2)	
Type of sex when breaking agreement[15] (%)	N=64	N=24		N=2	N=62	
Insertive anal Sex	21 (32.8)	12.33 (7.97)	.375	1 (4.8)	20 (95.2)	.599
Vs. No	43 (67.2)	9.67 (6.37)		1 (2.3)	42 (97.7)	
Receptive anal sex	34 (53.1)	10.26 (7.29)	.591	1 (2.9)	33 (97.1)	.928
Vs. No	30 (46.9)	12.20 (5.97)		1 (3.3)	29 (96.7)	
Other kind of Sex	25 (39.1)	9.60 (7.92)	.709	1 (4.0)	24 (96.0)	.747
Vs. No	39 (60.9)	10.95 (6.90)		1 (2.6)	38 (97.4)	
Always used condom when breaking agreement (SD)	N=45	N=22	.791	N=1	N=44	.101
	1.49 (1.55)	.060		4.00	1.43 (1.52)	
Engagement in technology-based MSM social networks	N=856	N=213		N=205 (23.9%)	N=651 (76.1%)	
Past 12-month social networking websites (%)	258 (30.1)	8.66 (5.91)	.965	55 (21.3)	203 (78.7)	.236
Vs. No	598 (69.9)	8.70 (6.51)		150 (25.1)	448 (74.9)	
Past 12-month MSM dating websites (%)	281 (32.8)	9.04 (6.37)	.528	62 (22.1)	219 (77.9)	.366
Vs. No	575 (67.2)	8.47 (6.30)		143 (24.9)	432 (75.1)	
Past 12-month mobile phone apps (%)	466 (54.4)	9.71 (6.43)	.006**	112 (24.0)	354 (76.0)	.949
Vs. No	390 (45.6)	7.30 (5.91)		93 (23.8)	297 (76.2)	
Use frequency of social networking websites (SD)	2.66 (1.29)	.209	.100	2.56 (1.27)	2.69 (1.29)	.531
Use frequency of MSM dating websites (SD)	2.93 (1.18)	.150	.196	3.13 (1.10)	2.87 (1.20)	.130
Use frequency of mobile phone apps (SD)	3.02 (1.16)	.090	.339	2.99 (1.16)	3.03 (1.16)	.747

[15] Sample size represents participants who indicated breaking their sexual agreement one or more times in the past 12 months. Participants have the option to skip any survey question.

Table 3. Multivariate models regarding correlates of HIV prevention conversation scores and condomless anal intercourse

	HIV prevention conversation score in the past 6 months[a] N=213			Condomless anal intercourse within the past 12 months[b] N=852			Condomless anal intercourse within the past 12 months[c] N=511		
	B	**95% CI**	**P**	**OR**	**95% CI**	**p**	**OR**	**95% CI**	**p**
Age	-.08	-.15, -.01	.026*	1.03	.99, 1.02	.713	1.00	.974, 1.02	.660
Race/Ethnicity									
Non-Hispanic White	Ref	--	--	Ref	--	--	Ref	--	--
Non-Hispanic Black	-1.69	-3.95, .57	.143	1.27	.65, 2.50	.489	.81	.29, 2.34	.694
Hispanic	-.86	-3.20, 1.49	.472	.79	.51, 1.22	.280	.83	.45, 1.52	.537
Other	-1.43	-4.58, 1.72	.370	.85	.47, 1.51	.568	1.19	.52, 2.72	.678
Education level									
≤High school diploma	Ref	--	--	Ref	--	--	Ref	--	--
Some college	2.63	-.18, 5.44	.066	1.38	.90, 2.12	.135	1.91	1.06, 3.45	.031*
≥Bachelor's degree	3.05	.44, 5.66	.022*	1.21	.77, 1.90	.411	1.81	.96, 3.41	.065
Self-reported HIV status									
HIV – Negative	Ref	--	--	Ref	--	--	Ref	--	--
HIV – Positive	1.30	-.59, 3.18	.177	.96	.57, 1.60	.863	1.05	.49, 2.25	.908
HIV – Unknown	0.29	-6.95, 7.52	.937	1.25	.83, 1.89	.281	1.67	.94, 2.95	.079
Number of sexual partners in past 12 months									
1 Partner	Ref	--	--	Ref	--	--	Ref	--	--
>1 Partner	4.10	1.42, 6.78	.003**	.92	.62, 1.36	.668	.72	.42, 1.24	.233
Legally married to male partner	1.53	-.93, 3.98	.222	2.07	1.01, 4.23	.048*	1.79	.76, 4.18	.182
Vs. No	Ref	--	--	Ref	--	--	Ref	--	--

Past 12-month non-injection drug use	-0.74	-2.55, 1.08	.424	1.60	1.11, 2.30	.012*	1.50	.91, 2.48	.110
Vs. No	Ref	--	--	Ref	--	--	Ref	--	--
Type of agreement									
No sex with outside partners	Ref	--	--	Ref	--	--	Ref	--	--
Sex with outside partners, with conditions	-1.14	-3.58, 1.29	.356	.82	.50, 1.34	.420	.96	.52, 1.76	.890
Sex with outside partners, without conditions	-1.85	-4.82, 1.12	.220	2.62	1.04, 6.56	.040*	3.72	1.28, 10.86	.016*
No agreement	-2.83	-5.07, -.59	.014*	.87	.59, 1.29	.491	--	--	--
Past 12-month mobile phone apps (%)	1.23	-.71, 3.17	.211	1.00	.70, 1.42	.999	.76	.46, 1.25	.280
Vs. No	Ref	--	--	Ref	--	--	Ref	--	--
Length of agreement (%)	--	--	--	--	--	--			
≤1 year	--	--	--	--	--	--	Ref	--	--
>1 year	--	--	--	--	--	--	1.22	.70, 2.15	.482
Past 12-months participant broke sexual agreement (%)	--	--	--	--	--	--			
0 times	--	--	--	--	--	--	Ref	--	--
≥1 time	--	--	--	--	--	--	11.83	2.74, 51.13	.001*
Past 12-months partner broke sexual agreement (%)	--	--	--	--	--	--			

0 times	--	--	--	--	--	--	Ref	--	--
≥1 time	--	--	--	--	--	--	1.64	.64, 4.20	.304

[a] Adjusted R-squared=.102.
[b] Nagelkerke R-squared=.045.
[c] Nagelkerke R-squared=.132.

Chapter 5: Discussion

Individual and Interpersonal Characteristics of Non-concordant Dyads

The first research aim was to describe the individual and interpersonal characteristics of non-concordant dyads. In this subsample of participants, the mean HIV prevention conversation score among MSM participants in non-concordant main partnerships was somewhat low while CAI was high. No association was found between HIV prevention scores and CAI at the bivariate level. Additionally, there was no significant difference by HIV status for either outcome. These findings suggest that HIV prevention conversation alone may not mitigate potential HIV transmission risk within the dyad.

The majority of respondents in this subsample indicated having a sexual agreement with their main partner. Among respondents with a sexual agreement, two thirds reported having a strictly monogamous agreement while one third reported some form of open sexual agreements. This finding is higher than the rates reported in the literature (11, 12, 14). Approximately half of respondents indicated that the length of the agreement was more than one year, which is consistent with the literature (12-14). About 12% of respondents had broken their sexual agreement within the past 12 months, which is lower than literature estimates (9, 12, 14). The type of sex participants engaged in when breaking their agreement and frequency of condom usage during agreement breaks has not been documented in the literature. However, due to the small sample size, results from this study may not be generalizable. Levels of engagement in technology-based MSM social networks varied by medium for the study sample: one third of respondents reported using social networking websites and MSM dating websites over the past 12

months while over half of respondents used mobile phone apps over the same time period. These levels of engagement were consistent with previous literature (65).

One third of respondents indicated non-injection drug usage in the past 12 months. This usage rate is lower than what has been reported in the literature (38-40). Approximately half of respondents who had used non-injection drugs reported polydrug use, as well, which is in line with the literature (38-45). The CDC perceived community tolerance of MSM score and the JHS sexual behavior stigma score indicated low levels of real or perceived stigma related to sexual orientation among participants. These findings reflect the literature, especially when considering that previous studies have found lower levels of this kind of stigma among white MSM than MSM of color (47-51, 53). In addition, participants had a neutral average HIV stigma score, indicating that they neither agreed nor disagreed that HIV-related discrimination occurred in their community. This is different from previous literature, which generally presents high levels of HIV-related stigma among MSM (53, 54). Lastly, almost 80% of participants reported one or more ACE exposures. One third of participants specifically reported childhood sexual abuse as an ACE exposure. The literature often focuses on MSM history of childhood sexual abuse instead of physical or emotional abuse. The childhood sexual abuse findings of this study are consistent with previously reported prevalence (55, 56).

Factors Associated with HIV Prevention Conversations

The second research aim was to examine the individual and interpersonal factors associated with HIV prevention conversations and CAI. A multivariate linear regression model examined the relationship between age, race/ethnicity, education level, self-reported HIV status, number of partners in the past 12 months, marital status, non-

injection drug use within the past 12 months, sexual agreement type, and mobile phone app usage in the past 12 months with HIV prevention conversation. Participants who were younger, had at least a Bachelor's degree, and had more than one partner in the past 12 months were significantly associated with higher HIV prevention conversation scores. Participants who did not have a sexual agreement had significantly lower HIV prevention conversation scores when compared to participants with a closed sexual agreement. This is an interesting finding because the majority of participants without a sexual agreement had more than one partner within the past 12 months; presumably, respondents with multiple sexual partners should have a higher HIV prevention score. However, exploratory analyses reveal that many participants, regardless of sexual agreement type, reported more than one sexual partner in the past 12 months. About half of respondents with a closed sexual agreement, and more than 80% of respondents with an open sexual agreement with or without conditions had more than one partner in the past 12 months. Consequently, it appears that having multiple sexual partners will not automatically increase a participant's HIV prevention conversation score. Participants who communicate with their partners about sexual agreements may have increased willingness to communicate in general, leading to increased HIV prevention conversation scores. Additionally, the act of giving structure and meaning to a relationship via sexual agreement discussions may indicate participants' investment in that relationship; increased investment in a relationship may lead to increased communication, including HIV prevention conversation (8, 10, 12, 15).

Factors Associated with CAI

Two multivariate logistic regressions examined the relationship between individual and interpersonal factors with CAI. Specifically, the first multivariate logistic regression tested the relationship between age, race/ethnicity, education level, self-reported HIV status, number of partners in the past 12 months, marital status, non-injection drug use within the past 12 months, sexual agreement type, and mobile phone app usage in the past 12 months with CAI. Participants who were married, had used non-injection drugs within the past 12 months, or had an open sexual agreement without conditions were 1.5 to 2 times more likely to engage in CAI than those who had not engaged in these activities. These findings are consistent with previous literature and may help explain continuing HIV transmission within the MSM community (5, 8, 12, 41-45). The second multivariate logistic regression tested the relationship between individual and interpersonal factors mentioned above in addition to length of sexual agreement, frequency of broken agreements by the participant within the past 12 months, and frequency of perceived broken agreements by the participant's partner within the past 12 months with CAI. Participants who had some college education were almost twice as likely to engage in CAI as participants with a high school education. Respondents who reported an open sexual agreement without conditions were now almost four times as likely to engage in CAI as their counterparts within a closed sexual agreement. Finally, participants who reported breaking their sexual agreement were approximately 12 times as likely to engage in CAI as participants who had not reported a broken agreement.

These analyses resulted in two important findings. First, there was potentially increased HIV transmission risk within and outside of the dyad. The highest odds of engaging in CAI were among participants who reported breaking their sexual agreement

at least once in the past 12 months followed by participants who have open sexual agreements without conditions. Approximately 75% of agreement breaks were reported by participants with a closed sexual agreement (n=44). While it is unknown if survey respondents disclosed agreement breaks to their partners, the literature suggests that the disclosure rate is low (9, 12, 14). Failing to disclose a sexual agreement break, especially within monogamous partnerships, may potentially increase risk within the dyad (10, 11). This transmission risk may be unknown to an unsuspecting partner within a monogamous pairing. On the other hand, participants who have open sexual agreements without conditions could potentially increase HIV transmission outside of the dyad. Further research is needed to understand why participants would choose to have this kind of open sexual agreement as opposed to one with conditions, such as using condoms with casual sexual partners.

Second, analyses suggested that communication could be significantly associated with CAI rates. Although HIV prevention conversations within this sample were not associated with CAI, communication via sexual agreement among the dyad was. Specifically, participants engaging in open sexual agreements without conditions were more likely to have CAI than participants in a monogamous relationship. Relationship dynamics, and the conversations which accompany them, may play a more influential role in CAI decision-making. Previous studies have found that increased levels of attachment and intimacy may increase CAI with a main partner while higher levels of primary relationship commitment, satisfaction, equality, and investment in the sexual agreement decrease CAI with casual partners (5, 7, 14, 15). Therefore, HIV prevention conversations that only include topics such as condom usage, PrEP or HIV treatment

adherence, or HIV testing may not be as salient to non-concordant dyads. This may make the intervention less effective in reducing CAI. CAI is the primary risk behavior for acquiring HIV among MSM (4, 14).

Bivariate Level Outcomes in Relation to the Literature

The following covariates were significantly associated with HIV prevention conversation at the bivariate level: age, number of sexual partners in the past 12 months, perceived community tolerance of MSM, HIV stigma score, and ACE index score. Mobile phone app usage in the past 12 months was the only interpersonal factor significantly associated with HIV prevention conversation at this level. My hypothesis that higher levels of substance use, perceived or experienced stigma, childhood adverse events, lacking sexual agreements, and engagement in technology-based dating activity would be associated with lower HIV prevention conversation scores was generally not supported by the study results. No association was found between non-injection drug use or polydrug use and HIV prevention conversation. This was surprising when considering the literature, which suggested that MSM engaging in polydrug use were less likely to disclose their HIV status (27). Two of three stigma scales were associated with HIV prevention conversation, but results show that participants who felt more stigmatized were more, not less, likely to engage in these conversations. This again is a departure from the literature, which associated higher levels of internalized homophobia and HIV-related stigma to lower rates of testing, HIV treatment, and HIV status disclosure (6, 46, 47, 51, 52, 54). Participants who experienced ACE had varying levels of HIV prevention conversation. Interestingly, those who were exposed to one ACE had the highest HIV prevention conversation scores. However, participants who had experienced two or more

ACE had lower HIV prevention conversation scores than participants with 0 or 1 ACE exposure. This finding is partially supported by the literature, which has found that higher levels of syndemic stress are associated with lower rates of HIV status disclosure (27). Although sexual agreement type was not associated with HIV prevention conversation, respondents who had an open or closed sexual agreement averaged approximately two points higher in HIV prevention conversation than respondents who had no agreement. Finally, participants who used mobile phone apps had significantly higher HIV prevention conversation scores than those that did not. Limited literature has suggested that HIV-positive individuals may feel more comfortable with disclosing their HIV status to potential online partners (67); this finding supports the idea that online environments may facilitate HIV prevention conversation.

Bivariate analyses of individual and interpersonal factors revealed marital status, non-injection drug use within the past 12 months, poly-drug use within the past 12 months, sexual agreement type, sexual agreement length, and participant breaking the sexual agreement within the past 12 months to be significantly associated with CAI. My hypothesis that higher levels of substance abuse, perceived or experienced stigma, childhood adverse events, lacking dating agreements, higher engagement in technology-based dating activity, and lower HIV prevention conversation scores would be associated with higher risk of CAI among MSM in non-concordant relationships was partially supported by study results. Study findings indicate higher levels of CAI among non-injection drug users and poly-drug users within the past 12 months, which supports the literature (41-45). Interestingly, stigma scales were not associated with CAI in this study. This may be due to the nature of the study population, the majority of whom identified as

non-Hispanic White; the literature has documented increased stigma and CAI among MSM of color (49, 50). ACE index scores were also not associated with CAI. This may be due to the nature of the measure as it encompasses verbal, physical, emotional, and sexual abuse; previous literature has only documented the association of childhood sexual abuse and CAI among MSM (55-57, 59, 60). Participants who have an open sexual agreement without conditions were more likely to engage in CAI than those with a closed sexual agreement, an open agreement with conditions, or no agreement; this is consistent with the literature (12, 14). Although not present in the literature, length of sexual agreement and frequency of participant breaking the sexual agreement were also associated with CAI. Specifically, participants with longer sexual agreements and those who had broken their sexual agreement at least once in the past 12 months had significantly higher levels of CAI than their counterparts. There was no association between engagement in technology-based dating activity and CAI. This result reflects the dissonance found in the literature, with some studies suggesting higher risk of CAI among technology users (67, 68) while other studies finding no difference (66, 69).

Limitations

This study is subject to a number of limitations. First, AMIS participants recruited online via convenience sampling may not be representative of the target population (81). Men who have sex with men without access to the internet or who do not see the banner advertisements on social media will not have an opportunity to participate, which may lower generalizability. However, convenience sampling is appropriate due to the lack of sampling frame and increased efficiency in reaching this population on a nationwide scale. Second, participant inclusion and exclusion criteria were narrow and could lead to

a lack of generalizability between the study subsample and the broader AMIS sample. The sociodemographic characteristics of study subsample participants included in this study were found to be significantly different from excluded broader AMIS sample participants. Excluded participants were more likely to be older, have higher levels of education and income, have a self-reported HIV-negative status, and have one partner in the past 12 months. Third, the survey does not differentiate HIV prevention scores if more than one main partner was indicated. However, multiple partners may influence communication patterns; this characteristic will therefore remain unexplored. Fourth, the CAI measure does not account for other forms of HIV prevention. It does not differentiate CAI among main and casual partners; respondents who reported CAI in the past year may have had CAI with main partners only while using condoms with casual partners, which is safer than not using condoms at all. The measure does not account for adherence to pre-exposure prophylaxis (PrEP or treatment as prevention (TasP) strategies either. Fifth, cross-sectional study designs do not allow researchers to infer causality between the study variables of interest, HIV prevention conversation, or CAI (81). Finally, self-reported data can be subject to several bias', including social desirability bias and recall bias (81).

Implications of Findings and Future Areas of Research and Programs

Despite these limitations, this study provides key information about the individual and interpersonal factors that may influence the frequency of HIV prevention conversation and CAI among a high-risk population. This study will fill a gap in the literature about communication among MSM non-concordant dyads. Additionally, findings from this study can strengthen HIV prevention conversation campaigns. These

interventions can incorporate additional resources for factors found to inhibit or promote dialogue. For example, CDC's "Start Talking. Stop HIV" campaign could consider adding communication elements regarding relationship satisfaction, sexual agreements, and commitment to the HIV prevention conversation repertoire. The campaign could also provide guidance on how to formally establish and maintain sexual agreements. Interventions should consider that some MSM actively choose to have multiple sexual partners as a means of increasing primary relationship satisfaction, as well. Therefore, promoting harm reduction within HIV prevention conversations could be one potential method of reducing HIV transmission; this could include promoting open sexual agreements with conditions for dyads interested in pursuing multiple sexual partners. Furthermore, it appears unlikely that HIV prevention conversation campaigns would need significant adaptation to reach populations with different HIV status. As mentioned in the methods section, sensitivity analyses reveal that respondents with an unknown HIV status use similar methods of negotiating risk as HIV-positive and HIV-negative respondents.

Finally, future qualitative or quantitative studies can focus on why certain factors hinder HIV prevention conversation or foster CAI. Specifically, further research should investigate the decision-making process of non-concordant dyads when developing and maintaining sexual agreements. These studies would further assist the development of HIV prevention interventions.

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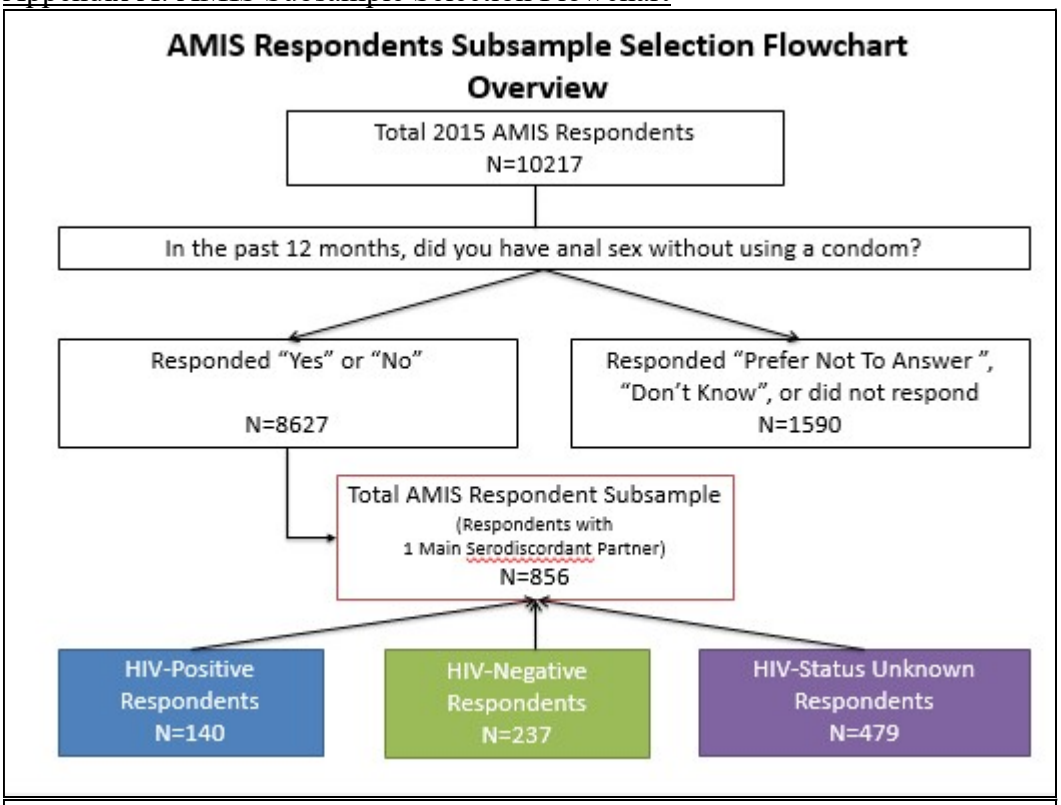
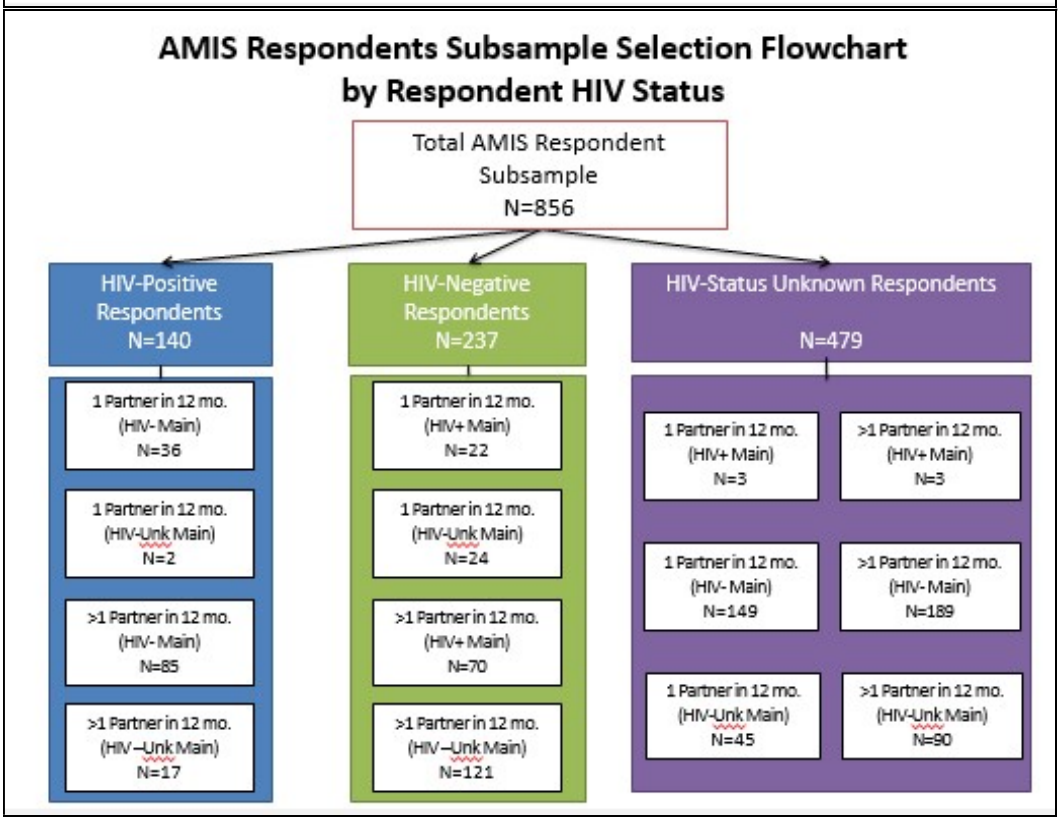
Appendix A: AMIS Subsample Selection Flowchart





Appendix B: AMIS HIV Prevention Conversation Items

Conversations with partners - HIV Positive respondents

These next questions are about conversations you may have had with your main partner.

In the last 6 months, how many times have you talked with [question("value"), id="691"] about:

	Never	1-2 times	3-4 times	5 or more times
Your antiviral medication adherence {MP_TALK1_A}	(0)	(1)	(2)	(3)
Your viral load or viral suppression {MP_TALK1_B}	(0)	(1)	(2)	(3)
Scheduling your HIV provider visits {MP_TALK1_C}	(0)	(1)	(2)	(3)
Attending your HIV provider visits {MP_TALK1_D}	(0)	(1)	(2)	(3)
PrEP to protect [question("value"), id="691"]? Pre-exposure prophylaxis (PrEP) is taking an antiretroviral pill, also called Truvada, every	(0)	(1)	(2)	(3)

day for months or years to reduce a persons chance of getting HIV. {MP_TALK1_E}				

Logic: Hidden unless: (Question "What was [question("value"), id="245"]'s HIV status?" is one of the following answers ("HIV-negative") OR Question "The last time you had sex with [question("value"), id="245"], did you know his HIV status?" #61 is one of the following answers ("No","I prefer not to answer"))

In the last 6 months, how many times have you talked with [question("value"), id="691"] about:

	Never	**1-2 times**	**3-4 times**	**5 or more times**
PrEP to protect [question("value"), id="691"]? Pre-exposure prophylaxis (PrEP) is taking an antiretroviral pill, also called Truvada, every day for months or years to reduce a persons chance of getting HIV. {MP_TALK2_A}	(0)	(1)	(2)	(3)
Your antiviral adherence to protect [question("value"), id="691"]? {MP_TALK2_B}	(0)	(1)	(2)	(3)

Consistent condom use to protect [question("value"), id="691"]? {MP_TALK2_C}	(0)	(1)	(2)	(3)
HIV testing or test results for [question("value"), id="691"]? MP_TALK2_D}	(0)	(1)	(2)	(3)
[question("value"), id="691"]refraining from receptive anal sex (bottoming)? {MP_TALK2_E}	(0)	(1)	(2)	(3)

Conversations with partners - HIV negative respondents

These next questions are about conversations you may have had with your main partner.

In the last 6 months, how many times have you talked with [question("value"), id="691"] about:

	Never	**1-2 times**	**3-4 times**	**5 or more times**
[question("value"), id="691"]'s antiviral medication adherence {MP_TALK3_A}	(0)	(1)	(2)	(3)
[question("value"), id="691"]'s viral load or viral	(0)	(1)	(2)	(3)

suppression {MP_TALK3_B}				
Scheduling [question("value"), id="691"]'s HIV provider visits {MP_ TALK3_C}	(0)	(1)	(2)	(3)
Attending [question("value"), id="691"]'s HIV provider visits {MP_TALK3_D}	(0)	(1)	(2)	(3)
PrEP to protect you? {MP_TALK3_E}	(0)	(1)	(2)	(3)
Consistent condom use to protect you? {MP_TALK3_F}	(0)	(1)	(2)	(3)
HIV testing or your test results? {MP_TALK3_G}	(0)	(1)	(2)	(3)
You refraining from receptive anal sex (bottoming)? {MP_TALK3_H}	(0)	(1)	(2)	(3)

Appendix C: CDC Stigma Items

Stigma module 1

During the past 12 months**, have any of the following things happened to you because someone knew or assumes you were attracted to men?**

	No	**Yes**	**I prefer not to answer**	**Don't Know**
You were called names or insulted {STIG_1A}	(0)	(1)	(7)	(9)
You received poorer services than other people in restaurants, stores, other businesses or agencies {STIG_1B}	(0)	(1)	(7)	(9)
You were treated unfairly at work or school {STIG_1C}	(0)	(1)	(7)	(9)
You were denied or given lower quality health care {STIG_1D}	(0)	(1)	(7)	(9)

You were physically attacked or injured {STIG_1E}	(0)	(1)	(7)	(9)

How strongly do you agree or disagree with the following statement: "Most people in my area are tolerant of gays and bisexuals."

{STIG_TOLER}

(01) Strongly agree

(02) Agree

(03) Neither agree nor disagree

(04) Disagree

(05) Strongly disagree

(07) I prefer not to answer

(09) Don't know

Most people in my area would discriminate against someone with HIV.

{HHIVDISC}

(01) Strongly agree

(02) Agree

(03) Neither agree nor disagree

(04) Disagree

(05) Strongly disagree

(07) I prefer not to answer

(09) Don't know

Variable name: SSUPPHIV

Most people in my area would support the rights of a person with HIV to live and work wherever they wanted to.

(01) Strongly agree

(02) Agree

(03) Neither agree nor disagree

(04) Disagree

(05) Strongly disagree

(07) I prefer not to answer

(09) Don't know

Variable name: EERFRHIV

Most people in my area would not be friends with someone with HIV.

(01) Strongly agree

(02) Agree

(03) Neither agree nor disagree

(04) Disagree

(05) Strongly disagree

(07) I prefer not to answer

(09) Don't know

Variable name: PPUNISHH

Most people in my area would think that people who got HIV through sex or drug use have gotten what they deserve.

(01) Strongly agree

(02) Agree

(03) Neither agree nor disagree

(04) Disagree

(05) Strongly disagree

(07) I prefer not to answer

(09) Don't know

Appendix D: JHS Stigma Items

Stigma module 2

The next questions are about things you may have ever experienced because someone knew or assumed you have sex with men.

	Yes	**No**	**Doesn't Apply**	**I prefer not to answer**	**Don't know**
Have you ever felt excluded from family gatherings because you have sex with men? {STIG_2A}	(1)	(0)	(2)	(7)	(9)
Have you ever felt that family members have made discriminatory remarks or gossiped about you because you have sex with men? {STIG_2B}	(1)	(0)	(2)	(7)	(9)
Have you ever felt rejected by your friends because you have sex with men? {STIG_2C}	(1)	(0)	(2)	(7)	(9)

Have you ever felt afraid to go to health care services because you worry someone may learn you have sex with men? {STIG_2D}	(1)	(0)	(2)	(7)	(9)
Have you ever felt that health care providers did not treat you well or gave you lower quality care because you have sex with men? {STIG_2E}	(1)	(0)	(2)	(7)	(9)
Have you ever avoided going to health care services because you worried someone may learn you have sex with men? {STIG_2F}	(1)	(0)	(2)	(7)	(9)
Have you ever heard health care providers make discriminatory remarks or gossip about you because you have sex	(1)	(0)	(2)	(7)	(9)

with men? {STIG_2G}					
Have you ever felt that the police refused to protect you because you have sex with men? {STIG_2H}	(1)	(0)	(2)	(7)	(9)

The next questions are about things you may have ever experienced because someone knew or assumed you have sex with men.

	Yes	**No**	**I prefer not to answer**	**Don't know**
Have you ever felt scared to walk around in public places because you have sex with men? {STIG_3A}	(1)	(0)	(7)	(9)
Have you ever been verbally harassed because you have sex with men? {STIG_3B}	(1)	(0)	(7)	(9)

Have you ever been blackmailed by someone because you have sex with men? {STIG_3C}	(1)	(0)	(7)	(9)
Have you ever been physically aggressed (pushed, shoved, slapped, hit, kicked, choked or physically hurt) because you have sex with men? {STIG_3D}	(1)	(0)	(7)	(9)
Have you ever been forced to have sex when you did not want to? By forced, I mean physically forced, coerced to have sex, or penetrated with an object when you did not want to.	(1)	(0)	(7)	(9)

{STIG_3E}				

Appendix E – ACE Subcategory Exposure Decision Matrix

ACE Exposure Subcategory	**Items**	**Answer Options**	**Definitions of Exposure to ACE Subcategory**
Verbal abuse (2 items)	How often did a parent, stepparent, or adult living in your home: 1. Swear at you, insult you, or put you down? 2. Threaten to hit you or throw something at you, but didn't do it?	Likert Scale ranging from (1) "Never" to (5) "Very Often"	Responses of (4) "Often" or (5) "Very Often" to either item = exposure to verbal abuse. All other responses = no exposure to verbal abuse.
Physical abuse (2 items)	Sometimes parents or other adults hurt children. While you were growing up, that is, in your first 18 years of life, how often did a parent, stepparent, or adult living in your home: 1. Push, grab, slap, or throw something at you? 2. Hit you so hard that you had marks or were injured?	Likert Scale ranging from (1) "Never" to (5) "Very Often"	Responses of (4) "Often" or (5) "Very Often" to first item and/or responses of (3) "Sometimes" to (5) "Very Often" = exposure to physical abuse. All other responses = no exposure to verbal abuse.
Sexual abuse (4 items)	During the first 18 years of life, did an adult, relative, family friend, or stranger ever: 1. Touch or fondle your body in a sexual way? 2. Have you touch their body in a sexual way? 3. Attempt to have any type of sexual intercourse (oral or anal) with you? 4. Actually have any type of sexual intercourse (oral or anal) with you?	"Yes", "No", "I prefer not to answer", or "Don't Know"	Responses of "Yes" to any item = exposure to sexual abuse. All other responses = no exposure to sexual abuse.

Battered mother (4 items)	Sometimes physical blows occur between parents. While you were growing up in your first 18 years of life, how often did your father (or stepfather) or mother's boyfriend do any of these things to your mother (or stepmother): 1. Push, grab, slap, or throw something at her? 2. Kick, bite, hit her with a fist, or hit her with something hard? 3. Repeatedly hit her over at least a few minutes? 4. Threaten her with a knife or gun, or use a knife to hurt her?	Likert Scale ranging from (1) "Never" to (5) "Very Often"	Responses of (3) "Sometimes" to (5) "Very Often" to at least one of the first two items or responses (2) "Once or Twice" to (5) "Very Often" to one of the last two items = exposure to battered mother. All other response = no exposure to battered mother.
Household substance use (2 items)	1. Did you live with anyone who was a problem drinker or alcoholic? 2. Did you live with anyone who used street drugs?	"Yes", "No", "I prefer not to answer", or "Don't Know"	Responses of "Yes" to any item = exposure to household substance use. All other responses = no exposure to household substance use.
Mental Illness in household (2 items)	1. Was a household member depressed or mentally ill? 2. Did a household member attempt suicide?	"Yes", "No", "I prefer not to answer", or "Don't Know"	Responses of "Yes" to any item = exposure to mental illness in household. All other responses = no exposure to mental illness in household.
Parental separation or divorce (1 item)	1. While you were growing up, in your first 18 years of life, were your parents ever separated or divorced?	"Yes", "No", "I prefer not to answer", or "Don't Know"	Responses of "Yes" to item = exposure to parental separation or divorce.

			All other responses = no exposure to parental separation or divorce.
Incarcerated household members (1 item)	1. Did a household member go to prison?	"Yes", "No", "I prefer not to answer", or "Don't Know"	Responses of "Yes" to item = exposure to incarcerated household members. All other responses = no exposure to incarcerated household members.