Risk Factors for Sexually Transmitted Infections and HIV in Men who have Sex with Men: Examination of a PSA Biomarker, Sexual Behaviors, and the Role of Body Image

Dissertation

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By

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Abstract

Introduction: Human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) are significant public health problems. While these diseases are associated with detrimental health outcomes in many populations, no group is more affected than men who have sex with men (MSM). Despite this, significant gaps exist in the understanding of the increased incidence of infection in this population. We examined three distinct topics that would make substantial contributions to the HIV/STI prevention among MSM literature. First, research related to HIV/STI transmission from sexual intercourse in MSM has relied on self-reports of sexual activity, which is flawed because participants may misreport behavior. A biological marker of semen exposure in rectal swabs, indicative of unprotected receptive anal intercourse (uRAI), would reduce or eliminate researchers' reliance on self-reported behavior. Second, little is known about the spectrum of sexual behaviors being practiced within the MSM community. Because of the paucity of information on the prevalence of specific sexual practices, even less is known about the risks associated with these behaviors. Third, preliminary information suggests that MSM with negative or positive body image, compared to MSM with moderate body image, may be more likely to engage in risky sexual behaviors. No prior study has examined the direct association between body image and STI in MSM.
Methods: We conducted a cross-sectional study of MSM (N=235) recruited from the Sexual Health Clinic (SHC) at an urban health department. Clinical and behavioral data

were collected from each participant. For the first aim (n=54), we quantified PSA from rectal swabs collected from MSM and compared PSA results to self-reports of unprotected RAI. For the second aim (n=231), we used data from the self-administered behavioral survey to calculate the prevalence of specific sexual behaviors and substance use in the past three months and over a man's lifetime. We used modified Poisson regression to evaluate the association between one of these behaviors, group sex, and prevalent STI. To address the third aim, participants self-administered the Male Body Attitudes Scale (MBAS) to assess body image. We used modified Poisson regression to assess whether body image is associated with prevalent STI.

Results: In our first analysis, only one (2%) rectal swab was PSA-positive and it was collected from a man who reported no uRAI in the 72 hours preceding swab collection. In our second analysis, participation in group sex in the past three months was associated with a more than two-fold (adjusted prevalence ratio (APR): 2.11, 95% confidence interval (CI): 1.13, 3.95) increased prevalence of gonorrhea, but not with chlamydia, after adjustment for race, age, and drug use. Our third analysis revealed no significant association between body image and prevalent STI in unadjusted or adjusted models (APR: 1.17; 95% CI: 0.89, 1.53).

Conclusions: Using current methods, PSA is not likely to a suitable biomarker of unprotected RAI among MSM. Group sex, which previously has been linked to risky behaviors, is strongly associated with increased prevalence of gonorrhea. Our findings suggest that group sex may act as a source of disease transmission and may be an important behavior for HIV/STI prevention messages to address. Our findings indicate that body image may not directly affect disease prevalence in MSM and may not be an appropriate target for STI prevention programs among MSM.

Dedication

For Carson and Amelia

“Everything changed the day I figured out there was exactly enough time for the important things in my life.” – Brian Andreas

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Fields of Study

Major Field: Public Health
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Chapter 1

Literature Review

1.1 Sexually Transmitted Infections and HIV among Men who have Sex with Men

Human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) are significant public health problems. According to the United States (US) Centers for Disease Control and Prevention (CDC), approximately 1.2 million Americans are infected with HIV, 20% of whom are unaware of their HIV-positive status (CDC, 2011a). In 2009, an estimated 48,100 new HIV infections occurred (Prejean et al, 2011). Since the HIV epidemic began in 1981, nearly 600,000 Americans have died of AIDS (CDC, 2011b). STIs, both bacterial and viral, affect a much larger proportion of the population than HIV. A recent CDC report indicates that 1,422,976 chlamydia cases were reported in 2012, the highest number of annual cases ever reported to the CDC for any condition (CDC, 2013). STIs are associated with substantial morbidity, resulting in significant detrimental health outcomes, including infertility, pelvic inflammatory disease, epididymitis, ectopic pregnancy (Low et al, 2006), visual impairment, stroke (CDC, 2013), cancer, neonatal infections and death (WHO, 2007).The complex synergy between HIV and other STIs, where infection with one increases risk of infection with the other (Galvin & Cohen, 2004), underscores the need for better control of these diseases.

While these diseases are of concern to a variety of populations, there is arguably no group more impacted than men who have sex with men (MSM). MSM is a broad term,

first introduced in 1992, used to describe male-male sexual behaviors and to avoid characterization of men by sexual orientation (Doll, 1992; Beyrer, 2012). According to the CDC, MSM account for approximately 4% of men in the U.S. population (CDC, 2011c).

1.1.1 MSM and HIV

Acquired immunodeficiency syndrome (AIDS) was first recognized as a new disease in the US in 1981, after clinicians reported immunosuppression among otherwise healthy homosexual men. By 1984, the human immunodeficiency virus (HIV) had been identified as the virus that causes AIDS. The new epidemic was initially concentrated in the MSM population: MSM accounted for 71% of HIV cases in the US in 1983 (Holmberg, 1996). These early high rates of HIV contributed to an already deeply held social stigma against MSM. The stigma associated with homosexuality and HIV, which persists to the current day, has important health consequences and is one factor leading to the marginalization of this population (Courtenay-Quirk et al, 2006).

Today, MSM remain particularly vulnerable to and disproportionately affected by HIV. While MSM now account for 49% (CDC, 2011e) of prevalent HIV cases (a marked decline from 1983), they are still at high risk. Of the estimated 48,100 incident HIV cases in the US in 2009, most (61%) occurred in gay and bisexual men (Prejean et al, 2011). MSM are sixty times more likely to be diagnosed with HIV than other men and 54 times more likely than women (Hall, 2008). Nearly half (44%) of HIV-positive MSM are not aware of their HIV status (CDC, 2011c). A 2010 report found an annual increase of approximately 8% in HIV infections in MSM in the US since 2001 (CDC, 2010).

Within the MSM population, the epidemic does not impact all subgroups proportionally. White MSM are the most affected subpopulation in terms of new HIV

infections, but incident rates among young black MSM are increasing substantially (CDC, 2011c). Young MSM are less likely than older MSM to know their HIV status, and MSM of color are less likely than Caucasian MSM to know their HIV status (CDC, 2011c).

1.1.2 MSM and STI

In the decade following the emergence of AIDS, the US and many other Western countries saw a widespread decline of many bacterial STIs, including syphilis. Declines were attributed to safer sex practices, selective mortality of individuals with the highest risk behavior, and effectiveness of targeted sexual health promotion and education. However, by the late 1990s, the declining trend began to reverse and some regions saw rates of STIs surpass pre-AIDS levels.

Current data indicates that 75% of primary and secondary syphilis cases in the US occur in MSM (CDC, 2013) and that syphilis incidence rates among MSM are 46 times that of other US men (CDC, 2011d). Data from notifiable disease surveillance on syphilis and from the Gonococcal Isolate Surveillance Project (GISP) suggest that some STIs in MSM are increasing (Heffelfinger, 2007; Chen, 2002; CDC, 2013). Incidence rates of primary and secondary syphilis among MSM increased 15% between 2011 and 2012 (CDC, 2013). During the same time period, the incidence of gonococcal infection among all US men increased 8%, an increase that is largely attributed to infections among MSM (CDC, 2013). Increasing STI rates are problematic not only because of the morbidity associated with them, but also because STIs and their associated behaviors increase the likelihood of acquiring and transmitting HIV (Fleming, 1999; Bernstein et al, 2010; CDC, 2013). The CDC estimates that four in ten MSM with syphilis are also HIV-positive (CDC, 2013).

While existing data indicate trends of increasing STI incidence rates, these data likely underestimate the problem. Because most national STI surveillance data do not include information on sexual behavior, national data on STIs in MSM is lacking (CDC, 2011d). Furthermore, some testing strategies may be suboptimal for detecting STIs in MSM. Testing for gonorrhea and chlamydia in MSM largely focuses on detecting urethral infections, which are more likely to be symptomatic than oropharyngeal or rectal infections (CDC, 2011d). Up to 53% of chlamydial infections and 64% of gonococcal infections in MSM are at nonurethral sites and, thus, are potentially missed and left untreated when testing is limited to urethral screening (Kent et al, 2005).

1.1.3 Factors that Increase STI/HIV Risk in MSM

Multiple characteristics likely contribute to the increased risk for HIV and STIs among MSM. Fenton & Imrie (2005) developed a conceptual framework that outlines some of the individual and sociocultural contributing factors. Individual level factors include demographics, such as race/ethnicity and economic status. Black MSM have higher rates of untreated STIs than white MSM. Similarly, HIV-positive black MSM are less likely to know their serostatus and less likely to take antiretrovirals (HIV therapy) than white MSM (Millett, 2006; Oster, 2011; Millett, 2007). Other individual factors are risk behaviors such as unsafe sex, sex for payment, increased number of lifetime sexual partners, high rates of partner change, and substance use (Koblin et al, 2006; Fenton & Imrie, 2005). On a population demographic level, the proportion of men who report sex with other men is increasing and life expectancy for HIV-positive MSM is increasing (Fenton & Imrie, 2005). This increased life expectancy results in increased prevalence of HIV within the MSM community, which increases the likelihood that uninfected members of the population will encounter it. The relatively higher prevalence of HIV among MSM

coupled with the large proportion of MSM who do not know their HIV status creates a situation where there is increased risk of unknowingly exposing oneself to infection (Fenton & Imrie, 2005, Kalichman, 2007). The sociocultural environment has also changed over the last several decades, contributing to increased risk among MSM. The "sexual marketplace" has expanded with the growth of the Internet, popularity of sex in venues (bathhouses and other locations), sex parties, and sex tourism. There are widespread reports of complacency about risk among MSM, attributed in part to the common belief that HIV treatment eliminates transmissibility (Kalichman, 2007). In addition, discrimination and homophobia are major factors in the sociocultural environment surrounding MSM and create barriers to appropriate care seeking and treatment (CDC, 2013).

MSM remain the subpopulation in the US most impacted by the HIV epidemic. A complex network of factors keeps them at high risk and contributes to increasing rates of HIV and STIs. While significant research has been done to understand epidemic dynamics within this population, there are still significant knowledge gaps (amfAR, 2008).

1.2 Validation of PSA as a biomarker of recent unprotected anal intercourse in MSM

1.2.1 Key Points

- Unprotected receptive anal intercourse is one of the most efficient methods of HIV transmission
- Research related to STI/HIV prevention usually relies on self-report of sexual activity

- Prostate-specific antigen has been validated as a biomarker of recent sexual activity in women
- Validation of a similar biomarker in men would represent a significant methodological advancement

1.2.2 Receptive Anal Intercourse

Unprotected receptive anal intercourse (RAI) is one of the most efficient methods of sexual transmission of HIV (Vittinghoff et al, 1999; Powers et al, 2008). However, transmission rates vary substantially in published reports. A 1999 analysis of RAI reported an estimated transmission rate among MSM of 0.82% per unprotected act for the receptive partner with a known HIV-infected partner and 0.27% when partners with unknown HIV status were included (Vittinghoff et al, 1999). These numbers may represent an underestimate, as the transmission rate is enhanced by multiple factors, including increased HIV viral load of the infected partner; lack of male circumcision in the susceptible partner, if he is the insertive partner; and concurrent sexually transmitted infections (Auvert et al, 2005; Gregson et al, 2002; Quinn et al, 2000; Rottingen et al, 2001). A meta-analysis of heterosexual transmission of HIV estimated the transmission rate to be 3.38% per penile-to-anal exposure, where the receptive partner was female (Powers et al, 2008), three times as high as the per-act transmission estimate for MSM (Vittinghoff et al, 1999). The reasons for the substantial difference in these estimates are not clear, but may reflect the different prevalence for MSM and women of the transmission co-factors described above, as opposed to an actual meaningful difference in risk of RAI in men and women. HIV transmission is dependent on the exchange of bodily fluids, including semen, and is substantially influenced by direction of transmission

(insertive-to-receptive or receptive-to-insertive), with receptive being much riskier (Nicolosi et al,1994; Jin et al, 2010).

1.2.3 Validity of Self-Report Data

To date, research related to HIV/STI transmission from sexual intercourse has generally relied on self-reports of sexual activity (Gallo et al, 2006). However, the validity of such data is questionable (Zenilman et al, 1995; Gallo et al, 2013); individuals may not accurately report whether, when, and how often they engage in behaviors that may place them at increased risk of disease acquisition, and thus research findings based on this self-reported information may be biased. Substantial methodological evidence has documented the threat of reporting error, especially when participants are asked to report embarrassing or socially desirable behaviors (Tourangeau & Smith, 1996). For example, a recent analysis of discordance between incident STI and self-reported sexual behavior reported that 17% of adolescent girls with a laboratory-confirmed STI reported either lifetime abstinence or recent abstinence from vaginal sex (Brown et al, 2012). Other research on self-report of numbers of sex partners found that both men and women are prone to systematic error, where men overstate their number of sex partners and women underreport theirs, with increasing discrepancy as the reference period increases (Smith, 1992). One study concluded that more than 20% of women misreport recent unprotected sex (as measured by detection of semen); either through misreport of sexual activity or through misreport of condom use (Gallo et al, 2006).

Currently, despite the recognized limitations of self-reported sexual behavior data, all large scale clinical trials of HIV/STI prevention interventions in MSM rely on self-reported information (McKirnan et al, 2010; Lu et al, 2011). Even among men who are

willing to divulge sensitive information honestly, reporting error is possible. Men may report using condoms, but may not accurately be able to report whether the condom was used correctly. They may be unaware of slippage or breakage and receptive partners may not know if a condom was used for the entirety of the sexual act. Careful classification of condom use is critical for disease prevention interventions: past research indicated that among men using a condom during anal sex, 20% did not use a condom from start to finish, 6% reported slippage, and 7% reported breakage (Crosby & Mettey, 2004). This study did not indicate whether the insertive or receptive partner reported these occurrences.

1.2.4 Prostate-specific Antigen

Prostate-specific antigen (PSA) has been used as a biomarker of recent unprotected sex in women (Gallo et al, 2006; Macaluso et al, 2007; Macaluso et al, 1999; Walsh et al, 1999). PSA (also known as y-seminoprotein, Protein E and Protein p30) is a single polypeptide with a molecular mass of about 31,000 Da. The prostate gland produces PSA and secretes it in an alkaline liquid into the urethra during ejaculation. PSA liquefies semen, which facilitates the free movement of sperm, and is instrumental in dissolving cervical mucus, allowing the entry of sperm into the uterus (Balk, 2003; Hellstrom, 1999). PSA is a major protein in seminal fluid, with a concentration of 0.5 to 2.0 mg/mL (Wang et al, 1981; Lovgren et al, 1999). The detection of PSA in vaginal fluid historically has been used in forensic medicine as evidence of recent exposure to semen, and researchers hypothesized that the presence of PSA in vaginal swabs could similarly be used as a biomarker of recent exposure to semen in sexual health research. Lawson et al. inoculated twenty women, who were at low risk for STI and who were either using birth control or planning a pregnancy, with increasing amounts of semen and

intermittently measured their vaginal fluid for three semen biomarkers. Results indicated that 100% of post-inoculation samples were positive for PSA, significantly better than the other measured biomarkers, acid phosphatase and human seminal plasma antigen (Lawson et al, 1998). A similar study inoculated forty women with three different amounts of their partner's semen and evaluated the response in the PSA signal over time. Researchers concluded that PSA is highly specific in detecting exposure to 1mL of semen in women (Macaluso, 1999; Jamshidi, 2013). Sensitivity was highest immediately after exposure (98%) and decreased over time with 92% sensitivity one hour after insemination and 29% after twenty-four hours. Specificity ranged from 91-97%, with 9% of the pre-exposure specimens testing positive for PSA and 3% of samples taken 48 hours after exposure testing positive (Macaluso,1999). Other controlled trials yielded similar results (Walsh et al, 1999). Today, PSA is considered a valid biomarker of semen exposure in women and has been used to assess reliability of self-reported sexual behavior and as a proxy measure of condom efficacy (Gallo et al, 2006; Macaluso et al, 1999; Aho et al, 2010). PSA has been employed as a semen biomarker in research related to interventions for the prevention of pregnancy and HIV/STI (Macaluso et al, 1999; Mauck et al, 2007).

We aimed to evaluate PSA as a biomarker of recent unprotected receptive rectal sex among MSM. PSA is not thought to be endogenous to the rectum and its presence in rectal fluid would not be expected in the absence of recent exposure to a partner's semen (Ajay K. Nangia, MBBS, FACS Associate Professor of Urology, University of Kansas Medical Center; written communication on June 22, 2010). However, in a study of 39 adult male cadavers, researchers detected PSA in 64% of the rectal swab specimens collected from the cadavers. Male cadavers were a mean age of 54 years (range 19-87) and had no history of sexual assault. Other sexual history was

unreported. The postmortem interval for these cadavers ranged from 2-136 days (Lunetta & Sippel, 2009). It is unknown whether the PSA was present as a result of sexual exposure or only because of post-mortem migration through the tissue connecting the prostate and rectum; however, PSA was more likely to be detected in decomposing cadavers, supporting the hypothesis of post-mortem migration. To our knowledge, no other studies have evaluated rectal specimens in men or women for PSA or other biological markers of semen. HIV/STI prevention research in women has been meaningfully strengthened by the availability of the PSA biomarker of recent unprotected sex. The need for a biomarker to replace self-report among MSM is similarly great. MSM are arguably the population in the United States most impacted by the HIV epidemic and are therefore the focus of much HIV/STI prevention research. The validation of a biological marker of unprotected sexual intercourse – one that could be measured by an assay and independent of self-report – may more accurately assess risk of HIV/STI acquisition and substantially improve the validity and reliability of prevention research, providing a significant methodological advancement.

1.3 Assessing the spectrum of sexual behaviors in MSM

1.3.1 Key Points

- "Sex" among MSM is much broader than anal sex, yet no comprehensive study has documented the spectrum of sexual behaviors in MSM in the United States.
- MSM may engage in alternative sexual behaviors (other than anal sex) as part of preference, seroadaptation, sexual identity, or other reasons.
- The relationship between most sexual behaviors other than anal sex and HIV/STI has generally not been measured.

- Sexual health research on MSM often relies on unprotected anal intercourse as a proxy for risky behavior, which may be incomplete.
- An understanding of the sexual behaviors practiced by MSM and associated risks of STI/HIV would inform future intervention strategies and improve future measures of risky behavior.

The Foundation for AIDS Research, amfAR, has identified the sexual practices of MSM as a topic in need of additional high-quality research (amfAR, 2008). While it is well-documented that MSM are at increased risk of HIV acquisition (Hall, 2008; Prejean et al, 2011) and that unprotected anal intercourse is the one of the most effective methods of sexual transmission of HIV, little is known about other sexual behaviors practiced by MSM and their associated risk with HIV and other STIs. . The Sex, Health, and Anti-Retrovirals Project (SHARP) (1999-2000) attempted to capture some of this previously undocumented behavioral data and found that many behaviors, including using a finger to provide sexual stimulation to the anus (known as “anal fingering”), using the tongue to provide sexual stimulation to the anus (“rimming”), inserting a fist into the anus (“fisting”), and sex in a public venue are engaged in by a substantial proportion of MSM in the UK (Turner et al, 2006). However, no similar work has been undertaken in the United States.

In studies of MSM, unprotected anal sex (“barebacking”) is often used as a proxy for overall risky sexual behavior (McKirnan et al, 2010; Kraft et al, 2006; Allensworth-Davies et al, 2008). While unprotected anal intercourse is a risky sexual practice insofar as it is an efficient mode of HIV transmission (Vittinghoff, 1999; Powers et al, 2008), it may also be a flawed proxy to characterize a risky profile. In many scenarios, men who

practice unprotected anal intercourse remain at very low risk for HIV/STI transmission. Disease-free MSM in mutually monogamous relationships may engage in unprotected sex with no risk of disease acquisition. Classifying these men as “risky” for research purposes is highly flawed and induces misclassification bias. MSM report many reasons for avoiding condoms, including perception of low risk for STI transmission, decreased intimacy, change of perception of HIV from fatal illness to chronic illness with the development of antiretroviral therapy, complacency about HIV in particular among young gay men who were not present for the emergence of AIDS, and rebellion against societal pressure to use condoms (Crossley, 2004). Lack of condom use does not necessarily imply risk-seeking behavior. In addition, sexual behaviors other than anal sex have rarely been acknowledged in the literature, perhaps because of societal norms or perceived right to privacy. It is plausible that other behaviors practiced by MSM, alone or in conjunction with unprotected anal intercourse would serve as usefulbehavioral markers for risk.

1.3.2 Subcommunities within the MSM Population

Choice of sexual behavior may be influenced by identification of oneself as part of a specific subcommunity (Moskowitz, 2011). Research suggests that the MSM community, like all heterogeneous population groups, is made up of many different, and sometimes overlapping sub-communities, which differ with respect to perceptions of sex, sexuality, and risk; sociodemographics; sexual practices; behavioral norms; and risk of HIV (amfAR, 2008; Moskowitz, 2011). Three of the largest sub-communities are defined by self-identification of sexual orientation: heterosexual, homosexual, and bisexual (amfAR, 2006). Other sub-communities are narrower, defined by a specific set of behavioral norms, for example the “leather community.” Still other sub-communities are

defined by HIV status. Membership in one community does not preclude membership in another, and men often incorporate the traits of multiple communities into their own identities. While specific behaviors transmit HIV from infected to susceptible MSM, these behaviors may be more or less prevalent within specific communities, such that sexual identity may act as a marker of risky behavior (amfAR, 2006).

1.3.3 MSM and Seroadaptive Behavior

While some MSM participate in specific sexual behaviors due to sexual desire or identity, others may engage in specific practices in a 'harm reduction' effort, that is, behavior undertaken specifically to reduce the risk of HIV transmission. Such harm reduction may be motivated by a fear of HIV acquisition or, in men who are HIV-infected, in order to protect their HIV-negative partner(s). This collection of risk reduction behaviors has been termed "seroadaptation". Seroadaptation can be split in to "serosorting", which refers to choosing sex partners with concordant HIV status, and "seropositioning", which refers to choosing specific sexual behaviors based on serostatus (Breyer, 2012). Some specific seropositioning acts may include condom negotiation, position negotiation, or behavior selection (Snowden et al, 2009). A study of serodiscordant MSM couples (i.e., one partner HIV positive and one partner HIV-negative) revealed that these couples engaged in oral sex for 65% of sexual episodes to lower their risk of HIV transmission (McFarland et al, 2011). Other HIV-infected men elected to engage in receptive anal intercourse instead of insertive to lower risk of transmission to partners ("strategic positioning") (Van de Ven et al, 2002). Some men report abstaining from anal sex entirely due to its documented higher risk and instead engage in other behaviors that are perceived to carry lower risk of disease (Snowden et al, 2009, McFarland et al, 2011). It is the perception of most people that "normal" sex for

MSM is anal intercourse, but that may not be accurate (Reisner et al, 2009). With men self-selecting alternative behaviors because of perceived lower HIV/STI risk, it is important to understand whether such behaviors are, indeed, associated with lower risk of disease. Some alternate behaviors may actually increase risk, as some partner or sex-act choices lead to lower condom use (Gorbach, 2011).

The absence of information on the spectrum of sexual practices is noteworthy. Klein (2011) documented the lack of scientific information available on sucking or eating semen out of a partner's anus ("felching"). In a subsequent study, Klein found that 16.5% of MSM recruited from men seeking unprotected intercourse with other men via the internet expressed desire to find a felching partner and that these same men were more likely to engage in other behaviors traditionally deemed high risk, namely unprotected anal or oral sex, sex while high on drugs or alcohol, and group sex (Klein, 2011). This study highlights the need for similar information to be collected on other understudied behaviors and to further evaluate any association with disease transmission.

In this project we investigated several categories of sexual behavior we hypothesized may be associated with increased HIV/STI prevalence in MSM: receptive/insertive behaviors such as anal fingering, fisting, and use of sex toys; sexual practices that do not include receptive/insertive behavior such as rimming, felching, and snowballing; venues where sexual activity or its solicitation occurs; and sexual activity involving substance use.

1.3.4 Insertive/Receptive Behaviors

The UK Gay Men's Sex Survey, conducted in 2002, found that nearly 13% of respondents had engaged in fisting within the previous twelve months. Among men who had receptive anal intercourse, men who reported being the receptive partner during

fisting were more likely to report no condom use during RAI than men who reported being the receptive partner but had not been fisted (Hickson et al, 2003). A US study found a similar prevalence, with 15% of men at a sex resort reporting fisting, either as the insertive or receptive partner (Crosby & Mettey, 2004). Published case studies highlight serious complications that can result from fisting, including colorectal perforation and even death (Cohen, 2004). Fisting may also increase risk of rectal abrasions, increasing risk of transmission of bloodborne pathogens, including HIV and hepatitis B and C viruses (Schmidt et al, 2011). The documented complications from fisting likely apply to other insertive/receptive sexual behaviors, including use of sex toys and enemas. Sounding (inserting a "sound," a knitting needle-shaped implement, into the urethra) and use of catheters as part of a sexual experience likely carries risks as well, including abrasions to the urethral walls.

The non-use of lubricant can increase the risk associated with insertive behaviors, particularly RAI. Non-use of lubrication during anal sex may promote condom breakage or slippage or, in the absence of condoms, increase penile or rectal abrasions (Royce, 1997). Estimates vary considerably regarding the prevalence of lubricant use. A 2007 study reported 89% of US MSM always using lubricant during RAI (Carballo-Dieguez, 2007) whereas a 2012 study found that 36% of US MSM reported consistent lubricant use in the past month (Gorbach et al, 2012). However, while lack of lubrication is associated with some negative outcomes, use of certain lubricants can also be problematic. Recent research indicates that water-based lubricants, such as KY Jelly and Astroglide, and silicone lubricants, such as Gun Oil and Wet Platinum, may be associated with higher STI prevalence, although whether this is biologically increased susceptibility to STI because of chemical effect of the lubricant, or a proxy for increased sexual frequency and possible STI exposure, is not known (Gorbach et al, 2012). Use of

saliva as a lubricant is common, reported by up to 87% of MSM as a lifetime exposure, which could be associated with transmission of saliva-borne pathogens (Butler et al, 2009).

1.3.5 Non-Insertive Sexual Behaviors

While receptive/insertive sexual behaviors are associated with several risks, non-insertive sexual behaviors may also be associated with HIV/STI risk. However, little research has been published which quantifies the prevalence of these behaviors or the risk of disease associated with them. One such behavior is felching, which was reported as a desired activity among one-sixth of MSM who engage in unprotected sex (Klein, 2011). However, this study was conducted among MSM expected to be at high risk of infection -- men seeking partners on the Internet who would be willing to engage in unprotected anal intercourse – and reflects desires rather than actual activity. The results may not be generalizable to the general population of MSM. Felching involves oral exposure to semen, which may contain HIV or other pathogens. While HIV transmission through oral exposure to semen is low, it is not zero (Campo et al, 2006). Oral exposure to semen also carries a substantial risk of transmission of other STIs including gonorrhea. Another non-insertive behavior is exposure to urine during sexual acts ("watersports"). Sixteen percent of respondents of the UK Gay Men's Sex Survey endorsed watersports in the last twelve months (Hickson et al, 2003), but it is largely undocumented among US MSM. Other sexual behaviors, including rimming, snowballing (oral exchange of semen between partners), and scatalogia, have also never been characterized in MSM in the US.

1.3.6 Group Sex

While some sexual behaviors are specific acts that occur as part of a sexual experience, other sexual behaviors, such as group sex, define the sexual experience. Group sex is a broad term describing sexual acts involving more than one person at a time, and may include threesomes, spontaneous group sex, or organized sex parties (Grov, 2013). Group sexual encounters (GSE) are a potential factor in STI transmission for several reasons (Phillips, 2013; Friedman, 2008; Mimiaga, 2011). First, men who participate in GSE may be men who engage in risky behaviors, even without their GSE participation. A recent analysis concluded that MSM who participate in GSE are more likely to be HIV-positive, report drug use in the past three months, and report unprotected anal intercourse in the past three months, compared to MSM who do not participate in GSE (Grov, 2013). Qualitative research also demonstrated that MSM participating in GSE worried less about HIV acquisition and valued pleasure over safety (Sowell et al, 1998). Second, high risk behaviors often occur as part of a GSE. Several studies have found high rates of unprotected anal intercourse, alcohol and drug use during GSE (Mimiaga, 2010; Phillips, 2013; Prestage et al, 2008). The "Three or More Study" (TOMS), a large study of GSE among Australian MSM, found that unprotected anal intercourse during GSE is more prevalent among HIV-positive MSM (Prestage et al, 2008). Third, the dynamics of GSE allow for an individual to be exposed to multiple potential sources of disease in a very short period of time, increasing the likelihood of STI acquisition.

1.3.7 Venue

Venue-based characteristics of where and how men meet create environments that can significantly impact negotiation of and participation in risky behaviors (Grov et al, 2007; Pollock & Halkitis, 2009).The Internet, bathhouses, sex resorts, bars and clubs,

public cruising, circuit parties, and private sex parties have all been reported as sites for MSM to meet sex partners (Grov et al, 2007; Crosby & Mettey, 2004). Venue has been associated with HIV status, drug and alcohol use, group sex, HIV disclosure, sexual behavior, and use of other venues for meeting partners (Grov, 2011; Crosby & Mettey, 2004; Mettey et al, 2003). While venue may not have a direct biological effect on HIV/STI risk, specific venues may be associated with specific risky behaviors (e.g. anonymous sex at bathhouses) or may be associated with disease prevalence among potential partners, and, therefore, venue is an epidemiological marker of sexual risk-taking. Increasing HIV incidence rates among MSM, have led to a need for identification of locations associated with increased risk (Navejas, Neaigus, Torian, & Morrill, 2011).

1.3.8 Drug Use

For the first 25 years of the HIV epidemic, researchers ignored the risk of sexual transmission of HIV among drug users, believing the primary route to be parenteral (Celentano et al, 2008). However, newer research reveals that sexual risks and drug use are often entangled (Celentano et al, 2008). Many drugs, including ecstasy, crystal methamphetamine, cocaine, ketamine, nitrous oxide ("whip-its"), and amyl or butyl nitrates ("poppers") have been independently tied to risky sexual behavior in MSM (Celentano et al, 2008; Cohen, 2004; Fisher et al, 2006). These substances, termed "party drugs" or "club drugs" may increase the duration of sex or increase men's willingness to engage in certain sexual behaviors (Cohen, 2004; Crosby & Mettey, 2004), such as condom non-use (Carey, 2008). Methamphetamine, in particular, is associated with libido enhancement, loss of time reference, decreases in inhibition and control, and may lead to prolonged sexual behavior with multiple partners (Celentano et al, 2008) or highly aggressive sexual encounters (Fisher et al, 2006). Amyl or butyl

nitrates relax sphincter muscles (Romanelli & Smith, 2004), allowing for easier penetration of the anus by the penis or other insertive body. Recreational sildenafil (Viagra) use, which leads to increased erection size and longer duration of intercourse, was endorsed by 15% of MSM at a large sex resort in the southern United States (Crosby & Mettey, 2004). Sildenafil has been associated with amphetamine use (Fisher et al, 2006) and amyl or butyl nitrates (Celentano et al, 2008). This combination of drug use and sexual activity is of particular concern because increased erection size and increased duration of sex could lead to damaged penile or rectal tissue, increasing risk for transmission of STIs and HIV. While research (Cohen, 2004; Crosby & Mettey, 2004) has documented the association between party drugs and risky sexual behaviors, little research has evaluated the direct relation between party drugs and STI/HIV prevalence (Hirschfield, 2004). An additional drug potentially affecting sexual behavior and HIV/STI risk is PrEP, or HIV pre-exposure prophylaxis, which has been approved for use by the US Food and Drug Administration. PrEP protocols require HIV-negative individuals who are at high HIV risk to take daily antiretroviral medication to lower the risk of HIV infection at the time of exposure. Concerns about more widespread PrEP use include behavioral disinhibition (decreased fear of contracting HIV, and thus engaging in riskier behavior) and HIV resistance (Buchbinder & Liu, 2011).

While existing data indicate that a variety insertive/receptive, non-insertive, and substance use-related behaviors are occurring in the MSM community, there is no existing research that has characterized the type, prevalence and frequency of alternative behaviors nor quantified the disease risks associated with these behaviors. The studies that have assessed many of these behaviors are limited by sampling MSM expected to engage in high risk behaviors, such as those seeking unprotected anal intercourse via internet chat rooms (Klein, 2011) or attending a “sex resort” (Crosby &

Mettey, 2004), or because of small sample size (Schmidt, 2011). Increased knowledge of the prevalence of these behaviors, and their associations with STI/HIV, in a more general MSM sample could provide valuable information as to whether these are appropriate behaviors to target in future disease prevention efforts. Knowledge of these behaviors could also contribute to a more accurate definition of "risky sex," to avoid the current reliance on unprotected anal intercourse as the primary marker of high risk behavior (McKirnan et al, 2010; Kraft et al, 2006; Allensworth-Davies et al, 2008).

1.4 Examining body image in MSM as a predictor of prevalent STI

1.4.1 Key Points

- MSM are more prone to body dissatisfaction than men who have sex with only women.
- MSM may value appearance and body strength more than other men.
- There is a hypothesized, but understudied, relationship between body image and sexual risk behaviors in MSM.
- No research has evaluated the relationship between body image and STI/HIV, highlighting the need for study of this potentially important risk factor.

1.4.2 Body Image

"Body image" refers to an individual's own subjective experiences of their appearance. Research over the last several decades has revealed that this concept is more psychosocially powerful than the objective reality of one's appearance (Cash, 2004). It is a concept that encompasses the multiple perceptions, attitudes, beliefs, thoughts, and behaviors one has about his/her body (Cash, 2004; Gillen et al, 2006).

Body image has been conceptualized as having two components: orientation (also termed investment or preoccupation) (Tylka, 2005), defined as investment in one's appearance, and satisfaction, defined as overall evaluation of one's body (Gillen et al, 2006; Tylka, 2005). Researchers have noted the importance of distinguishing these two components, as some individuals may have high satisfaction, but also high preoccupation, which may be indicative of a disordered body image (Thompson, 2004).

A variety of conceptual frameworks have been proposed for understanding body image, including the cognitive-behavioral model, genetic and neuroscientific model, and sociocultural model (Cash & Smolak, 2011). According to the cognitive-behavioral model, a host of factors, both developmental and proximal, combine to shape an individual's body image**.** The genetic and neuroscientific model claims that some individuals are at increased susceptibility to develop poor body image, due to genetic or neurological differences, such as specific genetic differences or abnormalities in areas of the brain, from those without poor body image. Finally, the sociocultural model claims that satisfaction or dissatisfaction with one's body image is a function of the extent to which one meets societal ideals which have been internalized by the individual (Cash & Smolak, 2011).

Historically, research on body image has focused on women and adolescent girls and their desire to be thinner (Pope, Phillips, & Olivardia, 2000), often manifesting in eating disorders (Cash & Pruzinsky, 2002). A 1995 representative survey of American adult women revealed that nearly 50% of women had a negative body image, with respect to appearance evaluation and overweight preoccupation (Cash & Henry, 1995). This high prevalence is similar to other findings and underlies the idea that body dissatisfaction in women has become so prevalent in society that it has become normative (Cash & Henry, 1995).

1.4.3 Body Image in MSM

Research and cultural attention regarding men's body image has increased substantially since 2000 (Filiault & Drummond, 2009; Tylka 2005). However, the body image issues specific to MSM have remained less examined, despite multiple peer-reviewed reports of distinct differences in body image between homosexual and heterosexual men. *Chasing Adonis* highlights the unique nature of body image in gay men and reveals the destructive role it plays in the gay community (Bergling, 2007). The differences between gay men and heterosexual men with respect to body image were evaluated by a meta-analysis that synthesized 27 studies (N=5220) and concluded that gay men are more prone to body image dissatisfaction (Morrison, Morrison, & Seger, 2004). MSM may consider appearance more central to their sense of self (Silberstein, 1989) and may be more fearful of becoming fat (Kaminski, 2005). Despite the recent recognition that disordered body image may exist in men generally and in MSM specifically, significant gaps exist in the current literature. The majority of body image research among MSM has assumed homogeneity among MSM, without attention to the role of race/ethnicity or SES (Filiault & Drummond, 2009).

Multiple explanations have been proposed for the higher prevalence of body image dissatisfaction in MSM. One long-held theory attributes the dissatisfaction to the prominence of physicality among gay men (Epstein 1996; Siever 1994). Some propose this physicality has been a response to the AIDS epidemic (Epstein, 1996) and the stigmas associated with phobias of homosexuality and AIDS (Herek et al, 2002), implying that MSM strive for a strong, muscular physique that defies the stereotype of the AIDS patient. Other researchers have suggested that body image dissatisfaction among MSM is due to high HIV prevalence and related high prevalence of use of

HAART (Highly Active Antiretroviral Therapy). Lipodystrophy, which includes fat atrophy and hypertrophy throughout the body (Guaraldi et al, 2008), is a common side effect of HAART (Ammassari et al, 2002; Santos et al, 2005). . However, this theory has been refuted by a single published comparison of body image in HIV-positive and HIV-negative gay men, which found no significant differences in prevalence of body image dissatisfaction (Blashill & Vander Wal, 2011).

1.4.4 Body Image and Sexual Risk Behaviors

Much of what is known about the relation between body image and risky sexual behavior comes from research on women. Some research has concluded that body image impacts sexual risk behaviors in women by affecting confidence and security. Women with a negative body image report more anxiety about intimacy and increased concerns about being judged as worthy by significant others (Cash, Theriault, & Annis, 2004). This anxiety could lead to a lack of comfort or confidence in sexual interactions or self-consciousness of one's body during sex (Ackard et al, 2000; Cash, Maikkula, & Yamamiya, 2004). It may also result in lower confidence in negotiating condom use (Wingood et al, 2002). This anxiety may manifest itself through use of sexual activity as a strategy to secure a relationship (Littleton, 2005) or through substance use (Striegel-Moore & Huydic, 1993), which, in turn, may be associated with increased engagement in risky sexual behaviors (Santelli et al, 2001; Wingood & DiClemente, 1998). An analysis of the 2005 Youth Risk Behavior Surveillance Survey (YRBSS) revealed that sexually active girls who perceived themselves as overweight were more likely to initiate sex before age thirteen (Akers et al, 2009). Body dissatisfaction (Wingood et al, 2002) or overweight misperception (Akers, 2009) has been associated in women with both unprotected sex (Wingood et al, 2002; Akers 2009; Littleton 2005) and fear of

negotiating condom use (Wingood et al, 2002). Negative body image in women has also been associated with having multiple sex partners and having sex after using alcohol or drugs (Littleton, 2005).

1.4.5 Body Image & Sexual Risk Behaviors in Males and MSM

Among all men (not limited to MSM), research evaluating the relation between body image and risky sexual behavior has produced mixed results. Positive body image in men may boost males' confidence in sexual situations where they may already feel pressure to fulfill the traditional masculine ideal of sexual risk-taker and decision maker (Shearer et al, 2005). This increased confidence may be manifested in higher numbers of sexual partners or decreased condom use (Gillen, 2006). However, other research has proposed that *poor* body image in men may be related to increased prevalence of risky sexual behaviors, as poor body image has been associated with low self-esteem (Beren et al, 1996) and depression (NIH, 2004). Depression and low-self-esteem may lead to use of sexual encounters as a coping strategy (Martin & Knox, 1997). For example, Bancroft et al (2003) reported that 24% of gay men reported increased sexual interest when they experienced anxiety and 14% of gay men reported reduced concern about sexual risk when depressed (Bancroft, 2003).

Research examining the relation between body image and sexual risk behaviors in MSM, specifically, has also produced mixed findings. One analysis revealed an association between body image and anal sex in MSM (Kraft, 2006), meaning that MSM with positive body image were more likely to engage in anal sex with or without condoms. Other research concluded that positive body image was associated with increased unprotected receptive anal intercourse (Meanley, 2013). Conversely, another study found that MSM with high body satisfaction were *less* likely to report unprotected

anal intercourse (Allensworth-Davies, 2008). Similarly, a study of black MSM found that men with poor body image were less likely to use condoms during anal intercourse (Wilton, 2009). However, the measures used by Allensworth-Davies et al. (2008) and Wilton (2009) were crude, assessing body image satisfaction through a single question.

While an increasing body of research has documented the prevalence of body image disorders in MSM (Morrison, Morrison, & Seger, 2004), and examined its association with risky behaviors (Wilton, 2009; Allensworth-Davies, 2008; Kraft, 2006), none, to our knowledge, has examined its direct association with prevalent HIV/STI. We hypothesized that both MSM with poor body image, and those with better body image, would have increased prevalence of STI compared to MSM with average body image. An understanding of the relationship between body image and HIV/STI could potentially identify body image as a target for public health STI-reduction interventions.

To explore these gaps in the literature on STI/HIV risk factors among MSM, we conducted a cross-sectional study in an urban, public STD clinic in a Midwestern US city. Our study had three aims:1) to determine if prostate-specific antigen (PSA), collected via rectal swab, serves as an appropriate biomarker of recent semen exposure in MSM who report recent receptive anal intercourse; 2) to quantify specific sexual behaviors being practiced in the MSM community and, subsequently, to evaluate the association between these behaviors and STI/HIV prevalence; and 3) to evaluate the association between body image dissatisfaction and STI/HIV prevalence among MSM. As a whole, this project aims to improve the sexual health of MSM with a multi-disciplinary, translational approach.

Chapter 2

Methods: The Men and Sexual Health (MASH) Study

We conducted a cross-sectional study of MSM presenting for care at a metropolitan public sexual health clinic. The study, titled “Men and Sexual Health” (MASH), was conducted between July 2012 and October 2013.

2.1 Study Setting

This study was conducted in the walk-in Sexual Health Clinic (SHC), an STD clinic housed within the city public health department. The health department has a range of programs providing clinical, environmental, health promotion, and population-based service, an annual budget of approximately $46 million, and 400 full- and part-time employees.

The SHC has an on-site, CLIA-certified laboratory that processes approximately 120,000 tests per year. Services include testing for gonorrhea, chlamydia, bacterial vaginosis, trichomoniasis, syphilis, and HIV.

2.2 Study Population

Previously published data reveal that the SHC has approximately 10,000 patient visits annually. It is estimated that approximately 60% of SHC patients are male, of whom 13% report anal sex in the past year. Patients (both male and female) are a mean age of 29 years and most are black (60%) or white (29%) (Norris Turner, 2011).

A man was eligible for MASH if he was 18 years or older, was at the clinic for a visit that included STI testing, spoke and read English, and reported having receptive or insertive anal sex with another man within the past year. To be eligible for Aim 1, which evaluated PSA as a biomarker, men were required to report receptive anal intercourse in the past two weeks in addition to meeting all other eligibility criteria (Table 2.1).

Table 2.1 Eligibility Criteria for MASH Study

ELIGIBILITY CRITERIA	OVERALL STUDY	AIM 1: PSA	AIM 2: Specific Behaviors	Aim 3: Body Image
Male	X	X	X	X
Age 18+	X	X	X	X
Clinic Visit included STI/HIV Testing	X	X	X	X
Reads English	X	X	X	X
Speaks English	X	X	X	X
Reports anal sex with another man in the previous year	X	X	X	X
Reports receptive anal intercourse in previous 2 weeks		X		

2.3 Recruitment & Retention

Participants were recruited by MASH staff when they presented for care at the SHC. Per normal SHC protocol, men are assigned an appointment time in the order that they check in at the clinic. They are instructed to return to the clinic at least fifteen minutes prior to their scheduled appointment time. MASH staff spoke with each man during the fifteen-minute waiting period prior to his appointment. After calling men back to the MASH interview room, study staff provided a brief description of the study and administered the eligibility questionnaire (Appendix A). No personal identifiers were collected on the Eligibility Questionnaire. The Eligibility Questionnaire purposely asked several questions not related to eligibility, so that screened men would not be able to determine what criteria were being

used to include or exclude potential participants. This was important to protect the confidentiality of participants, so that participation would not identify a man as MSM.

If a man expressed interest and met all eligibility criteria, he underwent the informed consent process and provided written informed consent for the study. Study staff asked men to consent to participation in the questionnaires; collection of additional rectal swabs, as required for Aim 1; and to allow study staff to access and extract data from his medical record (EHR). Men who consented to the study were also asked to sign a HIPAA research waiver to allow study staff to access EHRs to extract relevant information for the purposes of the research.

We assigned a participant identification number (PIN), which was recorded on all subsequent study materials, to all men who consented to study participation. A paper Study ID Log linked each man's PIN with his medical record number (MRN), and served as the only link between the PIN and personally-identifying information.

2.4 Sample Size

We aimed to enroll a convenience sample of 500 men. Of these, we expected that at least half (n=250) would have a history of *receptive* anal intercourse and would participate in the PSA analysis, as described in Chapter 4.

2.5 Data Collection

We collected two types of data: 1) survey data; and 2) clinical data.

2.5.1 Survey Data

The questionnaire (Appendix B) was administered after the participant's clinical exam, in the window of time that he was required to wait at SHC for results of HIV and

syphilis testing. The questionnaire was divided into two parts. The first part was administered by a trained MASH staff member using REDCap (Harris, 2009), a secure web application designed for capturing research data. The second part, which assessed the most sensitive information, was a computer-assisted self-interview (CASI), also completed using REDCap (Harris, 2009). The questionnaire assessed demographic characteristics, sexual history and identity, sexual behaviors, substance use, select mental health conditions (depression and anxiety), and body image.

2.5.2 Clinical Data

MSM seen at SHC are routinely tested for HIV, syphilis, urethral gonorrhea, and urethral chlamydia. Men who report receptive anal intercourse in the last year also undergo testing for rectal gonorrhea and chlamydial infection; those who report oral sex undergo oropharyngeal screening for gonorrhea infection. Depending on reported risk factors and symptoms, men may also be tested for trichomoniasis, herpes simplex virus (HSV), and Hepatitis C. Results from these tests are entered into CPH electronic health records; these results were extracted using a standardized data collection sheet (Appendix C) and subsequently linked with survey data from the REDCap questionnaire (Appendix B) for analysis. Each man was compensated $10 in cash for his participation in MASH.

Data collection methods, specific to individual aims, are included in Chapters 4, 5, and 6, of this document.

2.6 Data Analysis

Statistical analyses were conducted using SAS (Version 9.2, Cary, NC).

Aim-specific statistical methods are detailed in Chapters 4, 5, and 6. Methods used to generate overall results (Chapter 3) are included below.

We calculated simple frequencies of participant characteristics, including demographics, sexual profile variables, self-report of behaviors and substance use, and body image variables.

2.6.1 STI Status

We computed the prevalence and 95% confidence intervals (CIs) of gonorrhea and chlamydial infection, overall and by anatomical site, and prevalence of primary, secondary, and latent syphilis. We created a composite STI variable, in which any man who tested positive for gonorrhea, chlamydia, or primary/secondary syphilis, regardless of site of infection, was coded as STI-positive and any man who tested negative for gonorrhea, chlamydia, and primary/secondary syphilis was coded as STI-negative.

2.6.2 HIV Status

We calculated HIV prevalence using two methods. “Known HIV status” was defined as the status that men *thought* they had at time of study participation. Because men completed the study questionnaires in the window of time between their clinical exam and receiving results, test results from the date of participation were not included. For “known HIV status”, men were classified as HIV-positive if they had a positive HIV test in their EHR from a previous visit or if they self-reported being HIV-positive to the clinician. Men were classified as HIV-negative if they had no history of a positive HIV test, either because they had always tested negative or because they had no history of being tested.

"Biological HIV status" was defined as a man's actual HIV status, including results from the test performed on the date of study participation. Men were classified as HIV-positive if they had ever received a positive HIV result, which could have been extracted from the EHR or obtained through self-report by the participant. Men were classified as HIV-negative if they had only ever received negative HIV results. Men who had never been tested for HIV were coded as "missing".

2.6.3 Body Image

We assessed body image with the Male Body Attitudes Scale (MBAS). The MBAS, which was developed for use among men (Tylka et al, 2005) and has been validated in a sample of gay men (Blashill & Vanderwal, 2009), consists of 24 total questions administered as three subscales focused on body fat, muscularity, and height dimensions (Tylka et al, 2005). The total MBAS score assesses overall body attitudes, and subscale scores capture attitudes for each specific dimension. Both the overall scale and each subscale are scored on a 6-point Likert scale, where higher scores indicate poorer body image.

2.6.4 Depression

We screened for depression using a modified Patient Health Questionnaire -2 (PHQ-2) (Kroenke, 2003). We provided contact information for mental health resources to any man who responded affirmatively to either of the two items.

2.6.5 Sexual Behaviors and Substance Use

We assessed sexual behaviors and substance use within the past three months and over the course of participants' lifetime. The questions used for assessment,

including definitions of each behavior, are available in the MASH Questionnaire (Appendix B).

2.6.6 Bivariate Associations

Unadjusted associations were calculated between individual behaviors and prevalent STI using modified Poisson Regression (Zou, 2004). Modified Poisson regression, which has a robust error variance, is appropriate for estimation of the relative risk in the presence of a common outcome (Zou, 2004). Each relationship was calculated among the entire sample and separately for HIV-positive and HIV-negative participants. A Z-score and p-value, as provided in modified Poisson Regression, were calculated to assess whether the association differed significantly between HIV-positive and HIV-negative men. Modified Poisson regression was also used to calculate the unadjusted associations between specific behaviors and known HIV status.

Chapter 3

MASH: Overall Results

3.1 Enrollment

Between July 2012 and October 2013, a total of 1,866 men presenting to the SHC were screened for study eligibility. As our protocol indicated, we screened all men presenting to SHC for STI testing, regardless of any *a priori* information on sexual behavior, including the sex of men's sexual partners. The overwhelming majority of men screened were not eligible because they did not report anal sex with men in the past year (99%, n=1,568). Other exclusions were due to underage status (n=13) or inability to speak English (n=10). Of the 1,866 screened, 286 men met eligibility requirements for Aims 2 and 3. Of the 286, 79 met eligibility requirements for Aim 1. In total, 235 MSM consented to participate in the study, of which 54 were enrolled in Aim 1. Fifty-one additional men met eligibility criteria for the overall study but chose not to enroll due to time constraints or lack of interest.

We enrolled substantially fewer participants than we anticipated, with a final sample size of 235 compared to our projected sample size of 500. In general, our low enrollment numbers are due to a smaller sampling frame than we anticipated during the study design process. Previous research completed at SHC indicated that approximately 10,000 patients are seen each year, of which 59% are male (Norris Turner, 2011). Thus, we projected that MASH could screen approximately 2900 men

over the course of six months. In sharp contrast, we screened 1866 over the course of fifteen months. During the enrollment period, SHC went through several periods of understaffing, thus decreasing the number of patients seen per day, which decreased our sampling frame. It is also possible that, despite a full-time presence by MASH staff, some men missed screening due to error or limited staffing (e.g. Often, only one MASH staff member was present, so men may have been missed if several men required screening at the same time). Of men screened (n=1866), 15% met eligibility criteria, which is similar to our projected eligibility rate of 13%, which was based on previous literature (Norris Turner, 2011). Of those eligible (n=286), we were successful in enrolling 82% (n=235).

3.2 Description of Sample

3.2.1 Demographics of Sample (Table 1)

Participants (n=235) had a median age of 26 years, and the majority were white (57%). Most men had completed at least some college (71%) and were currently employed (73%). Sixty-one percent were not in a committed relationship. A large minority (43%) were depressed according to the PHQ-2 (Kroenke, 2003).

3.2.2 Sexual Behaviors (Table 2)

Participants predominantly self-identified as gay (76%) or bisexual (14%). Sixty-five percent reported sexual attraction to only men and another 24% were sexually attracted to mostly men, but sometimes women. When asked about sexual position in the last 12 months, 37% reported being exclusively or mostly a “top”, 34% as half “top” and half “bottom” (versatile), and 27% as mostly or exclusively “bottom”. Two-thirds of participants reported that all or almost all of their friends and family knew that they had

sex with other men. Median “gay age”, defined as years since first acting on sexual attraction to men, was 10 years (interquartile range (IQR): 5-18 years). Median number of sexual partners over the lifetime was 25 (IQR: 14 -100 partners), which was very similar to the median number of *male* sexual partners over the lifetime (median: 23, IQR: 11-75 partners). When asked about number of sexual partners in the last 12 months, men reported a median of 4 partners (IQR: 3-8 partners), which did not differ from the median report of *male* partners in the last year (median: 4, IQR: 2-8 partners). Over the lifetime, 10% of participants reported never or almost never knowing their partner’s HIV status. A majority, 78%, reported no specific sexual community, although 6% reported being a part of the “bears” community and 5% part of the “kink” community.

3.2.3 STI and HIV Prevalence (Table 3)

The prevalence of urethral gonorrhea and chlamydial infection was 9% (95% confidence interval (CI): 5%, 13%) and 6% (95% CI: 3%, 9%) , respectively. The prevalence of rectal gonorrhea was 15% (95% CI: 10%, 19%) and rectal chlamydial infection was 17% (95% CI: 12%, 21%). Two percent (95% CI: 0%, 4%) of men tested positive for oropharyngeal gonorrhea. Across all anatomical sites, 18% (95% CI: 13%, 23%) of men had gonorrhea and 19% (95% CI: 14%, 24%) of men were infected with chlamydia. The sample had low prevalence of syphilis, with only 12 cases (5%) of primary or secondary infection and 13 cases (6%, 95% CI: 3%, 8%)of latent infection. In total, 35% (95% CI: 29%, 41%) of enrolled men tested positive for gonorrhea, chlamydia, or syphilis infection, and were treated as STI-positive in subsequent analyses.

Forty-one men (17%, 95% CI: 13%, 22%) knew they were HIV-positive at the time of enrollment. An additional nine men were diagnosed as HIV-positive on the date

of enrollment (but after completing study questionnaires), resulting in a total biological HIV prevalence of 21% (95% CI: 16%, 27%) in this sample.

3.2.4 Body Image (Table 4)

Participants' median BMI was 24.27. Approximately half had a BMI in the "healthy" range, with only 3% classified as underweight and 44% classified as overweight or obese. When asked to rate their physical and sexual attractiveness on a scale of 0 to 6 (0 was the least attractive rating), the majority (69% and 65%, respectively) rated themselves as 4 or higher. Half of men perceived their penis size to be average, with only 6% reporting "below average" size and 41% reporting "above average" or "well above average" size. MBAS scores (available for only 104 men) ranged from 1.00-5.38, with a median score of 2.83 (IQR: 2.06, 3.42). Subscores for body fat, muscle, and height were similar with median values of 2.63 (IQR: 1.75, 3.75), 2.95 (IQR: 2.15, 3.70), and 2.42 (IQR: 1.00, 3.50), respectively.

3.2.5 Sexual Behaviors & Substance Use (Tables 5 & 6)

Self-Reports of Behavior over Lifetime

The vast majority of men reported ever having oral sex or unprotected anal sex, with respective lifetime prevalences of 99% and 90%. Two-thirds of men reported ever participating in group sex and 58% reported ever having anonymous sex. Nearly half of men had used enemas in their lifetime. Anal fingering, use of insertive sex toys, and fisting were reported by 83%, 65%, and 15%, respectively.

Lifetime use of drugs was reported by 77% of participants; 52% had ever used drugs other than marijuana. Other than marijuana, cocaine, "poppers", and MDMA were the most commonly reported drugs, with respective lifetime prevalences of 29%, 24%, and 19%.

Self-Reports of Behavior over Past Three Months

Oral sex in the past three months was reported by 94% of the sample. Two-thirds (67%) of men reported UAI in the past three months. Rimming and anal fingering in the past three months were reported by a majority of men, with endorsement by 62% and 57%, respectively. Approximately one-third (31%) of men reported sex with an anonymous partner in the last three months and slightly fewer (25%) reported participation in group sex in the same time period.

In total, 52% of men reported use of any drug in the past three months. When marijuana was excluded, the prevalence of drug use in the past three months decreased to 30%. The most commonly endorsed drugs, other than marijuana, for the previous 3-month time period were “poppers” (15%), cocaine (9%), Viagra (6%), and methamphetamines (5%).

3.3 Unadjusted Associations using Modified Poisson Regression

3.3.1 Associations between specific behaviors in the past three months and STI, stratified by known HIV status (Table 7)

We present, here, a subset of associations between specific behaviors in the past three months and prevalent STI. If the association was homogenous across HIV status, a single prevalence ratio (PR) is reported. If the association differed significantly by HIV status, we present one PR for HIV-positive men and one PR for HIV-negative men. If endorsement of a behavior was infrequent or if endorsement did not vary by disease status, we could not obtain PR estimates.

Associations that were homogenous across HIV status

STI prevalence (including chlamydial infection, gonorrhea or primary/secondary syphilis) was significantly higher among those who reported several sexual behaviors, including use of a sex sling (PR: 2.04, 95% CI: 1.40, 2.98), fisting (PR: 1.74, 95% CI: 1.02, 2.99), or use of insertive sex toys (PR: 1.44, 95% CI: 1.02, 2.03) in the past three months. Anonymous sex and group sex were also both significantly associated with prevalent STI, with respective PRs of 1.81 (95% CI: 1.3, 2.53) and 1.43 (95% CI: 1.02, 2.02). Men who reported drug use, excluding marijuana, in the past three months, had nearly twice the prevalence of STI (PR: 1.77, 95% CI: 1.27, 2.48) compared to those who did not report drug use.

Associations that differed by known HIV status

Felching was associated with a 3-fold increase in STI prevalence among HIV-negative men (PR: 3.24, 95% CI: 2.62, 4.01), but was not significantly associated with STI prevalence among HIV-positive men (PR: 1.2, 95% CI: 0.55, 2.64). Rimming was similar, with a two-fold increase in STI prevalence among HIV-negative men (PR: 2.05, 95% CI: 1.22, 3.45) but an insignificant relationship among HIV-positive men (PR: 0.86, 95% CI: 0.47, 1.57). UAI was significantly associated with increased STI prevalence among HIV-negative MSM (PR: 1.83, 95% CI: 1.07, 3.12), but not among HIV-positive MSM (PR: 0.81, 95% CI: 0.43, 1.50). Meanwhile, oral sex was not associated with prevalent STI among HIV-negative men (PR: 1.64, 95% CI: 0.47, 5.76), but was associated with *decreased* STI prevalence among HIV-positive men (PR: 0.47, 95% CI: 0.34, 0.66), but not.

3.3.2 Unadjusted associations between specific behaviors in the past three months and known HIV status (Table 8)

Men who endorsed fisting in the past three months were almost five times as likely to be HIV-positive (to their knowledge, at time of enrollment)as those who did not endorse fisting (PR: 4.81, 95% CI: 2.87, 8.07). Felching (PR: 3.92, 95% CI: 2.12, 7.25) and enema use (PR: 4.04, 95% CI: 2.28, 7.14) were each independently associated with a four-fold increase in HIV prevalence. Use of a sex sling (PR: 2.47, 95% CI: 1.28, 4.76) and group sex (PR: 1.92, 95% CI: 1.10, 3.34) in the past three months were also significantly more common among HIV-positive men. Men who endorsed any drug use in the past three months were approximately two times as likely to be HIV-positive (PR: 1.98, 95% CI: 1.08, 3.62). These relationships were not meaningfully changed if biological HIV status was used in place of known HIV status (data not shown).

In summary, a variety of specific sexual and substance using behaviors were endorsed by a substantial percent of our sample. Many of these behaviors were significantly associated with prevalent STI and HIV in unadjusted analyses. However, due to the nature of this study, we cannot determine a causal relationship. For example, the relationship between HIV status and fisting may be because fisting increases risk of HIV or may be because HIV-positive men are more likely to engage in fisting, perhaps as a seroadaptive behavior. Additional research is needed to evaluate whether our findings persist after adjustment for confounders and to determine the temporality of the associations.

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Table 3.1. Participant Demographics (n=235)		
	n	%
Age		
18-24	100	43%
25+	135	57%
Race/Ethnicity		
White	134	57%
Minority	101	43%
Education		
HS Diploma or less	69	29%
At least some college	166	71%
Employment		
Currently employed	172	73%
Unemployed	58	25%
Missing	5	2%
Relationship Status		
Committed partner	91	39%
No committed partner	143	61%
Missing	1	0%
Patient Health Questionnaire-2 Depression Screening		
Yes to both items	59	25%
Yes to one item	41	17%
No	135	57%

Table 3.2. Sexual Characteristics of Participants (n=235)

	n	%
Self-reported sexual orientation		
Gay	179	76%
Bisexual	32	14%
Other	23	10%
Missing	1	0%
Who are you sexually attracted to?		
Men only	154	66%
Mostly men, sometimes women	56	24%
Men and women equally	13	6%
Mostly women, sometimes men	10	4%
Only women	1	0%
Other	1	0%
Proportion of friends/family/colleagues that know you are MSM		
All or almost all	155	66%
More than half	36	15%
About half	8	3%
Less than half	12	5%
Few	12	5%
None	9	4%
Missing	3	1%
Classification of sexual position over past 12 months		
Exclusively Top	42	18%
Mostly Top	45	19%
About half top and half bottom	81	34%
Mostly bottom	50	21%
Exclusively bottom	13	6%
Missing	4	2%

Continued

Table 3.2 (continued) How often do you know partner's HIV status?		
Always/almost always	84	36%
Most of the time	62	26%
About half the time	33	14%
Sometimes, but less than half	28	12%
Never/almost never	23	10%
Missing	5	2%
Sexual Community^		
Leatherman	4	2%
Rubber	0	0%
Breath Control	3	1%
Bondage & Discipline	5	2%
Master/Slaves	4	2%
S & M	8	3%
Kink	11	5%
Bears	15	6%
Chubs	5	2%
Twink	8	3%
Jock	2	1%
Punk	2	1%
Other	8	3%
None	184	78%
Refuse	2	1%
"Gay Age"		
Median	10	
IQR	5, 18	
Range	0, 54	
Missing	0	
Lifetime number of sexual partners		
Median	25	
IQR	14, 100	
Range	1, 15000	
Missing	12	
		Continued

Table 3.2 (continued)	
Lifetime number of *male* sexual partners	
Median	23
IQR	11, 75
Range	1, 15000
Missing	8
Number of sexual partners in last 12 months	
Median	4
IQR	3,8
Range	1, 100
Missing	0
Number of *male* sexual partners in last 12 months	
Median	4
IQR	2, 8
Range	0, 100
Missing	0
^May not sum to 235 - participants allowed to choose more than one response	

Table 3.3. Prevalent Disease Status of Participants (n=235)

		n	Prevalence	95% C.I.
Gonorrhea				
Rectal				
	Positive	34	14%	(10%, 19%)
	Negative	143	61%	(55%, 67%)
	Missing	58	25%	
Urethral				
	Positive	21	9%	(5%, 13%)
	Negative	201	86%	(81%, 90%)
	Missing	13	6%	
Oral				
	Positive	5	2%	(0%, 4%)
	Negative	182	77%	(72%, 83%)
	Missing	48	20%	
Total				
	Positive	42	18%	(13%, 23%)
	Negative	189	80%	(75%, 86%)
	Missing	4	2%	
Chlamydia				
Rectal				
	Positive	39	17%	(12%, 21%)
	Negative	133	57%	(50%, 63%)
	Missing	63	27%	
Urethral				
	Positive	14	6%	(3%, 9%)
	Negative	210	89%	(85%,93%)
	Missing	11	5%	
Total				
	Positive	45	19%	(14%, 24%)
	Negative	185	79%	(73%, 84%)
	Missing	5	2%	

Continued

Table 3.3 (continued)				
Syphilis				
	Primary	3	1%	(0%, 3%)
	Secondary	9	4%	(1%, 6%)
	Latent	13	6%	(3%, 8%)
	Negative	201	86%	(81%,90%)
	Missing	9	4%	
Composite STI (GC/CT/Syphilis)				
	Positive	82	35%	(29%, 41%)
	Negative	151	64%	(58%, 70%)
	Missing	2	1%	
Known HIV Status				
	Positive	41	17%	(13%, 22%)
	Negative	194	83%	(78%, 87%)
Biological HIV Status				
	Positive	50	21%	(16%, 27%)
	Negative	178	76%	(70%, 81%)
	Missing	7	3%	

Table 3.4. Body Image and Body Size of Participants (n=235)		
MBAS**		
Median	2.83	
IQR	2.06, 3.42	
Range	1.00, 5.38	
Missing	131	
MBAS Body Fat**		
Median	2.63	
IQR	1.75, 3.75	
Range	1.00, 6.00	
Missing	131	
MBAS Muscle**		
Median	2.95	
IQR	2.15, 3.70	
Range	1.00, 5.90	
Missing	131	
MBAS Height**		
Median	2.42	
IQR	1.00, 3.50	
Range	1.00, 6.00	
Missing	131	
BMI		
Median	24.27	
IQR	21.48, 28.00	
Range	15.95, 49.65	
Missing	4	
BMI	n	%
Underweight (Less than 18.5)	8	3.4%
Healthy Weight (18.5 - 24.9)	119	50.6%
Overweight (25.0 - 29.9)	72	30.6%

Continued

Table 3.4 (continued)		
Obese (30.0 or higher)	32	13.6%
Missing	4	1.7%
Physical Attractiveness	n	%
0 (Least Attractive)	2	0.9%
1	5	2.1%
2	12	5.1%
3	51	21.7%
4	87	37.0%
5	48	20.4%
6 (Most Attractive)	28	11.9%
Missing	2	0.9%
Sexual Attractiveness	n	%
0 (Least Attractive)	1	0.4%
1	5	2.1%
2	13	5.5%
3	62	26.4%
4	73	31.1%
5	42	17.9%
6 (Most Attractive)	38	16.2%
Missing	1	0.4%
Penis Size	n	%
Below Average	15	6.4%
Average	121	51.5%
Above Average	74	31.5%
Well above average	23	9.8%
Missing	1	0.4%
***Due to study operational issues, MBAS was only administered to 104 men. The men who did and did not provide MBAS responses did not differ significantly with respect to age, race, education, employment, or disease status.		

Table 3.5. Specific Sexual Behaviors* of Participants (Lifetime and Past Three Months) (n=235)

		Lifetime		Past 3 Months	
		n	%	n	%
Anal sex without condom					
Yes		212	90%	158	67%
	Active	36		38	
	Passive	20		20	
	Both	155		97	
No		21	9%	75	32%
Missing		2	1%	2	1%
Oral Sex					
Yes		233	99%	220	94%
	Active	18		22	
	Passive	10		24	
	Both	205		173	
No		1	0%	13	6%
	Missing	1	0%	2	1%
Anal Fingering					
Yes		196	83%	135	57%
	Insertive	28		32	
	Receptive	16		18	
	Both	151		85	
No		38	16%	99	42%
Missing		1	0%	1	0%
Fisting					
Yes		34	14%	10	4%
	Insertive	21		6	
	Receptive	4		2	
	Both	9		2	
No		196	83%	220	94%
Missing		1	0%	5	2%

continued

Table 3.5
(continued)

Sounding					
	Yes	14	6%	1	0%
	Insertive	1		0	
	Receptive	3		1	
	Both	5		0	
	No	218	93%	230	98%
	Missing	3	1%	4	2%
Enema					
	Yes	116	49%	70	30%
	No	117	50%	163	69%
	Missing	2	1%	2	1%
Catheter					
	Yes	8	3%	2	1%
	No	225	96%	231	98%
	Missing	2	1%	2	1%
Rimming					
	Yes	200	85%	146	62%
	Active	11		26	
	Passive	20		27	
	Both	169		91	
	No	32	14%	86	37%
	Missing	3	1%	3	1%
Felching					
	Yes	23	10%	8	3%
	Active	4		2	
	Passive	6		1	
	Both	13		5	
	No	211	90%	226	96%
	Missing	1	0%	1	0%

continue

Table 3.5 (continued)					
Watersports					
	Yes	60	26%	18	8%
	Active	11		5	
	Passive	13		3	
	Both	36		10	
	No	174	74%	216	92%
	Missing	1	0%	1	0%
Scatalogia					
	Yes	4	2%	1	0%
	Active	2		1	
	Passive	1		0	
	Both	1		0	
	No	230	98%	233	99%
	Missing	1	0%	1	0%
Snowball					
	Yes	67	29%	28	12%
	No	167	71%	206	88%
	Missing	1	0%	1	0%
Sex sling					
	Yes -in sling	42	18%	11	5%
	Yes- not in sling	20	9%	7	3%
	No	172	73%	216	92%
	Missing	1	0%	1	0%
Insertive Sex toys with partner					
	Yes	152	65%	79	34%
	Insertive	17		14	
	receptive	15		13	
	Both	92		34	
	None	82	35%	155	66%
	Missing	1	0%	1	0%

Continue

Table 3.5 (continued)					
Erotic Asphyxiation					
	Yes	27	11%	14	6%
	No	206	88%	219	93%
	Missing	2	1%	2	1%
Anonymous Sex					
	Yes	136	58%	73	31%
	No	97	41%	159	68%
	Missing	2	1%	3	1%
Group Sex					
	Yes	160	68%	58	25%
	No	73	31%	174	74%
	Missing	2	1%	3	1%
*Definitions of behaviors are provided in questionnaire (Appendix B).					

Table 3.6. Self-Reported Drug Use of Participants (Lifetime and Past 3 months) (n=235)

	Lifetime		Past 3 Months	
	n	%	n	%
Marijuana				
Yes	73	31%	87	37%
No	162	69%	148	63%
Viagra				
Yes	43	18%	15	6%
No	192	82%	220	94%
MDMA				
Yes	45	19%	6	3%
No	190	81%	229	97%
Methamphetamines				
Yes	35	15%	12	5%
No	200	85%	223	95%
Amyl/Butyl Nitrates				
Yes	57	24%	35	15%
No	178	76%	200	85%
Nitrous Oxide				
Yes	16	7%	2	1%
No	219	93%	233	99%
Rohypnol				
Yes	3	1%	0	0%
No	232	99%	235	100%
Ketamine				
Yes	21	9%	0	0%
No	214	91%	235	100%

continued

Table 3.6 (continued)					
GHB					
	Yes	28	12%	7	3%
	No	207	88%	228	97%
Heroin					
	Yes	8	3%	3	1%
	No	227	97%	232	99%
Cocaine					
	Yes	69	29%	20	9%
	No	166	71%	215	91%
Mephedrone					
	Yes	4	2%	3	1%
	No	231	98%	232	99%
Bath Salts					
	Yes	8	3%	1	0%
	No	227	97%	234	100%
Prescription Pain Medicine					
	Yes	39	17%	11	5%
	No	196	83%	224	95%
Other Drugs					
	Yes	14	6%	4	2%
	No	221	94%	231	98%
All Drugs					
	Yes	182	77%	122	52%
	No	52	22%	112	48%
	Missing	1	0%	1	0%
All Drugs Not Marijuana					
	Yes	121	51%	71	30%

continued

Table 3.6 (continued)				
No	113	48%	163	69%
Missing	1	0%	1	0%
Injection Drugs				
Yes	19	8%	9	4%
No	214	91%	222	94%
Missing	2	1%	4	2%
Inserted Drugs in to Rectum				
Yes	16	7%	3	1%
No	218	93%	231	98%
Missing	1	0%	1	0%

Table 3.7. Unadjusted Associations between Behaviors (in past 3 months) and Prevalent STI by HIV Status

EXPOSURE	OVERALL (n=235)		HIV-POSITIVE (n=41)		HIV-NEGATIVE (n=194)		Test of Heterogeneity
	PR	95% CI	PR	95% CI	PR	95% CI	p-value
Unprotected Anal Intercourse							
Any vs None	1.53	(1.00, 2.36)	0.81	(0.43, 1.50)	1.83	(1.07, 3.12)	0.05
Any Receptive vs No Receptive	1.7	(1.17, 2.47)	0.89	(0.49, 1.60)	2.04	(1.30, 3.22)	0.03
Any Insertive vs No Insertive	1.46	(0.99, 2.14)	0.86	(0.47, 1.57)	1.63	(1.03, 2.59)	0.10
Oral Sex							
Any vs None	0.92	(0.45, 1.87)	0.47	(0.34, 0.66)	1.64	(0.47, 5.76)	0.06
Any Receptive vs No Receptive	1.14	(0.68, 1.93)	0.9	(0.46, 1.77)	1.44	(0.69, 2.99)	0.36
Any Insertive vs No Insertive	1.53	(0.84, 2.79)	0.59	(0.34,1.03)	2.24	(0.97, 5.16)	0.01
Anal Fingering							
Any vs None	1.27	(0.88, 1.83)	1.42	(0.73, 1.74)	1.22	(0.79, 1.87)	0.71

Continued

Table 3.7 (continued)							
Any Receptive vs No Receptive	1.37	(0.97, 1.94)	0.95	(0.52, 1.74)	1.52	(1.01, 2.30)	0.21
Any Insertive vs No Insertive	1.5	(1.05, 2.14)	1.72	(0.89, 3.37)	1.41	(0.92, 2.14)	0.61
Fisting							
Any vs None	1.74	(1.02, 2.99)	1.08	(0.52, 2.21)	2.14	(0.93, 4.89)	0.22
Any Receptive vs No Receptive	1.42	(0.52, 3.84)	0.92	(0.33, 2.57)	No Estimate		N/A
Any Insertive vs No Insertive	1.81	(1.03, 3.19)	1.13	(0.52, 2.48)	2.14	(0.93, 4.89)	0.28
Sounding							
Any vs None	No Estimate		No Estimate		No Estimate		N/A
Any Receptive vs No Receptive	No Estimate		No Estimate		No Estimate		N/A
Any Insertive vs No Insertive	No Estimate		No Estimate		No Estimate		N/A
Rimming							
Any vs None	1.67	(1.10, 2.55)	0.86	(0.47, 1.57)	2.05	(1.22, 3.45)	0.03
							continued

Table 3.7 (continued)							
Any Active vs No Active	1.35	(0.94, 1.94)	0.98	(0.92, 2.18)	1.42	(0.92, 2.18)	0.32
Felching							
Any vs None	2.21	(1.42, 3.43)	1.2	(0.55, 2.64)	3.24	(2.62, 4.01)	0.02
Any Passive vs No Passive	1.93	(1.07, 3.50)	0.97	(0.35, 2.72)	3.2	(2.59, 3.96)	0.03
Any Active vs No Active	2.54	(1.78, 3.61)	1.54	(0.80,2.97)	3.24	(2.62, 4.01)	0.03
Enemas							
Yes vs None	1.4	(0.99, 1.98)	0.77	(0.43, 1.38)	1.5	(0.98, 2.29)	0.07
Catheters							
Yes vs None	1.43	(0.35, 5.78)	No Estimate		1.59	(0.39, 6.47)	N/A
Watersports							
Any vs None	1.29	(0.74, 2.22)	1.82	(1.10, 3.03)	0.77	(0.28, 2.10)	0.13
Any Passive vs No Passive	0.86	(0.38, 1.99)	1.33	(0.56, 3.15)	0.61	(0.17, 2.16)	0.32

Continued

Table 3.7 (continued)

Any Active vs No Active	1.56	(0.94, 2.60	1.82	(1.10, 3.03)	1.05	(0.41, 2.70)	0.31
Scatalogia							
Any vs None	2.82	(2.39, 3.40)	No Estimate		No Estimate		N/A
Any Passive vs No Passive	No Estimate		No Estimate		No Estimate		N/A
Any Active vs No Active	No Estimate		No Estimate		No Estimate		N/A
Snowball							
Any vs None	1.5	(0.99, 2.28)	1.14	(0.55, 2.36)	1.59	(0.96, 2.63)	0.47
Sex Sling							
Any vs None	2.04	(1.40, 2.98)	1.52	(0.84, 2.73)	2.12	(1.29, 3.50)	0.40
In Sling vs Not in sling	2.17	(1.45, 3.26)	1.2	(0.55, 2.64)	2.75	(1.81, 4.19)	0.07
Sex Toys							
Any vs None	1.44	(1.02, 2.03)	0.87	(0.47, 1.62)	1.65	(1.10, 2.48)	0.09
Any Receptive vs No Receptive	1.5	(1.03, 2.20)	0.96	(0.49, 1.90)	1.66	(1.11, 2.61)	0.19

Continued

Table 3.7 (continued)							
Any Insertive vs No Insertive	1.28	(0.86, 1.91)	0.74	(0.35, 1.58)	1.47	(0.92, 2.34)	0.13
Erotic Asphyxiation							
Any vs None	1.45	(0.83, 2.52)	No Estimate		1.63	(0.92, 2.88)	N/A
Anonymous Sex							
Any vs None	1.43	(1.02, 2.02)	1.06	(0.58, 1.93)	1.51	(1.00, 2.28)	0.34
Group Sex							
Any vs None	1.81	(1.30, 2.53)	1.72	(0.96, 3.07)	1.72	(1.14, 2.59)	1.00
All Drugs							
Any vs None	1.34	(0.94, 1.92)	1.49	(0.70, 3.17)	1.22	(0.80, 1.84)	0.65
Excluding Marijuana							
Any vs None	1.77	(1.27, 2.48)	1.9	(0.98, 3.72)	1.59	(1.05, 2.40)	0.65

Table 3.8. Unadjusted Associations between Specific Behaviors (in the past three months) and HIV Status (n=235)			
		Prevalence Ratio (PR)	95% CI
Unprotected Anal Intercourse			
	Any vs None	1.47	(0.76, 2.84)
Oral Sex			
	Any vs None	0.75	(0.26, 2.10)
Anal Fingering			
	Any vs None	1.03	(0.59, 1.82)
Fisting			
	Any vs None	4.81	(2.87, 8.07)
Sounding			
	Any vs None	No Estimate	
Rimming			
	Any vs None	1.37	(0.74, 2.56)
Felching			
	Any vs None	3.92	(2.12, 7.25)
Enemas			
	Yes vs None	4.04	(2.28, 7.14)
Catheters			
	Yes vs None	No Estimate	
			Continued

Table 3.8 (continued) Watersports			
	Any vs None	2.06	(1.00, 4.23)
Scatalogia			
	Any vs None	No Estimate	
Snowball			
	Any vs None	1.51	(0.74, 3.08)
Sex Sling			
	Any vs None	2.47	(1.28, 4.76)
Sex Toys			
	Any vs None	1.39	(0.79, 2.43)
Erotic Asphyxiation			
	Any vs None	No Estimate	
Anonymous Sex			
	Any vs None	1.54	(0.88, 2.69)
Group Sex			
	Any vs None	1.92	(1.10, 3.34)
All Drugs			
	Any vs None	1.98	(1.08, 3.62)
Drug Use Excluding Marijuana			
	Any vs None	2.41	(1.40, 4.16)

Chapter 4

Prostate-specific antigen is unlikely to be a suitable biomarker of semen exposure from recent unprotected receptive anal intercourse in men who have sex with men

4.1 Abstract

A biomarker of unprotected receptive anal intercourse (RAI) could improve validity of sexual behavior measurement. We quantified prostate-specific antigen (PSA) from rectal swabs from men who have sex with men (MSM). One swab was PSA-positive. Using current methods, PSA is an inadequate biomarker of recent unprotected RAI in MSM.

4.2 Introduction

Men who have sex with men (MSM) in the United States are particularly vulnerable to and disproportionately affected by HIV.

The estimated probability of HIV transmission per act of unprotected receptive anal intercourse (RAI) ranges from 0.27% (Vittinghoff, 1999) to 3.38% (Powers, 2008). Valid measurement of sexual behaviors, including RAI, is critical for HIV prevention interventions. Yet, to date, nearly all sexual health research has relied on self-reported data, despite questionable validity (Gallo, 2006; Zenilman,1995). Individuals may not accurately report whether, when, and how often they engage in risky behaviors, and research findings based on self-reported information may be biased. Because no other

measures have been available, despite the recognized limitations of self-reported sexual behavior data, all large-scale HIV prevention clinical trials among MSM rely on self-reported information (McKirnan, 2010; Lu, 2011). A biomarker that replaces self-reported sexual behavior data would be a meaningful methodological advancement.

Prostate-specific antigen (PSA) is a protein produced in the prostate and secreted into the urethra during ejaculation. The detection of PSA in vaginal fluid has been used in forensic medicine, and more recently in research, as a biomarker of recent exposure to semen (Macaluso et al, 1999; Gallo et al, 2006; Macaluso et al, 2007). PSA is highly specific in confirming exposure to ≥1mL of semen in women, with excellent detection immediately after exposure and almost complete clearance by 48 hours after exposure (Macaluso et al, 1999; Jamshidi et al, 2013). PSA has been used in many studies to assess the reliability of self-reported sexual behavior and as a proxy measure of condom efficacy (Macaluso et al, 1999; Gallo et al, 2006; Aho et al, 2010).

We evaluated PSA as a biomarker of recent unprotected RAI among MSM. We hypothesized that rectal specimens would be PSA-positive only following recent unprotected RAI or RAI marked by condom misuse or malfunction.

4.3 Methods

This investigation was part of a larger study of MSM recruited from a public sexual health clinic in the Midwestern United States. Participants were 18 or older, spoke and read English, and reported anal intercourse (receptive or insertive) with another man within the past year. The subset of men who reported receptive anal intercourse within the past two weeks was included in this analysis.

Per clinic protocol, any man reporting RAI in the past year had a rectal swab collected for assessment of gonococcal and chlamydial infection via nucleic acid

amplification tests. Swabs were inserted 2-4 centimeters into the rectum and gently rotated clockwise for 2-3 seconds to ensure adequate specimen collection. To measure PSA, an additional rectal swab was collected from each participant and frozen at -80°C until testing.

Following their physical examination, participants completed a comprehensive behavioral questionnaire. Exposure to semen was assessed through questions about sexual practices in three time periods: the last 24 hours, 24 to 48 hours ago, and 48 to 72 hours ago. For each time period, participants were asked whether: they had RAI; a condom was used; any issues occurred with condom usage; the partner ejaculated; the partner withdrew prior to ejaculation; and lubricant was used. Men were also asked to provide the date and time of their last bowel movement and last anal douching. Men were compensated $10.

PSA was measured using methods previously developed for vaginal swab specimens (Macaluso et al, 1999; Macaluso et al, 2007; Lawson et al, 1998). Swabs were hydrated for 10 minutes in 1 mL of phosphate-buffered saline and vortexed vigorously to elute the contents into the buffer. Eluates were then centrifuged for 10 minutes at 10,000 RPM in a microcentrifuge to remove particulate matter; 300□L of the resulting supernatant was tested with the Abbott Architect Total PSA assay (Abbott Diagnostics, Abbott Park, IL, USA). The PSA assay has excellent sensitivity (detectable range: 0.01-100 ng/mL) and specificity. In accordance with prior studies using vaginal swab specimens, a positive PSA result was defined as ≥1 ng PSA/mL rectal swab eluate.

Statistical analyses were conducted using SAS (Version 9.3, Cary NC). Using a Kruskal-Wallis test, we compared PSA concentrations by self-reported sexual behavior within the past 48 hours: no RAI, protected RAI only, and at least one unprotected RAI

act. Among those who reported any RAI within 72 hours, we used Spearman's rank correlation coefficient to quantify the association between PSA concentration and hours since last reported RAI (Fowler et al, 1987).

4.4 Results

Fifty-four men met eligibility criteria, provided informed consent, and enrolled. Participants were 18-56 years of age (median: 26 years). Two-thirds had completed at least some college (n=36). Eighty-one percent (n=44) identified as gay. When asked about position preference, nine men (17%) classified themselves as "mostly top", 23 (43%) as "half top and half bottom", 20 (37%) as "mostly bottom", and two men (4%) as "exclusively bottom".

Of 54 participants, 41 reported no RAI in the past 48 hours, 3 reported only protected (condom) RAI in the past 48 hours, and 10 reported unprotected RAI in the past 48 hours (Table 4.1). PSA concentrations for the 54 specimens ranged from 0.000 ng/mL to 1.512 ng/mL, with a median of 0.017 ng/mL (IQR: 0.003 to 0.040). One specimen with 1.512 ng/mL tested positive for PSA according to the 1 ng/mL threshold for positivity (Table 4.1). The single positive specimen was collected from a man who reported *protected* RAI 14 hours prior to swab collection, and no *unprotected* RAI in the 72 hours preceding swab collection.

PSA concentrations for men who reported no RAI in the past 48 hours (median, 0.017 ng/mL); protected RAI only (median, 0.051 ng/mL); or at least one unprotected act (median, 0.018 ng/mL) did not differ significantly (Kruskal-Wallis test, p=0.49) (Table 1). Among those who reported any RAI in the last 72 hours (n=21), PSA concentration was not significantly correlated with hours since last RAI (p=0.41). Figure 1 depicts the relationship among MSM who report RAI in the previous 72 hours between PSA

concentration and hours since last RAI by self-report of RAI behavior (unprotected, protected, or none) in the previous 48 hours (Figure 4.1).

4.5 Discussion

HIV/STI prevention research in women has been meaningfully strengthened by the availability of biomarkers of recent unprotected sex, including PSA. The validation of a biological marker of unprotected RAI would help to assess exposure to HIV or STIs and substantially improve the validity and reliability of prevention research in MSM.

Of 54 men, five reported RAI in the previous 24 hours (3 unprotected), 13 in the previous 48 hours (10 unprotected), and 21 in the previous 72 hours (14 unprotected). Given these self-reports, we detected PSA in substantially fewer men than expected, especially compared to similar work in women (Gallo, 2013). Low PSA levels prevented us from performing more sophisticated analyses of discordance (positive PSA despite report of no unprotected sex). The low number of men reporting recent RAI may be related to our STD clinic sample. Men often present at an STD clinic because of symptoms or suspicion of infection, which may limit their sexual activity in the days immediately preceding the visit. However, Anderson et al, recently detected PSA in 8% of symptomatic women presenting to an STD clinic, which provides support for our study design (Anderson et al, 2013).

In women, PSA sensitivity is highest immediately after exposure (96%) and decreases over time, with 65% sensitivity six hours after sex, 21-29% after 24 hours, and 3-7% after 48 hours (Macaluso et al, 1999; Jamshidi et al, 2013). Specificity ranges from 91-97% (Macaluso et al, 1999). Given the high specificity of the PSA assay in women, a positive test for PSA is unlikely to occur without exposure to semen. However, whether PSA persists similarly in the rectum and in men is unknown. The only previous

study on PSA testing on rectal swabs from men was completed on cadavers, and found PSA in 64% of male rectal swabs (Lunetta & Sippel, 2009). Sexual orientation of men in that study was unknown (Lunetta & Sippel, 2009), and whether PSA migrated to the rectum post-mortem is unclear. Notably, the single individual in whom PSA was detected in our study reported *protected* RAI 14 hours prior to collection of the rectal swab, highlighting the potential weaknesses of self-report.

PSA concentration was not significantly correlated with time since last RAI among men who reported RAI in the past 72 hours. While Figure 4.1 suggests a correlation between PSA and time since last RAI among men with the most recent sexual encounters, with one exception, detected PSA levels in this small study were all below the accepted threshold for positivity and orders of magnitude below levels reported in post-coitus vaginal samples (Gallo et al, 2013). Even if the positive result detected in this analysis represents a true positive, a biomarker with such limited range would be of limited utility, as it would be difficult to separate true positives from background noise. In contrast, PSA used for identifying vaginal exposures results in much higher concentrations. Gallo *et al* found PSA levels of 100 ng/mL or higher in more than 20% of women (Gallo et al, 2006), while median PSA levels in our study were well below 1 ng/mL, even after stratification by timing of last RAI (Table 4.1).

We hypothesized that PSA clearance from the rectum could be affected by anal douching, bowel movements, or lubricant use (Snead et al, 2013). However, of the 13 men reporting sex in the last 48 hours, only one did not report having a bowel movement in the time between last RAI and his examination. Similarly, 12 of 13 reported lubricant use at last RAI. Thus, we could not assess the effect of these behaviors on PSA detection because of lack of variability in participant reports. Similarly, PSA detection

may be affected by whether ejaculation occurred. Nine of the 13 men reporting RAI in the last 48 hours report ejaculation as part of the sex act.

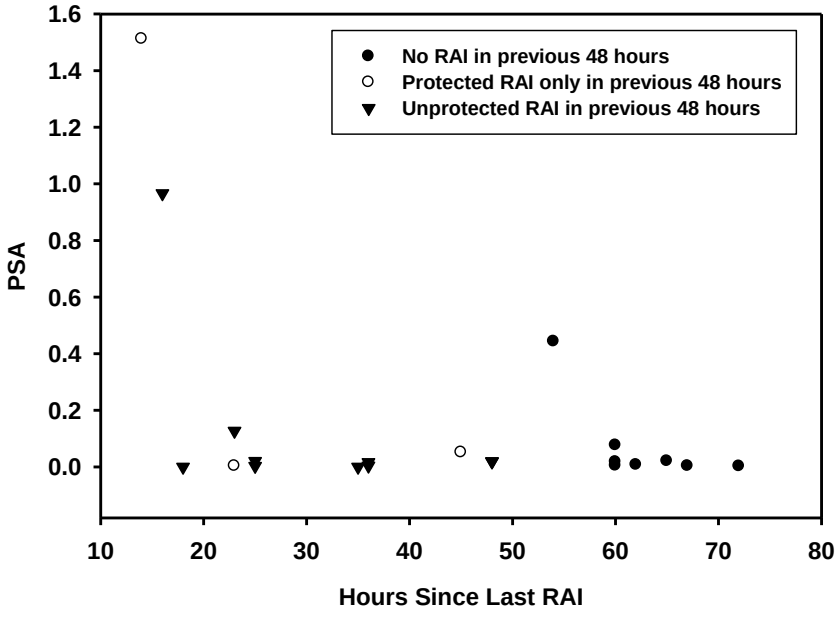
Our data suggest that PSA is not a suitable biomarker of recent unprotected RAI in MSM recruited from a STD clinic. However, our data do not rule out a use for PSA in a highly controlled setting. Future studies may assess whether PSA can be reliably measured immediately after a known rectal exposure – in the absence of lubricant use, anal hygiene, or bowel movements – in order to use the biomarker in future studies to evaluate the effectiveness of barrier methods for RAI (Macaluso et al, 2003).

To our knowledge, the lack of association between PSA and recent RAI presented here is the first evidence that PSA, as currently measured, is not a suitable biomarker of unprotected RAI among MSM. The need for a biomarker in this population remains high.

Table 4.1. PSA Level by Self-reported Sexual Behavior (n=54)

Self-Reports	Median (ng PSA/mL)	IQR (ng PSA/mL)	PSA Positive		PSA Negative	
			N	(%)	N	(%)
Past 24 hours						
>=1 Unprotected RAI	0.127	0.000-0.966	0	(0)	3	(6)
Protected RAI only	0.758	0.003-1.512	1	(2)	1	(2)
No RAI	0.017	0.003-0.034	0	(0)	49	(91)
Past 48 hours						
>=1 Unprotected RAI	0.018	0.000-0.020	0	(0)	10	(19)
Protected RAI only	0.051	0.003-1.512	1	(2)	2	(4)
No RAI	0.017	0.002-0.037	0	(0)	41	(76)

Figure 4.1. Among those who reported RAI in the previous 72 hours (n=21), PSA concentration (ng/mL) by hours since last RAI



Chapter 5

Group Sex and Prevalent STI among Men who Have Sex with Men (MSM)

5.1 Abstract

INTRODUCTION: We evaluated the direct relation between group sex and prevalent STI in a cross-sectional study of MSM presenting at an urban STI clinic in the Midwestern US. **METHODS**: Among 231 men who enrolled and reported that they have sex with men, we collected behavioral data using a combination of interviewer and self-administered surveys and extracted STI data from electronic health records. We used modified Poisson regression to examine the unadjusted and adjusted associations between group sex participation and prevalent STI. **RESULTS**: One-quarter of participants (n=58) reported group sex participation in the last three months. Eighteen percent of participants (n=42) had gonorrhea and 19% (n=45) had chlamydial infection. Men who reported recent group sex were more likely to be HIV positive, to report recent drug use, and to report unprotected receptive anal intercourse in the past three months. After adjustment for age, race and recent drug use, recent participation in group sex was associated with prevalent gonorrhea infection [prevalence ratio (PR) = 2.11, 95% confidence interval (CI) = (1.13, 3.95)] but not chlamydia infection [PR=1.03, 95% CI = (0.58, 1.84)]. We performed a sensitivity analysis in which we also adjusted for unprotected receptive anal intercourse and the results were not substantively changed. **CONCLUSIONS**: Participation in group sex in the past three months was associated with a more than two-fold increased prevalence of gonorrhea, but not with chlamydia.

These findings support group sex participation as a potential contributor to increased STI prevalence.

5.2 Introduction

5.2.1 MSM

Men who have sex with men (MSM) are at increased risk for sexually transmitted infections (STI) and HIV. For example, 75% of primary and secondary syphilis reported to the Centers for Disease Control and Prevention (CDC) in 2012 was detected in MSM (CDC, 2013). In addition, STI rates appear to be increasing in this population. The rate of primary and secondary syphilis among MSM in the United States increased 15% between 2011 and 2012 (CDC, 2013). The incidence rate of gonorrhea among all men increased more than 8% in the same time period, an increase that is largely attributed to increased infections in MSM (CDC, 2013). Given that the risk of HIV acquisition is increased in STI-infected individuals, these rising rates are of particular concern (CDC, 2013).

The Foundation for AIDS Research has identified the sexual practices of MSM as a topic in need of additional high-quality research (amfAR, 2008). While it is well-documented that MSM are at increased risk of HIV acquisition (Hall, 2008; Prejean et al, 2011) and that unprotected anal intercourse is among the most efficient modes of sexual transmission of HIV, little is known about other sexual behaviors practiced by MSM and their associations with HIV and other STIs.

5.2.2 Group Sex

Group sex is one such behavior that may contribute to the high prevalence of STI among MSM. Group sex is a broad term describing sexual acts involving more than one

person at a time, and may include threesomes, spontaneous group sex, or organized sex parties (Grov, 2013). The CDC recognizes the increased STI risk associated with multiple sex partners, and 2010 treatment guidelines specifically state that MSM with multiple sex partners should be screened for STIs at 3-6 month intervals, compared to the annual STI screening recommendation for MSM generally (CDC, 2010).

Group sexual encounters (GSE) are a potential factor in STI transmission for several reasons (Phillips et al, 2013; Friedman et al, 2008; Mimiaga et al, 2011). First, men who participate in GSE may be more likely to endorse other high risk sexual behaviors outside of GSE. A recent analysis demonstrated that MSM who participate in GSE are more likely to be HIV-positive, report drug use in the past three months, and report unprotected anal intercourse in the past three months, compared to MSM who do not participate in GSE (Grov, 2013). Another study found that 44% of MSM at a private sex party (N=103) self-identified as "barebackers" (Mimiaga et al, 2011) compared to 12% of a community sample of MSM (Parsons, 2007). Qualitative research also demonstrated that MSM participating in GSE worried less about HIV acquisition and valued pleasure over safety (Sowell et al, 1998).

Second, high risk behaviors often occur as part of a GSE. Several studies have found high rates of unprotected anal intercourse (UAI) during GSE, ranging from 25% (Mimiaga, 2010) to 33% (Phillips, 2013). The "Three or More Study" (TOMS), a large study of GSE among Australian MSM, found that unprotected anal intercourse during GSE is more prevalent among HIV-positive MSM (Prestage et al, 2008). Alcohol and drug use is also common within GSE. Illicit drug use during last GSE is reported by approximately half of MSM (Mimiaga, 2010; Prestage et al, 2008). Fifty-eight percent of a small study of MSM who either attended or hosted sex parties used alcohol at their last GSE (Mimiaga, 2010) and 11% of "TOMS" participants reported drinking five or more

drinks during last GSE (Prestage et al, 2008). Other studies have found high reports of rimming (47%), oral sex (87%), and use of sex toys (18%) at last GSE (Grov, 2013). While some of these behaviors (e.g. use of sex toys) may not be high risk on their own, they may be indicative of membership in a sex culture of "adventurism" or experimentation where other directly risky behaviors may be common (Kippax, 1998).

Third, the dynamics of GSE allow for an individual to be exposed to multiple potential sources of disease in a very short period of time and, likewise, for a source to be exposed to multiple susceptible partners increasing the likelihood of STI transmission. In the "TOMS" study, 37% of MSM reported sex with two other men at their last GSE and 17% reported sex with more than five other men (Prestage et al, 2008).

To our knowledge, no study has quantified the association between recent GSE and STI prevalence.

5.3 Methods

5.3.1 Study Design and Setting

We conducted this cross-sectional study in the sexual health clinic (SHC) of a major Midwestern metropolitan health department. All men who presented to the SHC for STI/HIV testing between July 2012 and October 2013 were screened for eligibility. Men were required to speak and read English, be at least 18 years old, and report anal sex (receptive or insertive) with another man in the last year to be eligible for the study. Eligible men were asked to consent to a two-part questionnaire and to allow access to their SHC electronic health record (EHR) by study staff.

5.3.2 Data Collection

Survey Data

Survey data were collected via a two-part questionnaire, administered in REDCap, a secure web application designed for collecting research data (Harris, 2009). The survey consisted of an interviewer-administered portion and a self-administered portion. The most sensitive questions, including sexual and substance using behaviors, were included on the self-administered portion. Men were compensated $10 for their participation.

To assess recent GSE, men were asked, “Within the past three months, have you had group sex?” Group sex was defined as sex with more than one individual at the same time. Drug use was assessed with a multiple response question. Men were asked to indicate all drugs (marijuana, Viagra, MDMA, methamphetamines, amyl/butyl nitrates, nitrous oxide, rohypnol, ketamine, GHB, heroin, cocaine, mephedrone, bath salts, prescription pain medicine, other) used within the past three months. We coded drug use as “marijuana only” if marijuana was the only drug indicated, “other drugs” (including endorsement of any drug other than marijuana), and “no drug use” within the past three months.

Clinical Data

Clinical data were extracted from the EHR. SHC protocol indicates that all male patients undergo diagnostic testing for HIV, syphilis, urethral gonorrhea, and urethral chlamydia. Men who report receptive anal intercourse within the last year are also tested for rectal gonorrhea and rectal chlamydial infection. Men reporting oral sex undergo testing for oropharyngeal gonorrhea. All test results are entered by SHC staff in to the

EHR, along with self-reported results of previous HIV tests. For this analysis, STI and HIV test results were extracted from EHRs and linked with survey data.

We used *known* HIV status, the HIV status that men believed they had when they completed the questionnaire, in this analysis. We chose known HIV status because we hypothesized, *a priori*, that participation in GSE would be affected more by a man's known HIV status than his actual (biological) HIV status. Men were classified as HIV-positive if their EHR had a history of positive HIV test prior to the enrollment date, from either a test completed at a prior visit or from the participant's self-report. Men were classified as not HIV-positive if they had history of negative HIV test(s) or no history of HIV testing.

For this analysis, a man was coded as positive for gonorrhea or chlamydia, separately, if he tested positive at any anatomical site (urethral, rectal, or oropharyngeal). If he tested negative at all anatomical sites tested, he was coded as negative. Indeterminate results were coded as missing.

5.3.3 Statistical Analyses

All statistical analyses were performed in SAS (Version 9.2, Cary, NC).

Descriptive Analysis

We calculated frequencies of participant demographics. We computed the prevalence of rectal, urethral, and oropharyngeal gonorrhea, rectal and urethral chlamydial infection, and primary, secondary, and latent syphilis. Using Wald chi-square tests, we evaluated the unadjusted associations between group sex and each demographic and behavioral variable.

Modified Poisson Regression

We used modified Poisson regression (Zou, 2004) to examine the association between GSE in the last three months and STI prevalence in two separate models: one using prevalent chlamydial infection (all anatomical sites) as the primary outcome and one using prevalent gonorrhea (all anatomical sites) as the primary outcome. The modified Poisson regression model, which has a robust error variance, is recommended to estimate the relative risk in studies where the outcome is common (Zou, 2004). Only twelve men were diagnosed with primary or secondary syphilis on the date of study enrollment, preventing us from building a model with syphilis as the outcome. For each model, we specified self-report of GSE in the past three months as the primary exposure. Based on previous literature and analysis of a Directed Acyclic Graph (DAG) (Greenland, 1999), we assessed age, race, sexual identity, relationship status, education, known HIV status, and drug use within the past three months as potential confounders. Other specific risky sexual behaviors, such as unprotected anal intercourse, were not included because we hypothesized that they lie on the causal pathway between group sex and STI (Figure 5.1a), and thus do not meet the criteria for confounding. The fully adjusted models included GSE, all potential confounders, and product-interaction terms between GSE and HIV and GSE and drug use. Manual backward elimination procedures were used to reduce the full model (Maldonado, 1993).

We evaluated whether the association between group sex and STI varied by known HIV status or drug use by examining the significance of the interaction terms using likelihood ratio tests (Selvin, 2004). Our *a priori* criterion for statistical significance and retention of interaction terms was $\alpha = 0.20$. Potential confounders were assessed one-by-one and retained in the final model if removal of the confounding variable led to a change of 10% or more in the main effect estimate or in any level of any significant

interaction variable. If a variable qualified as an effect modifier or confounder in either the chlamydia or gonorrhea model, it was retained in both models. We determined *a priori* from prior literature that age and race/ethnicity would be retained in both models.

5.3.4 Sensitivity Analyses

We did not adjust for sexual risk behaviors, such as unprotected anal intercourse or number of recent sexual partners, in our primary analysis because we hypothesized that they lie on the causal pathway between GSE and STI. However, as a sensitivity analysis, we examined an alternative interpretation of the relationships between key variables of interest. If risky behavior instead shares a common unmeasured cause with GSE (Figure 5.1b), analysis of the resulting DAG indicates that risky behavior should be treated as a confounder and included in the adjustment set (Hernan, 2002). In sensitivity analyses, we computed adjusted GSE-STI associations after controlling for unprotected anal intercourse within the past three months and number of sex partners in the last year (in addition to other confounding variables).

We also evaluated whether the association between GSE and STI remained stable across anatomical site of infection. We calculated unadjusted prevalence ratios to measure the associations between GSE and rectal gonorrhea, urethral gonorrhea, oral gonorrhea, rectal chlamydia, and urethral chlamydia, separately.

5.3.5 Ethics

This study was approved by The Ohio State University Institutional Review Board (protocol # 2011H0154). The SHC is an official research site of The Ohio State University.

5.4 Results

We screened 1,866 men presenting to the SHC between July 2012 and October 2013 for study eligibility. Contingent on study staff availability, we screened all men presenting to SHC for STI testing. The overwhelming majority of men screened were not eligible because they did not report anal sex with men in the past year (84%, n=1568). Other exclusions were due to underage status (n=13) or inability to speak English (n=10). Of the 1,866 screened, 286 men met eligibility requirements and 235 enrolled in the study. Fifty-one men met eligibility criteria, but chose not to enroll due to time constraints or lack of interest. Of the 235 men who enrolled, 231 provided GSE data and were included in this analysis.

5.4.1 Demographics

Participants (n=231) ranged in age from 18 to 60 years (median: 26 years, interquartile range (IQR): 22-35). Fifty-six percent of the population was white. Seventy-one percent had completed at least some college and seventy-four percent were employed. The majority of participants self-identified as gay (76%), 13% as bisexual and 10% as another sexual orientation. Sixty-one percent were not in a committed relationship. Forty-one men (18%) knew they were HIV-positive (Table 5.1).

5.4.2 Behavioral Data

Twenty-three percent of the population reported use of only marijuana in the previous three months, 30% reported use of other drugs in the past three months, and

47% reported no drug use in past three months. Unprotected anal intercourse in the past three months was reported by 68% of participants (Table 5.1).

5.4.3 STI Prevalence

Of the 231 men included in this analysis, 223 were screened for urethral gonorrhea/chlamydia, 178 were screened for rectal gonorrhea/chlamydia, and 185 were screened for oropharyngeal gonorrhea. In total, 229 men (99%) were screened for gonococcal infection and 228 men (99%) were screened for chlamydial infections at least one anatomical site. 224 participants (97%) were screened for syphilis. Among men screened for urethral infections, fourteen (6%) tested positive for urethral chlamydia and 21 (9%) tested positive for urethral gonorrhea. Of men undergoing rectal screening, 34 (19%) tested positive for rectal gonorrhea and 39 (22%) tested positive for rectal chlamydia. Of the 185 screened for oral gonorrhea, five (3%) tested positive. Across anatomical sites, overall prevalence of chlamydia and gonococcal infection was 19% and 18%, respectively. Of the 224 men screened for syphilis, three were diagnosed with primary syphilis, nine with secondary syphilis, and thirteen with latent infection (Table 5.1).

5.4.4 Group Sex

A quarter of the population (n=58, 25%) reported GSE within the past three months (Table 5.2). GSE differed significantly by drug use in the past three months, known HIV status, and unprotected anal intercourse within the past three months. Men who reported GSE in the past three months were significantly more likely than men who did not report GSE to report use of other drugs (62% vs. 19%). Similarly, unprotected anal intercourse in the past three months was significantly more common among men

with a history of GSE in the past three months (88% vs. 62%). Men who reported recent GSE were significantly more likely to be HIV-positive (28% vs. 15%). GSE in the past three months was similar across age, race/ethnicity, education, employment, relationship status and sexual orientation (Table 5.2).

5.4.5 Unadjusted and Adjusted Associations

Group Sex and Gonorrhea

Group sex was significantly associated with prevalent gonococcal infection in the unadjusted model (prevalence ratio (PR): 2.21, 95% confidence interval (CI): 1.30, 3.77) (Table 3). This relationship did not differ by either of the hypothesized effect modifiers, known HIV status and drug use in the past three months; interaction terms were therefore not retained in the model. After backwards elimination, age, race/ethnicity and drug use were retained in the model. Education, employment, relationship status, and known HIV status did not meet criteria for confounding. The prevalence of gonorrhea among those who reported GSE in the past 3 months was more than twice the prevalence of gonorrhea among those who did not report GSE (AOR: 2.11, 95% CI: 1.13, 3.95) (Table 5.3) after adjustment for potential confounders including age, race/ethnicity, and drug use in past three months,.

Group Sex and Chlamydial Infection

The unadjusted model revealed a non- significant increased prevalence of chlamydial infection among MSM reporting GSE in the last three months (PR: 1.47, 95% CI: 0.85, 2.52) (Table 5.3). Adjustment for the same set of confounders led to an attenuated measure of association between GSE and chlamydial infection (APR: 1.03; 95% CI: 0.58, 1.84) (Table 5.3).

5.4.6 Sensitivity Analyses

Including unprotected anal intercourse in the past three months and number of partners in the last year (in addition to the other confounding variables) in the final models slightly reduced the adjusted estimates of effect for the association between GSE and gonorrhea and chlamydial infections (APR for GSE and gonococcal infection: 1.92, 95% CI: 1.00, 3.69; APR for GSE and chlamydial infection: 0.90, 95% CI: 0.48, 1.70) (Table 5.3).

Unadjusted models using anatomical site-specific STI did not differ meaningfully from the unadjusted models that used gonorrhea and chlamydia from all anatomical sites. The unadjusted PR for the association between GSE and rectal gonorrhea was 2.06 (95% CI: 1.14, 3.73), and between GSE and urethral gonorrhea was 2.15 (95% CI: 0.95, 4.82), compared to 2.21 (95% CI: 1.30, 3.77) using the all-anatomical-site gonorrhea. Sample size prevented analysis of the association between GSE and oral gonorrhea. The associations between GSE and rectal chlamydia (PR: 1.41, 95% CI: 0.80, 2.47) and between GSE and urethral chlamydia (PR: 2.17, 95% CI: 0.79, 5.99) were similar to the association between GSE and all-anatomical-site chlamydia (PR: 1.47, 95% CI: 0.85, 2.52).

5.5 Discussion

In a sample of MSM presenting to an urban sexual health clinic, we found that self-reported recent participation in group sex was associated with a more than two-fold increased prevalence of gonorrhea infection, but not chlamydia infection.

In this sample of MSM, 25% reported participation in GSE within the past three months. This is similar to other published reports, where 27% of a community-based sample of MSM reported GSE within the past year (Phillips, 2013). We found that

participation in GSE in the past three months differed significantly by reported drug use in past three months, known HIV status, and history of unprotected anal intercourse in past three months. GSE participation did not differ significantly by age, race/ethnicity, education, employment status, relationship status, or sexual orientation. The prevalence of gonorrhea among those who reported GSE in the past three months was approximately twice the prevalence of gonorrhea among those who did not report GSE. However, GSE was not significantly associated with prevalent chlamydial infection in unadjusted or adjusted analyses. The measures of association between GSE and prevalent STI remain nearly constant in unadjusted and adjusted models, and our sensitivity analysis confirms the robustness of the primary findings.

Given the absence of data on the association between GSE and STI, DAG analysis was challenging. In *a priori* discussions, we hypothesized that GSE may cause STI, but only by facilitating another behavior through which disease transmission could occur. For example, GSE may lead to unprotected anal intercourse, which then exposes men to STI acquisition. Therefore, we hypothesized that unprotected anal intercourse was the primary mechanism through which GSE causes STI, placing it on the causal pathway and eliminating the requirement to control for it in multivariate analyses (Figure 5.1a). However, alternative hypotheses lead to different conclusions. First, it is plausible that unprotected anal intercourse is not actually on the causal pathway between GSE and STI. It may instead be a separate behavior that shares a common cause with GSE. While there is substantial overlap between men who report GSE and those who report unprotected anal intercourse, perhaps this is because a common cause such as a general affinity for risk-taking behavior, or “sexual adventurism” (Kippax, 1998) increases engagement in both GSE and unprotected anal intercourse . If Figure 5.1b best describes the relationship between GSE, unprotected anal intercourse and STI, then our

sensitivity analysis is the proper statistical analysis. Finally, a third scenario must be noted. Assuming that unprotected anal intercourse does lie on the causal pathway between GSE and STI (Figure 5.1a), other biologically plausible pathways may also lead from GSE to STI. For example, other behaviors that have been noted to accompany GSE may also transmit disease, such as oral sex and sharing of sex toys. Through adjustment for unprotected anal intercourse in our sensitivity analysis, we may be capturing the risk of disease associated with GSE that occurs outside of the unprotected anal intercourse pathway.

As others have found (Phillips 2013), we found that men who report GSE within the past three months are more likely to report other risky behaviors. In this sample, group sex participants were more likely to report unprotected anal intercourse within the past three months and drug use within the past three months. This supports previous suggestions that MSM who engage in group sex may be high-risk individuals, even without their GSE participation (Sowell, 1998). A majority (88%) of men in our sample who reported GSE in the past three months reported unprotected anal intercourse in the same time period. This is significantly more than the 62% of MSM in our sample who did not report GSE, and higher than CDC estimates which found that 54% of MSM, in general, report unprotected anal intercourse within the past 12 months (Finlayson, 2011).

HIV-positive status was more common among men reporting GSE in the last three months than among men not reporting GSE in this sample. Another study found positive HIV status to be significantly associated with spontaneous group sex and organized sex parties (Grov, 2013). These findings, coupled with the high prevalence of unprotected anal intercourse within the GSE experience (Grov, 2013; Prestage et al, 2008) highlight the potential role of GSE in HIV transmission.

We assessed participation in GSE with a single question that asked about any sex with more than one individual at the same time. This question improves upon much of the literature, as most prior studies focus exclusively on GSE within bathhouses, sex clubs, or other venues where sex might occur (Binson et al, 2001; Woods et al, 2007; Reidy et al, 2009). Because we ask about group sex in a general way, we likely capture a broader range of experiences and obtain a more inclusive measure of the behavior. However, our question is limiting in that we do not collect additional details, such as type of GSE (threesome vs organized sex party, etc.) or specific behaviors occurring within the GSE. Grov *et al*. recently concluded that types of GSE have significantly different behaviors and participants (Grov, 2013) and, therefore, likely also differ with respect to risk of disease transmission.

In this analysis, GSE was significantly associated with gonorrhea but not chlamydial infection. The reason for this finding is unclear, although it is consistent with prior literature. A 2013 study conducted on a different sample of MSM from the same sexual health clinic found a significant association between HIV and rectal chlamydial infection, but not between HIV and rectal gonorrhea (Norris Turner, 2013). One possible explanation for findings such as this is the presence of different pathogens within different sexual networks. For example, other research has concluded that LGV-inducing strains of chlamydia are found exclusively in networks of riskier MSM (Born, 2013).

This analysis is strengthened by its use of biologically-confirmed STI as the outcome. The methodologic advantages of using biological instead of (self-reported) behavioral outcomes are well-documented (Gallo, 2013). Our outcome is additionally strengthened by the inclusion of urethral, rectal, and oropharyngeal results. STI data among MSM largely relies on urethral infections (CDC, 2011d). However, up to 53% of chlamydial infections and 64% of gonococcal infections in MSM are at nonurethral sites

(Kent et al, 2005) and, thus, are potentially missed and misclassified when testing is limited to urethral screening.

This cross-sectional study has several limitations. First, this analysis relied on self-reported behaviors for inclusion in the study, classification of the primary exposure (GSE), and most confounders. Self-report of sensitive behaviors in particular may be affected by recall or social-desirability bias (Zenilman, 1995; NIMH, 2008). Second, men had to report during the screening process anal sex (receptive or insertive) with another man within the past year to be eligible for this study. This criterion limits the generalizability of our findings. MSM who did not engage in anal sex in the past year were not included in this study. Finally, because of the cross-sectional nature of our data, we cannot assess the temporality of the relation between GSE and STI. However, we limited our analysis to STIs that likely would have been recently acquired and GSE in the past three months to minimize this limitation.

In summary, GSE is a prevalent behavior among this sample of MSM. We documented a robust, significant association between GSE and prevalent gonococcal infection, which suggests that GSE may be a behavior of interest for public health intervention programs. Given the increasing rates of STI in MSM, and the increased HIV risk in individuals with prevalent STI, it is imperative that research continues to identify behaviors associated with increased STI risk.

Table 5.1. Participant Characteristics (N=231)			
		n	%
Age			
	18-24	100	43%
	25+	131	57%
Race/Ethnicity			
	White	130	56%
	Minority	101	44%
Education			
	HS Diploma or less	67	29%
	At least some college	164	71%
Employment			
	Currently Employed	170	74%
	Unemployed	58	25%
	Missing	3	1%
Relationship			
	Committed Partner	88	38%
	No committed partner	142	61%
	Missing	1	0%
Sexual Orientation			
	Gay	176	76%
	Bisexual	31	13%
	Other	23	10%
	Missing	1	0%
Drug Use Past 3 Months			
	Marijuana Only	53	23%
	Other Drug Use (may include marijuana)	69	30%
	None	108	47%
	Missing	1	0%
			continued

Table 5.1 (continued) Unprotected Anal Intercourse Past 3 Months			
	Yes	157	68%
	None	73	32%
	Missing	1	0%
Known HIV Status			
	Positive	41	18%
	Negative	190	82%
Gonorrhea			
Rectal*			
	Positive	34	15%
	Negative	143	62%
	Indeterminate	1	0%
Urethral*			
	Positive	21	9%
	Negative	199	86%
	Indeterminate	3	1%
Oral*			
	Positive	5	2%
	Negative	180	78%
Total*			
	Positive	42	18%
	Negative	187	81%
	Missing	2	1%
Chlamydia			
Rectal*			
	Positive	39	17%
	Negative	133	58%
	Indeterminate	6	3%
Urethral*			
	Positive	14	6%
	Negative	208	90%
	Indeterminate	2	1%
Total*			
	Positive	45	19%
	Negative	183	79%

continued

Table 5.1 (continued)			
	Missing	3	1%
Syphilis**			
	Primary	3	1%
	Secondary	9	4%
	Latent	13	6%
	Negative	199	86%
	Missing	7	3%

*178 men were screened for rectal infections, 223 men were screened for urethral infections, and 185 men were screened for oral infections. In total, 229men were screened for gonorrhea and/or chlamydial infection of at least one anatomical site. 224 men were screened for syphilis.

Table 5.2. MSM Characteristics by Reported Group Sex Participation in past 3 Months (N=231)

	Men who Report Group Sex in Past 3 Months (N=58)		Men who Report No Group Sex in Past 3 Months (N=173)		Wald Chi-Square p-value
	N	%	N	%	
Age					
18-24	22	38%	78	45%	
25+	36	62%	95	55%	
					0.34
Race/Ethnicity					
White	31	53%	99	57%	
Minority	27	47%	74	43%	
					0.62
Education					
HS Diploma or less	13	22%	54	31%	
At least some college	45	78%	119	69%	
					0.20
Employment*					
Currently Employed	39	68%	131	77%	
Unemployed	18	32%	40	23%	
					0.22
Relationship*					
Committed Partner	24	41%	64	37%	
No committed partner	34	59%	108	63%	
					0.57
Sexual Orientation*					
Gay	45	79%	131	76%	
Other	12	21%	42	24%	
					0.62

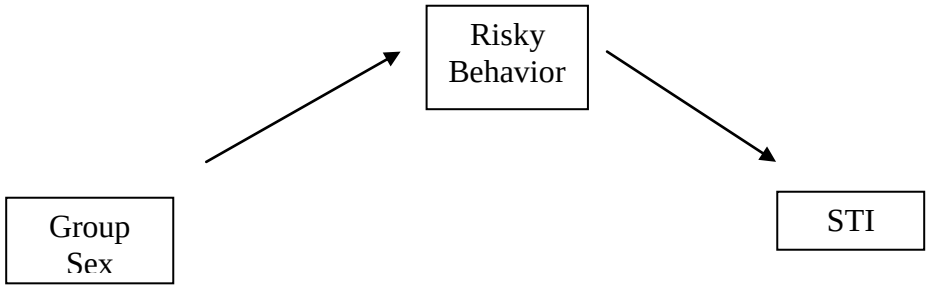
Continued

Table 5.2 (continued) Drug Use Past 3 Months*					
Marijuana Only	5	9%	48	28%	
Other Drug Use	36	62%	33	19%	
No drug use	17	29%	91	53%	
					<.0001
Known HIV Status					
Positive	16	28%	25	15%	
Negative	42	72%	148	86%	
					0.02
Unprotected Receptive Anal Intercourse Past 3 Months					
Yes	51	88%	106	62%	
None	7	12%	66	38%	
					0.00
*Frequencies do not sum to 231 due to missing data.					

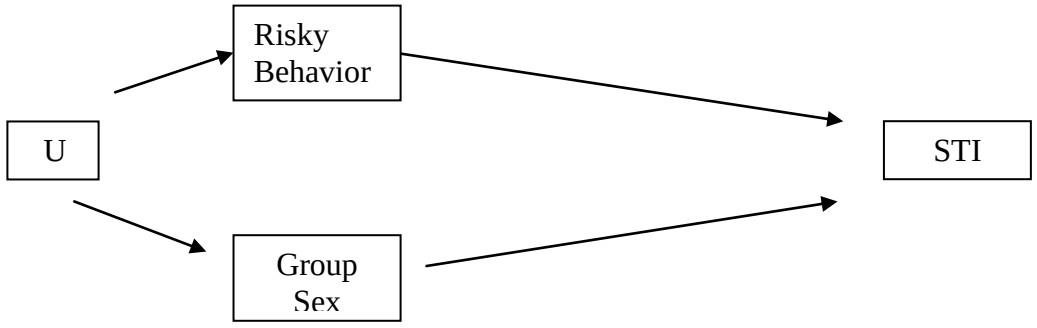
Table 5.3. Modified Poisson regression predicting Gonorrhea and Chlamydial Infection				
	Gonorrhea		Chlamydia	
Model 1: Unadjusted	OR	95% CI	OR	95% CI
Group Sex in Past 3 Months	2.21	(1.30, 3.77)	1.47	(0.85, 2.52)
Model 2: Final Model*				
Group Sex in Past 3 Months	2.11**	(1.13, 3.95)	1.03**	(0.58, 1.84)
Model 3: Sensitivity Analysis Model^				
Group Sex in Past 3 Months	1.92^^	(1.00, 3.69)	0.90^^	(0.48, 1.70)
*Final model created using backwards selection.				
**Adjusted for age, race, and drug use in past 3 months				
^Model that adjusts for URAI in addition to all confounders in Final model				
^^Adjusted for age, race/ethnicity, drug use in past 3 months, number of partners in last year,and URAI in past 3 months				

Figure 5.1. Directed Acyclic Graphs for possible relationship between group sex, risky behaviors, and sexually transmitted infection (STI)

a.)Risky behaviors on causal pathway between group sex and STI



b.) Common unmeasured cause (U) of risky behavior & group sex



Chapter 6

Body image and STI prevalence among men who have sex with men

6.1 Abstract

Men who have sex with men (MSM) are at increased risk for body image dissatisfaction and are also disproportionately impacted by HIV and other sexually transmitted infections (STIs). Several studies have examined the association between body image and risky sexual behaviors as a proxy for STI risk. Some have concluded that *poor* body image increases sexual risk taking, while others have found that *good* body image is associated with risky sexual behavior. As part of a cross-sectional study conducted in a public STI clinic, we assessed the body image of 104 MSM using the Male Body Attitudes Scale (MBAS). We examined the association between body image and prevalent STI (gonorrhea, chlamydia, or primary/secondary syphilis) using unadjusted and adjusted modified Poisson regression. Participants had a median age of 26 years and 56% were Caucasian. Seventy-four percent identified as gay, and 32% tested positive for at least one STI. Body image differed significantly by body mass index (BMI) and whether the participant had a committed partner, but did not differ significantly across age, race, education level, employment status, or HIV status. Body image was not associated with prevalent STI status in unadjusted models (prevalence ratio (PR): 1.14, 95% confidence interval (CI): 0.86, 1.52) or models adjusted for HIV status, relationship status, race, and age (APR: 1.17, 95% CI: 0.89, 1.53).

6.2 Introduction

Human immunodeficiency virus (HIV) and other sexually transmitted infections (STIs) disproportionately impact men who have sex with men (MSM) in the United States (US). In 2008, MSM accounted for 53% of incident HIV infections and this population group was 60 times more likely to be diagnosed with HIV than other men (Hall, 2008). Primary and secondary syphilis rates among MSM are 46 times that of other US men (CDC, 2011d). Furthermore, surveillance suggests rising rates of STIs among MSM (CDC, 2013; Heffelfinger, 2007; Chen, 2002), which is particularly concerning because prevalent STI increases the likelihood of acquiring and transmitting HIV (Fleming, 1999). These data likely underestimate the true scope of the problem, as there are limited national data specific to MSM (CDC, 2011d).

"Body image" refers to an individual's own subjective experiences of their appearance. Research over the last several decades has revealed that this concept is more psychosocially powerful than the objective reality of one's appearance (Cash, 2004). Research and cultural attention regarding men's body image has increased substantially since 2000 (Filiault & Drummond, 2009; Tylka et al, 2005). A 2004 meta-analysis concluded that gay men are more prone to body image dissatisfaction than heterosexual men (Morrison, Morrison, & Sager, 2004). Multiple explanations have been proposed for the higher prevalence of poor body image in MSM. Some MSM may consider appearance more central to their sense of self (Silberstein, 1989) and may be more fearful of becoming fat than heterosexual men (Kaminski, 2005). One long-held theory attributes this body image dissatisfaction to the prominence of physicality, or preoccupation with one's body, among gay men (Epstein, 1996; Siever, 1994). Other researchers have suggested that body image dissatisfaction among MSM is due to high HIV prevalence and, thus, high prevalence of use of antiretroviral therapy, which can

result in lipodystrophy (Ammassari et al, 2002; Santos et al, 2005). However, the single published comparison of body image in HIV-positive vs. HIV-negative gay men found no significant differences in body image by HIV status (Blashill & Vander Wal, 2011).

6.2.1 Body Image & Sexual Risk in Men and MSM

Among all men (not limited to MSM), some research has hypothesized that *better* body image in men may boost confidence in sexual situations (Shearer et al, 2005), which is then manifested in riskier behaviors (Gillen, 2006). Other research has proposed the opposite association, that *poorer* body image in men – again, not restricted to MSM – may be related to increased prevalence of risky sexual behaviors. Poor body image has been associated with low self-esteem (Beren et al, 1996) and depression (NIH, 2004), which may lead to increased sexual activity as a coping strategy (Martin & Knox, 1997).

Research evaluating the relation between body image and risky sexual behavior in MSM has resulted in mixed findings. Positive body image has been associated with increased engagement in anal sex (Kraft, 2006) and unprotected receptive anal intercourse (Meanley, 2013). Conversely, poor body image has been associated with decreased condom use (Wilton, 2009) and history of STI (Brennan, Craig, & Thompson, 2012). Still another study reported that better body image was protective against risky sexual behaviors (Allensworth-Davies, 2008). This existing literature is weakened by its reliance on behavioral outcomes instead of biologically-confirmed STI. Prior studies have presumably used risky behavior as a proxy for STI, as STI reduction is the target of sexual health research.

While an increasing amount of research has documented the prevalence of poor body image in MSM (Brand et al, 1992; Siever, 1994; Schneider et al, 1995; Morrison, Morrison, & Sager, 2004; McCreary et al, 2007; Peplau et al, 2009), and explored

associations between body image and risky behaviors in MSM (Wilton, 2009; Allensworth-Davies, 2008; Kraft, 2006; Meanley, 2013), to our knowledge, no research has examined the association between body image and biologically-confirmed STI. We hypothesize that both MSM with poor body image, and those with better body image, will have increased prevalence of STI compared to MSM with average body image.

6.3 Methods

This analysis utilizes data from a cross-sectional study of MSM presenting for care at a metropolitan public sexual health clinic (SHC) in the Midwestern US. To be eligible for the parent study, men were required to be 18 or older, to speak and read English, and to report anal intercourse (receptive or insertive) with another man within the past year. This analysis was completed on a subsample of participants who also completed a body image questionnaire.

6.3.1 Survey Data

All survey data were directly entered into REDCap, a secure web application designed for capturing research data (Harris et al, 2009). The questionnaire was divided into two sections, interviewer-administered and self-administered. The self-administered questionnaire assessed the most sensitive information, including sexual behaviors and body image. Participants were compensated $10.

Body image was assessed using the Male Body Attitudes Scale (MBAS), a measure of men's body attitudes across three dimensions: low body fat, muscularity, and height (Tylka et al, 2005). The MBAS consists of 24 total questions administered as three subscales focused on body fat, muscularity, and height dimensions (Tylka et al, 2005). The total MBAS score assesses overall body attitudes, and subscale scores

capture attitudes for each individual dimension. Both the overall scale and each subscale are scored on a 6-point scale, where higher scores indicate poorer body image. For example, one question asks men to state their level of agreement (Never, Rarely, Sometimes, Often, Usually, Always) with the statement, “Seeing my reflection (in a mirror or window) makes me feel badly about my size or shape”.

6.3.2 Clinical Data

Per standard SHC protocol, all men underwent diagnostic testing for HIV, syphilis, urethral gonorrhea, and urethral chlamydia. Men who reported receptive anal intercourse in the last year also underwent testing for rectal gonorrhea and chlamydial infection; those reporting receptive oral sex underwent oropharyngeal gonorrhea testing. Results for all SHC patients were entered into electronic health records (EHR); self-reported results of past HIV testing were also recorded in the EHR. For this study, participants’ STI and HIV results were extracted from EHRs and linked with survey data for analysis.

6.3.3 Statistical Methods

Statistical analyses were conducted using SAS (Version 9.2, Cary NC).

Descriptive Analysis

We calculated simple frequencies of participant characteristics, including demographic data, BMI, and HIV status. We computed the prevalence of rectal, urethral, and oropharyngeal gonorrhea, rectal and urethral chlamydial infection, and primary, secondary, and latent syphilis, separately and as a composite STI outcome. Using

Wilcoxon-Mann-Whitney and Kruskal-Wallis tests, we compared MBAS total scores and subscores by demographics and STI outcome variables.

Multivariate Analysis

Outcome Assessment:

Participants were classified as STI-positive if they tested positive for primary or secondary syphilis, gonorrhea, or chlamydia on the date of enrollment, regardless of the site of infection (urethral, rectal, or oropharyngeal). We used a binary composite variable (prevalent STI versus none) as the outcome variable in multivariate analysis.

MBAS

We calculated total MBAS score as directed by the scale developer (personal communication with Tracy Tylka, 1/26/12), by averaging participant responses (1-6) for the 24 items. Given our hypothesis that men with higher and lower body image scores would have increased STI prevalence compared to men with average body image, we assessed whether continuous MBAS score met the linearity assumption (Hosmer & Lemeshow, 2000) for modified Poisson regression. Because this assumption was met, we used continuous MBAS score as the primary independent variable in our analysis.

HIV Status

In this analysis we adjusted for men's *known* HIV status – in other words, the HIV status men thought they had when completing the survey and body image scale. We hypothesized that sexual behaviors and body image would be more influenced by what men knew as their HIV status than their actual biological status. Men were classified as HIV-positive if they had a positive HIV test noted in their EHR from a prior visit, or if they self-reported being HIV-positive to the clinician. Men were classified as not HIV-positive if they had no history of a positive HIV test, including both men who had only negative HIV tests or men who had no history of being tested per medical record or self report.

Modified Poisson Regression

To evaluate the association between body image and STI prevalence, we ran unadjusted and adjusted modified Poisson regression models (Zou, 2004) specifying continuous MBAS score as the primary exposure and prevalent STI (gonorrhea, chlamydia, or primary/secondary syphilis) as the outcome. Based on previous literature and analysis of a Directed Acyclic Graph (Greenland et al, 1999), we adjusted for known HIV status, age, race, and relationship status. We did not adjust for sexual behaviors because we hypothesized that these lie on the causal pathway between body image and prevalent STI and, thus, do not confound our primary association of interest. Sample size limitations prevented us from using MBAS subscores as the primary exposure. Because we hypothesized that men at the extremes of body image would have the highest STI prevalence, we also calculated unadjusted and adjusted prevalence ratios

comparing those with body image scores in the highest and lowest tertiles to those in the middle tertile.

6.3.4 Sensitivity Analyses

First, to confirm that use of a composite STI outcome was appropriate, we completed a sensitivity analysis examining the effect of body image on chlamydial infection only, and separately, on gonorrhea only. Sample size prevented us from examining the effect of body image on syphilis only.

Second, while we hypothesized that risky sexual behavior was on the causal pathway and, thus, should not be adjusted for in this analysis, we anticipated that others may not agree. In our second sensitivity analysis we examined whether our primary findings about the relationship between body image and prevalent STI changed following adjustment for unprotected anal intercourse (UAI) in the last three months.

6.3.5 Ethical Approval

This study was approved by The Ohio State University Institutional Review Board (protocol # 2011H0154).

6.4 Results

Between July 2012 and October 2013, we screened 1,866 men presenting to the SHC for study eligibility. The overwhelming majority of exclusions were men who did not report receptive or insertive anal sex with men in the past year (99%, n=1568). Other

exclusions were attributable to underage status (n=13) or inability to speak English (n=10). Of the 1,866 screened, 286 men met eligibility requirements and 235 enrolled in the larger study. Fifty-one eligible men did not enroll due to time constraints or lack of interest. Due to study operational issues, only 104 (44%) of the 235 enrolled men completed the MBAS and were included in this analysis. These 104 MSM did not differ significantly from the MSM who did not complete the MBAS with respect to age, race, education, employment, or disease status (data not shown).

6.4.1 Participant Characteristics

Participants were 18-66 years of age (median: 26 years, interquartile range (IQR): 22-35). Fifty-three percent of participants were white and 47% reported a minority race or ethnicity. A majority had completed at least some college (n=73, 70%) and were employed (n=75, 73%). Seventy-four percent (n=77) identified as gay, 15% (n=16) as bisexual, and 11% (n=11) as having another sexual orientation. Thirty-six percent were in a committed relationship at time of the interview (Table 6.1). At enrollment, 20 men (19%) were known to be HIV positive and 84 men (81%) had no self-reported or EHR-documented history of a positive HIV test. Half of participants (51%) had healthy BMI, while 7% were underweight, 30% overweight, and 11% obese (Table 6.1).

6.4.2 STI Prevalence

Of the 104 men included in this analysis, 98 were screened for urethral gonorrhea/chlamydial infections, 81 were screened for rectal gonorrhea and rectal

chlamydial infections, and 79 were screened for oropharyngeal gonorrhea infections. Ninety-nine men were screened for syphilis. One man did not receive any STI testing because he presented to the clinic for treatment of a known infection and refused additional screening. Of men undergoing urethral screening, nine (9%) tested positive for urethral gonorrhea and two (2%) for urethral chlamydial infection. Among men screened for rectal infections, rectal gonorrhea and rectal chlamydial infections were present in 21% (n=17) and 19% (n=15), respectively. Two (3%) men were diagnosed with oropharyngeal gonorrhea. Of those screened for syphilis, four (4%) were diagnosed with secondary syphilis and seven (7%) had latent syphilis (early, late, or unknown duration). In total, 32% of men (n=33) were STI-positive (Table 6.1).

6.4.3 Body Image

Total MBAS scores for the 104 participants ranged from 1.00 to 5.38, with a median score of 2.83 (IQR: 2.06 to 3.42). MBAS subscores had similar distributions: the median height subscore was 2.00 (IQR: 1.00 to 3.50), the median muscle score was 2.95 (IQR: 2.15 to 3.70), and the median body fat score was 2.63 (IQR: 1.75 to 3.75) (Table 6.2).

Neither total MBAS score nor individual subscores differed significantly by age, race, education level, employment status, or sexual orientation (Table 6.2). Men who did not have a committed partner at the time of interview had significantly poorer total body image and body fat body image compared to men who had a committed partner. Total body image and body fat body image differed significantly across BMI categories, with

body image significantly worsening with increasing BMI. Neither total MBAS nor individual subscores differed significantly by STI status or known HIV status (Table 6.2).

6.4.4 Unadjusted and Adjusted Associations between Body Image and Prevalent STI

The unadjusted model revealed no significant association between total MBAS score and STI: increasing MBAS score (indicating poorer body image) was not associated with the prevalence of STI (PR: 1.14, 95% CI: 0.86, 1.52) (Table 6.3). Adjustment for potential confounders, including known HIV status, relationship status, race, and age, did not meaningfully change the estimate for the effect of MBAS on STI (APR: 1.17, 95% CI: 0.89, 1.53) (Table 6.3). We ran unadjusted and adjusted models using MBAS score trichotomized into tertiles to compare MSM with the extremes of body image to those with average body image. We observed no significant association between body image and prevalent STI when comparing those with poorest to those with moderate body image (PR: 1.04, 95% CI: 0.83, 1.30; APR: 1.05, 95% CI: 0.84, 1.31) or when comparing those with best to those with moderate body image (PR: 0.98, 95% CI: 0.79, 1.23; APR: 0.98, 95% CI: 0.79, 1.22).

6.4.5 Sensitivity Analyses

Unadjusted and adjusted models using single biological outcomes (gonorrhea or chlamydial infection) did not differ meaningfully from the model using a composite disease outcome (Table 6.3). The adjusted PR for the association between body image and gonorrhea was 1.12 (95% CI: 0.76, 1.64), and between body image and chlamydial

infection was 1.14 (95% CI: 0.73, 1.78), compared to 1.17 (95% CI: 0.89, 1.53) using the composite outcome.

Body image was not associated with self-report of UAI in the past three months in this sample (p-value: 0.46). The adjusted PR for the association between body image and STI with adjustment for UAI (as well as other confounding variables included in the primary analysis) was 1.19 (95% CI: 0.90, 1.57), nearly unchanged from the adjusted prevalence ratio in our primary analysis (APR: 1.17, 95% CI: 0.89, 1.53).

6.5 Discussion

In this analysis, we found that total body image and body fat body image differed significantly by relationship status and BMI. Body image did not differ significantly across race, age, education level, employment status, HIV status, or STI status. We found no significant association between body image and prevalent STI in this sample.

Because we are the first, to our knowledge, to examine the direct relationship between body image and STI among MSM, we relied on existing research that evaluated the association between body image and sexual behavior to formulate our hypotheses. The existing data suggest that body image is associated with riskier sexual behaviors, which themselves have been associated with STI risk. One study reported a significant relation between body image and anal sex in MSM (Kraft, 2006), meaning that MSM with better body image were more likely to engage in anal sex, with or without condoms. However, the same study found no significant association between body image and unprotected anal intercourse (Kraft, 2006). A study of black MSM found that men with poor body image were less likely to use condoms during anal intercourse (Wilton, 2009). Similarly, another study reported that MSM with high body satisfaction were less likely to report unprotected anal intercourse (Allensworth-Davies, 2008).

Based on these findings, we hypothesized that MBAS would have a non-linear relationship with STI prevalence, with MSM at the extremes of body image – both high and low – likely to have increased STI prevalence compared to MSM with moderate body image. However, our analyses revealed no significant relationship between MBAS and STI prevalence in unadjusted or adjusted analyses.

We hypothesized, a priori, that risky behaviors were on the causal pathway between body image and STI. Body image cannot, by itself, affect STI acquisition, but instead may affect behavior, which then may increase risk of STI. Because they are on the causal pathway, behaviors were not included in our primary analysis. However, given of the vital role of behavior in any discussion of STI, we examined UAI in sensitivity analyses. There was no association between body image and UAI in this sample. While this is in contrast to much of the literature, it confirms the findings of Kraft et al (2006), which reported no significant relation between body image and UAI. The differential findings, with respect to the association between body image and risky behaviors among MSM, highlight the flaws of using self-reported behaviors as outcomes. Self-reports of risky sexual behaviors are prone to both recall and social desirability bias. The limitations of self-report are well-documented and support the use of biologically confirmed variables whenever possible (Zenilman, 1995; Schachter, 2000). Thus, use of biologically-confirmed STI as our outcome strengthens this analysis. We also confirmed that treating UAI as a variable on the causal pathway, and not including it in the primary analysis, was appropriate. Adjustment for UAI in the final model did not meaningfully change our results and would not have affected our conclusions.

Much of the previous research evaluating the association between body image and sexual risk among MSM has relied on simple, unvalidated body image measures

(Allensworth-Davies et al, 2008; Wilton, 2009). Our work is strengthened by use of the MBAS, a comprehensive body image scale developed specifically for use among men, which has excellent psychometric properties (Tylka et al, 2005) and displayed strong factorial validity in a confirmatory analysis in a sample of gay men (Blashill & Vander Wal, 2009).

If HIV status were driving the high prevalence of body image dissatisfaction among MSM, we would expect to see a significant difference between the body image of HIV-positive and HIV-negative men. However, body image did not differ by known HIV status in this sample, a finding that is concordant with previous research comparing body image in HIV-positive and HIV-negative men (Blashill & Vander Wal, 2011). This finding further refutes the theory that body dissatisfaction among gay men is due to HIV and the lipodystrophy-related side effects of antiretroviral therapy (Ammassari et al, 2002; Santos et al, 2005). While antiretroviral therapy has been associated with poor body image (Huang et al, 2006), previously reported high levels of body dissatisfaction among HIV-positive men may be a conflation of the high prevalence of HIV among MSM and the high prevalence of body dissatisfaction among MSM (Blashill & Vander Wal, 2011). Alternatively, this phenomenon may have been observed when older HIV-treatment regimens, which had much higher rates of lipodystrophy, were in use.

Previous research on body image in MSM has assumed homogeneity among MSM, without attention to the role of race/ethnicity or socioeconomic status (Filiault & Drummond, 2009). This study addressed this limitation, and found no significant differences in body image across age, race, education, or employment status.

This analysis is limited by its sampling frame, eligibility procedures and eligibility criteria. Men presenting at the SHC for STI testing served as the sampling frame for this study, which may not be representative of men in the community at large. Men were

screened for eligibility using a brief questionnaire. In addition to meeting basic requirements of speaking and reading English and being 18 years or older, men were required to endorse anal sex with another man in the past year. Misreport of sexual behavior is common (Zenilman, 1995), especially when participants are asked to self-report embarrassing or socially desirable behaviors (Tourangeau & Smith, 1996). It is possible that men were not forthcoming during the eligibility questionnaire and were not enrolled, despite actually meeting criteria for inclusion. Furthermore, including only men who have had anal sex with another man in the last year limits our generalizability, even among MSM. MSM who do not have anal sex with other men are likely at substantially decreased risk for STI acquisition. By limiting our sample to MSM who do have anal sex, we likely excluded the men with the lowest disease prevalence.

Men presenting at the SHC are routinely screened for urethral infections, and screened for rectal and oropharyngeal infections only if a patient's self-reported behavior suggests risk of infection in those sites. Our access to data from all anatomical sites serves as both a strength and limitation of this analysis. There is a general trend of reliance on only urethral data for STI research (CDC, 2011d). However, more than half of chlamydial and gonococcal infections in MSM are at nonurethral sites and are potentially missed when testing is limited to urethral screening (Kent et al, 2005). Thus, our estimates of STI prevalence likely capture more infection, strengthening this analysis. However, men must report certain risk behaviors to SHC clinicians in order to receive rectal and oropharyngeal screening. Given the flaws of self-report, it is likely that infections at rectal and oropharyngeal sites are still being missed among MSM presenting at sexual health clinics. These missed infections may induce misclassification that is differential by body image. MSM with poor body image may be more uncomfortable during sexual health exams and less likely to discuss sexual behavior in a

candid manner. If they do not disclose receptive anal or oral sex to the SHC clinician, these men may miss being screened for rectal or oropharyngeal infection. Men did not always provide concordant reports of sexual behavior to SHC clinicians and study staff.

Our outcome was prevalent STI, and the timing of disease acquisition is unknown. Because one's body image can fluctuate and change over time, we restricted our outcome to infections that were likely acquired recently (gonococcal and chlamydial infection, and primary/secondary syphilis), so that a participant's reported body image at the time of the interview was more likely to agree with his body image at the time of STI acquisition. Given the cross-sectional nature of our data and the length of time that HIV can remain undiagnosed, we chose not to evaluate HIV as an outcome, as it would not be possible to determine whether body image at the time of the interview was a contributing factor to acquisition of, or a consequence of, HIV infection. We hypothesized that the relation between body image and STI would be different for HIV-positive and HIV-negative men. However, only 20 HIV-positive men completed the MBAS, and 9 of these were STI-positive, limiting our ability to examine whether body image has a different association on STI prevalence in HIV-positive men vs. HIV-negative men.

In summary, while previous research suggests that body image may be associated with risky sexual behaviors, these studies did not assess the effect of body image on STIs. Reliance on self-report of risky behavior as an outcome is inherently flawed and prone to bias. This analysis provides a substantial contribution with its use of a validated body image measure and biologically-confirmed outcome. We found no significant association between body image and prevalent STI, suggesting that poor body image may not be an appropriate target for public health interventions focused on reducing STI prevalence. While body image may be an important indicator of

psychological well-being on its own, it appears to have no direct influence on disease prevalence among MSM.

6.6 Addendum

In total, 235 men enrolled in this cross-sectional study. Due to administrator error, the first 123 participants were given a flawed MBAS. Of those 123, 110 completed the MBAS. We completed a sensitivity analysis to evaluate the effect of the errors in administration. We used this analysis to determine whether correcting the flawed data using various approaches would permit us to combine those flawed data with the data from the 104 men who completed the MBAS as designed.

Three errors were detected in the administration of MBAS:

1.) Response options were given in reverse order. Participants should have seen the responses as:

Never

Rarely

Sometimes

Often

Usually

Always

But participants saw these options instead:

Always

Usually

Often

Sometimes

Never

2.) The “rarely” response option was missing for all items.

3.) MBAS is a 24-item scale. Participants only saw 23 items. They did not receive item #16, which states “I think my chest should be larger and more defined.”

To assess the effect of these errors, we completed a sensitivity analysis using four different algorithms to correct the existing data:

1.) MBAS was scored as it was administered. Thus, there were no “rarely” responses. MBAS total score was calculated as a mean of 23 items, as recommended by the scale developer to address missing items (personal communication with Tracy Tylka, 1/26/12).

2.) MBAS was scored so that all “sometimes” responses were re-classified as “rarely”. MBAS total score was again calculated as a mean of 23 items.

3.) MBAS was scored so that all “never” responses were re-classified as “rarely”. MBAS total score was calculated as a mean of 23 items.

4.) MBAS was scored so that all “sometimes” and all “never” responses by men were re-classified as “rarely”. MBAS total score was calculated as a mean of 23 items.

Using logistic regression, we calculated unadjusted associations between each corrected MBAS score and prevalent STI, using only the data from the 110 men that completed the flawed MBAS. The PRs obtained using the four correction algorithms (0.91, 0.88, 0.86, 0.83) (Table 6.4) are meaningfully different from the unadjusted PR from the primary analysis, computed among the 104 men who completed the MBAS as designed (PR: 1.14) (Table 6.3).All corrected PRs were protective, indicating that as

body image worsens (MBAS score increases), prevalent STI *decreases*. In contrast, the unadjusted PR (1.14) in our primary analysis suggests that worsening body image is associated with *increased* STI prevalence. However, all PRs from both primary and sensitivity analyses fell close to the null value of 1 and were statistically insignificant.

Finally, we calculated the unadjusted OR between MBAS score and prevalent STI, combining the data corrected under the four algorithms described above (n=110) with the data from participants who received the MBAS as designed (n=104) for a total sample size of n=214. As expected, the four resulting PRs from the combined dataset (PR: 0.99, 0.97, 1.00, 0.97) fell between the PR from our primary analysis using the MBAS as designed (OR: 1.14) and the PRs from each of the four correction algorithms (0.91, 0.88, 0.86, 0.83).

This sensitivity analysis allowed us to distinguish the effects of the three errors committed during MBAS administration. We concluded that the second error (absence of "rarely" as a response option) did not meaningfully change the association between body image and prevalent STI: after various correction algorithms addressing the missing response option, the prevalence ratios were all quite similar to each other (Table 6.4), indicating that this error had minimal impact on the observed PR.

We also concluded that the third error (absence of item #16) did not meaningfully change the scale. First, according to the scale developer, removal of a single item from the scale should not impact the findings (personal communication with Tracy Tylka, 1/26/12). In the case of missing data, the developer recommends scoring the MBAS using a mean score of the total items administered, such that men who only answered 23 questions would have a score calculated as the mean of those 23 items (Tylka, personal communication). We confirmed this in our own data by re-analyzing the MBAS data when the scale was administered as designed (n=104). We excluded item 16 from

analysis and found that the resulting PR (PR: 1.14, 95% CI: 0.85, 1.51) was essentially unchanged from the PR calculated using all 24 items (PR: 1.14, 95% CI: 0.86, 1.52).

We were not able to correct for the first error – seeing response options in reverse order – in our sensitivity analyses. We conclude that this is the error responsible for the differences between the observed PR in our primary analysis and the corrected PRs from the sensitivity analyses of men who took the flawed MBAS. The importance of response order is well-documented in survey literature (Bishop et al, 1988; Krosnick and Alwin, 1987; Mingay and Greenwell, 1989). Recency effects (choosing the last option) and primacy effects (choosing one of the first options) are two documented effects that may have played a role in our results.

Based on the results of this sensitivity analysis, these 123 men were not merged with the 104 men in the primary analysis. We were unable to correct for the error in response option order and, thus, could not merge the data.

Table 6.1. Participant Characteristics (n=104)			
		N	%
Age			
	18-24	43	41%
	25+	61	59%
Race/Ethnicity*			
	White	63	61%
	Black	37	36%
	Asian/Pacific Islander	4	4%
	Native American/Hawaiian	7	7%
	Hispanic	7	7%
Education			
	HS Diploma or less	31	30%
	At least some college	73	70%
Employment			
	Currently Employed	75	73%
	Unemployed	28	27%
	Missing	1	1%
Relationship			
	Committed Partner	37	36%
	No committed partner at time of interview	67	64%
Sexual Orientation			
	Gay	77	74%
	Bisexual	16	15%
	Other	11	11%
BMI			
	Underweight (Below 18.5)	7	7%
	Normal (18.5 – 24.9)	55	53%
	Overweight (25.0 – 29.9)	31	30%
	Obese (30.0 and Above)	11	11%
			continued

Table 6.1 (continued)		
Known HIV Status at time of Interview		
Positive	20	19%
No history of positive	84	81%
Gonorrhea		
Rectal**		
Positive	17	16%
Negative	64	62%
Urethral**		
Positive	9	9%
Negative	89	86%
Oral**		
Positive	2	2%
Negative	77	74%
Chlamydia		
Rectal**		
Positive	15	14%
Negative	64	62%
Indeterminate	2	2%
Urethral**		
Positive	2	2%
Negative	96	92%
Syphilis**		
Primary	0	0%
Secondary	4	4%
Latent	7	7%
Negative	88	85%
GC/CT/Syphilis Results**		
Positive	33	32%
Negative	70	68%
*Percentages do not sum to 100%. Participants were permitted to identify multiple races/ethnicities.		
**98 men were screened for urethral infections. 81 were screened for rectal infections. 79 were screened for oral infections. 99 men were screened for syphilis. In total, 103 men were screened for at least one STI.		

Table 6.2. Comparison of median body image scores by participant characteristics (n=104)

	MBAS Total	MBAS Body Fat	MBAS Height	MBAS Muscularity
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
Age				
18-24	2.75 (2.00-3.33)	2.38 (1.63-3.50)	1.50 (1.00-3.50)	3.10 (2.10-3.60)
25+	2.83 (2.08-3.50)	2.63 (1.88-3.88)	2.00 (1.00-3.50)	2.70 (2.20-3.80)
p-value*	0.75	0.6	0.46	0.79
Race/Ethnicity				
White	2.92 (2.17-3.88)	3.13(1.88-3.88)	2.00 (1.00-3.50)	2.90 (2.10-3.80)
Minority	2.62 (2.04-3.33)	2.25 (1.63-3.50)	2.00 (1.00-3.50)	3.10 (2.30-3.60)
p-value*	0.25	0.17	0.81	0.75
Education				
HS Diploma or less	2.63 (1.96-3.96)	2.63 (1.63-4.25)	2.00 (1.00-3.50)	3.00 (1.90-4.30)
At least some college	2.83 (2.21-3.33)	2.63 (2.00-3.63)	2.46 (1.00-3.50)	2.90 (2.20-3.60)
p-value*	0.94	0.77	0.95	0.97
Employment				
Currently Employed	2.79 (2.04-3.42)	2.63 (1.63-3.88)	2.00 (1.00-3.50)	2.80 (2.10-3.70)
Unemployed	2.83 (2.13-3.46)	2.64 (1.75-3.31)	1.50 (1.00-3.50)	3.25 (2.70-3.80)
p-value*	0.76	0.37	0.83	0.09

continued

Table 6.2 (continued)				
Relationship Status				
Committed Partner	2.67 (2.00-2.96)	2.25 (1.63-3.38)	2.00 (1.00-3.00)	2.70 (2.10-3.40)
No Committed Partner	2.88 (2.21-3.92)	2.88 (2.00-4.25)	2.00 (1.00-3.50)	3.10 (2.20-3.80)
p-value*	0.03	0.02	0.58	0.18
Sexual Orientation				
Gay	2.83 (2.17-3.50)	2.63 (1.75-3.75)	2.00 (1.00-3.50)	3.00 (2.20-3.80)
Other MSM	2.63 (2.04-3.42)	2.50 (1.75-3.38)	2.00 (1.50-3.50)	2.80 (1.90-3.60)
p-value*	0.5	0.56	0.49	0.29
BMI				
Underweight	2.63 (1.92-2.92)	1.88 (1.63-3.13)	1.50 (1.00-2.50)	2.40 (1.60-3.80)
Normal	2.67 (1.96-3.33)	2.25 (1.25-3.25)	2.00 (1.00-3.50)	3.10 (2.30-3.80)
Overweight/Obese	2.95 (2.42-4.00)	3.81 (2.63-4.75)	2.00 (1.00-3.50)	2.75 (2.10-3.70)
p-value**	0.03	<.0001	0.76	0.43
Known HIV Status at time of Interview				
Positive	2.73 (1.92-3.27)	2.19 (1.50-3.44)	2.00 (1.50-4.25)	3.05 (2.10-3.60)
No history of positive	2.85 (2.13-3.46)	2.81 (1.88-3.81)	2.00 (1.00-3.50)	2.90 (2.15-3.75)
p-value*	0.49	0.26	0.20	0.83
GC/CT/Syphilis Results on Date of Visit				
Positive/Primary or Secondary	2.88 (2.29-3.54)	2.88 (2.25-3.50)	2.00 (1.00-3.50)	3.10 (2.20-3.70)
Negative	2.83 (2.04-3.42)	2.50 (1.63-3.88)	2.00 (1.00-3.50)	2.80 (2.20-3.70)
p-value*	0.56	0.39	0.58	0.70
*p-value from Wilcoxon-Mann-Whitney test,				
**p-value from Kruskal-Wallis test				

Table 6. 3. Modified Poisson Regression Predicting Prevalent STI

	Gonorrhea/Chlamydia/Syphilis Composite Outcome (n=103)		Gonorrhea (n=101)		Chlamydia (n=100)	
Model 1: Unadjusted	PR	95% CI	PR	95% CI	PR	95% CI
Body Image	1.14	(0.86, 1.52)	1.17	(0.77, 1.77)	1.06	(0.67, 1.67)
Model 2: Fully Adjusted*						
Body Image*	1.17	(0.89, 1.53)	1.12	(0.76, 1.64)	1.14	(0.73, 1.78)

*Adjusted for known HIV status, relationship status, race, and age

Table 6.4. Sensitivity Analysis on Flawed MBAS Administration		
Model 1. Association between flawed MBAS and STI (Algorithm 1) (n=110)		
	PR	95% CI
MBAS (flawed only)	0.91	(0.72, 1.14)
Model 2. Association between flawed MBAS and STI (Algorithm 2) (n=110)		
	PR	95% CI
MBAS	0.88	(0.71, 1.10)
Model 3. Association between flawed MBAS and STI (Algorithm 3) (n=110)		
	PR	95% CI
MBAS	0.86	(0.64, 1.16)
Model 4. Association between flawed MBAS and STI (Algorithm 4) (n=110)		
	PR	95% CI
MBAS	0.83	(0.63, 1.10)
Model 5. Association between combined MBAS (flawed and correct) and STI (Algorithm 1) (n=214)		
	PR	95% CI
MBAS	0.99	(0.82, 1.18)
Model 6. Association between combined MBAS (flawed and correct) and STI (Algorithm 2) (n=214)		
	PR	95% CI
MBAS	0.97	(0.81, 1.15)
Model 7. Association between combined MBAS (flawed and correct) and STI (Algorithm 3) (n=214)		
	PR	95% CI
MBAS	1.00	(0.83, 1.21)
Model 8. Association between combined MBAS (flawed and correct) and STI (Algorithm 4) (n=214)		
	PR	95% CI
MBAS	0.97	(0.80, 1.17)

Chapter 7

Discussion of Findings: Conclusions and Implications for Future Research

7.1 Overview

The overall findings from this study make substantial contributions to the HIV/STI prevention literature. This project was designed to explore three distinct topics related to the sexual health of MSM, an area which demands further research because of the rising incidence rates of STI and HIV observed in this population. Through this project, we explored but ultimately ruled out the suitability of a candidate biomarker of recent semen exposure among MSM. Identification of a validated, appropriate biomarker of unprotected anal intercourse remains a priority, with potential to lead to substantial methodologic advancements in HIV/STI research among MSM. We also identified several behaviors that appear to act, individually and in combination, as risk factors for disease acquisition. Our analyses highlighted the significant relationships between group sex, an understudied behavior, and STI. Additional analysis explored the more distal relationship between body image and STI. These analyses provide important information to other sexual health researchers, program planners and educators working in STI prevention, health practitioners, and MSM. The findings have implications beyond the specific conclusions offered here, as each analysis revealed topics needing further research. This chapter highlights the key findings of the project, discusses the implications of these findings, and suggests topics for future research.

7.2 Aim 1

7.2.1 Summary

Of the 54 rectal swabs analyzed for PSA, only one (2%) met the threshold for positivity. The single positive swab was collected from a man who reported *protected* RAI 14 hours prior to swab collection and no *unprotected* RAI in the 72 hours preceding swab collection.

7.2.2 Interpretation

Because we did not detect PSA suggesting recent unprotected anal sex on 98% of rectal swabs, it is unlikely that PSA will act as a suitable biomarker of semen exposure among MSM. The lack of positives in the rectal swabs suggests that either PSA clearance is faster in men than women (limiting our ability to detect it) or that men are engaging in behaviors that lead to interference in PSA detection (such as anal douching or use of lubricant).

7.2.3 Public Health Significance

Given the absence of a suitable biomarker of recent semen exposure among MSM, researchers are forced to rely on self-reported behavior despite its well-documented limitations. The need for a biomarker for MSM, which would reduce researchers' reliance on self-reported behavior and improve evaluation of HIV/STI intervention effectiveness, remains high.

7.2.4 Future Research Directions

PSA may still be useful as a measure among MSM in a controlled trial. For example, the effectiveness of male and female condoms for anal sex has never been not been formally evaluated. Previous research (Macaluso, 1999) evaluated the effectiveness of male and female condoms in women using a controlled study design involving pre- and post-coital testing, with the precise timing of sex well documented and the occurrence of other behaviors (e.g. hygiene practices), which could interfere with PSA measurement, also known A controlled trial in MSM may find that PSA is consistently recovered immediately post-exposure. If so, researchers could employ PSA in subsequent trials using the pre and post-coital design. For example, men would collect a rectal swab, have receptive anal intercourse using a test condom, and then collect a post-coital swab. An increase in PSA levels between pre- and post-coital swabs may indicate condom failure.

7.3 Aim 2

7.3.1 Summary

Many sexual behaviors that have not been previously well-documented in the literature are substantially prevalent among our sample of MSM. For example, in our study, 15% of men reported fisting in their lifetime. We found that many of these behaviors were significantly associated with prevalent STI and HIV in unadjusted analyses..

An analysis of group sex, specifically, revealed a significant and robust association with gonorrhea (APR: 2.11, 95% CI: 1.13, 3.95), where those who participated in group sex were more than twice as likely to have gonorrhea. No similar association was documented with chlamydia (APR: 1.03, 95% CI: 0.58, 1.84).

7.3.2 Interpretation

MSM engage in a wide spectrum of sexual behaviors; some of these behaviors are significantly correlated with STI and HIV prevalence.

Among MSM, group sex is significantly and robustly associated with prevalent gonococcal infection, suggesting that this behavior may be an effective target for public health prevention research.

7.3.3 Public Health Significance

This study provides the first comprehensive quantification of the prevalence of a range of sexual behaviors practiced by MSM, as well as associations between these behaviors and STI/HIV prevalence. These data can further inform education and intervention strategies for STI/HIV risk reduction among MSM, and provide a more comprehensive, robust assessment of which practices constitute “risky behavior” among MSM.

The identification of group sex as a possible source of disease transmission is a valuable contribution to the STI literature. With approximately one quarter of MSM (Rice et al, unpublished; Phillips, 2013) reporting participation in group sex in the past three months (Rice et al, Unpublished) and past year (Phillips, 2013), it may be an excellent candidate for prevention programming. For example, discussion of group sex may be incorporated into HIV testing and counseling dialogue, and risk reduction strategies during a group sex encounter (including knowing disease status of other participants, correct and complete condom usage, avoidance of simultaneous drug use) may be discussed. In addition, group sex participation may be used in future research as a

marker for risk, where men who report such behavior are identified as men who may warrant enhanced behavioral counseling.

7.3.4 Future Research Directions

Our assessment of the spectrum of sexual behaviors among MSM has led to numerous lines of inquiry for future research. Associations between most of these behaviors and STI and HIV prevalence are almost completely undocumented prior to this research, and our findings suggest that many sexual behaviors are correlated with increased disease prevalence. Further analyses should evaluate whether these unadjusted associations remain after controlling for confounders. In addition, many of these behaviors likely occur in conjunction with one another –a single sexual experience may include drug use, fisting, and anal intercourse – and the cumulative effect of these exposures on disease prevalence is unknown. While understanding the risk associated with individual behaviors is important, the risk associated with behaviors performed in combination will likely best capture the true risk that men are facing. We did not assess intent or context around these behaviors. Thus, additional research is needed to understand whether seroadaptive behavior or specific sexual environments are meaningful motivators for engaging in particular sexual behaviors over others (e.g. Some behaviors may only occur within monogamous relationships. Others may only occur in group sex or anonymous sex environments.)

Additional research could clarify our finding of a significant association between group sex and gonorrhea. This relationship was robust in unadjusted and adjusted models, and even after controlling for unprotected anal intercourse and number of recent sex partners. However, it remains unclear by which mechanism group sex may be increasing disease prevalence. It is not known whether men who participate in group sex

are more likely to acquire gonorrhea because of the actual participation in group sex or because group sex serves as a marker of other high-risk behaviors or involvement in a sexual network with higher disease prevalence. A study of group sex that assesses the specific details of group sex encounters (including substances used, behaviors involved, and number of partners involved), details of sexual behaviors *outside* of the group sex encounter, and men's STI status, may reveal pertinent information about the association between group sex and gonorrhea. In addition, a longitudinal study would enable researchers to better evaluate the direct risk of group sex.

Finally, while we found a robust, significant association between group sex and gonorrhea, we found no association between group sex and chlamydia. While other research (Norris Turner, 2013) has similarly identified significant associations with only one STI and not the other, questions persist as to why this might occur. Furthermore, much of the STI literature uses a composite STI variable as the outcome, likely to increase statistical power, but without examining whether identified associations persist for individual infections (Cordoba, 2010; Kamb, 1998; NIMH, 2010). Our finding, in combination with other research, highlights the need for future analyses to document whether a composite STI outcome is appropriate.

7.4 Aim 3

7.4.1 Summary

Analysis of 104 MSM revealed no significant association between body image and prevalent STI in unadjusted or adjusted (for HIV status, relationship status, race, and age) models.

7.4.2 Interpretation

Body image is a psychosocially powerful factor, but it appears not to have a direct effect on STI prevalence. While research has concluded that MSM have increased prevalence of body image dissatisfaction, our findings suggest that body image is not a driving factor in the increasing STI incidence in this population.

7.4.3 Public Health Significance

As STI and HIV incidence rates continue to climb among MSM, public health prevention researchers, educators, and program planners continue work to identify appropriate targets for STI prevention programs. While body image dissatisfaction is almost certainly a target of intervention to ensure overall good mental health, it is not a good candidate for the primary focus of STI prevention programs.

7.4.4 Future Research Directions

Further research is needed to understand the high prevalence of body image dissatisfaction among MSM and to understand how it may affect sexual health. Our analysis was limited by its sampling frame and eligibility criteria. It is possible that body image may be associated with STI in a more general sample of MSM, but not in the more specialized population of STI clinic patients. Furthermore, sample size limited our ability to stratify our analysis by HIV status. It is feasible that the association between body image and STI prevalence among MSM varies by HIV status. Sample size also limited our ability to use MBAS subscores (body fat, muscularity, and height) as the primary exposure. Perhaps one dimension of body image, e.g. body fat, is modestly associated with disease prevalence, but we lacked sufficient statistical power to capture it in our analysis.

7.5 Conclusion

In conclusion, MSM remain at disproportionate risk of STI and HIV acquisition. Given their increased risk, sexual health research must continue to improve its methods and broaden its focus, to insure that its findings are of the highest quality and relevant to MSM. This work, which explored the sexual health of MSM via three separate and distinct aims, identified several sexual behaviors that demand further research, group sex as independent risk factor, and the need to continue to evaluate biomarkers' suitability for use in MSM.

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Appendix A

MASH Eligibility Questionnaire

1	Participant ID	
2	Screener ID	
3	PIN	— — — —
4	Today's date	__ __ / __ __ / __ __ __ __ dd mm yyyy
5	How old did you turn on your last birthday?	___ ___ (age in years)
6	How old did you turn on your last birthday?	__ __ years Refuse to answer
7	Do you speak English?	Yes No
8	Do you read English?	Yes No
9	Within the past year, have you had vaginal sex with a woman?	Yes No Refuse to answer
10	Within the past year, have you had anal sex with a man (as either the insertive or receptive partner)?	Yes No Refuse to Answer
11	Have you had receptive anal sex (been a bottom) within the past two weeks? {Interviewer: Provide calendar reference}	Yes No Refuse to Answer
12	How many sex partners have you had in the last year? (Include oral, vaginal, and anal sex partners)	Write-in_____
13	Do you have a current main partner? By main partner, I mean a committed partner whom you have sex with.	Yes No Refuse to answer

14	How often do you use condoms?	Always/almost always Most of the time About half the time Sometimes but less than half the time Never/almost never

Eligible for MASH enrollment: Yes to Questions, 6,7,9 and 18 or older to Question 5

Eligible for Aim 1 enrollment: Enrolled in MASH and Yes to Question 10

Appendix B

MASH Questionnaire

[Please note: Questions 1-51 are interviewer-administered. Questions 52-188 are self-administered by the participant.]

#	**Question**	**Responses**
	Participant ID	
	Interviewer Initials	
1	PIN	— — — —
	[INTERVIEWER – DO NOT READ ALOUD] Is the participant in Aim 1?	Yes No
2	Today's date	__ __ / __ __ / __ __ __ __ dd mm yyyy
3	Time interview started: [*record in 24-hour time*]	__ __ : __ __
Thank you for agreeing to answer some questions today for this research study. Please remember that everything you say will be kept confidential. Your name will never be released to anybody outside the study staff. You can refuse to answer any question or stop this survey at any time. Thank you for your honesty as we study these important issues related to men's sexual health. Let's start with some questions about your background.		
4	How old did you turn on your last birthday?	__ __ years Refuse to answer
5	What is your race? You tell me more than one category if you wish. [*mark all that apply*]	White Black Pacific Islander Asian Native American Native Hawaiian Other Refuse to answer
6	Are you Hispanic?	Yes No Don't know Refuse to answer

7	What is the highest grade in school that you completed? [*Do not read responses*]	Less than high school 12th grade (finished high school or GED) Some college Finished college Refuse to answer
8	Which of the following options best describes how you think of yourself?	1=Gay or homosexual 2=Bisexual 3=Straight or heterosexual 4=Transgender 5=Any other term 6=I don't usually use a term Refuse to Answer
9	{If answered 4 to Q#8} probe for term	Write-in_____
10	Who are you sexually attracted to?	1=Only to men 2=Mostly to men and sometimes to women 3=both to men and women equally 4=mostly to women and sometimes to men 5=only to women 6=other Refuse to answer
11	(If Q10 = 6) Probe for term	_____ (Write in)
12	(If Q9 =1, 2, 3, or 4) Thinking about all the people who know you (including family, friends, and work or study colleagues), what proportion know that you are (sometimes) attracted to men? *Note to interviewer: Only say "sometimes" if the participant chooses 2-4 for Q9.*	1= All or almost all 2=More than half 3=Less than half 4=Few 5=None Refuse to answer
13	(If Q8 NE 5) At what age did you realize you were attracted to men?	____ (Enter age in years) Refuse to answer
14	At what age did you first discuss with someone else that you were attracted to men?	____ (Enter age in years) Refuse to answer
15	At what age did you first act on your attraction to men?	_____ (Enter age in years) Refuse to answer

16	Do you have a main partner right now? A “main partner,” is a committed partner with whom you are sexually involved.	Yes No → **SKIP TO Q21** Don’t know Refuse to answer
17	Do you live with this partner? “Live with” means you sleep in the same living space on average at least four nights a week.	Yes No Don’t know Refuse to answer
18	Is this partner a man or a woman?	Man Woman Refuse to answer
19	How old did your partner turn on his/her last birthday?	__ _ Years Refuse to answer
20	Do you and your partner have the same HIV status (UK Survey)?	Yes (both positive or both negative) No (one positive and one negative) I don’t know whether we have the same status Refuse to answer
Now let’s talk more specifically about sex. Some of these questions are about private topics and might make you uncomfortable. Remember that your individual answers will never be shared with anyone outside the study team, and your name will never be used in connection with the research.		
21	How many sex partners have you had over your <u>lifetime</u>, including male and female partners? For this question, please consider oral, anal, and vaginal sex partners. [*If the participant doesn’t know, encourage him to approximate*]	___ partners ___ approximate partners Don’t know Refuse to answer
22	How many <u>male</u> sex partners have you had over your <u>lifetime</u>? For this question, please consider oral and anal sex partners. [*If the participant doesn’t know, encourage him to approximate*]	___ partners ___ approximate partners Don’t know Refuse to answer
23	How many sex partners have you had in the past 12 months, including male and female partners? For this question, please consider oral, anal, and vaginal sex partners. [*If the participant doesn’t know, encourage him to approximate*]	___ partners ___ approximate partners Don’t know Refuse to answer

24	How many <u>male</u> sex partners have you had in the past 12 months? For this question, please consider oral and anal sex partners. [*If the participant doesn't know, encourage him to approximate*]	___ partners ___ approximate partners Don't know Refuse to answer		
25	Thinking about sex with men in the last 12 months, how would you classify yourself?	Exclusively top Mostly top About half top and half bottom Mostly bottom Exclusively bottom Refuse to answer		
The next set of questions ask about your behaviors in the last few days. {AIM 1 ONLY}				
26	{If in Aim 1} How many male sexual partners have you had in the last 48 hours [provide time reference]?	__ __ **[enter exact number]** **Refuse to answer**		
		In the last 24 hours [give exact timeframe] **Refuse to answer**	**≥ 24 hours ago, but <48 hours ago [give exact timeframe]** **Refuse to answer**	**≥ 48 hours ago, but <72 hours ago [give exact timeframe]** **Refuse to answer**
27	{Aim 1} Have you bottomed [*insert timeframe*]? *[Probe for number of sex acts.]*			
28	{Aim 1} Did your partner use a condom for any of these acts? *[Probe for number.]*			

29	{Aim 1} Did any of the following happen while you were the receptive partner (the bottom) during this time period? For example … *[Probe for number for each type.]* Did any condom break?	_____	_____	_____
30	{Aim 1} Was there complete slippage off your partner's penis during sex or withdrawal?	_____	_____	_____
31	{Aim 1} Did you start sex without a condom and then stop to put one on?	____	_____	_____
32	{Aim 1} Did you start sex with a condom and then take it off and resume sex?	_____	____	_____
33	{Aim 1} Was there leakage of semen onto your genital area when your partner withdrew?	____	_____	_____
34	{Aim 1} For any of these acts, did your partner either not ejaculate or did he pull out before ejaculation?	Yes No Don't know Refuse to answer	Yes No Don't know Refuse to answer	Yes No Don't know Refuse to answer
35	{Aim 1} For any of these acts, was a lubricant used?	Yes No Don't know Refuse to answer	Yes No Don't know Refuse to answer	Yes No Don't know Refuse to answer

36	{Aim 1} {If yes to QX (above)}Which one(s)? [*Mark all that apply*]	Gun oil Slick Wet KY Baby oil Vaseline Saliva Water Pre-cum Lotion Don't know Refuse to Answer Other 1: ________ Other 2: ________ Other 3: ________ Other 4: ________	Gun oil Slick Wet KY Baby oil Vaseline Saliva Water Pre-cum Lotion Don't know Refuse to Answer Other 1: ________ Other 2: ________ Other 3: ________ Other 4: ________	Gun oil Slick Wet KY Baby oil Vaseline Saliva Water Pre-cum Lotion Don't know Refuse to Answer Other 1: ____________ Other 2: ____________ Other 3: ____________ Other 4: ____________
37	{If in Aim 1} When is the last time you douched or had an enema?	Hour: __________ Never Don't know Refuse to answer	Hour: __________ Never Don't know Refuse to answer	Hour: __________ Never Don't know Refuse to answer
38				
39	{If in Aim 1} When is the last time you had a bowel movement?	Hour: __________ Don't know Refuse to answer	Hour: __________ Don't know Refuse to answer	Hour: __________ Don't know Refuse to answer
40	{If in Aim 1} When is the last time that you bottomed without a condom or bottomed with a condom that broke?			__ __ ____ __ __ __ Date __ __ :__ __ Time
41	{If in Aim 1} When is the last time that you bottomed with a condom?			__ __ ____ __ __ __ Date __ __ :__ __ Time
{If in Aim 1}: That is the last question I have about the last few days.				
42	At what age did you have sex (oral, anal, or vaginal) for the first time? This could include sex with a man or woman.		___ Years Don't Know Refuse to answer	

43	At what age did you have sex (anal or oral) with a man for the first time?	___ Years Don't know Refuse to answer
44	Over your lifetime, have you ever been told that you had a sexually transmitted disease (STD), not including HIV? This could include chlamydia, gonorrhea, syphilis, herpes, genital warts, trichomoniasis or other sexually transmitted diseases. This could be recently or many years ago.	Yes No Don't know Refuse to answer
45	During the past month, have you often been bothered by feeling down, depressed, or hopeless?	Yes No Don't know Refuse to answer
46	During the past month, have you often been bothered by little interest or pleasure in doing things?	Yes No Don't know Refuse to answer
My next questions are about future research we are considering doing here in Columbus.		
47	Have you ever heard of taking medicine **after** sex to prevent HIV (also called post-exposure prophylaxis, or PEP)?	Yes No I'm not sure/don't know Refuse to answer
48	Have you ever heard of taking medicine **before** sex to prevent HIV (also called pre-exposure prophylaxis, or PrEP)?	Yes No I'm not sure/don't know Refuse to answer
49	[If yes to 48], Have you ever taken PrEP?	Yes No I'm not sure/don't know Refuse to answer
50	[If yes to 49], Have you taken PrEP in the last 3 months?	Yes No I'm not sure/don't know Refuse to answer
51	If you could lower your risk of HIV by taking one pill every day, would you?	Yes No Maybe/don't know Refuse to answer
	How tall are you?	Feet: _____ Inches: _____
That is my last question of this portion of the interview. Next, you will complete the self-administered portion of the interview.		
	Please complete the survey below. Thank you!	
	PIN	
Before you start, we will have several practice questions to help you get used to the format of the interview. Please feel free to ask questions if you have problems with any of the questions.		

What color is your hair?		Brown Black Blonde Red Other Refuse to answer
Which of the following do you enjoy in your spare time? (Check all that apply.)		Watching television Reading books/magazines/newspapers Exercising Sleeping Spending time with friends/family Traveling Cooking Painting/Drawing/Sculpting Going to bars or clubs Other Refuse to answer
Enter the name of your favorite cartoon character.		_____
[Begin Self-Administered Portion] **Now that you have practiced with several questions, the interview will begin. The first set of questions relate to your behavior over your entire lifetime. For each behavior, please think about your whole life.**		
52	Have you ever had oral sex? (head, blowjobs, dome, brains, oral)	Yes No Refuse to answer
53	{If yes to 52} Were you the active partner (giving head), passive partner (receiving head), or both?	Active Passive Both active and passive Refuse to answer
54	{If yes to 52} Have you oral sex with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
55	Have you ever participated in barebacking (anal sex without a condom)?	Yes No Refuse to answer

56	{If yes to 55} Were you the insertive partner (top), receptive partner (bottom), or both?	Insertive Receptive Both insertive and receptive Refuse to answer
57	{If yes to 55} Over your lifetime, have you barebacked with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
58	Have you ever participated in anal fingering (using a finger to provide stimulation to the anus, fingering, finger fucking, ass)?	Yes No Refuse to answer
59	{If yes to 58} Were you the insertive partner, receptive partner, both insertive and receptive, or did you do it to yourself?	Insertive Receptive Both insertive and receptive Did it to self Refuse to answer
60	{If yes to 58} Over your lifetime, have you participated in anal fingering with a male partner, a female partner, or both?	Male Female Both males and females Refuse to answer
61	Have you ever participated in fisting (inserting fist in to rectum or vagina, fist fucking, handballing, punching, piston fisting)?	Yes No Refuse to answer
62	{If yes to 61} Were you the insertive partner (you used your fist in someone else), receptive partner (someone else used their fist in you), or both?	Insertive Receptive Both insertive and receptive Refuse to answer
63	{If yes to 61} Over your lifetime, have you fisted with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
64	Have you ever participated in sounding (inserting a “sound” such as a knitting needle in to the urethra, penis gauging, cockstorming, urethra enlarging, dong stretching)?	Yes No Refuse to answer

65	{If yes to 64} Were you the insertive partner, receptive partner, both the insertive and receptive partner, or did you do it to yourself?	Insertive Receptive Both insertive and receptive Did it to self Refuse to answer
66	{If yes to 64} Over your lifetime, have you sounded with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
67	Have you ever used enemas?	Yes No Refuse to answer
68	Have you ever used catheters?	Yes No Refuse to answer
69	Have you ever participated in rimming? (Using tongue to provide sexual stimulation to anus, analingus, rim, rimjob, kissing starfish, salad tossing, eating ass)	Yes No Refuse to answer
70	{If yes to 69} Were you the active partner (eating ass), the passive partner (having your ass eaten), or both?	Active Passive Both active and passive Refuse to answer
71	{If yes to 69} Have you rimmed with male partners, female partners, or both?	Male Female Both males and females Refuse to answer
72	Have you ever engaged in felching (the sucking or eating semen out of a partner's ass, sucking ass)?	Yes No Refuse to answer
73	{If yes to 72} Were you the active partner (sucking ass), passive partner (being sucked) or both?	Active Passive Both active and passive Refuse to answer
74	{If yes to 72} Over your lifetime, have you felched with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer

75	Have you ever participated in ”watersports” (use of urine during sexual acts, golden showers, piss play)?	Yes No Refuse to answer
76	{If yes to 75} Were you the active partner, passive partner or both?	Active Passive Both active and passive Refuse to answer
77	{If yes to 75} Over your lifetime, have you participated in watersports with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
78	Have you ever participated in scatalogia? (use of feces during sexual acts, scat)	Yes No Refuse to answer
79	{If yes to 78} Were you the active partner, passive partner or both?	Active Passive Both active and passive Refuse to answer
80	{If yes to 78} Over your lifetime, have you participated in scatalogia with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
81	Have you ever snowballed (oral exchange of semen between partners, cum swapped, swapped)?	Yes No Refuse to answer
82	{If yes to 81} Have you snowballed with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
83	Have you ever had sex using a sex sling?	Yes No Refuse to answer
84	Were you in the sling?	Yes No Refuse to answer

85	{If yes to 84} Over your lifetime, have you used a sex sling with male partners, female partners, or both?	Male Female Both males and females Refuse to answer
86	Have you ever used sex toys that are inserted inside the body (dildos, vibrators, beads, etc)?	Yes No Refuse to answer
87	{If yes to 86} Were you the insertive partner, receptive partner or both?	Insertive Receptive Both insertive and receptive Used by yourself Refuse to answer
88	{If yes to 86} Have you used insertive sex toys with a male partner, female partner, or both?	Male Female Both males and females Refuse to answer
89	Have you ever participated in breath control (erotic asphyxiation, autoerotic asphyxiation)?	Yes No Refuse to answer
90	{If yes to 89} Did you do that with a partner or by yourself?	With a partner By yourself Both with a partner and by yourself Refuse to answer
91	Next, please think about where you meet the people with whom you have sex. People may meet sex partners at a variety of locations. Have you *ever* met a sexual partner *for the first time* at [*mark all that apply*]:	Bar Other social venue Internet dating site (i.e. match.com) Online classified (i.e. craigslist) internet hook-up site/chat room (i.e. grinder.com, Adam4Adam, gay.com) Bathhouse Sex Resort Sex clubs Circuit party Anonymous public location (park, rest stop, etc.) None of the above Refuse to answer

92	{If internet/online/chat room answer to Q91} What internet sites do you usually use to meet partners? Please list.	_____ _____ _____ _____
93	People may have sexual activity in a variety of locations. Have you ever had sexual activity (including any of the behaviors we just discussed) at [*mark all that apply*]:	Bathhouse Sex resort Sex club Circuit Party Other public location (ie. Park, public restroom) None of the above Refuse to answer
94	Have you ever had sex with a partner that you didn't know his/her name?	Yes _ Man/men Yes _ Woman/women Yes_ Men & Women No Refuse to answer
95	What is the shortest amount of time you've known someone before you had sex?	_____ (Minutes, hours, days, Weeks, months, years)
96	Have you ever had sex with more than one individual at the same time (group sex)?	Yes No Refuse to answer
97	Thinking about anal sex over your lifetime: when you are the receptive partner (bottom), do you use lubricant?	Always/Almost always Most of the time About half the time Sometimes, but less than half the time Never/Almost Never N/A Never receptive Refuse to answer
98	Thinking about anal sex over your lifetime: when you are the insertive partner (top), do you use lubricant?	Always/Almost always Most of the time About half the time Sometimes, but less than half the time Never/Almost Never N/A Never insertive Refuse to answer

99	Over your lifetime, what lubricants have you used [*mark all that apply*]?	Gun oil Slick Wet KY Baby oil Vaseline Lotion Saliva Pre-cum Other_____ Other_____ Other _____ Other _____ Never used lubricant Refuse to answer
100	How often have you used lubricant for any other sexual behaviors (for example during fisting, with sex toys, or other times)?	Always/Almost always Most of the time About half the time Sometimes, but less than half the time Never/Almost never Refuse to answer
[SECTION LIMITED TO BEHAVIORS THAT WERE ENDORSED IN THE "EVER" SECTION ABOVE} Please answer the following questions, thinking only about THE PAST THREE MONTHS.		
101	In the past 3 months, have you had oral sex (head, blowjobs, dome, brains)?	Yes No Refuse to answer
102	{If yes to 101| Were you the active partner {giving head}, passive partner (receiving head), or both?	Active Passive Both active and passive Refuse to answer
103	In the past 3 months, have you engaged in barebacking (anal sex without a condom)?	Yes No Refuse to answer
104	{If yes to 103} In the past three months, when you have engaged in barebacking, were you the insertive partner (top), receptive partner (bottom), or both?	Insertive Receptive Both insertive and receptive Refuse to answer
105	In the past 3 months, have you participated in anal fingering (use of finger to provide sexual stimulation to anus)?	Yes No Refuse to answer

106	{If yes to 105} In the past 3 months, when you have engaged in anal fingering: were you the insertive partner, receptive partner, both insertive and receptive partner, or did you do it to yourself?	Insertive Receptive Both insertive and receptive Did it to self Refuse to answer
107	In the past three months, have you engaged in fisting? (insertion of fist in to rectum or vagina, fist fucking, handballing, punching, piston fucking)	Yes No Refuse to answer
108	{If yes to 107} In the past 3 months, when you have engaged in fisting, have you been the insertive partner, receptive partner, or both?	Insertive Receptive Both insertive and receptive Refuse to answer
109	In the past three months, have you engaged in sounding (insertion of sound, ie, knitting needle, in to urethra, penis gauging, cockstorming, urethra enlarging, dong stretching)?	Yes No Refuse to answer
110	{If yes to 109} In the past 3 months, when you have engaged in sounding, have you been the insertive partner, receptive partner, both the insertive and receptive partner, or did you do it to yourself?	Insertive Receptive Both insertive and receptive Did it to self Refuse to answer
111	In the past three months, have you used enemas?	Yes No Refuse to answer
112	In the past three months, have you used catheters?	Yes No Refuse to answer
113	In the past three months, have you engaged in rimming? (Use of tongue to provide sexual stimulation to anus, analingus, rim, rimjob, kissing starfish, salad tossing, eating ass)	Yes No Refuse to answer
114	{If yes to 113} In the past 3 months, when you have engaged in rimming, have you been the active partner (eating ass), passive partner (having your ass eaten), or both?	Active Passive Both active and passive Refuse to answer
115	In the past three months, have you engaged in felching (sucking or eating semen out of a partner's anus, sucking ass)?	Yes No Refuse to answer

116	{If yes to 115} In the past 3 months, when you have engaged in felching, have you been the active partner (sucked ass), passive partner (being sucked), or both?	Active Passive Both active and passive Refuse to answer
117	In the past three months, have you engaged in watersports (use of urine during sexual acts, golden showers, piss play)?	Yes No Refuse to answer
118	{If yes to 117} In the past 3 months, when you have engaged in watersports, have you been the active partner, passive partner, or both?	Active Passive Both active and passive Refuse to answer
119	In the past three months, have you engaged in scatalogia (use of feces during sexual acts, scat)?	Yes No Refuse to answer
120	{If yes to 119} In the past 3 months, when you have engaged in scatalogia, have you been the active partner, passive partner, or both?	Active Passive Both active and passive Refuse to answer
121	In the past three months, have you snowballed (oral exchange of semen between partners, cum swapped, swapped)?	Yes No Refuse to answer
122	In the past 3 months, have you used a sex sling?	Yes No Refuse to answer
123	{If yes to 122} In the past 3 months, were you in the sling?	Yes No Refuse to answer
124	In the past 3 months, have you used sex toys that are inserted inside the body (dildos, vibrators, beads, etc)?	Yes No Refuse to answer
125	{If yes to 124} In the past 3 months, when you have used insertive sex toys, have you been the insertive partner, receptive partner, both insertive and receptive, or did you use them by yourself ?	Insertive Receptive Both insertive and receptive Used them by yourself Refuse to answer
126	In the past 3 months, have you participated in breath control (erotic asphyxiation, autoerotic asphyxiation)?	Yes No Refuse to answer

127	{If yes to 126} When you participated in breath control in the past three months, did you do that with a partner or by yourself? [Check all that apply.]	With a partner By yourself Refuse to answer
128	Within the past three months, have you met a sex partner *for the first time* at [*mark all that apply*]:	Bar Other social venue Internet dating site (i.e. match.com) Online classified (i.e. Craigslist) Internet hook-up site/chat room (i.e. grindr.com, Adam4Adam, gay.com) Bathhouse Sex resort Sex club Circuit party Anonymous public location (park, rest stop) None of the above Refuse to answer
129	{If internet/chat room answer to above question Q 124} What internet sites do you usually use to meet partners? Please list.	_____ _____ _____
130	Within the past three months, have you had any sexual activity at: [*mark all that apply*]:	Bathhouse Sex resort Sex club Circuit Party Other public location (i.e. park, public restroom) None of the above Refuse to answer
131	In the <u>past three months</u>, have you ever had sex with a partner that you didn't know his/her name?	Yes _ Man Yes _ Woman Yes _ Men & Women No Refuse to answer
132	Within the past three months, have you had group sex?	Yes No Refuse to answer

133	Thinking about anal sex over the past three months – when you are the receptive partner, do you use lubricant:	Always/almost always Most of the time About half the time Sometimes, but less than half the time Never/Almost never N/A Never receptive Refuse to answer
134	Thinking about anal sex over the past three months – when you are the insertive partner, do you use lubricant:	Always/almost always Most of the time About half the time Sometimes, but less than half the time Never/Almost never N/A Never insertive Refuse to answer
135	{If ever to Q133 or Q134} What lubricants have you used in the past three months?	Gun oil Slick Wet KY Baby oil Vaseline Saliva Pre-Cum Other_____ Other_____ Other_____ Havn't used lubricant in past 3 months Refuse to answer
The following questions ask about drugs that some people use. Please remember that all your responses will be kept confidential and will not be shared outside the research team. Please think about your whole life when you answer the following questions.		

136	Have you *ever* used [*mark all that apply*]:	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls, pressies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone/methadone) Bath salts (molly) Prescription pain medicine Other_____ None of the above Refuse to answer
	If other, please enter the name of the drug(s) you have used in your lifetime.	_____

137	Which of these drugs have you *ever* used before or during sex [*mark all that apply*]?	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls, pressies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone/methadone) Bath salts (molly) Prescription pain medicine Other None of the above Refuse to answer
	If other, please enter the name of the drug(s) that you have ever used before or during sex.	_____
138	Have you *ever* used alcohol before or during sex?	Yes No Refuse to answer
139	Have you *ever* injected any drug that was not prescribed to you?	Yes No Refuse to answer
140	Have you *ever* inserted any drug that was not prescribed to you into your rectum?	Yes No Refuse to answer

141	{If yes to above question} Which drugs have you inserted in to your rectum [*mark all that apply*]?	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls. presssies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone.methedone) Bath salts (molly) Prescription pain medicine Other_____ None of the above Refuse to answer
	If other, please enter the name of the drug(s) that you have inserted in your rectum.	_____
	Have you ever inserted alcohol in to your rectum?	Yes No Refuse to answer
	You said you have inserted alcohol in your rectum. When you have done that, have you soaked something (like a tampon) in alcohol and then inserted it in to your rectum?	Yes No Don't know Refuse to answer
The following questions will refer to the past three months. Please only think about the past three months when you answer these questions.		

142	Now think only about the past three months. In that timeframe, have you used:	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls. presssies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone.methedone) Bath salts (molly) Prescription pain medicine Other None of the above Refuse to answer
	If other, enter the name of the drug(s) you have used in the last three months.	_____

143	In the past three months have you used any of these drugs before or during sex?	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls. presssies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone.methedone) Bath salts (molly) Prescription pain medicine Other None of the above Refuse to answer
	If other, enter the name of the drug(s) you have used before of during sex within the past three months.	_____
144	In the past three months, have you used alcohol before or during sex?	Yes No Refuse to answer
145	In the past three months, have you injected any drug that was not prescribed to you?	Yes No Refuse to answer
146	In the past three months, have you inserted any drug into your rectum that was not prescribed to you?	Yes No Refuse to answer

147	{If yes to Q146} Which ones have you inserted in the part three months [*mark all that apply*]?	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls. presssies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone.methedone) Bath salts (molly) Prescription pain medicine Other_____ None of the above Refuse to answer
	If other, enter name of drug(s) that you have inserted in to your rectum in the last three months.	_____
	Have you inserted alcohol in to your rectum in the past 3 months?	Yes No Refuse to answer
	You said that you have inserted alcohol in to your rectum in the past 3 months. When you have done that, have you soaked something (ie. tampon) in alcohol and then inserted that into your rectum?	Yes No Don't know Refuse to answer
148	{If AIM 1} Have you inserted a drug/alcohol into your rectum in the <u>past 48 hours</u>?	Yes No Don't know Refuse to answer
149	Sometimes people combine drugs (use more than one drug at the same time). Have you ever combined drugs?	Yes No Don't Know Refuse to answer

150	{If yes to Q149} Think about the last time you combined drugs. This could be last week, last year, or 20 years ago. Check all the drugs that you combined at that one time. [*mark all that apply]*	Marijuana (weed, pot, mary-jane, reefer) Viagra (blue pills, blue) MDMA (molly, rolls, pressies, 'rolling', xtc, pills) Methamphetamine (tina*, speed*, crank*, crystal, crack, ice, dope, tweaker, meth) Amyl/butyl nitrates (aroma, poppers) Nitrous Oxide (whip its) Rohypnol (rufies) Ketamine ('K') GHB ('G') Heroin (H, dog-food, crack, smack, awesome, junk, skag, horse) Cocaine (Tina, blow, white bitches, white, coke, yay, snow, powder, bumps) Mephedrone (done, meow-meow, meph, methadrone, methadone, methedrone/methadone) Bath salts (molly) Prescription pain medicine Other_____ Refuse to answer
	If other, enter the name of the drug(s) that you combined with other drugs.	_____
151	For the next question, please think about what you know about HIV transmission. Please rank the following behaviors in terms of how risky they are for transmitting HIV if they are done with a person who has HIV. Please choose the five behaviors that you think are MOST LIKELY to transmit HIV. [Remember to choose 5.]	Fisting Sounding Anal Fingering Rimming Felching Watersports Scatalogia Snowballing Oral sex Anal sex with a condom Anal sex without a condom Sharing sex toys Refuse to answer

152	Some people may identify themselves as part of specific sexual community. Please indicate if you consider yourself part of any of the following communities [*mark all that apply*]:	Leathermen Rubber Breath control Bondage & Discipline Master/Slaves S & M Kink Bears Chubs Other_ None Refuse to answer
153	{If answer "other" to Q 152}, enter name of community.	_____
154	Thinking about sex over your lifetime, how often do you know your sex partners' HIV status?	Always/almost always Most of the time About half the time Sometimes, but less than half the time Never/almost never Refuse to answer
155	If your partner has a different HIV status than you (for example, he/she is HIV-positive and you are HIV-negative, OR, you are HIV-positive and he/she is HIV-negative), how likely are you to change your sexual behaviors?	Very likely/ almost certain Likely Maybe Not likely Definitely won't Refuse to answer
156	If you and your partner have the SAME HIV status, what five sex acts are you most likely to do? [choose 5]	Fisting Sounding Anal Fingering Rimming Felching Watersports Scatalogia Snowballing Oral sex Anal sex with a condom Anal sex without a condom Sharing sex toys Refuse to answer

157	If you and your partner have DIFFERENT HIV statuses, what five sex acts are you most likely to do? [Please choose 5]	Fisting Sounding Anal Fingering Rimming Felching Watersports Scatalogia Snowballing Oral sex Anal sex with a condom Anal sex without a condom Sharing sex toys Refuse to answer
158	If you don't know your partner's HIV status, what five sex acts are you most likely to do? [Please choose five.]	Fisting Sounding Anal Fingering Rimming Felching Watersports Scatalogia Snowballing Oral sex Anal sex with a condom Anal sex without a condom Sharing sex toys Refuse to answer
Please indicate whether each question is true about you always, usually, often, sometimes, or never.		
160	I think I have too little muscle on my body.	Never Rarely Sometimes Often Usually Always Refuse to answer
161	I think that my body should be leaner.	Never Rarely Sometimes Often Usually Always Refuse to answer

162	I wish that my arms were stronger.	Never Rarely Sometimes Often Usually Always Refuse to answer
163	I feel satisfied with the definition in my abs (i.e. stomach muscles).	Never Rarely Sometimes Often Usually Always Refuse to answer
164	I think that my legs are <u>not</u> muscular enough.	Never Rarely Sometimes Often Usually Always Refuse to answer
165	I think my chest should be broader.	Never Rarely Sometimes Often Usually Always Refuse to answer
166	I think my shoulders are too narrow.	Never Rarely Sometimes Often Usually Always Refuse to answer
167	I am concerned that my stomach is too flabby.	Never Rarely Sometimes Often Usually Always Refuse to answer
168	I think that my arms should be larger (i.e. more muscular).	Never Rarely Sometimes Often Usually Always Refuse to answer

169	I feel dissatisfied with my overall body build.	Never Rarely Sometimes Often Usually Always Refuse to answer
170	I think that my calves should be larger (i.e. more muscular).	Never Rarely Sometimes Often Usually Always Refuse to answer
171	I wish I were taller.	Never Rarely Sometimes Often Usually Always Refuse to answer
172	I think that I have too much fat on my body.	Never Rarely Sometimes Often Usually Always Refuse to answer
173	I think that my abs are <u>not</u> thin enough.	Never Rarely Sometimes Often Usually Always Refuse to answer
174	I think my back should be larger and more defined.	Never Rarely Sometimes Often Usually Always Refuse to answer
	I think my chest should be larger and more defined.	Never Rarely Sometimes Often Usually Always Refuse to answer

175	I feel satisfied with the definition in my arms.	Never Rarely Sometimes Often Usually Always Refuse to answer
176	I feel satisfied with the size and shape of my body.	Never Rarely Sometimes Often Usually Always Refuse to answer
177	I am satisfied with my height.	Never Rarely Sometimes Often Usually Always Refuse to answer
178	Eating sweets, cakes, or other high calorie foods makes me feel fat or weak.	Never Rarely Sometimes Often Usually Always Refuse to answer
179	I feel excessively large and rounded (i.e. fat).	Never Rarely Sometimes Often Usually Always Refuse to answer
180	I feel ashamed of my body size or shape.	Never Rarely Sometimes Often Usually Always Refuse to answer
181	Seeing my reflection (e.g. in a mirror or window) makes me feel badly about my size or shape.	Never Rarely Sometimes Often Usually Always Refuse to answer

182	I worry about my body size or shape to the extent that I feel I should diet.	Never Rarely Sometimes Often Usually Always Refuse to answer
183	On a scale of 0 to 6, how physically attractive do you think you are?	0=not at all physically attractive 1 2 3 4 5 6=extremely physically attractive Refuse to answer
184	On a scale of 0 to 6, how sexually attractive do you think you are?	0=not at all sexually attractive 1 2 3 4 5 6=extremely sexually attractive Refuse to answer
185	Do you consider your penis size to be …	Below average Average Above average Well above average Refuse to answer
186	Overall, how would you rate your overall health now?	Excellent Good Fair Poor Very poor Refuse to answer
187	Are you currently employed?	Yes: Full-time Yes: Part-time No Refuse to answer
188	Would you be interested in participating in future research studies?	Yes No Don't Know Refuse to answer
That was the last question. Thank you again for your time today.		

Appendix C

EHR Extraction Form

#	**Question**	**Responses**
1	Participant ID	
2	PIN	
3	Today's Date	
4	Visit date when specimen collected	
5	Today's date	__ __ / __ __ / __ __ __ __ dd mm yyyy
6	Urethral GC	Positive Negative Indeterminate Not assessed
7	Urethral CT	Positive Negative Indeterminate Not assessed
8	Rectal GC	Positive Negative Indeterminate Not assessed
9	Rectal CT	Positive Negative Indeterminate Not assessed
10	Oral GC	Positive Negative Indeterminate Not assessed

11	Trichomoniasis	Positive Negative Indeterminate Not assessed
12	HSV	Positive Negative Indeterminate Not assessed
14	HPV	Positive Negative Indeterminate Not assessed
15	Syphilis	Positive Negative Indeterminate Not assessed
16	Hepatitis C	Positive Negative Indeterminate Not assessed
17	HIV Today's Test	Positive Negative Indeterminate Not assessed
18	HIV Previous Test	Positive Negative Indeterminate Not assessed Not applicable
19	Urethral gram stain	Positive Negative Indeterminate Not assessed
20	Other reproductive or sexually transmitted disease (specify)	
21	Other pertinent info from participant's clinical chart	