Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____   _____

Megan Dunlevy   Date

The Effect of Disclosure of HIV Serostatus on Condom Use Among MSM in Serodiscordant
Relationships

By

Megan Dunlevy

Masters of Public Health

Department of Epidemiology

_____

Jeb Jones, PhD, MPH, MS

Committee Chair

The Effect of Disclosure of HIV Serostatus on Condom Use Among MSM in Serodiscordant Relationships

By

Megan Dunlevy

Bachelors of Science- Biology

University of Cincinnati

2017

Thesis Committee Chair: Jeb Jones, PhD, MPH, MS

An abstract of

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Public Health in Epidemiology

2019

Abstract

The Effect of Disclosure of HIV Serostatus on Condom Use Among MSM in Serodiscordant
Relationships

By Megan Dunlevy

Introduction: Men who have sex with men (MSM) are disproportionally affected by the

HIV epidemic and 73% of HIV cases diagnosed in 2015 were attributed to male-to-male sexual

contact. Reports of condomless anal intercourse reported by MSM are increasing and MSM are

less likely than other groups to disclose their HIV status to sexual partners.

Methods: The Engag[ment]t study enrolled 400 HIV-positive men living in Atlanta, Georgia.

Participants were enrolled using a modified venue-day-time sampling approach and via

advertisements on web platforms frequently used by MSM. Participants completed computer

assisted interviews to report number of partners and partner type, number and type of sexual

encounters within 6 months of interview, age, marital status, stigma, and other demographics

upon enrollment into the study. Laboratory testing was conducted to determine participant viral

load. Generalized linear models were used to estimate the association between disclosure of

serostatus and condom usage controlling for stigma, exclusive relationships, age, race, avoiding

disclosure due to fear of prosecution, level of education, and suppression of viral load using a

Poisson regression with generalized estimating equations to account for multiple partnerships for

each participant.

Results: This analysis had a sample size of 108 participants with a total of 195 partners after

exclusions for HIV-positive status of partners or non-male natal sex of partners. 108 (91.5%)

participants reported disclosing to at least one sexual partner and 173 (88.7%) of the partners were disclosed to. Nonexclusive partnerships and participants of African American/Black race were significantly less likely to report condom use for receptive anal intercourse.

Conclusions: Decreased condom use during receptive anal intercourse was associated with serostatus disclosure, higher stigma, nonexclusive partnerships, African American/Black race, avoiding disclosure due to fear of prosecution, and having a suppressed viral load. Age, African American/Black race and avoiding disclosure due to fear of prosecution were associated with decreased condom use during insertive anal intercourse. Higher stigma, nonexclusive partnerships, African American/ Black race and avoiding disclosure due to fear of prosecution were associated with decreased condom use during any type of anal intercourse.

The Effect of Disclosure of HIV Serostatus on Condom Use Among MSM in Serodiscordant Relationships

By

Megan Dunlevy

Bachelors of Science- Biology

University of Cincinnati

2017

Thesis Committee Chair: Jeb Jones, PhD, MPH, MS

A thesis submitted to the Faculty of the

Rollins School of Public Health of Emory University

in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology

2019

Men who have sex with men (MSM) are disproportionately affected by the HIV epidemic and thus represent a vital population for HIV prevention efforts and interventions. In 2017, 70% of all diagnosed HIV infections were attributed to male-to-male sexual contact [1]. Disparities also exist based on race and geography. The rate of new HIV infections among Blacks/African Americans was 41.1 cases per 100,000 compared to 5.1 cases per 100,000 among whites in 2017[1]. In 2014, the southern region of the United States experienced a larger burden of new HIV diagnoses among MSM with a rate of 0.85 (95% CI: 0.63-1.05) diagnoses per 100 people compared to 0.63 (95% CI: 0.57-0.71) diagnoses per 100 people in the United States overall [2]. At the end of 2012, the estimated prevalence of HIV among MSM was 15% and Georgia was the only state with a prevalence greater than 15% [2]. The prevalence of HIV among males in 2015 was 3.5 times the rate among females (661.3 cases per 100,000 vs 187 cases per 100,000) and 73% of the infections in males can be attributed to male-to-male sexual contact [3].

The primary sexual risk factor for HIV infection among MSM is condomless receptive anal intercourse; however, alcohol and drug use, increased number of male partners, coinfection with other sexually transmitted diseases (STDs) and insertive anal intercourse with an HIV-positive partner have also been shown to increase risk of HIV infection [4-6]. There are numerous ways an individual can reduce their risk for HIV infection including condom use [7], pre-exposure prophylaxis (PrEP) [8], seropositioning (e.g., HIV-infected partner engaging in receptive instead of insertive anal intercourse) and serosorting (e.g., selecting sexual partners based on HIV serostatus) [9], abstinence [10], and anti-retroviral (ART) adherence for a HIV-positive partner [11]. Increasing the rate of HIV testing among HIV-negative MSM, particularly those in serodiscordant relationships or those engaging in condomless anal intercourse, may

increase individual's knowledge of their own and their potential partner's HIV status [12]. Male condom effectiveness among MSM reporting any anal intercourse with an HIV-positive partner has been estimated to be 70% with consistent condom use; there is no significant difference in protection comparing occasional condom use and no condom use [7]. Despite the high efficacy of consistent condom use, increases in condomless intercourse have been observed among both seroconcordant and serodiscordant MSM partnerships [13]. MSM may also adopt seroadaptive risk-reduction strategies based on their and their partners' perceived or known HIV status [11]. Serodiscordant couples have also reported condomless anal intercourse as a proxy to show love, commitment, trust, and intimacy to their partner [14].

The choice of which strategy or strategies an individual uses might depend on their HIV status and the status of their partner(s) [10, 11, 13]. Daily PrEP use has been shown to reduce the risk of HIV transmission among MSM; however, PrEP is most efficacious with high levels of adherence (risk reduction of 76% with 2 doses a week, 96% with four doses a week and 99% for 7 doses a week [15, 16]). MSM may face barriers to accessing PrEP such as lack of providers willing to prescribe PrEP and lack of knowledge about PrEP [17, 18]. Among serodiscordant relationships, disclosure of HIV status is an important component of HIV prevention for the HIV-negative partner [19]. Interventions aimed at helping HIV-positive partners to disclose their status have been shown to reduce the risk of HIV transmission by 45% and condom usage is higher among serodiscordant couples that disclose their status [20]. Disclosure of HIV status to all sexual partners is required by law in 33 US States and 2 territories with penalties ranging from fines to incarceration [20-23]. MSM are less likely to disclose their HIV status to any partner (primary and secondary) when compared to heterosexual men and women but among MSM disclosure is more likely to a primary partner than a secondary partner [19]. Stigma

related to HIV status has been shown to be inversely related with disclosure of HIV serostatus. Experiencing greater stigma is associated with lower odds of disclosing HIV status across all partner characteristics and sexual identities [19]. Reports of experiencing HIV related stigma are common among people living with HIV/AIDS (PLWHA) and individuals who experience more stigma are less likely to disclose their HIV status to potential partners regardless of sexual identity or partner characteristics [19, 24, 25]. Non-disclosure results from fear of rejection, discrimination, violence from partners and others, feelings of shame, and substituting safe-sex practices for disclosure [19, 24, 25]. A previous study has shown that MSM are more likely to report condomless anal intercourse when HIV status is not disclosed [24]. Among serodiscordant relationships condomless anal intercourse was more common in nonexclusive partnerships, increasing further if the partner's HIV status was unknown [24]. Among another cohort of MSM, disclosure was shown to significantly increase the rate of condom use during any anal intercourse, after adjustment for partnership type (i.e., exclusive, non-exclusive) [26].

The Engage[men]t study is a NIH-funded study designed to assess the prevalence and predictors of racial disparities in HIV care and treatment between black and white MSM in Atlanta, Georgia. We examined the relationship between disclosure of HIV status and the frequency of condom use among MSM in serodiscordant relationships in the Engage[men]t cohort. We examined the relationship between status disclosure and condom use overall as well as any differences in condom use based on sexual position (i.e., insertive or receptive).

Methods

Participants

The Engage[men]t study is a prospective cohort study that enrolled 400 non-Hispanic black and white MSM (200 in each racial group) living with HIV in Atlanta, Georgia. Once enrolled, each participant was followed for 2 years. Participants were enrolled in the study using both physical and internet venues such as Facebook and other social media ads, community-based HIV testing sites, mass transportation ads, community events such as Gay Pride and other venues using a modified venue-day-time screening approach [27]. Eligibility criteria included being assigned male at birth, currently identifying as male, age 16 or older, self-reported race either non-Hispanic black or non-Hispanic white, ability to complete survey procedures in English, living in the Atlanta metro area , intercourse with at least 1 male partner in the past 12 months, and not planning to exclusively receive HIV care outside of the metro Atlanta area in the next 2 years. Written informed consent was obtained from all participants prior to enrollment in the study. The study protocol was approved by the Institutional Review Board of Emory University.

At the baseline visit, participants completed a computer assisted self-interview (CASI), and laboratory testing for HIV, CD4 cell count, and HIV viral load. Participant-level data collected by the CASI included annual income, marital status, age, highest level of education, health literacy, drug use, number of sexual partners, sexual behavior, stigma, anxiety, and depression. Partner-level data included partner demographics, substance use during sexual encounters, and relationship dynamics were collected by CASI for up to the five most recent partners in the past six months.

Disclosure of HV Status

For each partner listed by a participant, the participant was asked if and how they disclosed their HIV status prior to the first sexual encounter with that partner. Disclosure could

occur if the participant told the partner in person or online, another person told the partner, or the couple was tested together. Disclosure was assessed individually for each partner that the participant had anal intercourse with. In separate analyses, participants were classified based on whether they had disclosed their serostatus to at least one partner versus disclosing to zero partners.

Statistical Analyses

Descriptive statistics were calculated for all variables included in the analysis to examine the data for any outliers and to examine the distribution of each variable. Condom use was condensed into a dichotomous variable to categorize participants as always using condoms or using condoms occasionally or never. We separately examined the outcomes of condom use during insertive anal intercourse, receptive anal intercourse, and during all (insertive and receptive) sexual encounters. Potential confounding variables were determined through the use of directed acyclic graphs (DAG). Covariates controlled for in this analysis included avoiding disclosure due to fear of prosecution, partner type (main vs secondary), viral load (suppressed vs not), race (African American/black vs Caucasian/white), highest level of education (some college or more vs high school or less), age (35 and under vs older than 35) and reported stigma. Bivariate analyses were performed between disclosure and all covariates, disclosure and all types of condom use, and covariates and all types of condom use. Fisher's Exact test was used to compare all bivariate analyses with an alpha level of 0.05. For all bivariate analyses with a continuous variable, a Kruskal-Wallis test with an alpha level of 0.05 was used. The level of reported stigma due to HIV status was combined into a single continuous variable as previously described in Berger et al where higher scores represent greater experiences of stigma [28]. To examine the relationship between disclosure of HIV status and condom use, generalized linear

models with generalized estimating equations (Proc Genmod with GEE) were used to estimate separate Poisson regression models for the outcomes of condom use during all subtypes of anal intercourse (insertive, receptive, and any). Adjusted risk ratios were calculated controlling for all covariates for insertive, receptive, and any anal intercourse and unadjusted risk ratios were calculated for each covariate by outcome. All analyses were conducted in SAS 9.4 (Cary, NC).

Results

Participants

The Engage[men]t study enrolled 400 HIV-positive men who contributed partner-level information on 910 sexual partners. The current analysis only included participants in serodiscordant relationships resulting in a study population of 118. Most participants were white/Caucasian (77 participants, 65.3%); the remainder were black/African American (41 participants, 34.8%). 108 (91.5 %) participants reported disclosing their HIV positive status to at least one partner with 38 (35.2%) participants identifying as black/African American and 70 (64.8%) participants identifying as white/Caucasian. 100 (84.8%) participants had completed at least some college, and 90 of these participants reported serostatus disclosure. Of the 7 (5.9%) participants that reported recent (within 90 days of completing survey) HIV diagnosis, 6 reported disclosure of HIV status to at least one partner while among the 111 participants (94.1%) that reported HIV diagnosis greater than 90 days prior to completing the survey, 102 reporting disclosure of HIV status to at least one partner. Viral load was suppressed in 96 (82.05%) participants. Of 96 participants who were virally suppressed, 88 (82.2%) reported disclosure to at least one partner. Median level of stigma related to HIV status among all participants was 23 while median stigma among participants that reported disclosure to at least one partner was 21.5 (p=0.05).

Partnerships

Of the 910 sexual partners included in the Engage[men]t study, 710 (78%) partners were excluded due to HIV positive status at first sexual encounter and 5 (0.5%) partners were excluded due to non-male natal sex resulting in a final sample size of 195 (21.4%) partners. HIV status was disclosed to 173 (88.7%) partners. Participants reported always using condoms for receptive anal intercourse with 44 (28.6%) partners and HIV status was disclosed to 39 (28.1%) of those partners. Consistent condom use was reported with 13 (19.1%) partners for insertive anal intercourse and HIV status was disclosed to 12 (19.7%) of those partners. Consistent condom use was reported with 53 partners for any type of anal intercourse and HIV status was disclosed to 48 (28.9%) of those partners. Being in an exclusive relationship was reported for 50 (27.0%) partners and HIV status was disclosed to 45 (24.3%) of these partners. Participants reported avoiding disclosing their HIV status due to fears of prosecution to 27 (13.9%) partners and 5 (35.7%) of these participants did not report disclosure to partners.

Bivariate Analysis

There was no significant difference in disclosure of HIV status by type of anal intercourse (insertive p= 1.00, receptive p=1.00, and any anal intercourse p=0.76). There was no significant difference in disclosure of HIV by highest level of education obtained (p=0.35), age group (p=1.00), exclusive partnerships (p=1.00), participant race (p=1.00), and reported stigma (p=0.08). Avoiding disclosing HIV status due to fear of prosecution did differ significantly based on disclosure of HIV status (p=0.02). There was no significant difference in use of condoms for receptive anal intercourse by highest level of education obtained (p=0.24), age (p=0.59), and avoiding disclosure due to fear of possible prosecution (p=0.78). Use of condoms for receptive anal intercourse did differ significantly based on race (p=0.02), exclusive

partnerships (p=0.01) and reported stigma (p=0.02). There was no difference in use of condoms for insertive anal intercourse by highest level of education obtained (p=0.44), age (p=0.76), race (p=1.00), exclusive partnerships (p=0.75), avoiding disclosing HIV status due to fear of prosecution (p=0.68), and reported stigma (p=0.76). There was no significant difference between condom use for any anal intercourse by highest level of education obtained (p=0.08), age (p=0.74), race (p=0.08), exclusive partnerships (p=0.09), and avoiding disclosing HIV status due to fear of prosecution (p=0.79). Use of condoms for any anal intercourse did differ significantly by reported stigma (p=0.05).

Regression Analyses

Disclosure was associated with lower rates of condom use for receptive anal intercourse (Adjusted RR (95% CL) =0.72 (0.42 – 1.22)) and any anal intercourse (Adjusted RR= 0.86 (0.45 – 1.66)); however, there was no association between disclosure and condom use for insertive anal intercourse (Adjusted RR = 1.00 (1.00 – 1.00)). Being in an exclusive partnership was associated with lower rates of condom use for receptive anal intercourse (Adjusted RR= 0.39 (0.17 - .87)) and any anal intercourse (Adjusted RR= 0.52 (0.27 – 1.01)). Condom use during receptive anal intercourse (Adjusted RR= 1.45 (0.79 – 2.66)) and any anal intercourse (Adjusted RR= 1.25 (0.70 – 2.14)) was higher among individuals aged 35 or younger. Participants who had some college education or more were more likely to use condoms during insertive (Adjusted RR= 1.34 (0.30 – 5.87)) and any anal intercourse (Adjusted RR= 1.02 (0.48 – 2.16)). Having a suppressed viral load was associated with increased use of condoms for insertive (Adjusted RR= 1.23 (0.37 – 4.12)) and any anal intercourse (Adjusted RR= 1.35 (0.75 – 2.42)). Reporting higher levels of stigma was associated with decreased condom use for receptive (Adjusted RR= 0.97 (0.94 – 1.00)) and any anal intercourse (Adjusted RR= 0.98 (0.95 – 1.01)). Condom use was

lower among African American/black participants for insertive (Adjusted RR= 0.90 (0.60 –

1.33)), receptive (Adjusted RR= 0.77 (0.64 – 0.94)) and any anal intercourse (Adjusted RR=

0.85 (0.71 – 1.02)). Avoiding disclosure due to fear of possible prosecution was associated with

lower rates of condom use for any anal intercourse (Adjusted RR= 0.94 (0.37 – 2.36)).

Discussion

Disclosure of HIV serostatus is one of several strategies for HIV prevention along with

condom use, serosorting, seropositioning, and biomedical options for HIV-negative and HIV-

positive individuals [8-11]. Condom use is an effective intervention to prevent HIV transmission

to HIV-uninfected partners in serodiscordant partnerships[7]. MSM continue to experience a

higher burden of HIV infection when compared to other groups and MSM are a key population

for HIV prevention efforts [1]. This analysis examined the relationship between condom use and

serostatus disclosure among a cohort of MSM in serodiscordant relationships adjusting for

participant age, participant race, reported stigma, relationship type, viral load suppression,

highest level of education, and if participant avoided disclosing due to fear of possible

prosecution. In this analysis the majority (91.5%) of participants reported disclosure to at least

one sexual partner. Compared to the high level of reported disclosure, there was a lower amount

of reported condom use for all types of anal intercourse (28.6% for receptive, 19.1% for insertive

and 28.8% for any). Results from this study suggest that disclosure reduces the amount of

reported condom use and that there are several other factors that affect the rate of condom use.

The highest risk of sexual transmission among MSM occurs from insertive anal

intercourse from an HIV positive partner [4-6]. Of the 195 partnerships included in this analysis,

the HIV-positive participant engaged in insertive anal intercourse in only 68 (34.9%) of the

partnerships. This indicates that participants might have selected sexual positions based on

serostatus (i.e., seropositioning) or reflects a preference for receptive anal intercourse among MSM living with HIV. Seropositioning is the term given when an HIV positive partner is the receptive partner. Results from this study indicated that condomless receptive intercourse was more common among serodiscordant MSM after controlling for disclosure, stigma, exclusive partnerships, participant race, avoiding disclosure due to fear of prosecution, and having a suppressed viral load. In this analysis participants were significantly less likely to report condom use in nonexclusive partnerships for receptive anal intercourse. Condom use in nonexclusive partnerships for any anal intercourse was less likely to be reported. This is supported by previous studies that showed that MSM were less likely to report condom use for causal partners when already in a committed relationship but MSM were more likely to serosort when selecting causal, ongoing partnerships [29]. MSM with a causal partner of an unknown status have also been shown to be at a greater risk for HIV infection [6]. Condom use for all types of anal intercourse was less common among African American/Black participants than among Caucasian/White participants. Considering African-American/Black MSM have a higher burden of HIV than Caucasian/White MSM [1], interventions aimed at increasing condom use or alternative HIV prevention interventions among African-American/Black MSM represent an important topic for future studies.

Limitations

This analysis used a convenience sample from the Engage[men]t study. Eligibility criteria for Engage[men]t did not include any restrictions on serostatus of partners nor did the study have specific enrollment goals for different subtypes of partnerships. Thus, Engage[men]t was not powered *a priori* to assess the effect of serostatus disclosure on condom use. The sample size was restricted further in analyses examining particular sexual positions (i.e., insertive, receptive).

Small sample sizes (N= 68 reported insertive anal intercourse) reduced statistical power to observe associations, particularly in multivariable models. The results of this analysis may not be generalizable to other populations. There was a high rate of disclosure with 108 (91.5%) participants disclosing to at least 1 partner compared to 69% disclosure of serostatus among MSM described by Przybyla et al[19]. The study population reflects relatively high socioeconomic status; the majority of the participants had completed some college, had health insurance, and were virally suppressed. Participants were also limited to reporting 5 sexual partners in 6 months prior to the survey date. It is possible that participants with more than 5 partners chose to report the partners with whom they engaged in the most HIV prevention behaviors. Because participants could only report up to 5 sexual partners, social desirability bias may influence participants to report partners in which safe sex practices (i.e., disclosing or always using condoms) were used instead of partners with whom they had riskier sex. Serostatus disclosure was assessed at the first sexual encounter. This may also result in recall bias if participants are unable to remember the details of their first sexual encounter with the reported partner.

Conclusions

Results from this analysis showed a low level of condom use among serodiscordant MSM with 28.6% in receptive, 19.1% in insertive and 28.8% in any anal intercourse. 108 (91.5%) participants reported disclosing their HIV status to at least one of their reported partners. Condom use was less likely among African American/Black participants for any type of anal intercourse. Participants were also less likely to report condom use if they reported avoiding disclosure due to fears of possible prosecution across all types of anal intercourse. Condom use was significantly less likely to be reported among nonexclusive partnerships engaging in

receptive anal sex and among African American/Black participants engaging in receptive anal intercourse.

In this analysis African American/Black MSM participants were less likely to use condoms for all types of anal intercourse increasing the risk of HIV transmission from sexual contact. African American/Black MSM continue to be identified as a target population for HIV prevention interventions and this will continue until African American/ Black MSM are no longer disproportionally affected by HIV. Due to the health disparities and higher burden of HIV among African American/ Black MSM it is important that research to understand transmission dynamics and barriers to prevention strategies continues in order to better serve this population. Condomless anal intercourse was common in this analysis among nonexclusive partnerships and participants reported more casual partners than exclusive partners. Previous research has shown that MSM are least likely to disclosure their HIV status to a nonexclusive partner [21]. With lower rates of condom use, lower rates of disclosure, and increasing numbers of nonexclusive partners, causal MSM partnerships may represent an at-risk population for future interventions. The small sample size of participants engaging in insertive anal intercourse suggests that in the study population there was a high amount of seropositioning. Seropositioning has been shown to be as protective as condomless anal intercourse with a HIV negative partner [9]. This is dependent on both partners knowing their HIV status which may not be possible in populations that lack access to HIV testing. Seropositioning is also dependent on partners disclosing their HIV status and MSM have been shown to be least likely to disclose [21]. Seropositioning will likely be most efficient when used with another HIV prevention strategy.

Results from this analysis suggest that MSM in nonexclusive serodiscordant relationships are less likely to report condom use for all subtypes of anal intercourse. MSM represent a target

population for HIV prevention interventions; however, different sexual behaviors and relationship characteristics convey different levels of risk of HIV infection. Reporting multiple male partners has been shown to increase an individual's risk of HIV infection [5]. Continued research of MSM in nonexclusive, serodiscordant relationships is needed in order to tailor HIV prevention interventions to this population, including PrEP use among HIV-uninfected partners. The study population displayed a significant amount of seropositioning as only 34.9% of the sexual encounters involved insertive anal intercourse. Seropositioning may have resulted as a behavioral adaption for HIV positive MSM to reduce the risk of transmission to a partner regardless of the partner's serostatus or from another unknown mechanism. Seropositioning is one of several seroadaptive strategies that may be used to reduce risk of HIV transmission but the benefits of seropositioning are not currently well defined and seroadptive strategies are not recommended as a primary method of HIV prevention [9, 30]. Participants in this analysis reported a higher rate of disclosure to at least one sexual partner than levels of disclosure previously observed [19]. Disclosure of serostatus prior to first intercourse allows for the appropriate use of HIV prevention strategies, such as condoms or PrEP, and for discussions about the treatment status of the HIV-infected partner. Interventions are needed to help MSM navigate serostatus discussions and to implement appropriate strategies to prevent HIV transmission, including condoms, PrEP for HIV-uninfected partners, and treatment as prevention for HIV-infected partners.

1.   Prevention, C.f.D.C.a. *HIV Surveillance Report*. 2017 [cited 2018 12/1]; Vol 29:[Available from: http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html.

2.   Rosenberg, E.S., et al., *Rates of prevalent and new HIV diagnoses by race and ethnicity among men who have sex with men, U.S. states, 2013–2014.* Annals of Epidemiology, 2018. **28**(12): p. 865-873.

3.   Prevention, C.f.D.C.a. *Estimated HIV incidence and prevalence in the United States, 2010–2015.* 2017 [cited 2018 December]; HIV Surveillance Supplemental Report 2018;23(No. 1):[Available from: http://www.cdc.gov/hiv/library/reports/hiv-surveillance.html.

4.   Stephenson, R., et al., *HIV testing behaviors and perceptions of risk of HIV infection among MSM with main partners.* AIDS and behavior, 2015. **19**(3): p. 553-560.

5.   Hoenigl, M., et al., *Risk Factors for Acute and Early HIV Infection Among Men Who Have Sex With Men (MSM) in San Diego, 2008 to 2014: A Cohort Study.* Medicine, 2015. **94**(30): p. e1242-e1242.

6.   Koblin, B.A., et al., *Risk factors for HIV infection among men who have sex with men.* 2006. **20**(5): p. 731-739.

7.   Smith, D.K., et al., *Condom Effectiveness for HIV Prevention by Consistency of Use Among Men Who Have Sex With Men in the United States.* 2015. **68**(3): p. 337-344.

8.   Grant, R.M., et al., *Preexposure chemoprophylaxis for HIV prevention in men who have sex with men.* The New England journal of medicine, 2010. **363**(27): p. 2587-2599.

9.   Vallabhaneni, S., et al., *Seroadaptive practices: association with HIV acquisition among HIV-negative men who have sex with men.* PloS one, 2012. **7**(10): p. e45718-e45718.

10.   McFarland, W., et al., *Behavior, Intention or Chance? A Longitudinal Study of HIV Seroadaptive Behaviors, Abstinence and Condom Use.* 2012. **16**(1): p. 121-131.

11.   Mitchell, J.W.J.A. and Behavior, *HIV-Negative and HIV-Discordant Gay Male Couples' Use of HIV Risk-Reduction Strategies: Differences by Partner Type and Couples' HIV-Status.* 2013. **17**(4): p. 1557-1569.

12.   Chakravarty, D., et al., *Rates of testing for HIV in the presence of serodiscordant UAI among HIV-negative gay men in committed relationships.* AIDS and behavior, 2012. **16**(7): p. 1944-1948.

13.   Paz-Bailey, G., et al., *Trends in condom use among MSM in the United States: the role of antiretroviral therapy and seroadaptive strategies.* AIDS (London, England), 2016. **30**(12): p. 1985-1990.

14.   Gamarel, K.E., et al., *Personal or relational? Examining sexual health in the context of HIV serodiscordant same-sex male couples.* AIDS and behavior, 2014. **18**(1): p. 171-179.

15.   Baeten, J.M., et al., *Antiretroviral prophylaxis for HIV prevention in heterosexual men and women.* The New England journal of medicine, 2012. **367**(5): p. 399-410.

16.   Anderson, P.L., et al., *Emtricitabine-tenofovir concentrations and pre-exposure prophylaxis efficacy in men who have sex with men.* Science translational medicine, 2012. **4**(151): p. 151ra125-151ra125.

17.   Mansergh, G., B.A. Koblin, and P.S. Sullivan, *Challenges for HIV Pre-Exposure Prophylaxis among Men Who Have Sex with Men in the United States.* PLOS Medicine, 2012. **9**(8): p. e1001286.

18.   Donnell, D., et al., *HIV protective efficacy and correlates of tenofovir blood concentrations in a clinical trial of PrEP for HIV prevention.* Journal of acquired immune deficiency syndromes (1999), 2014. **66**(3): p. 340-348.

19.   Przybyla, S.M., et al., *Serostatus disclosure to sexual partners among people living with HIV: Examining the roles of partner characteristics and stigma.* AIDS Care, 2013. **25**(5): p. 566-572.

20.   O'Connell, A.A., S.J. Reed, and J.A. Serovich, *The efficacy of serostatus disclosure for HIV Transmission risk reduction.* AIDS and behavior, 2015. **19**(2): p. 283-290.

21. Galletly, C.L., S.D.J.A. Pinkerton, and Behavior, *Conflicting Messages: How Criminal HIV Disclosure Laws Undermine Public Health Efforts to Control the Spread of HIV.* 2006. **10**(5): p. 451-461.

22. Horvath, K.J., R. Weinmeyer, and S. Rosser, *Should it be illegal for HIV-positive persons to have unprotected sex without disclosure? An examination of attitudes among US men who have sex with men and the impact of state law.* AIDS Care, 2010. **22**(10): p. 1221-1228.

23. Serovich, J.M., et al., *Relationship between serostatus disclosure and categories of HIV transmission risk in men who have sex with men living with HIV.* 2018. **29**(8): p. 744-750.

24. Ciccarone, D.H., et al., *Sex Without Disclosure of Positive HIV Serostatus in a US Probability Sample of Persons Receiving Medical Care for HIV Infection.* American Journal of Public Health, 2003. **93**(6): p. 949-954.

25. Klitzman, R., et al., *It's not just what you say: Relationships of HIV dislosure and risk reduction among MSM in the post-HAART era.* AIDS Care, 2007. **19**(6): p. 749-756.

26. Hightow-Weidman, L.B., et al., *Patterns of HIV Disclosure and Condom Use Among HIV-Infected Young Racial/Ethnic Minority Men Who Have Sex with Men.* AIDS and Behavior, 2013. **17**(1): p. 360-368.

27. MacKellar, D.A., et al., *Surveillance of HIV risk and prevention behaviors of men who have sex with men--a national application of venue-based, time-space sampling.* Public health reports (Washington, D.C. : 1974), 2007. **122 Suppl 1**(Suppl 1): p. 39-47.

28. Berger, B.E., C.E. Ferrans, and F.R. Lashley, *Measuring stigma in people with HIV: Psychometric assessment of the HIV stigma scale¶.* 2001. **24**(6): p. 518-529.

29. van den Boom, W., et al., *Serosorting and sexual risk behaviour according to different casual partnership types among MSM: the study of one-night stands and sex buddies.* AIDS Care, 2012. **24**(2): p. 167-173.

30. Cassels, S. and D.A. Katz, *Seroadaptation among men who have sex with men: emerging research themes.* Current HIV/AIDS reports, 2013. **10**(4): p. 305-313.

Appendix A: Tables

Table 1: Characteristics of Participants in Serodiscordant Relationships in the Engagement Study (N=118)								
	Total Population			Disclosed to partner at least once (N= 108)			Never disclosed to partner (10)		P-Value[2]
	N	%		N	%		N	%	
Age									
<= 35	52	44.07		49	45.37		3	30.00	0.51
35+	66	55.93		56	54.63		7	70.00	
Race									
Black/African American	41	34.75		38	35.19		3	30.00	1.00
White/Caucasian	77	65.25		70	64.81		7	70.00	
Highest Level of Education									
Some college or more	100	84.75		90	83.33		0	0.00	0.36
High school or less	18	15.25		18	16.67		10	50.00	
Insurance Status									
Insured	93	78.81		84	77.78		9	90.00	0.67
Not insured or don't know	25	21.19		24	22.22		1	10.00	
Income									
0 to $19,999 (yearly)	33	28.45		30	28.30		3	30.00	0.63
$20,000 to $74,999 (yearly)	57	49.14		51	48.11		6	60.00	
$75,000 or more (yearly)	26	22.41		25	23.58		1	10.00	
Sexual Identity									
Homosexual or Gay	112	94.92		103	95.37		9	90.00	0.42
Bisexual or other	6	5.08		5	4.63		1	10.00	
Housing Sitution									
Own house/apartment	92	77.97		83	76.85		9	90.00	0.46
Other	26	22.03		25	23.15		1	10.00	
Marital Status									
Married/ Domestic partnership	13	11.02		12	11.11		1	10.00	1.00
Other	105	88.98		96	88.89		9	90.00	
Time of HIV Diagnosis									
New (within 90 days of survey)	7	5.93		6	5.56		1	10.00	0.47
Previous (greater than 90 days of survey)	111	94.07		102	94.44		9	90.00	
Viral Load									
Suppressed	96	82.05		88	82.24		8	80.00	1
Not suppressed	21	17.95		19	17.76		2	20.00	
Stigma[1]									
Median (IQR)	23 (14)	.		21.5 (14)	.		24.5 (16)	.	0.05[a]
1: Stigma accessed using methods described in Bunn et al 2007 with a maximum value of 70									
2: P-value assessed using Fisher's Exact test									
A: Stigma p-value assessed using Kruskal-Wallis test									

Table 2: Characteristics of Serodiscordant Partnerships in the Engagement Study (N=195)								
	Total Population			HIV Status Disclosed (n=173)			HIV Status Not Disclosed (N=14)		P-value[1]
	N	%		N	%		N	%	
Condom Use: Receptive Anal Intercourse									
Always	44	28.57		39	28.06		3	27.27	1.00
Sometimes/Never	110	71.43		100	71.94		8	72.73	
Condom Use: Insertive Anal Intercourse									
Always	13	19.12		12	19.67		1	20.00	1.00
Sometimes/Never	55	80.88		49	80.33		4	80.00	
Condom Use: All Anal Intercourse									
Always	53	28.80		48	28.92		3	23.08	0.7607
Sometimes/Never	131	71.20		118	71.08		10	76.92	
Main Partnership									
Yes	50	27.03		45	24.27		3	23.08	1.00
No	135	72.97		120	72.73		10	76.92	
Avoided disclosing due to fear of possible prosecution									
Yes	27	13.85		20	11.56		5	35.71	0.0247
No	168	86.15		153	88.44		9	64.29	
1: P-value assessed using Fisher's Exact test									

| Table 3: Estimated risk ratios from multivariate regression						
	Condom Use: Insertive Anal Intercourse		Condom Use: Receptive Anal Intercourse		Condom Use: All Anal Intercourse	
Covariate Tested	Unadjusted RR (95% CI)	Adjusted RR (95% CI)	Unadjusted RR (95% CI)	Adjusted RR (95% CI)	Unadjusted RR (95% CI)	Adjusted RR (95% CI)
Disclosure	0.96 (0.22- 4.30)	1.00 (1.00- 1.00)	0.89 (0.36 - 2.19)	0.87 (0.38 - 2.02)	1.06 (0.44 - 2.50)	1.02 (0.43 - 2.42)
Stigma	1.02 (0.96 - 1.08)	1.04 (0.98- 1.10)	0.96 (0.93 - 1.00)	0.97 (0.94 - 1.00)	0.97 (0.95- 1.00)	0.98 (0.95 -1.01)
Main Partnership	1.27 (0.50 - 3.21)	1.00 (1.00- 1.00)	0.43 (0.21 - 0.85)	0.38 (0.17 - 0.87)	0.62 (0.36 - 1.08)	0.52 (0.27 - 1.01)
Age	0.88 (0.33 - 2.35)	0.84 (0.29 - 2.42)	1.13(0.64 - 1.98)	1.45 (0.79 - 2.66)	1.11 (0.67 - 1.86)	1.23 (0.70 - 2.14)
Race	0.94 (0.66 - 1.33)	0.90 (0.60- 1.33)	0.81 (0.67 - 0.97)	0.77 (0.64 - 0.94)	0.86 (0.73 - 1.01)	0.85 (0.71- 1.02)
Avoided disclosing due to fear of possible prosecution	0.41 (0.06- 2.88)	0.44 (0.06 - 3.23)	0.92 (0.33 - 2.58)	0.94 (0.37 - 2.40)	0.74 (0.30 - 1.87)	0.94 (0.37 - 2.36)
Level of education	0.94 (0.29 - 3.03)	1.34 (0.30 - 5.87)	1.13 (0.51 - 2.53)	1.05 (0.52 - 2.13)	0.94 (0.47 - 1.87)	1.02 (0.48 - 2.16)
Viral load suppressed	1.40 (0.44 - 4.43)	1.23 (0.37 - 4.12)	0.93 (0.45 - 1.94)	0.98 (0.53 - 1.80)	1.31 (0.71 - 2.40)	1.35 (0.75 - 2.42)

Appendix B: Figures
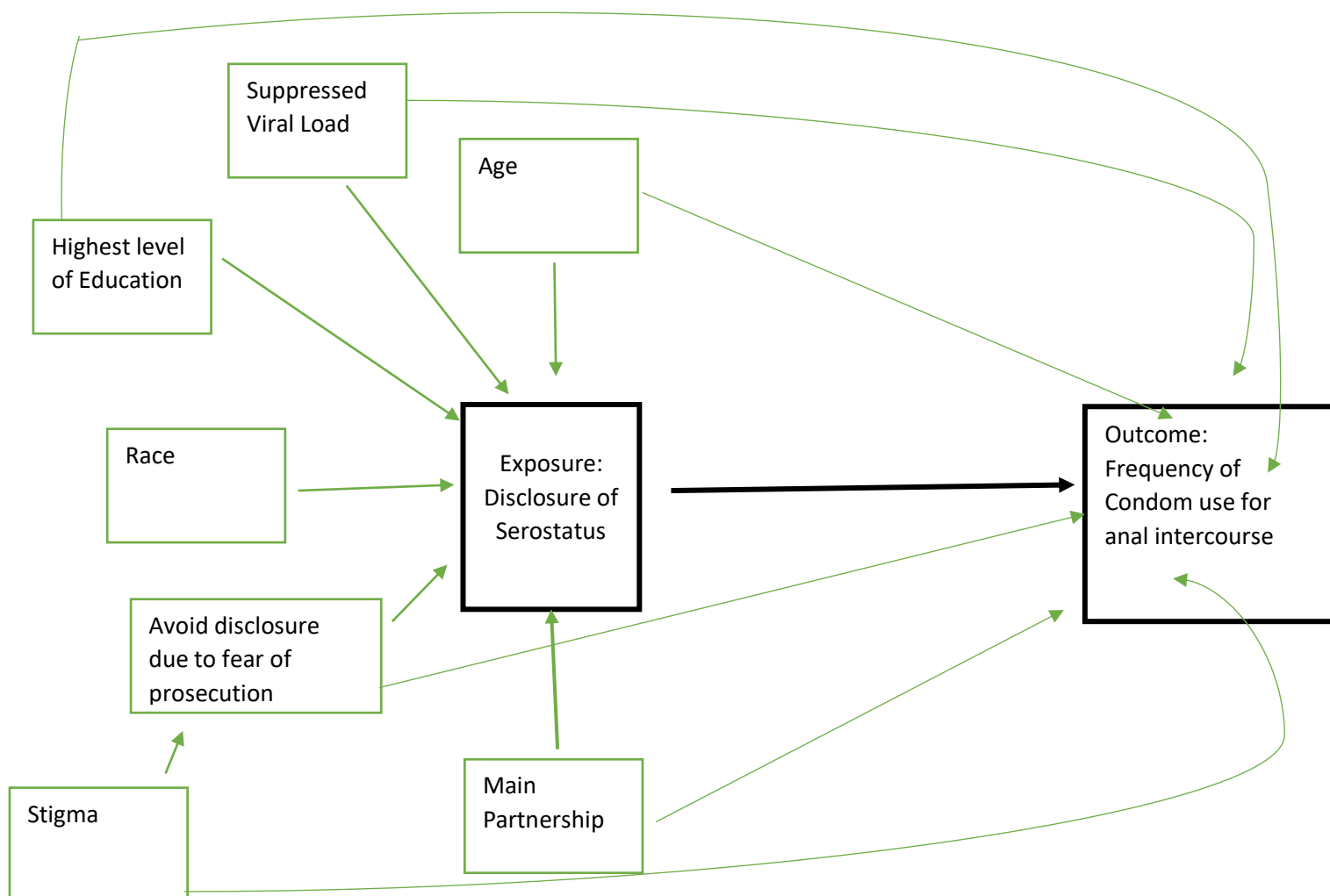
Figure 1: Directed Acyclic Graph (DAG) used to identify potential confounders of the exposure- disease relationship

910 partners reported

5 partners excluded due to non-male natal sex
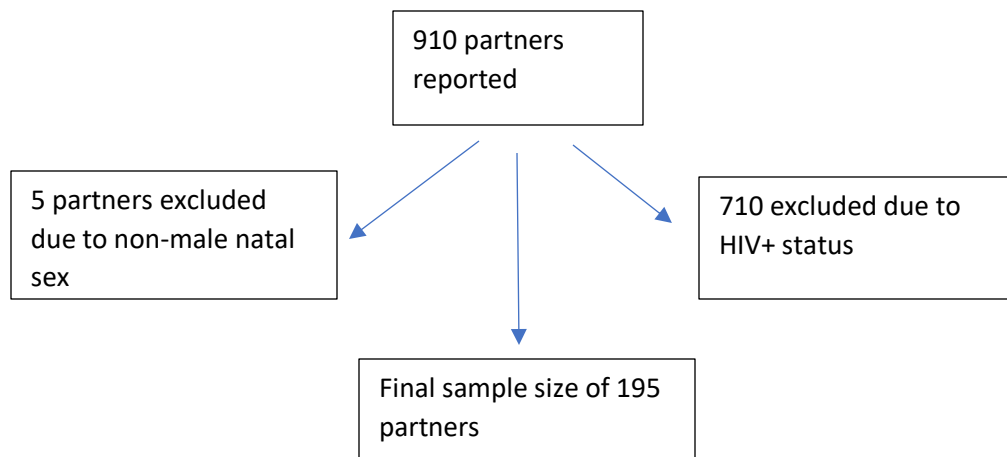
710 excluded due to HIV+ status

Final sample size of 195 partners

Figure 2: Flowchart depicting selection of study sample