Neighborhood Compositional Characteristics on HIV, Sexual Risk Behaviors, and Prevention Activities among Black and White Young Men Who have Sex with Men

Kenneth T. Jones

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ABSTRACT

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Kenneth T. Jones

This study examined associations between individual and neighborhood compositional characteristics for young black and white men who have sex with men (MSM), ages 15-25 years. Individual baseline data were collected during 1999-2000 as part of a 13-city randomized control trial. Neighborhood composition data at the zip code tabulation area were obtained from the 2000 US Census. Consistent with other studies, individual characteristics—including supportive condom use peer norms—were associated with any unprotected anal sex, HIV testing, having an HIV-positive/unknown test result, recent participation in prevention activities, and knowledge of antiretroviral therapies used to treat HIV. While young black men generally engaged in less risky sexual behaviors, they were more likely to test for HIV than were young white men but were also less likely to have recently participated in prevention programs or have knowledge of drugs used to treat HIV.

Associations were also observed for neighborhood compositional variables and HIV risk. Neighborhood percentage of single-parent female-headed households and neighborhood population turnover were associated with reduced HIV risk; while neighborhood composition measures of poverty and socioeconomic status were associated with increased HIV risk.

Neighborhood percentage of same-sex couples, also a measure of neighborhood gay presence, was associated both with factors that increase and factors that decrease risk for HIV transmission or acquisition. Young black men were more likely to live in neighborhoods characterized by increased risk while young white men were more likely to live in neighborhoods that were characterized by decreased risk.

These findings suggest that HIV risk disparities experienced among black and white young MSM can be partially explained by the neighborhoods in which these men reside. As such, prevention efforts for MSM should focus on both individual characteristics of these men and the neighborhoods in which they reside.

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Dedication

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Chapter 1: Introduction and literature review

1.1 Introduction

Drastic declines in HIV in the United States (US) have recently been reported (Holtgrave, Hall, Rhodes, & Wolitski, 2009). However, HIV infection continues to be greater for black men who have sex with men (MSM) compared to MSM of other races (CDC, 2001, 2005a, 2005b; Harawa et al., 2004; Lemp et al., 1994; Mansergh et al., 2002). In their systematic review, Millett and colleagues (2007) found that HIV disparities existed among black and white MSM despite commonly shared risk factors. Black and white MSM report similar, and sometimes lower, rates of unprotected anal intercourse (UAI), sex with HIV-positive individuals, and rates of HIV testing. This suggests the need for identifying and strengthening our understanding of other factors that drive HIV. Growing evidence suggests that neighborhood composition influences a number of health-related problems (Cubbin & Winkleby, 2005; Diez Roux et al., 2001; Diez Roux et al., 1999; Kawachi & Berkman, 2003; Ross & Mirowsky, 2001; Stafford & Marmot, 2003; D. R. Williams & Collins, 2001; Yen & Kaplan, 1999a, 1999b). However, this work continues to be limited for MSM.

In fact, few studies have identified the contribution of neighborhood composition on HIV and related risk and prevention efforts for MSM (Frye et al., 2010; Frye et al., 2006). While Pierce and colleagues (2007) found HIV prevention services to be located in neighborhoods where HIV prevalence was high, fewer prevention services were located in zip codes where young black MSM who report high risk behaviors lived. Given the dearth of research in this area for MSM, the current research investigated whether neighborhood compositional characteristics

were associated with HIV and related sexual risk taking, and HIV prevention efforts and knowledge for black and white MSM.

In 2010, the US government for the first time in the third decade of the HIV/AIDS epidemic unveiled the nation's coordinated strategy for reducing and ultimately ending the nation's HIV burden (Millett et al., 2010). A primary objective of the National HIV/AIDS Strategy (NHAS) is to reduce HIV incidence though multiple efforts. Action steps include 1) increasing strategies to prevent HIV in communities heavily impacted by HIV; 2) expanding efforts to prevent new HIV infections through the use multiple evidence-based approaches; and 3) educating all Americans about the disease and how to prevent it. Essentially, NHAS seeks to identify and understand communities where HIV is concentrated and expand current use and knowledge of prevention strategies including HIV testing and participation in knowledge of behavioral and biomedical approaches use to treat and prevent HIV infection (e.g., antiretroviral therapy and its pre-exposure use) in hardest hit communities.

In line with NHAS, and in an effort to improve current understandings of neighborhoods types impacted most by HIV among MSM, the current study retrospectively examined neighborhood compositional characteristics associated with HIV. Individual data were previously collected as part of the Community Intervention Trials for Youth (CITY) study (Guenther-Grey et al., 2005), a 13-community randomized control trial that assessed the effectiveness of a multi-component intervention among young MSM (YMSM). Neighborhood compositional data were obtained from the 2000 US Census. I was primarily interested in understanding whether neighborhood compositional characteristics were associated with HIV and participation in prevention activities for black and white YMSM. If associations were found, I was then interested in whether black and white YMSM resided in different types of

neighborhoods. Given the dearth of research examining neighborhood factors related to HIV acquisition and transmission among MSM, results from this study's investigation could possibly inform current planning and implementation of NHAS efforts. Essentially, I set out to answer 3 questions:

1. Which individual and neighborhood compositional characteristics are associated with HIV and participation in prevention activities for young black and white MSM?
2. After controlling for an individual's characteristics, which neighborhood compositional characteristics are associated with HIV prevention participation and knowledge?
3. If neighborhood compositional characteristics are associated with HIV and participation in prevention activities, do black and white MSM live in different types of neighborhoods and does that explain differences in their risk for HIV?

My selection of the primary neighborhood characteristics for investigation was influenced by personal interest as well as previous empirical research. Given that HIV disparities have been reported for black and white MSM (Millett, et al., 2007; Millett, Peterson, Wolitski, & Stall, 2006), I investigated neighborhoods whose composition varied in the percent of the following characteristics: African Americans, single-parent female-headed households, and same-sex couples. Additionally, I examined community measures of education, social economic status, and poverty. Finally, I included a peer norms measure as it might indicate how norms, whether conducive or not to high risk behaviors, impact risk behaviors. To determine YMSM's relative position to others I examine differences in an individual's educational attainment and the mean educational attainment levels in their neighborhoods.

In chapter 1, I highlight the impact of HIV on black and white YMSM. I then review recently published studies examining common individual factors associated with HIV and risk. I

focus on the "HIV risk paradox" for black MSM to show why focusing on individual level factors alone may be insufficient to explain HIV and risk disparities among black and white YMSM. I end this chapter by examining recent studies that have looked at neighborhood-level effects on HIV for MSM specifically. In chapter 2, I review several theoretical frameworks that were used to guide my thinking for this research. I then offer hypothesized relationships while considering these frameworks and consistent correlates of risk found in peer reviewed literature. In chapter 3, I justify the use of this data, the use of zip codes as a proxy of neighborhoods, and the methodology that I used to answer the aforementioned 3 research questions. In chapter 4, I describe the sample and the neighborhoods in which they reside. In chapter 5, I identify individual and neighborhood compositional characteristics that are associated with HIV and risk taking. In chapter 6, I review a series of multilevel models that I adjusted for individual-level and neighborhood compositional characteristics in my examination of factors related to HIV and prevention. In chapter 7, I describe neighborhoods where black and white MSM live. Finally, I conclude with a brief discussion in chapter 8 of the ways in which social workers practitioners and researchers can use these findings for planning, advocacy, and additional research in support of the NHAS.

1.2 Review of previous research

1.2.1 HIV risk among black and white YMSM

Drastic declines in HIV in the US have recently been reported (Holtgrave, et al., 2009). Nationally, MSM comprise 48% of people living with HIV and 53% of new HIV cases (CDC,

2010a). In a recent study of MSM in 21 major US cities, HIV prevalence was 28% for blacks. Nearly 60% were unaware of their HIV status (CDC, 2010b).

Rates of HIV infection continue to remain greater for black MSM as compared with other racial or ethnic groups of MSM (CDC, 2001; Harawa, et al., 2004; Lemp, et al., 1994; Mansergh, et al., 2002). Between 2001 and 2004, black MSM were the only subgroup of blacks for whom new HIV diagnoses actually increased rather than decreased (CDC, 2005b). An even more recent study found rates of HIV in the US to remain mostly stable for every risk group except for young MSM and black MSM. The study authors find that young black MSM are driving the HIV epidemic in the US (Prejean et al., 2011). This disturbing finding, which has continued for some time, has led some to observe HIV rates in black MSM to be analogous to those in some resource-limited countries (CDC, 2002, 2005a). Rates of new infections for black MSM between the ages of 13-29 remain greater than rates for any other age or racial group of MSM (CDC, 2010a, 2010b).

1.2.2 Review of individual-level determinants of HIV risk

Unprotected anal intercourse remains the primary vehicle for HIV transmission among MSM. Rates of UAI ranging from 26-55% have been reported generally among YMSM (Guenther-Grey et al., 2005; Valleroy et al., 2000). Rates of UAI among black MSM ranged from 34% and 47% for casual and main male partners, respectively, compared to rates among White MSM (39% and 64%, respectively) in a CDC (2006) study.

Low peer norms regarding condom use significantly predicted unprotected receptive anal intercourse (URAI) in a multi-city study of African American MSM (Hart & Peterson, 2004).

Similar finding have been reported by others (Carlos et al., 2010; Jones, Johnson, et al., 2008). Kelly (1991) successfully demonstrated the use of modifying community social norms by enlisting peers to successfully mitigate risky behaviors among MSM. This approach has also been tested successfully with black MSM (Jones, Gray, et al., 2008).

A recent analysis of HIV prevalence among MSM found less education to be associated with a greater likelihood of HIV (CDC, 2010b). Previous research has shown significant risk differences among MSM who identify as gay compared to those who do not (Goldbaum, Perdue, & Higgins, 1996; Jones, Johnson, et al., 2008; Wolitski, Jones, Wasserman, & Smith, 2006) and among younger MSM (CDC, 2010b). Commercial sex work and sex in exchange of housing, food, and money may be important risk factors for HIV especially among MSM who are unemployed as well as MSM who engage in sex with women (Hightow et al., 2006). Among 439 YMSM with unrecognized HIV infection, 62 (14%) reported exchanging sex for something of value and were more likely to report UAI (MacKellar et al., 2005).

1.2.3 Review of neighborhoods on HIV risk for MSM

Only three published studies have identified the contribution of neighborhood composition on HIV and related risk and prevention efforts for MSM (Carpiano, Kelly, Easterbrook, & Parsons, 2011; Frye, et al., 2010; Pierce, et al., 2007). Pierce and colleagues (2007) found fewer HIV prevention services located in zip codes where young black MSM who report high risk behaviors live. Living in neighborhoods with a greater number of same-sex coupled households, a measure of gay presence, was associated with consistent condom use (Frye, et al., 2010). However, these neighborhoods have also been associated with other high-

risk behaviors. MSM who reported living in neighborhood with more gay men and lesbians were more likely to report risky drug use behaviors in another study (Carpiano, et al., 2011).

1.2.4 HIV risk paradox

In their attempt to explain racial HIV disparities for black and white MSM, Millett and colleagues (2007) reviewed the empirical literature and found that racial disparities for HIV existed despite commonly shared sexual risk factors for black and white MSM. Black MSM report similar, or even lower, rates of UAI, sex with a person known to be HIV-positive, and rates of HIV testing over their lives. However, black MSM also reported less substance use and fewer sexual partners than white MSM. In another review, Millett and colleagues (2006) found support for their hypothesis that black MSM are more likely than MSM of other races to report having a sexually transmitted disease (STD). STDs that contribute to HIV infection are disproportionately found among African Americans and those residing in predominantly black communities (Semaan, Sternberg, Zaidi, & Aral, 2007). Additionally, black MSM tend to reside in predominant black communities rather than gay urban ghettos, which tend to be highly populated by white lesbians and gay men (Battle, Cohen, Warren, Fergerson, & Audam, 2002).

Black MSM's social networks also provide some support, albeit limited, in explaining HIV disparities. Raymond and McFarland (2009) found that black MSM in San Francisco were significantly more likely to engage in assortative sexual pairing than would be expected by chance. MSM from other racial groups viewed blacks as least desirable sexually or even as friends. This exclusion by MSM of other races has provided some credence that black MSM's sexual networks, particularly with other black men, may explain disparate rates of HIV among

these men. However, Clerkin and colleagues (2010) found that black MSM were more likely to report using condoms when having sex with other black men.

Another reason for the disparate rates, especially given the aforementioned sexual pairing (Clerkin, Newcomb, & Mustanski, 2010; Raymond & McFarland, 2009), is background prevalence of HIV in certain communities (Das et al., 2010). Community viral load is a population level mark of HIV transmission. It is likely that a single per act probability of transmitting HIV is higher in communities with higher community viral load, which is likely the case in communities where black MSM live. Therefore, one instance of unprotected anal sex in communities where black MSM live likely increases the opportunity for HIV transmission or acquisition compared to communities where viral load on average is lower (Oster et al., 2011). This explanation has also been used to understand this HIV risk paradox.

Chapter 2: Theoretical frameworks and hypothesized relationships

2.1 Theoretical frameworks

An examination of neighborhood compositional characteristics may provide a better understanding of HIV risk (Kawachi & Berkman, 2003) given the aforementioned risk paradox at the individual-level and the reported differences in neighborhoods in which some black and white MSM live. Several theoretical frameworks were used to guide this research and selection of research questions and variables.

2.1.1 Social disorganization

Originating nearly 7 decades ago, social disorganization is one theory for understanding the connection between neighborhoods and various behaviors, particularly neighborhood-level crime (Kubrin & Weitzer, 2003). The earlier work of Shaw and McKay (1942, 1969) showed that certain neighborhood characteristics were associated with high crime rates in Chicago. Resulting from their work was the idea that lower economic status, fragmented families, population ethnic heterogeneity, and residential mobility disrupted the organization of communities. This disruption, according to Bursik (1988), impeded the ability "of local communities to realize the common values of their residents or solve commonly experienced problems" (p. 521). Shaw and McKay's (1942, 1969) original model posited three sources of social disorganization: socioeconomic status, residential mobility, and ethnic heterogeneity. Sampson (1987) offered family disruption as a fourth source. His articulation on the role of

family disruption in negative social and health outcomes closely resembles the arguments of Moynihan (1965) in *The Negro Family: The Case for National Action*.

While earlier Chicago School sociologists initially examined social disorganization and its effects on neighborhood-level crime, Sampson and Grove (1989), however, claim to have published the first complete test of the model in their seminal work. A recent examination of their data (Sun, Triplett, & Gainey, 2004) suggests that their model was only modestly supported by the data. Various others have since reported tests of the theory (Jones-Webb & Wall, 2008; Reichman, Teitler, & Hamilton, 2009; Taylor, 1996; Teitler & Weiss, 2000), and examinations of neighborhood-level effects more generally (Feldman & Steptoe, 2004; Malmstrom, Sundquist, & Johansson, 1999; Sampson, 2003; Sampson, Morenoff, & Gannon-Rowley, 2002; van Jaarsveld, Miles, & Wardle, 2007). Several have applied the theory to understanding HIV for various risk populations including intravenous drug users (Fuller et al., 2005; Latkin & Curry, 2003), MSM (Frye, et al., 2010; Frye, et al., 2006), and the transmission of STDs among youth (Dembo, Childs, Belenko, Schmeidler, & Wareham, 2009). No studies explicitly examining this particular theory with young MSM, or with a focus on black MSM, have been located in the published literature.

Constructs from social disorganization theory are relevant to recent arguments. Jones and colleagues (Jones, Johnson, et al., 2008; Jones, Wilton, Millett, & Johnson, 2010; Peterson & Jones, 2009) have argued the need for conceptual frameworks that explain black MSM's HIV risk. HIV disparities and protective risk differences, according to the authors, may result from child-rearing practices, stigma, and socialization experiences at home and within African American communities. It is possible that YMSM are socialized differently based on the neighborhoods where they live.

Family disruption refers to the limited ability of single parent households to socially control the behaviors of their children (Moynihan, et al., 1965; Sampson & Grove, 1989). The role of families, and particularly parents, are important to the sexual development of children. Parents confer expectations for sex through these relational ties (Dittus, Miller, Kotchick, & Forehand, 2004). Children in single-parent families may receive fewer messages about expectations for sex. Children from two-parent families are least likely to initiate sex early (Santelli, Lowry, Brener, & Robin, 2000). Research has demonstrated that males who grow up without fathers experience various social disadvantages (Booth, Scott, & King, 2010; Willis & Clark, 2009). While there are key differences in youth who come from single and two-parent families, family structure alone has provided only a limited understanding of risk behaviors (Blum et al., 2000). These differences in risk might be related to the sense of vulnerability and protection afforded within the different types of families (Zweig, Phillips, & Lindberg, 2002).

Little is known about how family structure influences HIV risk or the sexual risk behaviors of young MSM (Torian, Koblin, Guilin, Ren, & Makki, 2002). A few studies have suggested possible ways family structure operates at the individual level. In a study of black adolescent males, those from two-parent families reported more frequent use of condoms (Jemmott & Jemmott, 1992). Having multiple sex partners was associated with coming from a single-parent household among black youth in substance treatment (Mulatu, Leonard, Godette, & Fulmore, 2008). Even with these limited findings, family disruption at the neighborhood level diminishes the ability of adults in these neighborhoods from controlling youth's behaviors. This would suggest poor social control of neighborhoods and an increase of behaviors deemed problematic.

Another source of social disorganization is ethnic heterogeneity. Communities characterized by racial and ethnic heterogeneity often report weakened communication and interactions with racially and ethnically dissimilar community members. If racial and ethnic groups segregate, this can impede community members from working with others in addressing common issues affecting their neighborhood. This inability to come together is perhaps influenced by fear and mistrust of racially and ethnically dissimilar group members (Sampson & Grove, 1989; Sun, et al., 2004).

One expected finding from this perspective is that racially dissimilar communities would report more social and health problems. However, racial composition of neighborhoods from this perspective only finds limited support in the HIV literature. For example, adolescent initiation of intravenous drug use was associated with neighborhoods characterized by large percentages of minority residents and low adult education attainment levels (Fuller, et al., 2005). Neighborhoods with a high concentration of blacks were least associated with syringe sharing behaviors in another study (Bluthenthal et al., 2007). On the other hand, poorer health has been reported among individuals who live in neighborhoods with high concentration of blacks (White & Borrell, 2006). Also, few HIV prevention service have been observed in zip codes where young black MSM who report high risk behaviors live (Pierce, et al., 2007).

Residential mobility, also referred to population turnover, is another discussed source of social disorganization. Turnover in the neighborhoods limit resident's ability to come together and solve particular problems as existing residents may be more interested in leaving the neighborhood rather than continuing to live in the neighborhood. Social ties may be weakened and already established social relationships may be disrupted if residents leave the neighborhood.

Additionally, informal structures may not be quickly established due to weak social ties when a neighborhood constantly changes residents (Bursik, 1988; Bursik & Grasmick, 1993).

Sharkey and Sampson (2010) found that changing residents affected the trajectories of Chicago youth in their study. However, the authors do stress the importance of understanding the contextual characteristics of the move. For example, youth who moved but remained in the Chicago area were likely to continue violent behavior. The opposite was true for youth who moved outside of the Chicago area. Therefore, changing residents can be beneficial at the individual level if it disrupts social ties that encourage antithetical behaviors. Kirk (2009) found that ex-prisoners in Louisiana who were relocated to different areas after Hurricane Katrina showed reduced recidivism. It is likely in these instances that new social ties were established for the individual and different social norms were introduced into the social network containing the individual (Granovetter, 1983; Wasserman & Faust, 1994). Very few studies have identified the effects of residential mobility on HIV risk. However, German and colleagues (2007) observed, at the individual level, increased HIV risk in their sample of injection drug users. Those who moved more than twice in the past six months were more likely to report needle-sharing behavior and visiting a shooting gallery.

While Shaw and McKay (1942, 1969) did not formally tie low socioeconomic status, a final tenet of social disorganization, to rates of delinquency in their study (Bursik, 1988), they did find that neighborhoods characterized by low socioeconomic status experienced various changes including increased ethnic heterogeneity and high population turnover (Bursik, 1988; Bursik & Grasmick, 1993; Shaw & McKay, 1942, 1969). The link between low socioeconomic status and health disparities, for individuals and within communities, has been established in the literature (Adler et al., 1994; D. Phuong, 2009; Feldman & Steptoe, 2004; McLaughlin & Stokes,

2002; Steptoe & Feldman, 2001; Williams, 1999; Williams, Mohammed, Leavell, & Collins, 2010). Joy and colleagues (2008) investigated the impact neighborhood socioeconomic status and the uptake of HIV treatment in settings where universal health care was being offered. They found that low socioeconomic status was associated with treatment delay. In fact, the percent of neighborhood residents living below the poverty level was associated with increased AIDS deaths. This finding is consistent with another study that examined AIDS deaths before and after periods when medical options to treat HIV were available (McFarland, Chen, Hsu, Schwarcz, & Katz, 2003). Another study found socioeconomic status to be associated with inequitable provision of treatment for HIV (Wood et al., 2002). Persons who fell in the low socioeconomic strata were least likely to be prescribed combination therapy for the treatment of their HIV. Most recently, CDC authors and others have identified poverty as an important drive of HIV among heterosexual men and women in the US (Adimora et al., 2001; Denning & DiNenno, 2010; Hixson, Omer, del Rio, & Frew, 2011; LaLota et al., 2011; Raj & Bowleg, 2011). This evidence remains limited for MSM.

2.1.2 Presence of gays and stigma

Frye and colleagues (2010) and Carpiano (2011) used neighborhood percentage of same-sex unmarried partners as a proxy of gay presence. While greater neighborhood presence of gay men and lesbians was associated with increased condom use (Frye, et al., 2010), it was also associated with risky drug using behaviors among MSM in another study (Carpiano, et al., 2011). Neighborhoods characterized by greater percentages of gays tend to have more individuals with higher incomes, who are more likely to be involved with the gay community,

and more likely to report HIV testing (Mills et al., 2001). Black MSM are less likely to live in these neighborhoods (Battle, et al., 2002) or neighborhoods with large numbers of same-sex couples (Dang & Frazer, 2004).

The unwillingness of gay men and lesbians to publicly identify their partnerships because of anti-gay prejudices also serves as a proxy of community stigma. Goffman's (1963) seminal work has inspired much of the work on stigma. As a concept, stigma has been examined across various social situations by scores of multidisciplinary researchers (Link & Phelan, 2001). One operational definition of stigma is the social sanctioning of an individual whose attributes or behaviors are perceived to go against social norms or expected ways of behaving. Meyer (2003) has examined the effects that stigma has on lesbian, gay, and bisexual populations. Stigmatized individuals may experience status loss and discrimination. In the case of MSM, status loss may take the form of exclusion from familial roles or general participation in their communities because a stigmatized attribute or behavior is viewed as undesirable by others. As a result, MSM may be rejected outright from their families and communities. This may lead to increased psychological distress. Jones and colleagues (2010) have offered a similar conceptualization of the role of stigma and communities where black MSM live on their HIV risk.

Researchers have addressed the role that stigma plays in increasing rates of HIV. Stigma may limit black men's involvement in HIV prevention activities (Bogart & Thorburn, 2005). A similar finding was observed specifically among black MSM (Hutchinson et al., 2007). A study, the first of its kind, linked bans on same-sex marriage to increasing HIV rates in the US (Francis & Mialon, 2010). It has also been suggested that negative attitudes towards homosexuality may increase black MSM risk for HIV (Herek & Capitanio, 1995; Lewis, 2003; Stokes & Peterson, 1998; Ward, 2005; Woodyard, Peterson, & Stokes, 2000). A recent nationally representative

study looked at attitudes towards homosexuality (Glick & Golden, 2010). In comparing changes among those who believed that homosexuality was "always wrong," black respondents showed very little change since the 1970s. The proportion of blacks that endorsed this belief was 72.3%. White respondents showed a decline from 70.8% in the 1970s to 51.6% in 2008. Among MSM, 57.1% of blacks reported homosexuality as "always wrong" compared to 26.8% of whites. Stigma may increase fatalistic beliefs for MSM. For black MSM especially, these beliefs may diminish any sense of personal obligation to protect themselves or their sexual partners (Jones, et al., 2010; Peterson & Jones, 2009; Stokes & Peterson, 1998; Woodyard, et al., 2000).

In their seminal text on the social organization of sexuality, Laumann and colleagues (1994) stress that stigma related to homosexuality is a potential barrier to assessing survey items related to sexuality among gay men and lesbians. This has been observed more recently regarding same-sex partnership survey items on several population based government surveys including the US Census. Generally, stigma may prevent lesbian and gay cohabitating couples from revealing their same-sex partnerships on government forms (Gates, 2010). In his analysis of same-sex partnering data from the 2005 American Community Survey (ACS), Gates (2006) noted a 30% increase in the number of couples reporting same-sex partnerships. In the 2000 census, 594,391 couples were counted compared to 776,943 in the 2005 ACS. Gates notes that "most likely as stigma associated with same-sex partnering and homosexuality in general decreases, more same-sex couples are willing to identify themselves as such on government surveys like the ACS" (pg. 1). In their study of undercounting of same-sex partnerships in the 2000 Census, Badgett and Rogers (2003) found that concerns about confidentiality, most likely due to social prejudices against homosexuality, were among the highest cited reasons for gay men and lesbians to not identify their same-sex partnerships on the US Census. Therefore, it is

likely that the Census captures men and women who are more likely to be "out" about their sexual identity as long as societal prejudice against lesbians and gay men continues.

It is unclear how anti-gay stigma or presence of same-sex couples, at the neighborhood level, differently affects HIV risk taking among black and white MSM. The current study did not use a direct measure of stigma but a proxy—low neighborhood gay presence. Related findings will elucidate the extent to which stigma or gay presence are related to risk taking and whether black or white MSM are more likely to live in neighborhoods marked by stigma or gay presence.

2.1.3 Relative deprivation

Relative deprivation was first introduced as an explanation of soldier's satisfaction in the army (Stouffer, Scuhman, DeVinney, Star, & Williams, 1949; Walker & Smith, 2002). As Morrison (1971) points out, an individual's discontent should be measured in relation to what others around them have and not by their own lack of resources. Recent applications to crime (Kawachi, Kennedy, & Wilkinson, 1999) and relations between income and health (Kondo, Kawachi, Subramanian, Takeda, & Yamagata, 2008; Miller & Paxson, 2006) have been reported in the literature. In fact, Kawachi, Kennedy, and Wilkinson (1999) offer a conceptual model examining both relative deprivation and social disorganization.

The utility of relative deprivation theory in relation to HIV is growing prominence as discussions of social determinants of health begin to gain momentum (Fox, 2010; Marmot, 2005). While this work has been limited in the US, Fox (2010) has used this theory in explaining the relationship between poverty and HIV in sub-Saharan Africa. In her literature review, Fox argues that poorer countries are characterized by both absolute and relative impoverished

conditions. While HIV is often viewed as a poverty-related disease in many countries, those who are relatively poor, whereas their basic needs are met but they vary in terms of other economic resources, were more at risk than those who were absolutely poor, whereas their basic needs are not met. This theory provides a useful framework for examining and potentially explaining risk behaviors of MSM as they contend with their experiences living in neighborhoods that possess characteristics that may also influence their HIV risk.

2.1.4 Social and peer norms

Social and peer norms may be one mechanism through which neighborhood composition is related to individual behavioral risk. Generally, norms are rules or shared understanding of expected behaviors. The literature has often distinguished between two types of norms (Borsari & Carey, 2003). Descriptive norms describe behaviors, or an individual's perceptions of the behaviors, of others (e.g. *my friends use condoms during anal sex*). Injunctive norms, on the other hand, are morally based and describe what an individual thinks is right or wrong (e.g. *my friends believe that it is important to use condoms during anal sex*). Kitts and Chiang (2008) have discussed challenges that social scientists have faced in conceptualizing and measuring norms; however many scientists regards norms as having a proscriptive and prescriptive nature as in the case of injective norms. Nonetheless, the norm concept is widely used with no consensus in operationalizing and measuring the term.

Berkowitz (2004) posits that behaviors and attitudes are incorrectly influenced by false perceptions of how members of an individual's social group thinks or acts. In light of HIV risk behaviors, perceiving unhealthy sexual behaviors of others will result in an individual increase of

unsafe sexual practices. Norms are often established through observed behaviors in a social or peer group (Fuller, et al., 2005; Parsons & Halkitis, 2002). The recurrence of behaviors that others view as socially undesirable may lead an individual who observes the same behaviors to feel as if the behaviors are socially acceptable or normative. For example, low and non-supportive condom use peer norms are widely associated with increased HIV risk behaviors (Carlos, et al., 2010; Hart & Peterson, 2004; Jones, Johnson, et al., 2008). At the individual level, for example, youth from single-parent families report engaging in riskier sex (Jemmott & Jemmott, 1992; Mulatu, et al., 2008). Individuals in neighborhoods with more single parent families, which may be characterized by youth in these neighborhoods engaging in more risky sex, may regard risky sex as normative. Therefore, and to the extent that individual behaviors are associated with neighborhood composition, it is also possible that perceptions of norms are associated with neighborhood composition.

2.2. Hypothesized relationships

The goal of the current study was not to directly test social disorganization or any of the aforementioned frameworks, but to use these frameworks as a way to guide my current thinking for understanding HIV and risk and disparities for black and white MSM. Specifically, I sought to answer the following questions:

1. Which individual and neighborhood compositional characteristics are associated with HIV and participation in prevention activities for young black and white MSM?
2. After controlling for an individual's characteristics, which neighborhood compositional characteristics are associated with HIV prevention participation and knowledge?

3. If neighborhood compositional characteristics are associated with HIV and participation in prevention activities, do black and white MSM live in different types of neighborhoods and do that explain differences in their risk for HIV?

Given the previously discussed HIV risk paradox and living arrangements of black and white MSM (See 1.2.4), it is likely that relationships from social disorganization will not be consistently observed. For example, social disorganization theory in the context of HIV risk would suggest that neighborhoods with greater percentages of any of the following would be associated with HIV risk: Blacks, female-headed households, residential turnover or mobility, and low socioeconomic status. Additionally, relative deprivation and social norm theory may in fact be competing hypotheses with social disorganization theory. These frameworks may explain MSM's HIV risk behaviors from a neighborhood perspective differently. With these considerations in mind, and the previously reported findings, the following relationships below were hypothesized:

1. Given prior research (See 1.2), it is expected that race, age, gay identity, education, work status, trade sex, and supportive condom use peer norms will be associated with HIV risk. Black race, older age, employment, and supportive peer norms will be positively associated with related-outcomes that decrease risk of HIV and negatively associated with those outcomes associated with increased risk of HIV. However, gay-identity will be positively associated with both factors that decrease as well as increase risk of HIV. For example, it is likely that gay identified MSM will report more frequent testing but also report more unprotected anal sex, which is consistent with published literature showing increased HIV risk among gay identified MSM (CDC, 2001, 2002, 2005a, 2010b).

2. The presence of same-sex couples and black resident has found support in the literature (Frye, et al., 2010), it is expected that greater percentages of same-sex couples—as a measure of gay presence, black residents, and single-parent female-headed households will be positively associated with related-outcomes that decrease risk of HIV and negatively associated with factors that increase risk of HIV. Various sources of socioeconomic status in the neighborhood—community mean education and percent employed as managers—are expected to be positively associated with related-outcomes that decrease risk of HIV and negatively associated with factors that increase risk of HIV; while percent of residents with incomes below the poverty level and having relatively less education is expected to be positively associated with factors that increase risk of HIV and negatively associated with factors that decrease risk of HIV. Fewer percentages of same-sex couples can also serve as a proxy for stigma. In this case, fewer percentages or greater stigma within a community is expected to be positively associated with factors that increase risk for HIV testing.
3. In light of the HIV risk paradox (See 1.2.4) and given disparities experienced by black generally (D. Phuong, 2009; Williams & Collins, 2001), it is still expected that black MSM will be more likely to report living in neighborhoods with greater percentages of other black people, single-parent female-headed households, residents who have incomes below the poverty level, and neighborhoods with greater residential mobility. On the other hand, white MSM will be more likely to report living in neighborhoods with greater mean education and greater percentages of residents employed as managers and same-sex coupled households.

Chapter 3: Data and methodology

3.1 Overview of data sources

3.1.1 Individual risk and prevention data

Individual risk and prevention data were previously collected from 1999 to 2002 as part of the CITY study (Guenther-Grey, et al., 2005). The CITY study was a 13-community randomized control trial that assessed the effectiveness of a multi-component intervention among MSM, ages 15-25. Study populations varied in most cities according to race or ethnicity. African-American YMSM were targeted in Atlanta, GA; Birmingham, AL; and Chicago, IL. Hispanic/Latino YMSM were targeted in Washington Heights/South Bronx, NY; Jackson Heights/Queens, NY; Orange County, CA; and San Gabriel Valley, CA. Asian and Pacific Islander YMSM were targeted in Seattle, WA and San Diego, CA. The following cities had no racial or ethnic eligibility requirements: Milwaukee, WI; Detroit, MI, Minneapolis, MN; and West Hollywood, CA. As such, MSM of all races were included in the aforementioned cities. Baseline data, collected in 1999 and 2000, from African American and white respondents living in Atlanta, Birmingham, Detroit, Chicago, Milwaukee, Minneapolis, and West Hollywood were used for this research.

Sampling procedures for the CITY study have previously been described elsewhere (Muhib et al., 2001). Ethnographic methods were first used to identify a diverse set of venues that could potentially be used to reach YMSM. A sampling frame was then generated consisting of venues (public sex environments, sex businesses, non-gay businesses catering to the general

public, informal and formal organizations, special events, and bars and clubs), as well as the days and times at these venues that the population would likely be found—prior to and during—community data collection events (referred to as VDT units). Each VDT unit was next assessed to determine its optimum yield of members of the target population. The sampling frame was updated monthly using the number of YMSM that were located from each VDT.

Using a two-staged approach (Kalton & Anderson, 1986), VDTs were first stratified by size and then randomized. Next, trained interviewers visited the venue at the specified day and time, given by the VDT unit, to enroll YMSM for the survey. The sampling frame consisted of 300 VDTs across 140 venues. To ensure that a majority of individual did not come from a single VDT unit, limits were placed on the number of interviews (n = 24) per sampling event. To be eligible, respondents had to (1) be between the ages of 15 and 25 years old; (2) be a resident of the community, which was determined by their self-reported zip code; (3) report sex with another male within the year prior; and (4) meet the sampling racial or ethnic requirement if they were being sampled from a community in which there was such a requirement.

Complete sampling baseline data have not been previously reported. However, from May through August, 1999, 7,535 men were screened for eligibility, 2,987 met the eligibility requirements, and 2,621 completed the survey (Muhib, et al., 2001). Nearly a third of these men (n = 911) were under the age of 21. This suggests that the sampling approach did reach younger MSM who might not have met the legal age requirements for entrance into some venues such as bars and nightclubs. Over half racially identified as African American or white (29% and 25%, respectively).

A major strength of this sampling approach and dataset is that it has yielded one of the largest and most diverse datasets of YMSM across the US. However, there are some limitations.

It is likely that the data does not reflect those YMSM who did not attend any of the venues that the research team sampled. Also, YMSM attending venues that were heavily-trafficked were probably less likely to be approached by the study team compared to those venues that were less-trafficked. Biased estimates can be produced in venue-based approaches if important features about the venue are not weighted. Xia and colleagues (2006) found stark differences in HIV risk among YMSM who visited different venues and differed in frequency at venues. Therefore, the use of these unweighted data may be a source of bias. Nonetheless, this approach provides a systematic sample of difficult-to-reach men. Further, the sample is subject to fewer biases compared to non-systematic sampling approaches (e.g. convenience samples).

The original study was approved by the CDC and local institutional review boards (IRB). The current study was approved by the Columbia University IRB.

3.1.2 Neighborhood compositional data

The 2000 decennial US Census was used for neighborhood compositional data. Participants completing the individual risk and prevention assessment reported the zip code where they resided. These zip codes were then matched to the Census equivalent zip code tabulation area (ZCTA). ZCTAs are approximations of postal zip codes. Unlike postal zip codes, ZCTAs do not include rural areas but do include topological features such as lakes and rivers (Grubesic, 2008).

A limitation of this approach is that some postal zip codes will not be captured within a ZCTA. Also, ZCTAs can cross over multiple counties. According to the US Census Bureau (2010), 27 percent of ZCTAs found in the 2000 census crossed multiple counties. This raises the

concern of representational errors (Grubesic & Matisziw, 2006). Krieger and colleagues (2002) earlier noted various spatiotemporal mismatches between ZCTAs and postal zip codes. However, Carretta and Mick (2003) point out, in response to Krieger and colleagues (2002), that careful attention must be paid to all analyses using geocoding techniques, and not just with ZCTAs, given similar attributable errors.

3.1.3 Justification of data sources and potential uses of this research

The data for the individual and prevention responses were collected over a decade ago. This limits the generalizability of these data. A more suitable dataset for this study would have been the National HIV Behavioral Surveillance (NHBS) system (CDC, 2010b). The NHBS monitors both prevalence and trends in HIV risk behaviors, testing, and prevention activities for populations at risk for HIV infection including injection drug users, high risk heterosexuals, and MSM. Data from one risk group is collected during annual cycles. The most recent data collection targeting MSM occurred in 2008 in 21 metropolitan statistical areas (MSA) that were prioritized based on AIDS prevalence among MSM ages 18-64.

Unfortunately, significant challenges present when attempting to receive access and disseminate these surveillance data publicly. For example, NHBS does not contain individual-identifying information such as zip codes. However, the use of the current dataset, which is readily available, allowed for a retrospective look at associations between neighborhood composition at the zip code level. It also contains relevant HIV risk and prevention behaviors for an at-risk group of MSM currently hardest hit by the epidemic. Findings from the current study can assist with determining the most appropriate prevention responses to the HIV epidemic for

MSM. For example, differences in living arrangements may help to explain the current disparities in HIV diagnoses, testing, and potentially access to care as currently observed (CDC, 2010b).

These data were collected a decade prior to the official launch of the NHAS by the US White House (Millett, et al., 2010). In line with the goals of NHAS, the current study focuses on the identification of neighborhood factors that are associated with HIV in order to better approximate concentrations of HIV at the zip code level, identify neighborhood types that are most impacted, and inform placement of potential strategies that can reduce HIV incidence. Essentially, associations with neighborhood composition and individual characteristics can inform targeted responses that should be implemented and/or improved. This is especially the case for emerging biomedical strategies believed to be effective against HIV/AIDS (Grant et al., 2010). For example, the first combination therapy effective in the fight against HIV received approval from US federal regulators in 1997—nearly two years prior to the collection of these data (Portsmouth & Scott, 2007). These data can demonstrate which neighborhoods, if any, had this knowledge and those that could benefit most from targeted educational approaches about the development of emerging HIV treatments and services.

3.2. Measures

3.2.1 Individual risk and prevention measures

To be consistent with the strategies of NHAS (Millett, et al., 2010), dependent variables were classified into two groups: 1) HIV and 2) participation and knowledge of HIV prevention activities.

HIV and related risk

Three variables were used to examine HIV and related risk:

- HIV status. Participants were asked if they were willing to report the results of their last test for HIV. The acceptable result responses were: positive, negative, indeterminate, did not go back to get results, don't know, and refused. Given rates of unknown and undiagnosed HIV infection among MSM, and YMSM specifically (CDC, 2010b), HIV status was operationalized and analyzed in two ways. For these analyses, HIV status was positive, negative, or unknown. The unknown category combined indeterminate, did not go back to get results, don't know, refused, and missing responses. In adjusted analyses, a positive/unknown HIV status referred to those participants who reported anything other than a negative HIV test result for their last test. This approach is consistent with current public health practice focusing on HIV risk among MSM. Data have consistently showed that MSM with undiagnosed HIV infection to be at considerable risk for being HIV-positive and transmitting the virus to others. These men are likely to be previously infected with HIV and with an undiagnosed HIV infection (CDC, 2001, 2002, 2005a, 2010b). It is also likely that MSM with undiagnosed HIV infection could have been infected recently. During this acute phase, individuals contain very high amounts of virus in their blood and genital fluids. HIV testing during this stage can produce a negative or indeterminate HIV test result using many testing procedures (Eshleman et al., 2009; Fiebig et al., 2003). Given the high toll of HIV among MSM, and increased background

prevalence of HIV and higher HIV viral load in many communities that predicts the likelihood of sexual transmission risk (Castel et al., 2011; Das et al., 2010), combining MSM with positive and unknown HIV status is warranted.

Given that large proportions of MSM, especially young, are unaware of their status (CDC, 2005a, 2005b, 2010), the current data would likely show fewer MSM infected with HIV than what would be observed in the aforementioned surveillance studies. Therefore two proxies of HIV were also examined: unprotected anal sex and trade sex. These types of sex are associated with HIV disease among young MSM (Guenther-Grey et al., 2005; Hightow et al., 2006; Valleroy et al., 2000).

- Unprotected anal intercourse. Rates of unprotected anal sex were assessed by the following questions asked of the respondents in the past three months: "How many times have you had anal sex with men, where you were the *inserting* partner, and you did not use a condom?"(UIAI) and "How many times have you had anal sex where you were the *receptive* partner, and your partner did not use a condom?" (URAI). These variables were combined and dichotomized to indicate whether the respondent had engaged in any unprotected anal sex. Therefore, men who reported either UIAI or URAI in the past 3 months were classified as engaging in any UAI.
- Trade sex. Participants were asked if anyone had given them money, drugs, or anything valuable, such as food or a place to say, to have sex.

HIV prevention activities and knowledge.

The NHAS has identified HIV testing, combination prevention approaches, and educating all Americans about HIV and how to prevent the disease as crucial tactics in the fight against HIV (Millett, et al., 2010). Therefore, the following variables were also examined:

- HIV testing—ever and recent. Participants were asked if they had ever been tested for HIV and about how long ago was the last time they were tested for HIV. Responses to these items were used to determine ever and recent testing, respectively. Those who report testing within 1 year prior of data collection were considered recent testers.
- Recent participation in HIV prevention activities. Participants were asked separately if they had done any of the following in the past six months: participated in any workshops about AIDS prevention, attended any social events or parties that included AIDS prevention activities; talked to any educators or outreach workers about AIDS prevention, and seen any flyers or pamphlets about AIDS prevention. Responses were dichotomized into a single measure of participation in HIV prevention activities.
- Heard of drugs used to treat HIV. Participants were asked if they had heard of drugs used to treat HIV. They were specifically asked, "Have you heard about using a combination of drugs to treat HIV/AIDS, referred to sometimes as 'combination drug cocktails'? (Sometimes they include drugs called protease inhibitors)."

The following independent variables were assessed:

- Race. Participants were asked how they identified ethnically and racially. First, respondents reported Hispanic ethnicity and then selected all of the different ways they identified racially: American Indian or Alaska Native, Asian, black or African American, Native Hawaiian or Pacific Islander, white, or other. Those selecting more than one race

were classified as mixed. Only those who identified as black or African American or either white only were eligible for analysis.

- Education attainment level. Participants were asked to answer the following question: How many years of school have you completed? Responses were categorized into the following to be consistent with the related educational attainment neighborhood-level measure below: (1) 0-8 years; (2) 9-11 years; (3) 12 years; (4) 13-15 years; and (5) 16+ years. Respondents who report 12 years of school completed were considered as having finished high school. Those who had 16 or more years were considered as having obtained at least a bachelor's degree.
- Relative education. Educational levels have been associated with increase HIV prevalence (CDC, 2010). Therefore, relative education is the difference between the individual educational attainment level and the mean educational attainment level for the ZCTA in which the respondent lives.
- Perceived condom use behaviors. Perceptions of condom use behaviors were assessed using a 4-point Likert scale (from "strongly agree" to "strongly disagree") in response to the following statement: "Most of my friends are using condoms these days when they have anal sex." Those who disagreed/strongly disagreed with this perception were classified as having non-supportive peer norms and those who agree/strongly agree were classified as having supportive peer norms.

Additionally, the following demographic variables were asked of all study participants: sexual identity (gay or homosexual, bisexual, straight or heterosexual, and other), age, and current work status (full time paid job, part time paid job, and not working).

3.2.2 Neighborhood composition measures

The following neighborhood composition measures were examined for each ZCTA using the 2000 Census:

- Sources of social disorganization.
    - Family disruption. Percent of the families who reported a female householder with no husband present.
    - Ethnic heterogeneity. Percent of individuals within neighborhood who identify as either black or African American only was used to assess ethnic heterogeneity.
    - Residential mobility. Percent of the population who are 5 years and older who lived in a different house in the 5 years prior.
    - Socioeconomic status. Three indicators of neighborhood socioeconomic status were separately examined: 1) mean educational attainment level; 2) percent living below poverty; and 3) percent employed as managers. The educational attainment levels of adults, 25 years and older, was summed across the following categories: (1) less than 9th grade; (2) 9th to 12th grade, no diploma; (3) high school graduate (includes equivalency); (4) some college or an associate's degree; and (5) bachelor's degree or more. The mean educational attainment level was then calculated for each ZCTA. Percent living below the poverty level examined income poverty levels in the year prior. Finally, the percent employed as managers was the percent of civilian employed neighborhood residents, ages 16 and older, who were employed as management professionals and related occupations.

- Gay presence and community stigma. This measure was obtained by calculating the proportion of the summed unmarried partnered households containing two individuals of the same sex and the total households for each ZCTA, and it consistent with other studies (Carpiano, et al., 2011; Frye, et al., 2010). Reduced gay presence in neighborhoods may be a result of stigma. Stigma may lead individuals not to report their same-sex partnerships in governmental surveys (Gates, 2006, 2010). Laumann and colleagues (1994) stress that social stigma related to homosexuality is a barrier to assessing survey items related to sexuality especially among marginalized groups such as gay men and lesbians. In their study of undercounting of same-sex partnerships in the 2000 Census, Badgett and Rogers (2003) found that concerns about confidentiality were among the highest cited reasons for not identifying same-sex partnerships on the Census for gay men and lesbians.

3.3 Data analysis

Chi square and t-tests were conducted to determine differences in the sample in terms of missing zip codes, systematic differences that may have been attributed by the venue-based approach, and differences in the sample and neighborhood composition of participating MSM. Multilevel logistic regressions were conducted to examine correlates with a particular outcome as a function of MSM's zip codes, and with the inclusion of interested confounders. All data were analyzed using Stata (StataCorp, College Station, TX).

Betas and standard errors are presented for unadjusted and adjusted models. The "divide by 4 rule" was used for easy interpretation of beta coefficients. This rule applies because the

slope of the logistic curve is steepest at the point of β/4. This gives the upper bound for the predictive difference between a unit change, for continuous variables, and a category change, for categorical variables. (Gelman & Hill, 2007). This crude estimate is given for significant coefficients at $p < 0.05$. However, other estimates of the predicative difference attributed to an individual effect can be easily obtained using this rule.

3.3.1 Bivariate logistic regressions

Logistic regressions can be used to examine associations with the binary outcome. In a logistic regression, the logs odds are modeled as a linear function of a single or set of explanatory variables (Agresti, 2007). In the simplest form:

$$log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x$$

where p is represented as a binomial proportion and x is the explanatory variable of interest. In the logistic regression model, the parameters are β_0 and β_1. Similar to statistical inferences for simple linear models, statistical inferences for logistic regressions also use the estimates of model parameters and the standard errors (SE) for the estimate of these parameters. However, the standard normal z-value, opposed to the critical value from the t distribution, is used. The confidence interval for the slope β_1 is represented by

$$b_1 \pm zSE_{b_1}$$

It is necessary to transform the confidence interval for the slope in order to obtain the odds ratio. This is given by exponentiating β_1. In this case, the confidence interval for the odds ratio is

$$e^{b_1 \pm z SE_{b_1}}$$

and the test statistics necessary to test the hypothesis H_0:β_1=0 is given by

$$z = \frac{b_1}{SE_{b_1}}$$

For large samples, this test is referred to as the Wald Test. The test of the alternative hypothesis is H_A: $\beta_1 \neq 0$. Z is approximately equal to 1.96 for an alpha equal to 0.05. Therefore, coefficients within 2 standard errors of b_1 are consistent with significance at $p < 0.05$ (Gelman & Hill, 2007).

3.3.2 Multilevel logistic regressions

Fixed effects multilevel logistic regressions were used for this study given the nested structure of data at the neighborhood level. In hierarchical logistic regression models, the structure of the data is defined by observations at the level of neighborhoods where MSM reside and observations embedded within each of these neighborhoods (Wong & Mason, 1985). Therefore, this strategy is suitable to account for differences at two levels.

Similar to bivariate models (See 3.3.1), the logs odds are modeled as a function of a single or set of explanatory variables in a multilevel model. Analysis is also performed on the clusters that contain the observations (Agresti, 2007; Gelman & Hill, 2007; Li et al., 2010; Wong & Mason, 1985). This is represented by

$$log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta x_{ij} + \gamma w_j + r_{ij}$$

where x_{ij} represents a set containing individual observations of participant i living in zip code j. The term w_j represents the set of neighborhood explanatory characteristics. In this equation, β characterizes the association between an individual explanatory characteristic (i.e. race) and an outcome variable (i.e. unprotected anal sex); γ characterizes a partial association between a neighborhood explanatory characteristic (i.e. sources of social disorganization) and an outcome variable; and r_{ij} is a model intercept.

3.3.3 Equations for the current analyses

Separate fixed effect multilevel models were developed for these analyses. In these models, the likelihood of the dependent variable occurring was examined as a function of MSM's zip codes and the included variables of interest (Merlo et al., 2006). All continuous variables were mean-centered for inclusion into the model in order to improve interpretation of beta coefficients (Gelman & Hill, 2007).

The model below examines 1 individual covariate with an outcome variable that takes into account clustering at the level of zip codes. The one factor model is given by:

$$log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 x_i + r_{ij}$$

Four additional models, that were differently adjusted, were analyzed for each outcome in order to investigate the effect of neighborhood composition under the different scenarios offered below.

1. Model 1: Individual-level characteristics (race, age, gay identity, work status, and relative education)

$$log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 black\ race_i + \beta_2 age[18-21]_i + \beta_3 age[22-25]_i$$
$$+ \beta_4 gay\ identity_i + \beta_5 work[part\ time]_i + \beta_6 work[fulltime]_i$$
$$+ \beta_7 relative\ education_i + r_{ij}$$

2. Model 2: Individual-level characteristics (race, age, gay identity, work status, and relative education) and neighborhood composition (relative education deprivation, % black, % single-parent female headed households, % same-sex households, % employed as managers, % income below poverty level, and % moved in the past 5 years)

$$log\left(\frac{p_{ij}}{1-p_{ij}}\right) =$$
$$= \beta_0 + \beta_1 black\ race_i + \beta_2 age[18-21]_i + \beta_3 age[22-25]_i$$
$$+ \beta_4 gay\ identity_i + \beta_5 work[part\ time]_i + \beta_6 work[fulltime]_i$$
$$+ \beta_7 relative\ education_i + \beta_8 \%\ black_i + \beta_9 \%\ female_i$$
$$+ \beta_{10} \%\ samesex_i + \beta_{11} \%\ managers_i + \beta_{12} \%\ poverty_i$$
$$+ \beta_{13} \%\ moved_i + r_{ij}$$

3. Model 1 + supportive condom use peer norms

$$log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 black\ race_i + \beta_2 age[18-21]_i + \beta_3 age[22-25]_i$$
$$+ \beta_4 gay\ identity_i + \beta_5 work[part\ time]_i + \beta_6 work[fulltime]_i$$
$$+ \beta_7 relative\ education_i + \beta_8 peer\ norms_i + r_{ij}$$

4. Model 2 + supportive condom use peer norms

$$log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_1 black\ race_i + \beta_2 age[18-21]_i + \beta_3 age[22-25]_i$$
$$+ \beta_4 gay\ identity_i + \beta_5 work[part\ time]_i + \beta_6 work[fulltime]_i$$
$$+ \beta_7 relative\ education_i + \beta_8 peer\ norms_i + \beta_9 \%\ black_i$$
$$+ \beta_{10} \%\ female_i + \beta_{11} \%\ samesex_i + \beta_{13} \%\ managers_i$$
$$+ \beta_{13} \%\ poverty_i + \beta_{14} \%\ moved_i + r_{ij}$$

3.4 Missing data

Missing data can be a source of bias in applied research and can result in a loss of study power (Buhi, Goodson, & Neilands, 2008). Further, missing data can limit comparability of effects in various regression models from the same dataset. As this study attempted to model neighborhood associations, the analyses only include cases for which a comparable zip code and ZCTA match was obtained. However, it is likely that some data are missing among MSM participating in the individual risk and prevention assessments.

Missing data were handled in the following manner. First, I examined zip codes reported in the individual risk and prevention assessments for a corresponding Census ZCTA. Cases where no match could be obtained were compared to those where a match could be obtained. In total, 612 unique zip codes were identified; however, 12.9% (n = 79) could not be matched to a Census ZCTA. This resulted in dropping 128 (4.4%) observations, for a final analysis sample of 2,720 young black and white MSM.

A chi-square test was performed on each of the individual risk and prevention measures to determine whether significant differences existed between those with or without a missing zip

code as a source of potential bias. (Table 1). Significant differences were observed among MSM in the sample for the following variables: race, gay identity, work status, ever HIV testing, and participation in HIV prevention activities. Fewer black MSM (6.2%, n = 102) had a missing zip code compared to white MSM (2.2, n =2 6), X^2 (1, 2848) = 25.9. Nearly 6% of non-gay identified MSM (n = 5.7) had a missing zip code compared to 3.9% of gay identified MSM (X^2 (1, 2848) = 4.5). Seven percent of MSM who were not working (n = 31) has a missing zip code compared to 4.4% of part time employed MSM (n = 28) and 4.0% of fulltime employed MSM (n = 69), X^2 (2, 2848) = 6.3. Six percent of MSM (n = 38) who never tested for HIV had a missing zip code compared to 4.0% (n = 90), X^2 (1, 2848) = 4.9, who reported testing. Finally, 6.4% of MSM who did not report recent participation in HIV prevention activities (n = 40) had a missing zip code compared to 4.0% of MSM who reported participation (n = 88), X^2 (1, 2843) = 6.8. Marginally significant differences at $p < 0.10$ were observed for having heard of medications to treat HIV, X^2 (1, 2840) = 3.8, $p = .05$; and HIV status, X^2 (2, 2843) = 5.8, $p = .06$.

3.4.1 Treatment of missing independent variable observations

I examined each of the individual risk and prevention independent measures for instances where greater than 10% of responses were missing for a particular variable (Table 2). Very few variables met the threshold of more than 10% of responses missing. Approximately 10% of respondents (n = 277) had missing data for the peer norms measure. For the purposes of multilevel modeling, the mean value was substituted for missing responses for the peer norms measures. Next a dummy variable to indicate the “missingness” was entered into the adjusted models, along with the original variable with the mean substituted value, to determine the

randomness of the missing values (Orme & Reis, 1991). Newer techniques to correct for missing values have been described (Graham, 2009; van der Heijden, Donders, Stijnen, & Moons, 2006).

3.4.2 Treatment of missing dependent variable observations

Medvedeff (2008) used a Monte Carlo experiment to simulate the effects of different techniques to compensate for missing dependent variable observations. The reduced sample regression approach, where missing are were removed from the analyses, produced less biased and more efficient effect sizes. He extends his argument for this approach to cross-sectional data although his experiments used time-series data. Graham (2009) reviews strategies on handling missing data with a focus on multiple imputation methods that reduce the amount of biases attributed to imputing for both missing independent and dependent variables. While advocating for multiple imputation, he acknowledges that complete case analysis, where a case involving a missing value is dropped from the analysis, is appropriate when the number of cases containing missing variables is negligible. In multiple regressions, he recommends including pre-test covariates in the models to control for any introduced bias that may result. He validated this earlier in simulation studies (Graham & Donaldson, 1993).

In the current research, the analyses sample had less than 0.02% missing in the dependent variable. The reduced sample approach seemed appropriate given the very small amount of missing cases. As such, analyses samples differ by the amount of missing cases in dependent observations. However, adjusted models were adjusted by individual-level covariates to account for the unlikely introduction of bias or loss of power from using the complete case analysis approach.

3.5 Issues of power and confidence intervals

Non-significant results can be attributed to a lack of power in general. Power calculations are meant to improve the design of the study. These calculations are also helpful to ensure that analyses are optimized to detect differences at some established cut-off. Hoenig and Heisey (2001) warn against using power calculations after an analysis has been conducted. In demonstrating instances where post-hoc power calculations would incorrectly lead an analyst to reject the null hypothesis when hypotheses testing would suggest otherwise, they suggest focusing on the confidence interval and how closely the observed effect clusters within the interval. Therefore, 95% confidence intervals (CI) for given effects a displayed in forest plots (Lewis & Clarke, 2001), developed using Microsoft Excel (Redmond, WA), for each adjusted omnibus model for each outcome. Additionally, a post-hoc power calculation was conducted using Optimal Design (Ann Arbor, MI) to determine whether each multilevel analyses were sufficiently powered to detect racial differences in HIV and prevention activities on the number of clusters (J = 543). These are presented in Figures and discussed in the context of study findings in preceding sections.

Additionally, confidence intervals were used to assess changes across the 4 examine models. In this manner, an effect size from 1 model was evaluated against the confidence intervals for the same variable in the other 3 models to determine whether the inclusion of different variables in the each model produced less reliable estimates. Therefore, effect sizes that fall within each of the confidence intervals were viewed as more reliable (Gelman & Hill, 2007).

Chapter 4: Description of analyses sample and neighborhoods

4.1 Sample description

The analysis sample consists of 2720 black and white young MSM from Atlanta, Birmingham, Detroit, Chicago, Milwaukee, Minneapolis, and West Hollywood. Table 3 summarizes sample characteristics for young black and white MSM.

More than half of the sample (n = 1550) racially identified as black. Two-thirds of the sample (n = 1839) gay identified and half were between the ages of 18-21 years of age (n = 1384). A majority, 57.0% (n = 1551), were working fulltime. Eighty-three percent of the men (n = 2027) did report having friends that were supportive of using condoms.

A chi-square test was performed to examine significant differences between black and white MSM and variables of interest. Black and white YMSM reported similar work status and supportive condom use peer norms; however, these results were not significant. Differences did exist for the following variables: gay identity, X^2 (1, 2720) = 132.2; age, X^2 (2, 2720) = 13.9; and education, X^2 (2, 2720) = 14.2. Black MSM (58.7%) were less likely to be gay identified compared to white MSM (79.5%). These men tended to be slightly younger. Just under half of black MSM were 18-21 years of age compared to 53.8% of white MSM. Fifty-five percent of black MSM had some college education compared to 59.9% of white MSM. These differences are consistent with previous research. For example, black MSM tend to be non-gay identified compared to men of other races (Wolitski, et al., 2006).

Additional differences based on age and education in the sample could be an artifact of the sampling procedures used in the study. It is likely that regional differences inspire

participation in social and cultural venues that were used to sample YMSM for this research. However, the venue-based sampling approach can produced biased samples when sampling units are not weighted by venue-associated factors including venue type, characteristics of patrons, and frequency of visits to a given venue on a particular day and time. The importance of weighing these factors in order to produce unbiased estimates has been discussed elsewhere (Xia, et al., 2006).

4.2 Neighborhood composition description

The analysis sample subjects resided in 543 different zip codes (Table 4). On average, these neighborhoods were 21.5% black or African American (*SD* = 29.6%), 7.9% (*SD* = 5.5%) single-parent female-headed households, and less than 1% (*M* = 0.7, *SD* = 0.6) same-sex coupled households. A third of individuals in these neighborhoods, on average, were employed as managers (*M* = 36.3%, *SD* = 13.6%) and 12.6% (*SD* = 11.1%) had incomes in the previous year that were less than the poverty level. In these zip codes, half of the people on average (*M* = 47.5) reported living elsewhere in the 5 years prior (*SD* = 11.0). On average, the educational attainment level of these neighborhoods was some college education (*M* = 2.6; *SD* = 0.5).

Chapter 5: Individual-level and neighborhood composition HIV risk

In this chapter, I describe which individual and neighborhood composition characteristics are associated with HIV risk. Table 5 summarizes characteristics associated with each outcome variable.

5.1 Individual-level risk correlates

Individual-level risk data were previously collected as part a 13-community randomized control trial that assessed the effectiveness of a multi-component intervention among YMSM.

5.1.1 Race

Black race was negatively associated with several factors that increase risk for HIV. Black YMSM were less likely than white YMSM to report any unprotected anal sex (*beta* = -0.31, *SE* = 0.09) or to report having an HIV-positive or unknown status (*beta* = -0.03, *SE* = 0.09); however, they were more likely to report trade sex (*beta* = 0.43, *SE* = 0.13). While black YMSM were more likely to report ever HIV testing (*beta* = 0.12, *SE* = 0.09) and in the past year (*beta* = 0.21, *SE* = 0.09), they were less likely than white YMSM to report recent participation in HIV prevention activities (*beta* = -0.90, *SE* = 0.10) and having heard of drugs used to treat HIV (*beta* = -1.36, *SE* = 0.08).

Black race was significant at $p < 0.05$ for any unprotected anal sex, trade sex, HIV testing in the past year, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV. In terms of the predictive value, black race corresponds to no more than:

- 8% negative difference in the probability of reporting recent unprotected anal sex;
- 11% positive difference in the probability of reporting trade sex;
- 5% positive difference in the probability of HIV testing in the past year;
- 3% negative difference in the probability of participating in HIV prevention activities; and
- 34% negative difference in having heard of drugs used to treat HIV.

5.1.2 Age

Older age was positively associated with any anal unprotected anal sex (18-21: *beta* = 0.19, *SE* = 0.20; 22-25: *beta* = 0.25, *SE* = 0.20), trade sex (18-21: *beta* = 0.41, *SE* = 0.30; 22-25: *beta* = 0.25, *SE* = 0.41), ever HIV testing (18-21: *beta* = 0.75, *SE* = 0.18; 22-25: *beta* = 1.40, *SE* = 0.18), testing in the past year (18-21: *beta* = 0.77, *SE* = 0.17; 22-25: *beta* = 1.05, *SE* = 0.18), and having heard of drugs used to treat HIV (18-21: *beta* = 0.08, *SE* = 0.17; 22-25: *beta* = 0.34, *SE* = 0.17). Older age was negatively associated with having an HIV-positive or unknown status (18-21: *beta* = -0.88, *SE* = 0.17; 22-25: *beta* = -1.38, *SE* = 0.18). Compared to YMSM ages 15-17, the magnitude of the effect size grew with each increasing age category for these associations. Finally, YMSM ages 18-21 were more likely than YMSM ages 15-17 to report recent participation in HIV prevention activities (*beta* = 0.07, *SE* = 0.21); however YMSM ages 22-25 were less likely (*beta = -0.02*, *SE* = 0.21).

Associations were significant for ever HIV testing, testing in the past year and having a HIV-positive or unknown status result at $p < 0.05$. Compared to YMSM in the youngest age category, older age corresponds to no more than:

- 19% positive difference in the probability of ever testing;
- 35% positive difference in the probability of ever testing for YMSM ages 22-25;
- 19% positive difference in HIV testing in the past year for YMSM ages 18-21;
- 26% positive difference in the probability of HIV testing in the past year for YMSM ages 22-25;
- 22% negative difference in the probability of having a HIV-positive or unknown test result for YMSM ages 18-21; and
- 35% negative difference in the probability of having a HIV-positive or unknown test result for YMSM ages 22-25.

Having heard of drugs used to treat HIV was significant at $p = 0.05$ for YMSM ages 22-25. This corresponds to no more than a 9% positive difference in the probability of having heard of drugs between YMSM in the oldest age category and those in the youngest age category.

5.1.3 Gay identity

Gay identity was positively associated with factors that increase risk for HIV transmission and acquisition. Gay identified YMSM were more likely than non-gay identified YMSM to report any unprotected anal sex (*beta* = 0.36, *SE* = 0.09) and having an HIV-positive or unknown status (*beta* = 0.01, *SE* = 0.09). Gay identity was negatively associated with trade sex (*beta* = -0.28, SE = 0.12). Inconsistent associations were found for factors that decrease risk

for HIV. While gay identified YMSM were less likely to report ever HIV testing (*beta* = -0.05, *SE* = 0.10) and testing in the past year (*beta* = -0.08, *SE* = 0.09); compared to non-gay identified MSM, these men were more likely to report recent participation in HIV prevention activities (*beta* = 0.14, *SE* = 0.10) and having heard of drugs used to treat HIV (*beta* = 0.64, *SE* = 0.08).

Significant association were found for any unprotected anal sex, trade sex, and having heard of drugs used to treat HIV at $p < .05$. Compared to non-gay identified MSM, gay identity corresponds to no more than a:

- 9% positive difference in the probability of reporting any unprotected anal sex;
- 7% negative difference in the probability of report trade sex; and
- 16% positive difference in the probability of reporting any unprotected anal sex and having heard of drugs used to treat HIV.

5.1.4 Employment

Part time (PT) and fulltime (FT) employment were positively associated with any unprotected anal sex (PT: *beta* = 0.08, *SE* = 0.12; FT: *beta* = 0.06, *SE* = 0.14), HIV testing in the past year (PT: *beta* = 0.01, *SE* = 0.13; FT: *beta* = 0.39, *SE* = 0.12), recent participation in HIV prevention activities (PT: *beta* = 0.40, *SE* = 0.14; FT: *beta* = 0.55, *SE* = 0.12), and having heard of drugs used to treat HIV (PT: *beta* = 0.10, *SE* = 0.13; FT: *beta* = 0.22, *SE* = 0.1). Employed YMSM were more likely than YMSM who were not working to report these behaviors. Also, the magnitude of these effects sizes grew from part time to fulltime employment.

Fulltime employment was positively associated with ever HIV testing (*beta* = 0.54, *SE* = 0.13) while part time employment was negatively associated (*beta* = -0.03, *SE* = 0.14).

Compared to YMSM who were not working, YMSM employed fulltime were more likely to report ever HIV testing while those employed part time were less likely to report HIV testing. Employment was negatively associated with trade sex (PT: *beta* = -0.87, *SE* = 0.18; FT: *beta* = -0.96, *SE* = 0.14) and having an HIV-positive or unknown status (PT: *beta* = -0.04, *SE* = 0.14; FT: *beta* = -0.57, *SE* = 0.12). These effects decreased with greater employment.

Fulltime employment was significant at $p < 0.05$ for having an HIV-positive or unknown status and factors that decrease risk for HIV. Compared to YMSM not working, fulltime employment corresponds to no more than:

- 24% negative difference in the probability of engaging in trade sex;
- 14% negative difference in the probability of having an HIV-positive or unknown status;
- 14% positive difference in the probability of ever HIV testing;
- 10% positive difference in the probability of HIV testing in the past year;
- 14% positive difference in recent participation in HIV prevention activities; and
- 6% positive difference in having heard of drugs used to treat HIV.

Part time employment was significant at $p < 0.05$ for trade sex and recent participation in HIV prevention activities. Compared to YMSM not working, part time employment corresponds to no more than a 22% negative difference in reporting trade sex and 10% positive difference in the probability of recent participation in HIV prevention activities, respectively.

5.1.5 Relative education deprivation

Individual education was measured relative to education attainment levels within neighborhoods. Having less education was positively associated with factors that increase risk

for HIV and negatively associated with factors that decrease risk for HIV transmission. YMSM with relatively less education were more likely than those with relatively more education to report any unprotected anal sex (*beta* = 0.01, *SE* = 0.05), trade sex (*beta* = 0.22, *SE* = 0.06), and having an HIV-positive or unknown status (*beta* = 0.35, *SE* = 0.05). YMSM with less education were less likely to report ever HIV testing (*beta* = -0.38, *SE* = 0.05), HIV testing in the past year (*beta* = -0.28, *SE* = 0.05), recent participation in HIV prevention activities (*beta* = -0.19, *SE* = 0.05), and having heard of drugs used to treat HIV (*beta* = -0.16, *SE* = 0.04).

Education was significant at $p < 0.05$ for trade sex, having an HIV-positive or unknown status, ever HIV testing, testing in the past year, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV. A unit increase in relative education levels corresponds to no more than a:

- 6% positive difference in reporting trade sex;
- 9% positive difference in the probability of having an HIV-positive or unknown status;
- 10% negative difference in the probability of ever testing for HIV;
- 7% negative difference in the probability of testing for HIV in the past year;
- 5% negative difference in the probability of recent participation in HIV prevention activities; and
- 8% negative difference in the probability of having heard of drugs used to treat HIV.

5.1.6 Supportive condom use peer norms

Having supportive condom use peer norms was negatively associated with factors that increase risk for HIV and positively associated with most of the examined factors that decrease risk for HIV. Those who reported supportive condom use peer norms were less likely to report any unprotected anal sex (*beta* = -0.87, *SE* = 0.11), trade sex (*beta* = -0.85, *SE* = 0.14) and a HIV-positive or unknown status (*beta* = -0.08, *SE* = 0.12). These YMSM were also more likely to report ever HIV testing (*beta* = 0.06, *SE* = 0.13), HIV testing in the past year (*beta* = 0.01, *SE* = 0.12), and having heard of drugs used to treat HIV (*beta* = 0.14, *SE* = 0.11). YMSM with supportive peer norms were less likely than YMSM who reported non-supportive peer norms to report recent participation in HIV prevention activities (*beta* = -0.13, *SE* = 0.14). Any unprotected anal sex and trade sex was significantly associated with supportive peer norms at $p < 0.05$. Having supportive peer norms corresponds to a 22% and 21% negative difference in the probability of any unprotected anal sex, respectively.

5.2 Summary of individual-level correlates and risk

I described individual-level correlates of HIV risk in this section. Findings are consistent to what has previously been reported in the peer-reviewed literature (See 1.2.2). While black MSM were more likely to report behaviors protective against HIV such as HIV testing, they were less likely to report recent participation in HIV prevention activities and knowledge of drugs used to treat HIV. Black MSM were more likely to report trade sex. Gay identified MSM were more likely to report unprotected anal sex compared to non-gay identified MSM but were also more knowledgeable about drugs used to treat HIV. They were also less likely to report

trade sex. Tyler (2009) reported decreased odds of trade sex for white youth compared to non-white youth.

Similar findings were observed for age and employment status. Older MSM and those who were employed fulltime were more likely to test for HIV and were more likely to be knowledgeable about drugs used to treat the virus. These men were less likely to report being HIV-positive or unknown status. Employed MSM were less likely to report trade sex. YMSM with relatively less education were more likely to report any unprotected anal sex and trade sex, and were less likely to engage in factors related to decreased HIV risk.

MSM who had non-supportive condom use peer norms were more likely to report recent unprotected anal sex and trade sex.

5.3 Neighborhood composition

Neighborhood compositional data were obtained from the 2000 US Census for those YMSM reporting a ZCTA-equivalent zip code in the individual risk assessments.

5.3.1 Percent black residents

The percent of black residents measures the degree of ethnic heterogeneity in a neighborhood. Increased percentages of black residents was negatively associated with any unprotected anal sex (*beta* = -0.003, *SE* =*SE* = 0.001) but positively associated with trade sex (*beta* = 0.01, *SE* = 0.00). Percent black was negatively associated with recent participation in HIV prevention activities (*beta* = -0.01, *SE* =*SE* = 0.00) and having heard of drugs used to treat

HIV (*beta* = -0.01, *SE* =*SE* = 0.00). The likelihood of YMSM reporting any unprotected anal sex, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV decreased as the percentage of black residents increased. Increased percentages of black residents was positively associated with ever HIV testing (*beta* = 0.003, *SE* =*SE* = 0.001) and HIV testing in the past year (*beta* = 0.003, *SE* = 0.001). As the percentages of black residents in the neighborhoods increased, the likelihood that YMSM reported ever HIV testing and testing in the past year increased. The effect size of increased percentages of blacks on HIV-positive or unknown status was equal to 0.00 (*SE* = 0.00).

Associations at $p < 0.05$ were detected for any unprotected anal sex, trade sex, HIV testing in the past year, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV. A unit increase in the percentage of black residents corresponds to no more than:

- 0.08% negative difference in the probability of any unprotected anal sex;
- 0.25% positive difference in the probability of reporting trade sex;
- 0.08% positive difference in the probability of HIV testing in the past year;
- 0.25% negative difference in the probability of recent participation in HIV prevention activities; and
- 0.25% negative difference in the probability of having heard of drugs used to treat HIV.

Increased percentages of black residents was associated at $p = 0.05$ for ever HIV testing. A unit increase in the percentage of black residents corresponds to no more than a 0.08% positive difference in the probability of ever testing for HIV.

5.3.2 Percent single-parent female-headed households

The percent of single-parent female-headed households is a measure of family disruption within neighborhoods. Increased percentages of single-parent female headed households were negatively associated with any unprotected anal sex (*beta* = -0.01, *SE* = 0.01) but positively associated with trade sex (*beta* = 0.03, *SE* = 0.01). This neighborhood characteristic was negatively associated with recent participation in HIV prevention activities (*beta* = -0.01, *SE* = 0.00) and having heard of drugs used to treat HIV (*beta* = -0.06, *SE* = 0.00). As the percentages of single-parent female-headed households in the neighborhood increased, the likelihood of YMSM reporting any unprotected anal sex and having heard of drugs used to treat HIV decreased. Increased percentages of single-parent female headed households was positively associated with ever HIV testing (*beta* = 0.01, *SE* = 0.01) and HIV testing in the past year (*beta* = 0.02, *SE* = 0.01). As the percentages of single-parent female-headed households increased, the likelihood of YMSM reporting ever HIV testing and testing in the past year increased. The effect size of percentage of single-parent female headed households on HIV-positive or unknown status was equal to 0.00 (*SE* = 0.00).

Associations at $p < 0.05$ were detected for trade sex, HIV testing in the past year, and having heard of drugs used to treat HIV. A unit increase in the percentage of single-parent female-headed households corresponds to no more than a 1% positive difference in the probability of trade sex and HIV testing in the past year and no more than a 2% negative difference in the probability of having heard of drugs used to treat HIV. Percentage of single-parent female-headed residents was associated at $p < 0.10$ with ever HIV testing. A unit increase

in the percentage of single-parent female-headed households corresponds to no more than a 0.3% positive difference in the probability of ever testing for HIV.

5.3.3 Percent same-sex couples

Percentage of same-sex unmarried partners is a measure of gay community presence. Similarly, decreased percentage is a proxy of community stigma against homosexuality. Percent of same-sex couples was positively associated with any unprotected anal sex (*beta* = 0.09, *SE* = 0.05) and trade sex (*beta* = 0.20, *SE* = 0.06), It was also positively associated with ever HIV testing (*beta* = 0.24, *SE* = 0.07), HIV testing in the past year (*beta* = 0.15, *SE* = 0.15), and having heard of drugs used to treat HIV (*beta* = 0.27, *SE* = 0.05). The likelihood of YMSM reporting any unprotected anal sex, ever HIV testing, HIV testing in the past year, and having heard of drugs used to treat HIV increased as the percentage of same-sex couples in the neighborhood increased. Percentage of same-sex couples was negatively associated with HIV-positive or unknown status (*beta* = -0.18, *SE* = 0.06) and recent participation in HIV prevention activities (*beta* = -0.10, *SE* = 0.05). As the percentage of same-sex couples increased, the likelihood that YMSM reported an HIV- positive or unknown status and recent participation in HIV prevention activities decreased.

Associations at $p < 0.05$ were found for trade sex, HIV-positive and unknown status, ever HIV testing, testing in the past year, and having heard of drugs used to treat HIV. A unit increase in the percentage of same-sex unmarried partners corresponds to no more than:

- 5% negative difference in the probability of reporting trade sex;

- 5% negative difference in the probability of having a HIV-positive or unknown status;
- 6% positive difference in the probability for ever HIV testing;
- 4% positive difference in the probability of HIV testing in the past year;
- 7% positive difference in the probability of having heard of drugs used to treat HIV.

Significant associations at $p = 0.05$ were observed for any unprotected anal sex and recent participation in HIV prevention activities. A unit increase in the percentage of same-sex unmarried partners corresponds to no more than a 2% positive difference in the probability of any unprotected anal sex and no more than a 3% negative difference in the probability of participating in HIV prevention activities.

5.3.4 Percent employed as managers

The percent employed as managers is one of two measure of socioeconomic status. This measure was negatively associated with trade sex (*beta* = -0.01, *SE* = 0.00) and positively associated with having heard of drugs used to treat HIV (*beta* = 0.02, *SE* = 0.00), which was significantly associated at $p < 0.05$. As the percentage of individuals employed as managers increased, the likelihood of YMSM reported having heard of drugs used to treat HIV increased. A unit increase in the percent employed as managers corresponds to no more than a 1% positive difference in having heard of drugs used to treat HIV. The effect size was 0.00 (*SE* = 0.00) for any unprotected anal sex, HIV-positive or unknown status, ever HIV testing, testing in the past year, and recent participation in HIV prevention activities.

5.3.5 Percent with incomes below the poverty level

The percent with incomes below the poverty level was another measure of socioeconomic status. This measure was positively associated with trade sex (*beta* = 0.02, *SE* = 0.00), ever HIV testing (*beta* = 0.01, *SE* = 0.00), and testing in the past year (*beta* = 0.01, *SE* = 0.00). As the percentage of families with incomes below the poverty level increased, the likelihood of YMSM reporting ever HIV testing and testing in the past year increased. Percent with incomes below the poverty level was negatively associated with HIV-positive or unknown status (*beta* = -0.01, *SE* = 0.00) but also recent participation in HIV prevention activities (*beta* = -0.02, *SE* = 0.00) and having heard of drugs used to treat HIV (*beta* = -0.02, *SE* = 0.00). As the percentages of families with incomes below the poverty level within neighborhoods increased, the likelihood that YMSM reported a HIV-positive or unknown status, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV decreased.

Significant associations a $p < 0.05$ were observed trade sex, for ever HIV testing, testing in the past year, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV. A unit increase in the percentage of families with incomes below the poverty level in the neighborhood corresponds to no more than:

- 0.5% positive difference in the probability of reporting trade sex;
- 0.3% positive difference in the probability of ever HIV testing;
- 0.3% positive difference in the probability of testing in the past year;
- 1% negative difference in the probability of recent participation in HIV prevention activities; and

- 1% negative difference in the probability of having heard of drugs used to treat HIV.

5.3.6 Percent changed residences

The percent of residents who changed residences in the past 5 years is a measure of residential mobility. This measure was negatively associated with HIV-positive or unknown status (*beta* = -0.01, *SE* = 0.00) and positively associated with ever HIV testing (*beta* = 0.01, *SE* = 0.00), testing in the past year (*beta* = 0.01, *SE* = 0.00), and having heard of drugs used to treat HIV (*beta* = 0.02, *SE* = 0.00). As the percent of residents who changed residences in the past 5 years increased, the likelihood that YMSM reported a HIV-positive or unknown status decreased and the likelihood that YMSM reported ever HIV testing, testing in the past year, and having heard of drugs used to treat HIV increased. The effect size of any unprotected anal sex, trade sex, and recent participation in HIV prevention activities was 0.00 (*SE* = 0.00).

Significant associations at $p < 0.05$ were observed for any unprotected anal sex, ever HIV testing, testing in the past year, and having heard of drugs used to treat HIV. A unit increase in the percent of residents who changes residences in the past 5 years corresponds to no more than:

- 0.3% negative difference in the probability of reporting an HIV-positive or unknown status;
- 0.3% positive difference in the probability of ever HIV testing;
- 0.3% positive difference in the probability of testing in the past year; and
- 1% positive difference in the probability of having heard of drugs used to treat HIV.

5.4 Summary of neighborhood compositional correlates and risk

I described associations between neighborhood compositional characteristics and individuals' HIV risk behaviors. Neighborhood composition was associated differently with factors that decrease risk for HIV and factors that increase risk for HIV acquisition and transmission. Similar to findings reported elsewhere (Frye, et al., 2010; Frye, et al., 2006), neighborhoods with greater percentages of same-sex couples and greater percentage of black residents were associated with factors that decrease risk for HIV. As the percentage of same-sex couples and black in the neighborhoods increased, the likelihood of ever HIV testing increased. Also, while neighborhoods characterized by increased percentages of blacks increased, the likelihood of YMSM reporting unprotected anal sex decreased. YMSM in these neighborhoods were less likely to report recent participation in HIV prevention activities and having heard of drugs used to treat HIV.

Similar to findings from Carpiano (2011), who reported increased HIV risk in communities characterized by increased gay presence, YMSM in these neighborhoods were more likely to report unprotected anal sex. However, YMSM in these neighborhoods were also more likely to report having heard of drugs used to treat HIV and HIV testing in the past year. Interestingly, they were less likely to report participation in HIV prevention activities. It is possible that these men were being exposed to HIV prevention information in other ways not investigated in the survey as they were more likely to test for HIV and have knowledge of drugs used to treat HIV. However, it is also possible that these men's perception of HIV risk differed from their actual risk since they were more likely to engage in unprotected anal sex (Kellerman et al., 2002; MacKellar et al., 2007). Several investigators have explored MSM's participation in

HIV prevention activities (Kellerman, et al., 2002), which may help to explain the then re-emergence of HIV when these data were collected (Jaffe, Valdiserri, & De Cock, 2007).

The 2 measures for socioeconomic status in the neighborhood were associated similarly for having heard of drugs used to treat HIV. YMSM in neighborhoods with greater percentages of managers were more likely to report having heard of drugs used to treat HIV while those living in neighborhoods with greater percentages of incomes below the poverty level were less likely. Similar to findings for increased percentages of blacks, single-parent female-headed households, and same-sex couples, YMSM in neighborhoods with greater incomes below the poverty level were more likely to report HIV testing but less likely to report recent participation in HIV prevention activities.

Neighborhoods characterized by residential mobility or high population turnover were associated with factors that decrease risk for HIV. YMSM living in neighborhoods with greater percentages of residents who changed residences in the past 5 years were more likely to test for HIV and to have heard of drugs to treat HIV. These YMSM were also less likely to be HIV-positive or of unknown status and more likely to report having heard of drugs used to treat HIV. Mixed effects of changing residents have been reported in the literature (Kirk, 2009; Sharkey & Sampson, 2010). It is important to understand the contextual characteristics of the moves of residents who changed residences and possibly neighborhoods. It is possible that neighborhoods characterized by high population turnover experience an introduction of different social norms, as new network ties are established, that are protective against HIV (Granovetter, 1983; Wasserman & Faust, 1994).

These data indicate that trade sex was negatively associated with socioeconomic status, measured by the percent of individuals employed as managers, and positively associated with

percentages of individuals living in poverty. In future research, trade sex may be a viable proxy for low income among MSM.

Chapter 6: Adjusted neighborhood compositional associations with HIV and participation in prevention activities

In this chapter, I describe neighborhood compositional characteristics that are associated with HIV risk after controlling for individual-level characteristics over a series of 4 models previously described in 3.3.3. I start with a model that only includes the following individual-level characteristics: race, age, gay identity, work status, and relative education (Model 1). I then add each of the neighborhood compositional characteristics: percent black residents, percent single-parent female-headed households, percent employed as managers, percent with prior year incomes below poverty level, and percent residents who changed residences in the past 5 years (Model 2). I reexamine Model 1 by including an additional individual-level characteristic, supportive condom use peer norms (Model 3), to determine how the inclusion of supportive condom use peer norms affects associations of individual-level characteristics. Similarly, I reexamine Model 3 by including supportive condom use peer norms to determine how the inclusion of this measure affects associations of the neighborhood compositional factors after controlling for the individual-level characteristics (Model 4). Across each of the 4 models, I pay particular attention to race to determine the predictive ability of this measure in determining each of the risk outcomes. Changes across the 4 models are described first and then observations from the omnibus model (Model 4) are compared to Model 3 that includes the individual characteristics including supportive peer norms, unless otherwise stated.

6.1 HIV and related risk

6.1.1 HIV-positive/unknown status

Table 6 summarizes characteristics associated with reporting an HIV-positive or unknown status. Associations remained the same across the 4 models; however, the addition of neighborhood characteristics modified the magnitude of effect sizes, but not the standard errors, of individual level characteristics. Despite these changes across each of the models, the observed effect sizes fell within the respective 95% confidence intervals for the respective variable in the other models. Additionally, the directions of effects remained the same.

Black race, age, fulltime work status, and supportive peer norms were negatively associated with having an HIV-positive or unknown status. Black YMSM were less likely than white YMSM to report an HIV-positive or unknown status (*beta* = -0.03, *SE* = 0.16). YMSM ages 18-21 (*beta* = -0.48, *SE* = 0.20) and ages 22-25 (*beta* = -0.79, *SE* = 0.22) were less likely than YMSM ages 15-17 to have an HIV-positive or unknown status. YMSM working fulltime were less likely than YMSM not working to have an HIV-positive or unknown status (*beta* = -0.32, *SE* = 0.13). YMSM who reported supportive condom use peer norms were less likely than YMSM who did not to report having an HIV-positive or unknown status (*beta* = -0.05, *SE* = 0.13).

Gay identity, part time work status, and relative education were positively associated with having an HIV-positive or unknown status. Gay identified YMSM were more likely than non-gay identified YMSM to have an HIV-positive or unknown (*beta* = 0.01*, SE* = 0.10). Part time employed YMSM were more likely than YMSM not working to have an HIV-positive or unknown status (*beta* = 0.01, *SE* = 0.15). YMSM who had relatively less education were more likely to report having an HIV-positive or unknown status (*beta* = 0.27, *SE* = 0.06).

Significant associations were consistently observed across the four different models despite the addition of neighborhood composition and supportive peer norms. The following individual-level characteristics were significant at $p < 0.05$: age, fulltime work status, and relative education. Holding the other variables constant, the listed variable corresponds to no more than the following stated difference in the probability of having an HIV-positive or unknown status when supportive condom use peer norms and neighborhood compositional factors were accounted for:

- ages 18-21: 12% negative difference;
- ages 22-25: 20% negative difference; and
- fulltime work status: 8% negative difference.

Also, a unit increase in relative education corresponds to no more than a 7% positive difference that an YMSM would report an HIV-positive or unknown status. When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting an HIV-positive or unknown status were higher for age: 14% and 23% negative difference for ages 18-21 and 22-25, respectively. The predictive difference was reduced for relative education when neighborhood characteristics were not controlled for: 6% positive difference.

As mentioned, black race remained negatively associated with having an HIV-positive or unknown status across the four models. However, this association was non-significant. According to a post-hoc power analysis (see Figure 1), this model was sufficiently powered to detect racial differences in having an HIV-positive or unknown status.

The following 3 neighborhood compositional characteristics were negatively associated with YMSM reporting an HIV-positive or unknown status: percent single-parent female-headed households, percent same-sex couples, and percent moved in the past 5 years. The likelihood that

an YMSM reported an HIV-positive or unknown status decreased as the percentage of single-parent female-headed households (*beta* = -0.01, *SE* = 0.02), the percentage of same-sex couples (*beta* = -0.13, *SE* = 0.09), and the percentage of residents who changed residents in the previous 5 years (*beta* = -0.02, *SE* = 0.01) increased. The percentage of neighborhood residents with incomes below the poverty level was positively associated with YMSM reporting an HIV-positive or unknown status. As the percentage of residents with incomes below the poverty level increased (*beta* = 0.01, *SE* = 0.01), the likelihood of YMSM reporting an HIV-positive or unknown status increased. The effect size was 0.00 (*SE* = 0.00 – 0.01) for percent black and percent employed as mangers.

The percent of neighborhood residents who changed residences in the past 5 years was the only neighborhood compositional that was significantly associated at $p < 0.05$. Holding the other variables constant, a unit increase in the percent of neighborhood residents who changed residences in the past 5 years corresponds to no more than a 0.05% negative difference in the probability of a YMSM reporting a HIV-positive or unknown status. Figure 2 displays the adjusted odds ratios for having an HIV-positive or unknown status. For a unit increase in the percent of neighborhood residents who changed residents in the prior 5 years, there is a 2% decrease in the odds of an YMSM having a HIV-positive or unknown status (AOR = 0.98, 95% CI = 0.97 – 1.00).

6.1.2 Any unprotected anal sex in the past 3 months

Table 7 summarizes characteristics associated with any unprotected anal sex. Associations remained the same across the 4 models; however, the addition of neighborhood

characteristics modified the magnitude of effect sizes, and in some cases the standard errors, of individual level characteristics. Despite these changes across each of the models, the observed effect sizes fell within the respective 95% confidence intervals for the respective variable in the other models. Additionally, the directions of effects remained the same.

Black race and supportive condom use peer norms were the only individual-level characteristics that were negatively associated with any unprotected anal sex. Black YMSM were less likely than white YMSM to report any unprotected anal sex (*beta* = -0.27, *SE* = 0.13). YMSM who reported supportive condom use peer norms were less likely to report any unprotected anal sex (*beta* = -0.87, *SE* = 0.11).

Older age, gay identity, work status, relative education, and trade sex were positively associated with any unprotected anal sex. YMSM ages 18-21 (*beta* = 0.27, *SE* = 0.22) and 22-25 (beta = 0.37, *SE* = 0.24) were more likely than YMSM ages 15-17 to report unprotected anal sex. YMSM working part time (beta = 0.14, *SE* = 0.14) and fulltime (beta = 0.06, *SE* = 0.13) were more likely than YMSM not working to report any unprotected anal sex. YMSM with relatively less education than those in their neighborhoods were more likely to report any unprotected anal sex (beta = 0.4 *SE* = 0.06).

Significant associations at $p < 0.05$ were observed for the following individual-level characteristics: black race, gay identity, and supportive condom use peer norms. Holding the other variables constant, the listed variable corresponds to no more than the following stated differences in the probability of reporting any unprotected anal sex:

- black race: 7% negative difference;
- gay identity: 8% positive difference; and
- supportive condom use peer norms: 22% negative difference.

When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting unprotected sex were lower for race: 6% negative difference.

As mentioned, black race remained negatively and significantly associated with unprotected anal sex across the four models. Figure 1 displays the adjusted odds ratios (AOR) for reporting unprotected anal sex. The odds of reporting unprotected anal sex for black YMSM is 24% lower than the odds for white YMSM (AOR = 0.76, 95% CI = 0.59 – 0.98). According to a post-hoc power analysis (see Figure 4), this model was sufficiently powered to detect racial differences in any unprotected anal sex.

Models 2 and 4 included the neighborhood compositional measures. Only 2 neighborhood compositional characteristics were associated with any unprotected anal sex: percent single-parent female-headed households and percent same-sex couples. These associations were in the positive direction. As the percentage of single-parent female-headed households (beta = 0.03, *SE* = 0.02) and same-sex couples (beta = 0.11, *SE* = 0.05) increased, the likelihood that YMSM in these types of neighborhoods reporting any unprotected anal sex increased. The effect sizes were 0.00 (*SE* = 0.00 - 0.01) for the following neighborhood composition variables: percent black, percent employed as managers, percent incomes below poverty level, and percent moved in the past 5 years.

The percent of same-sex couples was significant at $p = 0.05$. Holding the other variables constant, a unit difference in the percent of same-sex couple households corresponds to no more than a 3% positive difference in the probability of reporting any unprotected anal sex
For a one-unit increase in the percent of single-parent female-headed household and same-sex couples in a given the neighborhood, there is a 10% (AOR = 1.10, 95% CI = 0.99 – 1.22) increase in the odds of an YMSM reporting unprotected anal sex.

6.1.3 Trade sex

Table 8 summarizes characteristics associated with trade sex. With the exception of black race, associations remained the same across the 4 models with the addition of neighborhood characteristics. Although the magnitude of effect sizes, and in some cases the standard errors, of individual level characteristics changed and the directions of effects remained mostly the same, the observed effect sizes for the respective variable in fell within the 95% confidence intervals of the other models. For black race, the 95% confidence intervals for effect size of 0.50 and 0.51, respectively, in Models 1 and 3, were 0.20 - 0.79 and 0.22 – 0.80 (significant at $p < 0.05$). The effect sizes of black race when neighborhood characteristics were considered in Models 2 and 4 were 0.16 (95% CI = 0.23 – 0.54) and 0.15 (0.23 – 0.53), and were no longer significant at $p < 0.05$.

Gay identity, employment, and supportive condom use peer norms were the only individual-level characteristics that were negatively associated with any trade sex. Gay identified YMSM were less likely than non-gay identified YMSM to report trade sex (*beta* = -0.20, *SE* = 0.13). Employed YMSM were less likely to report trade sex (PT: *beta* = -0.80, *SE* = 0.19; FT: *beta* = -0.79, *SE* = 0.16). YMSM with supportive condom use peer norms were also less likely to report trade sex (*beta* = -0.80, *SE* = 0.15).

Black race, age, and having relatively less education were positively associated with trade sex. Black MSM were more likely to report trade sex (*beta* = 0.15, *SE* = 0.19). YMSM ages 18-21 (*beta* = 0.93, *SE* = 0.33) and 22-25 (*beta* = 0.95, *SE* = 0.35) were more likely than YMSM

ages 15-17 to report trade sex. Also, YMSM with relatively less education than those in their neighborhoods were more likely to report trade sex (*beta* = 0.35, *SE* = 0.08).

Significant associations at $p < 0.05$ were observed for the following individual-level characteristics when neighborhood characteristics were accounted for: age, employment, supportive condom use peer norms, and relative education. Holding the other variables constant, the listed variable corresponds to no more than the following stated differences in the probability of reporting trade sex:

- ages 18-21: 23% positive difference;
- ages 22-25: 24% positive difference;
- part time employment: 20% negative difference;
- fulltime employment: 20% negative difference;
- supportive condom use peer norms: 20% negative difference.

Also, a unit increase in having relatively less education corresponds to no more than a 9% negative difference that an YMSM would trade sex. When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting trade sex were lower for age: 21% negative difference for ages 18-21 and 22-25. The predictive difference was also reduced for relative education when neighborhood characteristics were not controlled for: 6% negative difference. The effects were higher for fulltime employment: 21% negative difference.

As mentioned, black race remained negatively associated with trade sex across the four models. However, black race was only significant at $p < 0.05$ in models 1 and 3 that did not include neighborhood compositional factors. The effect sizes of Models 1 and 3 were 0.50 and 0.51, providing a 13% positive difference in the probability that black YMSM would report trade sex. However, this predictive difference was only 4%, and non-significant, when neighborhood

compositional characteristics were controlled for. Figure 5 displays the adjusted odds ratios (AOR) for trade sex. According to a post-hoc power analysis (see Figure 6), the omnibus model was sufficiently powered to detect racial differences in any unprotected anal sex.

Models 2 and 4 included the neighborhood compositional measures. Percentage of black, same-sex couples, and income below the poverty level were positively associated with trade sex. As the percentage of blacks (*beta* = 0.01, *SE* = 0.00), same-sex couples (*beta* = 0.23, *SE* = 0.08) and income below the poverty level (*beta* = 0.02, *SE* = 0.01) increased, the likelihood that YMSM in these types of neighborhoods reporting trade sex increased. Percent of female households (*beta* = -0.01, *SE* = 0.02) and those employed as managers in the neighborhoods (*beta* = -0.01, *SE* = 0.01) were negatively associated with trade sex. The effect size was 0.00 (*SE* = 0.01) for percent moved in the past 5 years.

The percent of same-sex couples was the only neighborhood composition variable significant at $p < 0.05$. Holding the other variables constant, a unit difference in the percent of same-sex couples corresponds to no more than a 6% positive difference in the probability of reporting trade sex. For a one-unit increase in the percent of same-sex couples in a given the neighborhood, there is a 26% (AOR = 1.26, 95% CI = 1.07 – 1.49) increase in the odds of an YMSM reporting trade sex.

6.2 Summary of neighborhood compositional characteristics and HIV

In this section, I describe neighborhood compositional characteristics that are associated with factors that increase MSM's risk for HIV. Briefly, MSM who identified as black and who had supportive peer norms for condom use were less likely to report recent unprotected sex while

gay-identified MSM. Older and fulltime employed MSM were less likely to report an HIV-positive or unknown status while having relatively less education was positively associated with being HIV-positive or unknown status. Older YMSM and those with less education were more likely to report trade sex while employed YMSM and those with supportive condom use peer norms were less likely. Higher percentages of same-sex coupled households was the only neighborhood compositional characteristic associated with trade sex at $p < 0.05$. These findings are consistent with previously reported risk correlates in the literature.

6.3 Prevention activities and HIV knowledge

6.3.1 HIV testing, ever

Table 9 summarizes characteristics associated with having ever tested for HIV. Associations remained the same across the 4 models. Although the effect sizes and standard errors did change with the addition of neighborhood compositional characteristics, the observed effect sizes for the respective variable within the respective 95% confidence intervals of the other models. Despite these changes in effect sizes across the 4 models, the directions of effects remained the same.

Black race, age, fulltime work status, and supportive condom use peer norms were positively associated with ever HIV testing. Black YMSM were more likely than white YMSM to report ever HIV testing (*beta* = 0.03, *SE* = 0.17). YMSM ages 18-21 (*beta* = 0.34, *SE* = 0.21) and ages 22-25 (*beta* = 0.78, *SE* = 0.24) were more likely than YMSM ages 15-17 to ever test for HIV. YMSM working fulltime were more likely than YMSM not working to ever test for HIV

(*beta* = 0.28, *SE* = 0.14). YMSM who reported supportive condom use peer norms were more likely than YMSM who did not to report ever HIV testing (*beta* = 0.02, *SE* = 0.14).

Gay identity, part time work status, and relative education were negatively associated with ever HIV testing. Gay identified YMSM were less likely than non-gay identified MSM to ever test for HIV (*beta* = -0.02*, SE* = 0.11). Part time employed YMSM were less likely than YMSM not working to ever HIV test (*beta* = -0.09, *SE* = 0.15). YMSM who had relatively less education were less likely to report ever HIV testing (*beta* = -0.29, *SE* = 0.07).

Significant associations were consistently observed across the four different models despite the addition of neighborhood composition and supportive peer norms. The following individual-level characteristics were significant at $p < 0.05$: ages 22-25 and relative education. Fulltime work status was significantly associated at $p = 0.05$. Holding the other variables constant, the listed variable corresponds to no more than the following stated difference in ever HIV testing:

- ages 22-25: 20% positive difference; and
- fulltime work status: 7% positive difference.

Also, a unit difference in relative education corresponds to no more than a 7% negative difference that an YMSM would report ever HIV testing. When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting ever HIV testing were higher for ages 22-25 and represented a 23% positive difference. Finally, black race remained positively associated with ever HIV testing. However, this association was non-significant. According to a post-hoc power analysis (see Figure 7), this model was insufficiently powered to detect racial differences in ever HIV testing.

Models 2 and 4 included neighborhood compositional variables. When supportive condom use peer norms was added to Model 4, the effect size for the percent of same-sex couples in the neighborhood decreased by 0.01. The following 3 neighborhood compositional characteristics were positively associated with YMSM ever HIV testing: percent single-parent female-headed households, percent same-sex couples, and percent moved in the past 5 years. The likelihood that an YMSM reported ever HIV testing increased as the percentage of single-parent female-headed households (*beta* = 0.01, *SE* = 0.02), the percentage of same-sex couples (*beta* = 0.18, *SE* = 0.10), and the percentage of residents who changed residents in the previous 5 years (*beta* = 0.02, *SE* = 0.01) increased. The percentage of neighborhood residents with incomes below the poverty level was negatively associated with YMSM reporting ever HIV testing. As the percentage of residents with incomes below the poverty level increased (*beta* = -0.01, *SE* = 0.01), the likelihood of YMSM reporting ever HIV testing decreased. The effect size was 0.00 (*SE* = 0.00 – 0.01) for percent black and percent employed as mangers.

The percent of neighborhood residents who changed residences in the past 5 years was the only neighborhood compositional variable that was significantly associated at $p < 0.05$. The percent of same-sex couples was significantly associated at $p = 0.05$ (Model 2). Holding the other variables constant, a unit difference in the percent of neighborhood residents who changed residences in the past 5 years and the percent of same-sex couples corresponds to no more than a 1% and 5%, respective, positive difference in the probability of an YMSM ever HIV testing.

Figure 8 displays the adjusted odds ratios for ever HIV testing. For a unit increase in the percent of neighborhood residents who changed residences in the prior 5 years, there is a 2% increase in the odds of an YMSM ever HIV testing (AOR = 1.02, 95% CI = 1.00 – 1.03). For a

unit increase in percentages of same sex couples in the neighborhoods, there is a 21% increase in the odds of an YMSM ever HIV testing (AOR = 1.21, 95% CI = 1.00 – 1.47).

6.3.2 HIV testing, past year

Table 10 summarizes characteristics associated with HIV testing in the past year. Although the magnitude of effect sizes, and in some cases the standard errors, of individual level characteristics changed and the directions of effects remained the same, the observed effect sizes for the respective variable in fell within the respective 95% confidence intervals of the other models.

Black race, age, and fulltime work status were positively associated HIV testing in the past year. Black YMSM were more likely than white YMSM to report HIV testing in the past year (*beta* = 0.15, *SE* = 0.11). YMSM ages 18-21 (*beta* = 0.50, *SE* = 0.20) and ages 22-25 (*beta* = 0.61, *SE* = 0.22) were more likely than YMSM ages 15-17 to test for HIV in the year prior. YMSM working fulltime were more likely than YMSM not working to test for HIV in the past year (*beta* = 0.21, *SE* = 0.13).

Gay identity, part time work status, and relative education were negatively associated with HIV testing in the past year. Gay identified YMSM were less likely than non-gay identified MSM to test for HIV in the past year (*beta* = -0.04, *SE* = 0.10). Part time employed YMSM were less likely than YMSM not working to HIV test in the prior year (*beta* = -0.03, *SE* = 0.14). YMSM who had relatively less education were less likely to report HIV testing in the past year (*beta* = -0.18, *SE* = 0.06).

The following individual-level characteristics were significant at $p < 0.05$ across all 4 models: age and relative education. Holding the other variables constant, compared to YMSM ages 15-17, age 18-21 and 22-25 correspond to no more than a 13% and 16%, respective, positive difference in HIV testing in the past year. Also, a unit difference in relative education corresponds to no more than a 5% negative difference that an YMSM would report HIV testing in the past year. When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting HIV testing in the past year were higher for ages 22-25 and represented a 17% positive difference.

Black race was significant at $p < 0.05$ when neighborhood composition was not included (Models 1 and 3). Black race was non-significant in models that included neighborhood composition (Models 2: $p = 0.30$; and 4: $p = 0.29$). In these models, black race corresponded to no more than 6% of the positive difference in HIV testing in the past year. However, when neighborhood compositional characteristics were considered, black race—which was non-significant, corresponded to no more than 4% positive difference in HIV testing in the past year. Nonetheless, this model was moderately powered to detect racial differences in HIV testing in past year according to a post-hoc power analysis (see Figure 9).

The following 3 neighborhood compositional characteristics were positively associated with HIV testing in the past year: percent single-parent female-headed households, percent same-sex couples, and percent moved in the past 5 years. The likelihood that an YMSM reported HIV testing in the past year increased as the percentage of single-parent female-headed households (*beta* = 0.01, *SE* = 0.02), percentage of same-sex couples (*beta* = 0.14, *SE* = 0.08), and percentage of residents who changed residences in the previous 5 years (*beta* = 0.01, *SE* = 0.01) increased. The effect size was 0.00 (*SE* = 0.00 – 0.01) for percent black, percent employed as

mangers, and percent income below poverty level. None of the neighborhood compositional variables were significantly associated at $p < 0.05$.

Figure 10 displays the adjusted odds ratios for HIV testing in the past year. For a one-unit increase in percentages of same sex couples in the neighborhoods, there is a 16% increase in the odds of an YMSM HIV testing in the past year (AOR = 1.16, 95% CI = 1.00 – 1.35).

6.3.3 Recent participation in HIV prevention activities

Table 11 summarizes characteristics associated with recent participation in HIV prevention activities. Associations remained the same across the 4 models, although the effect sizes and standard errors did change with the addition of neighborhood compositional variables and supportive condom use peer norms. The observed effect sizes, however, for the respective variable fell within the respective 95% confidence intervals of the same variable in the other models. Despite these changes in effect sizes across the 4 models, the directions of effects remained the same.

Gay identity and work status were positively associated with recent participation in HIV prevention activities. Gay identified YMSM were more likely than non-gay identified MSM to report recent participation in HIV prevention activities (*beta* = 0.02*, SE* = 0.12). YMSM working part time (*beta* = 0.35, *SE* = 0.17) and YMSM working fulltime (*beta* = 0.42, *SE* = 0.15) were more likely than YMSM not working to report recent participation in HIV prevention activities.

Race, age, relative education, and supportive condom use peer norms were negatively associated with recent participation in HIV prevention activities. Black YMSM were less likely than white YMSM to report participation (*beta* = -0.87, *SE* = 0.20). YMSM ages 18-21 (*beta* = -

0.43, *SE* = 0.26) and YMSM ages 22-25 (*beta* = -0.76, *SE* = 0.28) were less likely than YMSM ages 15-17 to report recent participation in HIV prevention activities. YMSM with relatively less education were less likely to report recent participation (*beta* = -0.34, *SE* = 0.07). YMSM who reported supportive condom use peer norms were less likely than YMSM who did not to report recent participation in HIV prevention activities (*beta* = -0.20, *SE* = 0.16).

Significant associations were consistently observed across the 4 different models $p < 0.05$. The following individual-level variables were significantly associated with recent participation in HIV prevention activities: race, ages 22-25, work status, and relative education. Holding the other variables constant, the following correspond to no more than the following differences in the probability of YMSM recently participating in HIV prevention activities:

- black race: 22% negative difference;
- ages 22-25: 19% negative difference;
- part time work: 8% positive difference; and
- fulltime work: 10% positive difference.

Also, a unit difference in relative education corresponds to no more than an 8% negative difference that an YMSM would report recent participation in HIV prevention activities. When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting recent participation in HIV prevention activities were lower. In this instance, black race corresponds to a 19% negative difference, ages 22-25 corresponds to a 17% negative difference, and relative education corresponds to a 7% negative difference in reporting recent participation.

Figure 11 displays the adjusted odds ratios for recent participation in HIV prevention activities. As mentioned, black race remained negatively and significantly associated with recent participation in HIV prevention activities at $p < 0.05$. The odds of reporting recent participation

for black YMSM is 58% lower than the odds for white YMSM (AOR = 0.42, 95% CI = 0.28 – 0.62). According to a post-hoc power analysis (see Figure 12), this model was sufficiently powered to detect racial differences in recent participation in HIV prevention activities.

The following 3 neighborhood compositional characteristics were positively associated with YMSM's recent participation in HIV prevention activities: percent single-parent female-headed households, percent employed as manages, and percent moved in the past 5 years. The likelihood that an YMSM reported recent participation in HIV prevention activities increased as the percentage of single-parent female-headed households (*beta* = 0.10, *SE* = 0.03), percentage of those employed as managers in a neighborhood (*beta* = 0.01, *SE* = 0.01), and percentage of residents who changed residences in the previous 5 years (*beta* = 0.04, *SE* = 0.01) increased.

The following neighborhood composition variables were negatively associated with recent participation in HIV prevention activities: percent same-sex couples and percent with incomes below the poverty level. The likelihood of YMSM reporting recent participation in HIV prevention activities decreased as the percentages of same-sex couples (*beta* = -0.03, *SE* = 0.07) and those with incomes below the poverty level (*beta* = -0.07, *SE* = 0.01) in the neighborhood increased. The effect size was 0.00 (*SE* = 0.00) for percent black.

The following neighborhood compositional variables were significant at $p < 0.05$: percent single-parent female-headed households, percent of residents with incomes below the poverty level, and the percent of residents who moved in the past 5 years. Holding the other variables constant, a unit increase in the following variables correspond to no more than the stated differences in the probability of YMSM reporting recent participation in HIV prevention activities:

- percent single-parent female headed households: 3% positive difference;

- percent with incomes below the poverty level: 2% negative difference; and
- percent residents who moved in the past 5 years: 1% positive difference.

For a unit increase in percentages of single-parent female-headed households, there is a 10% increase in the odds of an YMSM reporting recent participation in HIV prevention activities (AOR = 1.10, 95% CI = 1.05 – 1.17). For a unit increase in percentages of neighborhood residents with incomes below the poverty level, there is a 7% decrease in the odds of an YMSM reporting recent participation in HIV prevention activities (AOR = 0.93, 95% CI = 0.91 – 0.96). For a one-unit increase in percentages of percent of residents who moved in the past 5 years, there is a 4% increase in the odds of an YMSM reporting recent participation in HIV prevention activities (AOR = 1.04, 95% CI = 1.02 – 1.06).

6.3.4 Having heard of drugs used to treat HIV

Table 12 summarizes characteristics associated with having heard of drugs used to treat HIV. Associations were mostly the same across the 4 models. Although the effect sizes and standard errors did change with the addition of neighborhood compositional variables and supportive condom use peer norms, the observed effect sizes for the respective variable fell within the respective 95% confidence intervals for the same variable in the other models.

Gay identity, work status, and supportive condom use peer norms were positively associated with having heard of drugs used to treat HIV. Gay identified YMSM were more likely than non-gay identified YMSM to report having heard of drugs used to treat HIV (*beta* = 0.40, *SE* = 0.10). Employed YMSM (PT: *beta* = 0.09, *SE* = 0.14; FT: *beta* = 0.04, *SE* = 0.13) were more likely than YMSM not working to report hearing of drugs used to treat HIV. YMSM who

reported supportive condom use peer norms were more likely to report hearing of drugs used to treat HIV (*beta* = 0.19, *SE* = 0.12).

Race, age 18-21, and relative education were negatively associated with having heard of drugs used to treat HIV. Black YMSM were less likely than white YMSM to report having heard of drugs to treat HIV (*beta* = -1.36, *SE* = 0.14). YMSM ages 18-21 (*beta* = -0.39, *SE* = 0.21) were less likely than YMSM ages 15-17 to report having heard of drugs used to treat HIV. YMSM with relatively less education were less likely to report having heard of drugs used to treat HIV (*beta* = -0.39, *SE* = 0.06).

Associations were mixed across the four models for ages 22-. In models 1 and 3, ages 22-25 were positively associated with having heard of drugs used to treat HIV (*beta* = 0.01, *SE* = 0.23) but these associations were negative when neighborhood compositional variables were added (Models 2 and 4: *beta* = -0.23, *SE* = 0.23).

Significant associations were consistently observed across the four different models at $p < 0.05$ for the following individual-level variables: race, gay identity, and relative education. Holding the other variables constant, the following correspond to no more than the stated differences in the probability of YMSM having heard of drugs used to treat HIV:

- black race: 34% negative difference and
- gay identity: 10% positive difference.

Also, a unit increase in relative education corresponds to no more than a 10% negative difference in the probability that an YMSM would report having heard of drugs used to treat HIV. When neighborhood compositional factors were excluded (Model 3), the difference in probabilities for reporting having heard of drugs to treat HIV were lower. In this instance, black race corresponds

to a 33% negative difference, gay identity corresponds to a 17% negative difference, and relative education corresponds to an 8% negative difference.

Figure 13 displays the adjusted odds ratios for having heard of drugs used to treat HIV. As stated, black race remained negatively and significantly associated with recent participation in HIV prevention activities at $p < 0.05$. The odds of reporting recent participation for black YMSM is 74% lower than the odds for white YMSM (AOR = 0.26, 95% CI = 0.19 – 0.34). According to a post-hoc power analysis (see Figure 14), this model was sufficiently powered to detect racial differences in having heard of drugs used to treat HIV.

The following 4 neighborhood compositional characteristics were positively associated with YMSM having heard of drugs used to treat HIV: percent single-parent female-headed households, percent same sex couples, percent employed as managers, and percent who moved in the past 5 years. The likelihood that an YMSM reported having heard of drugs used to treat HIV increased as the percentage of single-parent female-headed households (*beta* = 0.01, *SE* = 0.02), percentage of same-sex couples (*beta* = 0.19, *SE* = 0.08), the percentages of those employed as managers in a neighborhood (*beta* = 0.01, *SE* = 0.01), and percentage of residents who changed residences in the previous 5 years (*beta* = 0.02, *SE* = 0.01) increased.

Percent with incomes below the poverty level was the only neighborhood composition variable that was negatively associated with having heard of drugs used to treat HIV. As the percentages of those with incomes below the poverty level in the neighborhood increased, the likelihood of YMSM having heard of drugs used to treat HIV decreased (*beta* = -0.01, *SE* = 0.01). The effect size was 0.00 (*SE* = 0.00) for percent black.

The following neighborhood compositional variables were significant at $p < 0.05$: percent same-sex couples, percent employed as managers, and the percent of residents who moved in the

past 5 years. Holding the other variables constant, a unit increase in the following variables correspond to no more than the stated differences in the probability of a YMSM having heard of drugs used to treat HIV:

- percent same sex couples: 5% positive difference;
- percent employed as managers: 0.3% positive difference; and
- percent residents who moved in the past 5 years: 1% positive difference.

For a unit increase in percentages of same-sex couples, there is a 22% increase in the odds of an YMSM having heard of drugs used to treat HIV (AOR = 1.22, 95% CI = 1.05 – 1.43). For a unit increase in percentages of neighborhood residents employed as managers, there is a 1% increase in the odds of an YMSM having heard of drugs used to treat HIV (AOR = 1.01, 95% CI = 1.00 – 1.03). For a one-unit increase in percentages of percent of residents who moved in the past 5 years, there is a 2% increase in the odds of an YMSM having heard of drugs used to treat HIV (AOR = 1.02, 95% CI = 1.01 – 1.03).

6.4 Summary of neighborhood compositional characteristics and race on participation in prevention activities and HIV knowledge

In this section, I focused on neighborhood compositional characteristics associated with factors that decrease MSM's risk for HIV or transmission of HIV to others. Briefly, black MSM were more likely than white MSM to report recent HIV testing but were less likely to report recent participation in HIV prevention activities or having heard of drugs used to treat HIV. Older MSM were more likely to report ever and recent HIV testing and, similar to gay-identified MSM, they were also more likely to have heard of drugs used to treat HIV. However, older

MSM were less likely to report recent participation in HIV prevention activities. Employed MSM were more likely to report ever HIV testing and recent participation in HIV prevention activities. Having supportive condom use peer norms was negatively associated with recent HIV testing. Having relatively less education was associated with each of the factors that decrease MSM's risk for HIV. MSM who have relatively less education than the average education attainment level of neighborhood residents were less likely to report HIV testing, participation in HIV prevention activities, and having heard of drugs used to treat HIV. These findings are consistent with previously reported individual-level risk correlates (See 1.2.2).

MSM who lived in neighborhoods with greater percentages of same-sex couples were more likely to report ever HIV testing and having heard of drugs used to treat HIV. These findings in relation to HIV risk generally are consistent with recent CDC (2010b) data and the work of Frye and colleagues (2010). MSM who lived in neighborhood with greater percentage of residents who change residences in the 5 years prior were more likely to report ever HIV testing, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV. As previously reported, I expected that MSM living in neighborhoods with high population turnover would be at increased risk. However, this aspect of neighborhoods may be protective in some situations. The influx of new residents likely introduces new and protective social norms in some communities (Granovetter, 1983; Wasserman & Faust, 1994). This claim, while not evaluated in the current study, should be further investigated in future work. Essentially, details of residential moves are warranted (Sharkey & Sampson, 2010).

As expected, greater percentage of residents with incomes below the poverty and residents employed as managers were associated with risk. YMSM who lived in neighborhoods with greater percentages of residents with incomes below the poverty level were less likely to

participate in HIV prevention activities and MSM who lived in neighborhoods with greater percentages of residents who were employed as managers were more likely to have heard of drugs used to treat HIV. The link between socioeconomic status has been established in the literature generally (Adler, et al., 1994; D. Phuong, 2009; Feldman & Steptoe, 2004; McLaughlin & Stokes, 2002; Steptoe & Feldman, 2001; Williams, 1999; Williams, et al., 2010) and for HIV risk and deaths (Joy, et al., 2008; McFarland, et al., 2003; Wood, et al., 2002). Denning & DiNenno (2010) reported concentrated areas of poverty in the US were associated with HIV among heterosexuals. Others have also reported similar findings for heterosexuals (Adimora, et al., 2001; Hixson, et al., 2011; LaLota, et al., 2011; Raj & Bowleg, 2011) but evidence has remained limited for MSM.

Percentage of single-parent female-headed households in a neighborhood was associated with recent participation in HIV prevention activities. Previous findings show increased HIV risk for children from these types of families (Blum, et al., 2000; Booth, et al., 2010; Jemmott & Jemmott, 1992; Mulatu, et al., 2008; Santelli, et al., 2000; Torian, et al., 2002; Willis & Clark, 2009; Zweig, et al., 2002). This is consistent with the previously reported finding from unadjusted bivariate analyses in the current study (See 5.3.2) but not for similar findings in the related multilevel model. In unadjusted analyses, YMSM in neighborhoods characterized by greater percentages of single-parent female-households were less likely to participate in prevention activities. While the role of family structure and neighborhoods on HIV risk for MSM specifically remains unclear, one possible explanation for the current finding from adjusted analyses is that on the individual level that MSM, similar to heterosexual youth, from single-parent female-headed households are a greater risk. However, from the community-level perspective, these YMSM, and other residents, may be aware of the greater risk attributed to

these types of families. As such these men might show persistent determination to overcome this expected disadvantage (Jones, et al., 2010). Additional research is warranted in this area.

Chapter 7: Neighborhoods where black and white MSM live

In this chapter, I sought to determine differences in black and white YMSM's HIV risk and whether YMSM live in different neighborhoods that may differentially explain their levels of HIV risk.

7.1 Differences in black and white MSM's HIV risk

Table 13 summarizes HIV risk factors for black and white YMSM. Consistent with findings from adjusted models (See Chapter 6), black YMSM were less likely to report engaging in any unprotected anal sex, X^2 (1, 2675) = 13.0 but were more likely to report trade sex, X^2 (1, 2720) = 11.9 . They were however more likely to report recent HIV testing, X^2 (1, 2720) = 6.2. One in 4 black YMSM (n = 395) engaged in unprotected anal sex compared to a third of white MSM (n = 368). Also, 75% of black YMSM (n = 1153) reported recent testing for HIV compared to 70.1% of white MSM (n = 820). However, black YMSM were less likely to report participation in HIV prevention activities, X^2 (1, 2715) = 79.4, or having heard of drugs used to treat HIV, X^2 (1, 2713) = 287.5.

7.2 Differences in neighborhoods where black and white MSM live

Table 14 summarizes neighborhoods where black and white YMSM live. Black YMSM were more likely to live in neighborhoods with greater percentages of blacks, $t(1) = -47.9$; single-parent female-headed households, $t(1) = -31.8$; and residents with incomes below the

poverty level, $t(1) = -23.3$. The average percent of blacks in neighborhoods where black YMSM lived was 58.7% (*SD* = 32.5) compared to 9.5% (*SD* = 15.4) for white YMSM. The average percent of single-parent female-households where black YMSM lived was 12.8% (*SD* = 6.5) compared to 6.0% for white YMSM (*SD* = 4.0). Slightly more than 20% (*SD* = 10.8) of residents where black YMSM lived had incomes below the poverty level compared to only 12.0% (*SD* = 10.7) of residents where white YMSM live.

White YMSM were more likely to live in neighborhoods with greater percentages of same-sex coupled households, $t(1) = 3.0$, and individuals employed as managers, $t(1) = 16.2$. One percent of households were occupied by same-sex couples in neighborhoods where white MSM (*SD* = 1.1) lived compared to 0.9% of households where black YMSM lived (*SD* = 0.7). In terms of residents employed as managers, 40% of individuals were employed as managers where white YMSM lived (*SD* = 12.7%) compared to 32.1% of individuals where black YMSM lived (*SD* = 12.7).

7.3 Summary of black and white MSM's risk and neighborhoods

I reported in previous chapters that neighborhoods compositional characteristics where MSM live are associated with testing, recent participation in prevention activities, and knowledge of drugs used to treat HIV. Neighborhood compositional characteristics associated with factors that protect against acquiring or transmitting HIV include higher percentages of same-sex couples, single female-parented households, individuals employed as managers, and residents who lived in other areas 5 years prior. MSM in neighborhoods with more people living in poverty were less likely to participate in or have knowledge of drugs used to treat HIV. MSM

who lived in neighborhoods with higher neighborhood turnover were less likely to report an HIV-positive or unknown status.

In this chapter, data again indicate that black MSM engage in less behavioral risk than white MSM, which is consistent with other findings (Millett, et al., 2007; Millett, et al., 2006). However, black MSM also participated less in HIV prevention activities and had less knowledge of drugs used to treat HIV. Pierce and colleagues (2007) reported fewer prevention services in zip codes where young black MSM who reported high risk behaviors live. In the current study, black MSM were more likely to live in neighborhoods that had characteristics associated with risk: neighborhoods with greater percentages of people with incomes below the poverty level. White MSM were more likely to live in neighborhoods with characteristics that were associated with decreased risk: higher percentages of same-sex couples and individuals employed as managers.

In this study, HIV risk and being diagnosed HIV-positive or being of unknown status was associated with race and neighborhood characteristics in different adjusted models and analyses. While black MSM were more likely to HIV test and engage in less behavioral risk, these men also report less participation in HIV prevention activities and are less knowledgeable of drugs used to treat HIV. It is also apparent in these analyses that black MSM are more likely to live in neighborhoods that have characteristics that are associated with HIV risk.

In adjusted models, YMSM in neighborhoods with a greater percentage of single-parent female-headed households were more likely to report recent participation in HIV prevention activities. Black MSM were more likely to come from this type of neighborhood compared to white MSM. Black MSM were also less likely to participate in HIV prevention activities while MSM with greater percentages of single-parent female-headed households were more likely.

Frye and colleagues (2010) found marginal protection for MSM in neighborhoods with great percentage of blacks despite black MSM being a greater risk. No associations were found for percentage of black in multilevel models for this study but were observed in the unadjusted models. It is unclear why this level of protection is afforded in these types of neighborhoods and with different study populations for these neighborhood characteristics. For example, the population for Frye's study was older MSM in New York City. More research is needed on the role of family structure and racially homogenous communities for MSM both at the neighborhood and individual levels.

The inclusion of neighborhood composition factors in the models reduced the significance level of certain individual-level variables that were previously significant at $p < 0.05$. Black race, although still in the positive direction, was no longer significantly associated with recent testing (Models 2: $p = 0.30$; and 4: $p = 0.29$). This was also the case for age and trade sex that previously were positively and negatively, respectively, associated with having heard of drugs used to treat HIV. This suggests the need for a better understanding of neighborhood compositional characteristics, and expanded analyses with other neighborhood variables should be considered to explain recent testing and knowledge of drugs used to treat HIV. A focus on neighborhood compositional characteristics may be warranted in the success of intervention programs and health communication campaigns aimed to address these issues.

Chapter 8: Discussion

For the first time in 30 years since the first diagnosed case of HIV the US government unveiled the nation's coordinated response to combat HIV/AIDS domestically. Major objectives of this strategy is to identify and understand communities hardest hit by HIV and educate all Americans on how to prevent the disease (Millett et al., 2010). Along these lines, I set out to answer 3 questions:

Which individual and neighborhood compositional characteristics are associated with HIV and participation in prevention activities for young black and white MSM?

After controlling for an individual's characteristics, which neighborhood compositional characteristics are associated with HIV prevention participation and knowledge?

If neighborhood compositional characteristics are associated with HIV and participation in prevention activities, do black and white MSM live in different types of neighborhoods and does that explain differences in their risk for HIV?

I found that individual and group-level characteristics are associated with different factors that increase or decrease risk for HIV. Namely, higher percentages of single-parent female-headed households, individuals employed as managers, and residents who lived in other neighborhoods 5 years prior were associated with decreased HIV risk while neighborhoods with greater percentages of people living in poverty and those having relatively less education were associated with more HIV risk. Additionally, the percentage of same-sex couple households was associated with behaviors that increase as well as decrease risk for HIV. Black MSM, who remain at greatest risk for HIV (Prejean, et al., 2011), tended to live in neighborhoods with characteristics that were associated with HIV risk.

This research used social disorganization, peer norms, and community gay presence and stigma to guide this research. From the social disorganization perspective, the following factors were expected to be associated with community problems or HIV risk for the current study: ethnic heterogeneity, fragmented families, low socioeconomic status, and residential mobility. No associations were observed for percent black residents, a measure of ethnic heterogeneity, in the adjusted models. However in unadjusted models, percent black was associated with less risky sex and HIV testing. It was also associated with decreased participation in HIV prevention activities and less knowledge of emerging biotechnologies to effectively combat HIV. It is possible that the predictive power of percent of black residents was diminished with the inclusion of other variables in the model (Shieh & Fouladi, 2003). YMSM from fragmented families, or single-parent female-headed households, were more likely to report recent participation in HIV prevention activities. Consistent with the theory was low socioeconomic status, which predicted HIV risk in the study. Surprisingly, residential mobility was associated with decrease HIV risk. In whole, social disorganization theory was only partially supported by this research.

Supportive condom use peer norms were associated with decreased risk. However, YMSM who reported supportive condom use peer norms were less likely to participate in HIV prevention activities similar to those from neighborhoods with increased percentages of same-sex couples. However, YMSM from these types of neighborhoods were more likely to report any unprotected anal sex unlike YMSM reporting supportive condom use peer norms. These frameworks were only partially supported. Finally, presence of gays was associated with HIV testing among YMSM in these neighborhoods. The inverse of presence of gays in neighborhoods was a proxy for stigma. Accordingly, expected findings between the presence of gays and the

inverse, stigma, were supported and consistent with other literature (Carpiano, et al., 2011; Frye, et al., 2010).

8.1 Implications for practice and further research

These findings have important implications for HIV prevention services and care with, and developing biomedical HIV prevention interventions targeting, MSM. Apparent in these findings is that neighborhoods characterized by low education and poverty should be targeted for HIV prevention and care services for MSM. This is important information as the nation implements targeted approaches consistent with the goals of NHAS. Future research activities with MSM should investigate whether targeted placement of particular interventions is sufficient in combating HIV especially among YMSM. Placing prevention programs in at-risk neighborhoods has the potential to reduce HIV and risk for all residents including those who have opposite and same-sex partners. This is warranted given current times of dwindling economic resources for HIV prevention (Rausch, Dieffenbach, Cheever, & Fenton, 2011). Future research activities should aim to understand the relative risk for HIV among black MSM, who are hardest hit by the epidemic, is worst among those living in neighborhood types associated with increased risk. It is also important that these findings are replicated in more current data such as NHBS.

These data are also consistent with recent behavioral surveillance data (CDC, 2010b). Most recently, researchers described the effectiveness of using medication to treat HIV in reducing infections among HIV-negative individuals when used daily and in conjunction with comprehensive prevention services (CDC, 2011; Grant, et al., 2010). The current data showed

that MSM with less education than those in their neighborhoods were less likely to be familiar with drugs used to treat HIV. However, neighborhoods characterized by higher socioeconomic status were more likely to be knowledgeable of these drugs. These findings are useful for efforts to strengthen knowledge of HIV care and treatment.

I believe that these data are among the first to show parallel effects of neighborhood poverty and low education, and other neighborhood characteristics, on HIV risk factors for YMSM. Associations with poverty and HIV risk has previously been reported for heterosexuals (Adimora, et al., 2001; CDC, 2010b; Denning & DiNenno, 2010; Hixson, et al., 2011; LaLota, et al., 2011; Raj & Bowleg, 2011). However, this work has been limited for MSM. Recent work has focused on establishing a sexual health framework that at least breaches the topic of social determinants of health including low education and poverty (Wolitski & Fenton, 2011). Also, some investigators have highlighted individual-level correlates of low income and education to make comparisons with concentrated areas of poverty and MSM's HIV risk (CDC, 2010b).

These data also highlight important structural differences in neighborhoods that place certain MSM at greater risk for HIV. Social workers can use the data to advocate for better services in affected communities that are characterized by associations with risk. As many of these differences are structural in nature, social workers could play an important role in creating opportunities for economic justice and empowerment for MSM in these communities. Creating educational and work opportunities may influences levels of risk for HIV among residents (Wohlfeiler, 2000). Economic approaches to preventing HIV have been discussed in international contexts and domestically among heterosexual women, who too are at risk for HIV infection (Stratford, Mizuno, Williams, Courtenay-Quirk, & O'Leary, 2008).

More than anything, these data provide additional tools that can be used to reach at risk MSM (Vermund et al., 2010) especially for encouraging participation in HIV risk reduction programs. Unfortunately evidence-based interventions for MSM are limited. Only two community-level interventions have been developed specifically for MSM (Kegeles, Hays, & Coates, 1996; Kelly, et al., 1991). A successful adaption of Kelly's (1991) popular opinion leader model has been developed for black MSM. The *d-up: Defend Yourself!* intervention attempts to address several issues related to these study findings including role of education and low income at both the individual and community levels (Jones, Gray, et al., 2008). These findings can be used to determine the most appropriate channels within communities to target interventions and health communication campaigns aimed at reducing HIV and risk behaviors among MSM.

Interventions are needed at the group and individual levels to meet the needs of individual MSM. Wilton and colleagues' group-level intervention for HIV-negative and unknown MSM was shown effective in reducing HIV risk (Wilton et al., 2009). Also interventions are needed for MSM that address their sexual and romantic same-sex relationships. Wu, El-Bassel, and colleagues (2010) recently published promising effects for a couple-based intervention for methamphetamine-using black MSM. Interventions of these types have the potential to improve individual behaviors of MSM, and their relationships.

Presence of gay men and women in the community was associated with protective factors against HIV such as HIV testing and having heard of drugs used to treat HIV. However, these neighborhoods were also marginally associated with unprotected anal sex among sampled MSM. These findings are supported by other studies (Carpiano, et al., 2011; Frye, et al., 2010) but the

marginal effect was divergent from Frye and colleagues (2010) who found significant positive associations with gay presence and consistent condom use. More research is needed in this area.

It should be noted that the inclusion of neighborhood-characteristics in models aimed to understand several aspects of MSM's HIV risk reduced or eliminated previous significant individual characteristics. For example, black race was no longer significantly associated with recent testing and age and trade sex were no longer associated with having heard of drugs used to treat HIV when neighborhood-level factors were included in multilevel models. Researchers and interventionists wishing to understand recent testing and knowledge of HIV technologies, including new and emerging biomedical strategies would benefit greatly from considering neighborhood-level characteristics where MSM live opposed to individual characteristics solely. This might be a more economical approach to targeting limited resources.

It should be mentioned that the magnitude of individual-level characteristics were greater than neighborhood compositional characteristics the effect sizes of continuous predictors tend to group around 1 in logistic models (Gelman & Hill, 2007). Black race was the variable with the largest predictive value for risk. Black race did remain significantly and negatively associated when group-level factors were added to models for unprotected anal sex, recent participation in HIV prevention activities, and having heard of drugs used to treat HIV. Gay identity remained significantly and positively associated with any unprotected anal sex for all models. Black MSM engage in less behavioral risk (i.e. unprotected anal sex), as supported by these and other findings (Millett, et al., 2007; Millett, et al., 2006), but were less likely to participate in prevention programming or have knowledge of drugs used to treat HIV infection. Gay identified men engage in more behavioral risk than non-gay identified MSM, which is supported by other literature (Goldbaum, et al., 1996; Jones, Johnson, et al., 2008; Wolitski, et al., 2006). As

YMSM, particularly black, continue to drive the HIV epidemic in the US (Prejean, et al., 2011), efforts to combat HIV in these communities should be intensified. For black MSM specifically, very few behavioral intervention options exist. The two interventions that were developed specifically for this population and that are being nationally disseminated recently were published in the literature (Jones, Gray, et al., 2008; Wilton, et al., 2009). However, it is also likely that in the coming years that additional biomedical interventions, including a microbicide and vaccine against HIV, will be available (Frew, Archibald, Hixson, & del Rio, 2011; Munier, Andersen, & Kelleher, 2011; Rausch, et al., 2011). Current findings suggest that black MSM, an at-risk group that desperately needs effective strategies to reduce HIV among them, may have less access or knowledge of these advances against HIV.

Supportive condom use peer norms remained significantly and negatively associated with unprotected anal sex. This finding has been consistently reported in the peer-reviewed literature for MSM (Carlos, et al., 2010; Hart & Peterson, 2004; Jones, Johnson, et al., 2008). Two available and successful community-level interventions for this population focus on modifying risky sex norms in the community in order to reduce community and individual rates of unprotected anal sex (Jones, Gray, et al., 2008; Kelly, et al., 1991). Strengthening and placing these interventions, including Jones's (2008) cultural adaptation for black MSM, in relevant neighborhoods should be considered.

Some positive associations were found in this study with neighborhood characteristics and HIV risk. Future studies should determine what level of protection is afforded from relevant types of neighborhoods including those characterized by greater percentages of single-parent female-headed households and neighborhoods with high turnover. Additionally, further analyses should determine the levels of risk of at-risk MSM, for example black males, in these

neighborhoods. One potential research question is whether MSM who are at greatest risk engage in more or less risk in neighborhoods positively associated with risk and neighborhoods negatively associated with risk.

In this study, population turnover was associated with factors related to less HIV risk. However, in one study that specifically looked at HIV risk and residential moves, researchers found that risky drug use practices were associated with residential moves (German, et al., 2007). It is important to understand the contextual characteristics of residential moves. As different norms may be introduced from one network or neighborhood to another (Granovetter, 1983), social work practitioners and researchers can assist with providing a better sense of these neighborhoods, what inspires moves from one neighborhood to another, and how these affect HIV risk and influence norms about sex.

8.2 Conclusion

Where MSM live is associated with their risk of being HIV-positive/unknown and whether or not they are tested for HIV, participate in HIV prevention programs, or are aware of medications used to treat HIV. Aspects of the neighborhood that appear to matter include levels of poverty, education, socioeconomic status (SES), residential mobility, and family structures. The data reveal aspects of the neighborhoods where MSM live may matter more than individual characteristics as individual's race, age, and involvement in exchange sex were no longer associated, in some cases, with HIV risk when neighborhood aspects were considered.

This current retrospective look at MSM's HIV risk while considering neighborhood factors has the potential to influence strategies used to mitigate today's epidemic, which is

consistent with NHAS. However, researchers must refocus current efforts as the nation's strategy calls for. This is especially important given the current economic crisis. A focus on neighborhoods, and adequately intervening on structural barriers that inspire disparities in HIV and risk behaviors, has the potential to reverse the destructive course of HIV infection that has taken place since the first cases were diagnosed over 30 years ago. This has the potential to impact those at risk beyond MSM.

Table 1. Percent of observations with missing zip codes (N = 2848)

Measure	Missing Zip Code				
	Yes (N = 128)		No (N = 2720)		
	%	n	%	n	X^2
Race					25.9 *
Black	6.2	102	93.8	1550	
White	2.2	26	97.8	1170	
Age					0.8
15-17	4.5	7	95.5	150	
18-21	4.2	60	95.8	1384	
22-25	4.9	61	95.1	1186	
Gay identified					4.5*
No	5.7	53	94.3	881	
Yes	3.9	75	96.1	1839	
Education					1.1
< High school	4.0	12	96.0	290	
High school diploma/GED	4.6	42	95.4	879	
> High school	3.7	60	96.3	1551	
Work status					6.3 *
Not working	6.7	31	93.3	433	
Working, part time	4.4	28	95.6	614	
Working, fulltime	4.0	69	96.0	1673	
Supportive condom use peer norms					0.7
No	4.8	21	95.2	416	
Yes	4.4	93	95.6	2027	
Trade sex					1.3
No	4.3	109	95.7	2405	

Yes	5.7	19	94.3	315	
Any unprotected anal sex, past 3 months					1.7
No	4.8	96	95.2	1912	
Yes	3.7	29	96.3	763	
HIV tested					
Ever					4.9 *
No	6.1	38	93.9	583	
Yes	4.0	90	96.0	2137	
Past year					2.3
No	5.4	43	94.6	747	
Yes	4.1	85	95.9	1973	
HIV status					5.8 ††
Unknown	6.1	42	93.9	647	
Negative	4.0	84	96.0	2043	
Positive	6.3	2	93.8	30	
Participated in HIV prevention activities					6.8 **
No	6.4	40	93.6	584	
Yes	4.0	88	96.0	2131	
Heard of drugs used to treat HIV					3.8 †
No	5.2	78	94.8	1427	
Yes	3.7	49	96.3	1286	

Note. * = $p < .05$, ** = $p < .01$, *** = $p < .001$, † = $p = .05$, †† = $p < .10$.

Table 2. Summary of missing analysis sample (N = 2720)

Measure	# Missing	% Missing
Zip code	0	0.0
Race	0	0.0
Age	0	0.0
Gay identified	0	0.0
Education	0	0.0
Work status	0	0.0
Supportive condom use peer norms	277	10.2
Trade sex	0	0.0
Any unprotected anal sex, past 3 months	45	1.7
HIV tested		
Ever	0	0.0
Past year	0	0.0
HIV status	0	0.0
Participated in HIV prevention activities	5	0.2
Heard of drugs to treat HIV	7	0.3

Table 3. Characteristics of young black and white MSM included in analyses (N = 2720)

Measure	Total		Race		
			Black (N=1550)	White (N=1170)	
	n	%	%	%	X^2
Gay identified	1839	67.6	58.7	79.5	132.2 ***
Age					13.9 ***
15-17	150	5.5	4.8	6.5	
18-21	1384	50.9	48.7	53.8	
22-25	1186	43.6	46.5	39.7	
Education					14.2 ***
< High school	290	10.7	9.9	11.6	
High school diploma/GED	879	32.3	35.2	28.5	
> High school	1551	57.0	54.8	59.9	
Work status					1.3
Not working	433	15.9	16.2	15.5	
Working, part time	1673	22.6	23.2	21.8	
Working, fulltime	614	61.5	60.6	62.7	
Supportive condom use peer norms	2027	83.0	83.9	81.7	2.0

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 4. Summary of neighborhood compositional characteristics at the Census zip code tabulation area (J = 543)

Measure	Min	Max	Mean	SD
% Black	0.0	98.2	21.5	29.6
% Female headed households	0.0	30.4	7.9	5.5
% Same sex coupled households	0.0	5.7	0.7	0.6
Mean education	0.9	3.7	2.6	0.5
% Employed as managers	7.8	71.7	36.3	13.6
% Income below poverty level	0	68.0	12.6	11.1
% Moved in the past 5 years	23.5	97.3	47.5	11.0

Note. For mean education, 0 = less than 9 grade; 1 = 9-12th grade; 2 = high school graduation or equivalency; 3 = some college; and 4 = bachelor's degree or more.

Table 5. Characteristics associated with HIV, risk behaviors, and participation in prevention activities for young black and white MSM, ages 15-25 (betas and standard errors)

	HIV and related risk behaviors			Prevention activities			
	Positive or unknown status	Any unprotected anal sex, past 3 months	Trade sex	HIV tested, ever	HIV tested, past year	Participated in HIV prevention activities	Heard of drugs used to treat HIV
Individual-level							
Race (black == 1)	-0.03 (0.09)	-0.31 (0.09) ***	0.43 (0.13) **	0.12 (0.09)	0.21 (0.09) *	-0.90 ().10) ***	-1.36 (0.08) ***
Age							
15-17	--	--	--	--	--	--	--
18-21	-0.88 (0.17) ***	0.19 (0.20)	0.41 (0.30)	0.75 (0.18) ***	0.77 (0.17) ***	0.07 (0.21)	0.08 (0.17)
22-25	-1.38 (0.18) ***	0.25 (0.20)	0.25 (0.41)	1.40 (0.18) ***	1.05 (0.18) ***	-0.02 (0.21)	0.34 (0.18) †
Gay identified	0.01 (0.09)	0.36 (0.09) ***	-0.28 (0.12) *	-0.05 (0.10)	-0.08 (0.09)	0.14 (0.10)	0.64 (0.08) ***
Work status							
Not working	--	--	--	--	--	--	--
Part time	-0.04 (0.14)	0.08 (0.12)	-0.87 (0.18) ***	-0.03 (0.14)	0.01 (0.13)	0.40 (0.14) **	0.10 (0.13)
Fulltime	-0.57 (0.12) ***	0.06 (0.14)	-0.96 (0.14) ***	0.54 (0.13) ***	0.39 (0.12) **	0.55 (0.12) ***	0.22 (0.11) *
Relative education	0.35 (0.05) ***	0.01 (0.05)	0.22 (0.06) **	-0.38 (0.05) ***	-0.28 (0.05) ***	-0.19 (0.05) ***	-0.16 (0.04) ***
Supportive condom use peer norms	-0.08 (0.12)	-0.87 (0.11) ***	-0.85 (0.14) **	0.06 (0.13)	0.01 (0.12)	-0.13 (0.14)	0.14 (0.11)

Neighborhood-level							
% Black	0.00 (0.00)	-0.003 (0.001) *	0.01 (0.00) ***	0.003 (0.001) †	0.003 (0.001) *	-0.01 (0.00) ***	-0.01 (0.00) ***
% Female headed households	0.00 (0.01)	-0.01 (0.01)	0.03 (0.01) ***	0.01 (0.01) ††	0.02 (0.01) *	-0.01 (0.01)	-0.06 (0.01) ***
% Same sex households	-0.18 (0.06) **	0.09 (0.05) †	0.20 (0.06) ***	0.24 (0.07) ***	0.15 (0.05) **	-0.10 (0.05) †	0.27 (0.05) ***
% Employed as managers	0.00 (0.00)	0.00 (0.00)	-0.01 (0.00) ††	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.02 (0.00) ***
% Income below poverty level	-0.01 (0.00)	0.00 (0.00)	0.02 (0.00) ***	0.01 (0.00) *	0.01 (0.00) *	-0.02 (0.00) ***	-0.02 (0.00) ***
% Moved in the past 5 years	-0.01 (0.00) ***	0.00 (0.00)	0.00 (0.00)	0.01 (0.00) **	0.01 (0.00) *	0.00 (0.00)	0.02 (0.00) ***

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 6. Multilevel models for characteristics associated with having an HIV-positive or unknown status among young black and white MSM, ages 15-25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	-0.12 (0.12)	-0.03 (0.16)	-0.12 (0.12)	-0.03 (0.16)
Age				
15-17	--	--	--	--
18-21	-0.57 (0.20) **	-0.48 (0.20) *	-0.57 (0.20) **	-0.48 (0.20) *
22-25	-0.90 (0.22) ***	-0.77 (0.22) ***	-0.91 (0.22) ***	-0.79 (0.22) ***
Gay identified	0.00 (0.10)	0.01 (0.10)	0.01 (0.10)	0.01 (0.10)
Work status				
Not working	--	--	--	--
Part time	0.01 (0.15)	0.01 (0.15)	0.01 (0.15)	0.01 (0.15)
Fulltime	-0.34 (0.13) *	-0.33 (0.13) *	-0.33 (0.13) *	-0.32 (0.13) *
Relative education	0.23 (0.06) ***	0.28 (0.06) ***	0.23 (0.06) ***	0.27 (0.06) ***
Supportive condom use peer norms	--	--	-0.06 (0.13)	-0.05 (0.13)
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.00 (0.00)
% Female headed households	--	-0.01 (0.02)	--	-0.01 (0.02)
% Same sex households	--	-0.13 (0.09)	--	-0.13 (0.09)
% Employed as managers	--	0.00 (0.01)	--	0.00 (0.01)
% Income below poverty level	--	0.01 (0.01)	--	0.01 (0.01)
% Moved in the past 5 years	--	-0.02 (0.01) **	--	-0.02 (0.01) **

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 7. Multilevel models for characteristics associated with any unprotected anal sex in the past 3 months among young black and white MSM, ages 15-25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	-0.26 (0.09) **	-0.26 (0.13) *	-0.25 (0.09) **	-0.27 (0.13) *
Age				
15-17	--	--	--	--
18-21	0.22 (0.22)	0.28 (0.22)	0.22 (0.22)	0.27 (0.22)
22-25	0.31 (0.23)	0.38 (0.23)	0.33 (0.23)	0.37 (0.24)
Gay identified	0.29 (0.10) **	0.30 (0.10) **	0.31 (0.10) **	0.32 (0.10) **
Work status				
Not working	--	--	--	--
Part time	0.09 (0.13)	0.09 (0.14)	0.13 (0.14)	0.14 (0.14)
Fulltime	0.02 (0.14)	0.03 (0.13)	0.05 (0.13)	0.06 (0.13)
Relative education	0.02 (0.05)	0.05 (0.06)	0.01 (0.05)	0.04 (0.06)
Supportive condom use peer norms	--	--	-0.88 (0.11) ***	-0.87 (0.11) ***
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.00 (0.00)
% Female headed households	--	0.03 (0.02) ††	--	0.03 (0.02) ††
% Same sex households	--	0.12 (0.05) *	--	0.11 (0.05) †
% Employed as managers	--	0.00 (0.01)	--	0.00 (0.01)
% Income below poverty level	--	0.00 (0.01)	--	0.00 (0.01)
% Moved in the past 5 years	--	0.00 (0.00)	--	0.00 (0.00)

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 8. Multilevel models for characteristics associated with trade sex among young black and white MSM, ages 15-25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	0.50 (0.15) **	0.16 (0.20)	0.51 (0.15) **	0.15 (0.19)
Age				
15-17	--	--	--	--
18-21	0.85 (0.33) **	0.95 (0.33) **	0.85 (0.33) **	0.93 (0.33) **
22-25	0.83 (0.34) *	0.97 (0.34) **	0.84 (0.34) *	0.95 (0.35) **
Gay identified	-0.22 (0.13)	-0.21 (0.13)	-0.21 (0.13)	-0.20 (0.13)
Work status				
Not working	--	--	--	--
Part time	-0.85 (0.18) ***	-0.83 (0.18) ***	-0.81 (0.19) ***	-0.80 (0.19) ***
Fulltime	-0.87 (0.16) ***	-0.82 (0.16) ***	-0.85 (0.16) ***	-0.79 (0.16) ***
Relative education	0.26 (0.07) ***	0.37 (0.08) ***	0.25 (0.07) **	0.35 (0.08) ***
Supportive condom use peer norms	--	--	-0.81 (0.15) ***	-0.80 (0.15) ***
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.01 (0.00)
% Female headed households	--	-0.01 (0.03)	--	-0.01 (0.02)
% Same sex households	--	0.24 (0.09) **	--	0.23 (0.08) **
% Employed as managers	--	-0.01 (0.01)	--	-0.01 (0.01)
% Income below poverty level	--	0.02 (0.01) ††	--	0.02 (0.01)
% Moved in the past 5 years	--	0.00 (0.01)	--	0.00 (0.01)

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 9. Multilevel models for characteristics associated with ever HIV testing among young black and white MSM, ages 15-25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	0.20 (0.15)	0.03 (0.17)	0.21 (0.14)	0.03 (0.17)
Age				
15-17	--	--	--	--
18-21	0.41 (0.21) †	0.33 (0.21)	0.42 (0.21) †	0.33 (0.21)
22-25	0.89 (0.23) ***	0.76 (0.24) **	0.90 (0.23) ***	0.77 (0.24) **
Gay identified	-0.02 (0.11)	-0.02 (0.11)	-0.02 (0.11)	-0.02 (0.11)
Work status				
Not working	--	--	--	--
Part time	-0.09 (0.15)	-0.08 (0.15)	-0.09 (0.15)	-0.08 (0.15)
Fulltime	0.29 (0.14) *	0.30 (0.14) *	0.28 (0.14) †	0.29 (0.14) *
Relative education	-0.27 (0.06) ***	-0.30 (0.07) ***	-0.26 (0.06) ***	-0.29 (0.07) ***
Supportive condom use peer norms	--	--	0.04 (0.14)	0.03 (0.14)
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.00 (0.00)
% Female headed households	--	0.00 (0.02)	--	0.01 (0.02)
% Same sex households	--	0.19 (0.10) †	--	0.19 (0.10) ††
% Employed as managers	--	0.00 (0.01)	--	0.00 (0.01)
% Income below poverty level	--	-0.01 (0.01)	--	-0.01 (0.01)
% Moved in the past 5 years	--	0.02 (0.01) *	--	0.02 (0.01) *

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 10. Multilevel models for characteristics associated with HIV testing in the past year among young black and white MSM, ages 15–25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	0.25 (0.11) *	0.15 (0.14)	0.25 (0.11) *	0.15 (0.14)
Age				
15-17	--	--	--	--
18-21	0.51 (0.20) **	0.47 (0.20) *	0.52 (0.20) **	0.50 (0.20) *
22-25	0.67 (0.21) **	0.59 (0.22) **	0.68 (0.21) **	0.61 (0.22) **
Gay identified	-0.03 (0.10)	-0.03 (0.10)	-0.03 (0.10)	-0.04 (0.10)
Work status				
Not working	--	--	--	--
Part time	-0.03 (0.14)	-0.02 (0.14)	-0.03 (0.14)	-0.03 (0.14)
Fulltime	0.22 (0.13) ††	0.22 (0.13) ††	0.21 (0.13)	0.21 (0.13) ††
Relative education	-0.18 (0.06) **	-0.19 (0.06) **	-0.17 (0.06) **	-0.18 (0.06) **
Supportive condom use peer norms	--	--	0.00 (0.13)	0.00 (0.13)
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.00 (0.00)
% Female headed households	--	0.01 (0.02)	--	0.01 (0.02)
% Same sex households	--	0.15 (0.08) †	--	0.14 (0.08) ††
% Employed as managers	--	0.00 (0.01)	--	0.00 (0.01)
% Income below poverty level	--	0.00 (0.01)	--	0.00 (0.01)
% Moved in the past 5 years	--	0.01 (0.01)	--	0.01 (0.01)

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 11. Multilevel models for characteristics associated with recent participation in HIV prevention activities among young black and white MSM, ages 15-25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	-0.75 (0.15) ***	-0.87 (0.20) ***	-0.75 (0.15) ***	-0.87 (0.20) ***
Age				
15-17	--	--	--	--
18-21	-0.36 (0.26)	-0.44 (0.26) ††	-0.36 (0.26)	-0.43 (0.26)
22-25	-0.67 (0.27) *	-0.77 (0.28) **	-0.66 (0.27) *	-0.76 (0.28) **
Gay identified	0.00 (0.12)	0.03 (0.12)	0.00 (0.12)	0.02 (0.12)
Work status				
Not working	--	--	--	--
Part time	0.36 (0.17) *	0.34 (0.17) *	0.37 (0.17) *	0.35 (0.17) *
Fulltime	0.47 (0.15) **	0.42 (0.15) **	0.45 (0.15) **	0.42 (0.15) **
Relative education	-0.27 (0.07) ***	-0.34 (0.07) ***	-0.27 (0.07) ***	-0.34 (0.07) ***
Supportive condom use peer norms	--	--	-0.17 (0.16)	-0.18 (0.16)
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.00 (0.00)
% Female headed households	--	0.10 (0.03) ***	--	0.10 (0.03) ***
% Same sex households	--	-0.02 (0.08)	--	-0.03 (0.07)
% Employed as managers	--	0.01 (0.01)	--	0.01 (0.01)
% Income below poverty level	--	-0.07 (0.01) ***	--	-0.07 (0.01) ***
% Moved in the past 5 years	--	0.04 (0.01) ***	--	0.04 (0.01) ***

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 12. Multilevel models for characteristics associated with having heard of drugs used to treat HIV among young black and white MSM, ages 15-25 (betas and standard errors)

	Model 1	Model 2	Model 3	Model 4
Individual-level				
Race (black == 1)	-1.31 (0.12) ***	-1.36 (0.14) ***	-1.32(0.12) ***	-1.36 (0.14) ***
Age				
15-17	--	--	--	--
18-21	-0.24 (0.21)	-0.39 (0.21) ††	-0.24 (0.21)	-0.39 (0.21) ††
22-25	0.01 (0.23)	-0.23 (0.23)	0.01 (0.23)	-0.23 (0.23)
Gay identified	0.42 (0.10) ***	0.41 (0.10) ***	0.42 (0.10) ***	0.40 (0.10) ***
Work status				
Not working	--	--	--	--
Part time	0.08 (0.15)	0.10 (0.14)	0.07 (0.15)	0.09 (0.14)
Fulltime	0.03 (0.13)	0.02 (0.13)	0.02 (0.13)	0.04 (0.13)
Relative education	-0.32 (0.06) ***	-0.40 (0.06) ***	-0.31 (0.06) ***	-0.39 (0.06) ***
Supportive condom use peer norms	--	--	0.21 (0.12) ††	0.19 (0.12)
Neighborhood-level				
% Black	--	0.00 (0.00)	--	0.00 (0.00)
% Female headed households	--	0.01 (0.02)	--	0.01 (0.02)
% Same sex households	--	0.20 (0.08) *	--	0.19 (0.08) *
% Employed as managers	--	0.01 (0.01) *	--	0.01 (0.01) *
% Income below poverty level	--	-0.01 (0.01)	--	-0.01 (0.01)
% Moved in the past 5 years	--	0.02 (0.01) **	--	0.02 (0.01) **

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 13. Summary of HIV risk factors among young and black white MSM (N = 2720)

Measure	Race			
	Total	Black	White	
	%	% (n)	% (n)	X^2
Any unprotected anal sex, past 3 months (N=2675)	28.5	25.8 (395)	32.2 (368)	13.0 ***
Trade sex (N = 2720)	11.6	13.4 (208)	9.2 (108)	11.9 ***
HIV tested, ever (N = 2720)	78.6	79.4 (1231)	77.4 (906)	0.2
HIV tested, past year (N = 2720)	72.5	74.4 (1153)	70.1 (820)	6.2 **
HIV-positive or unknown status (N = 2720)				2.6
Negative	75.11	75.4 (1169)	74.7 (874)	
Positive	1.1	1.4 (21)	0.8 (9)	
Unknown	23.8	23.2 (360)	24.5 (287)	
Participated in HIV prevention activities (N = 2715)	78.5	72.4 (1119)	86.6 (1012)	79.4 ***
Heard of drugs used to treat HIV (N=2713)	47.4	33.3 (514)	66.1 (772)	287.5 ***

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Table 14. Average (standard deviation) of neighborhood composition characteristics for black and white MSM (N = 2720)

Measure		Race		
		Black	White	
	Total	(N=1550)	(N=1170)	*T*
% Black	37.5 (36.1)	58.7 (32.5)	9.5 (15.4)	-47.9 ***
% Female headed households	9.9 (6.5)	12.8 (6.5)	6.0 (4.0)	-31.8 ***
% Same sex households	0.9 (0.9)	0.9 (0.7)	1.0 (1.1)	3.0 **
Community education	2.6 (0.5)	2.5 (0.5)	2.8 (0.5)	16.3 ***
% Employed as managers	35.5 (13.3)	32.1 (12.7)	40.0 (12.7)	16.2 ***
% Income below poverty level	17.5 (11.7)	21.7 (10.8)	12.0 (10.7)	-23.3 ***
% Moved in the past 5 years	50.3 (12.5)	50.6 (12.8)	50.0 (12.1)	-1.4

*Note. * = p < .05, ** = p < .01, *** = p < .001, † = p = .05, †† = p < .10.*

Figure 1. Required cluster size to detect racial differences with having an HIV-positive or unknown status among young black and white MSM, ages 15–25

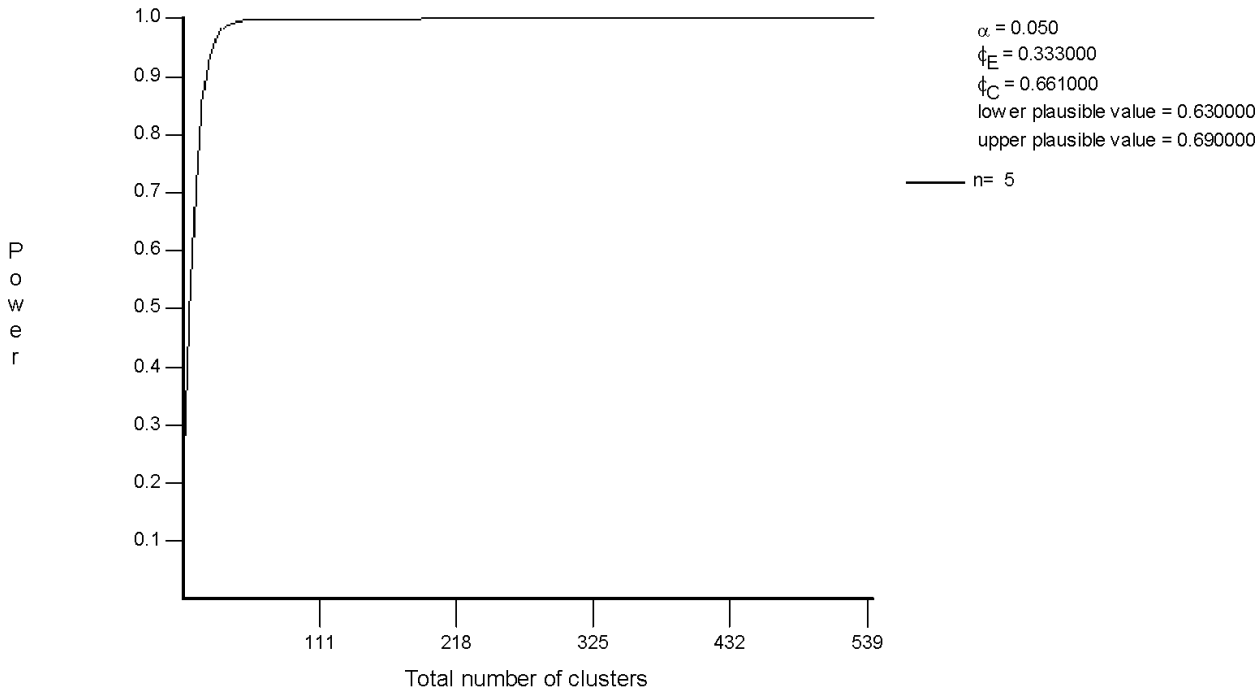


Figure 2. Multilevel associations with having an HIV-positive or unknown status among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

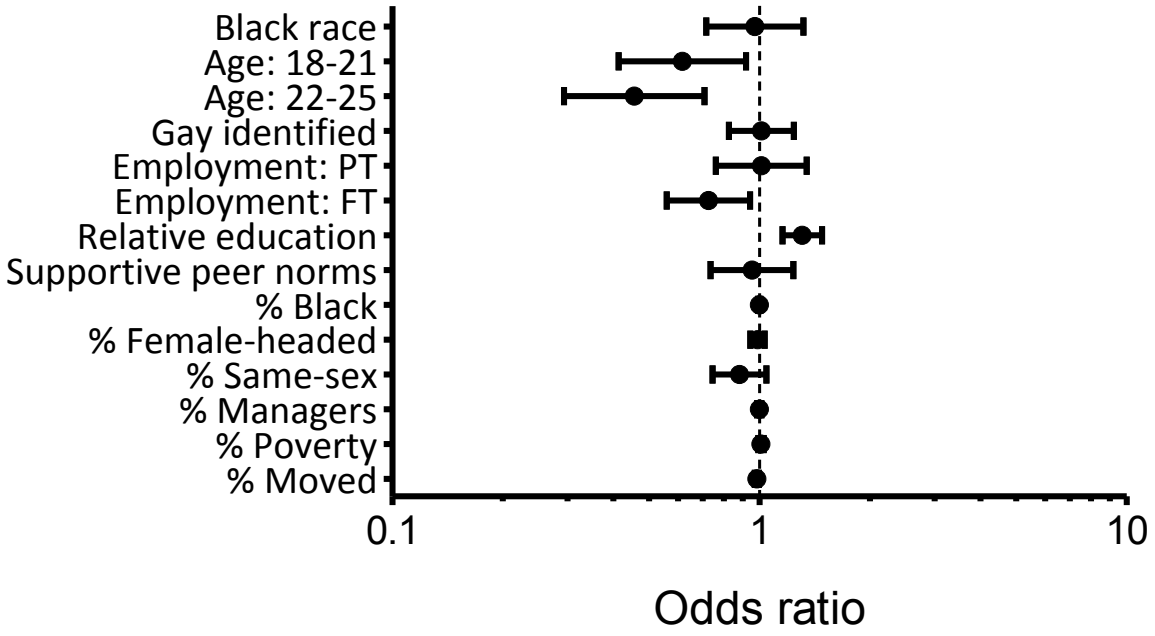


Figure 3. Multilevel associations with any unprotected anal sex in past 3 months among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

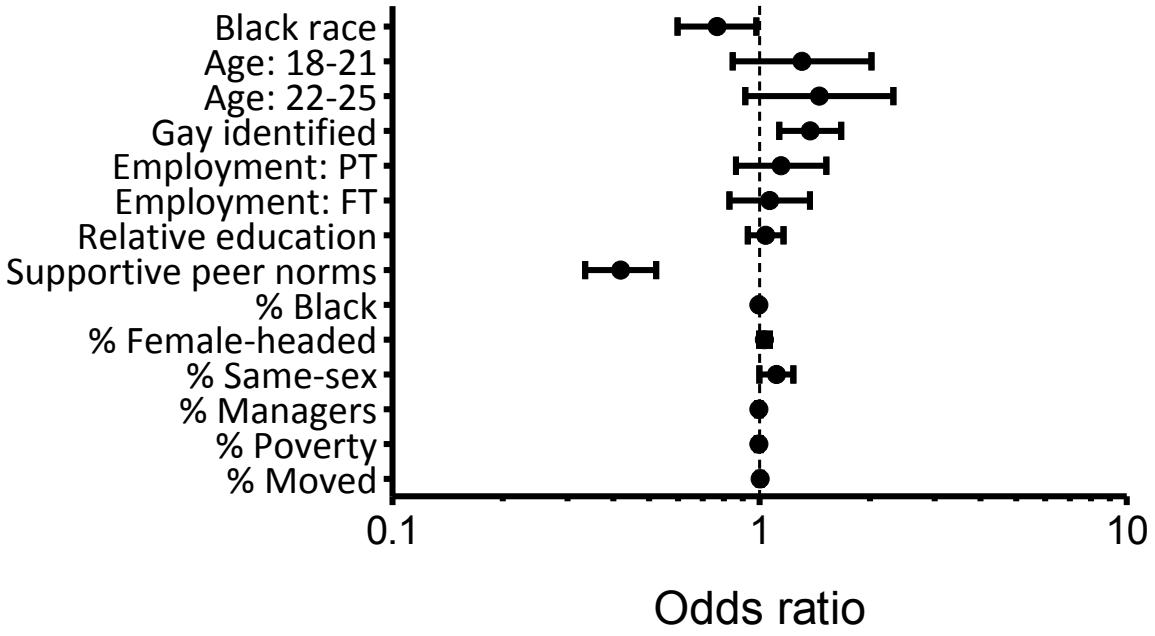


Figure 4. Required cluster size to detect racial differences in any unprotected anal sex in past 3 months among young black and white MSM, ages 15–25

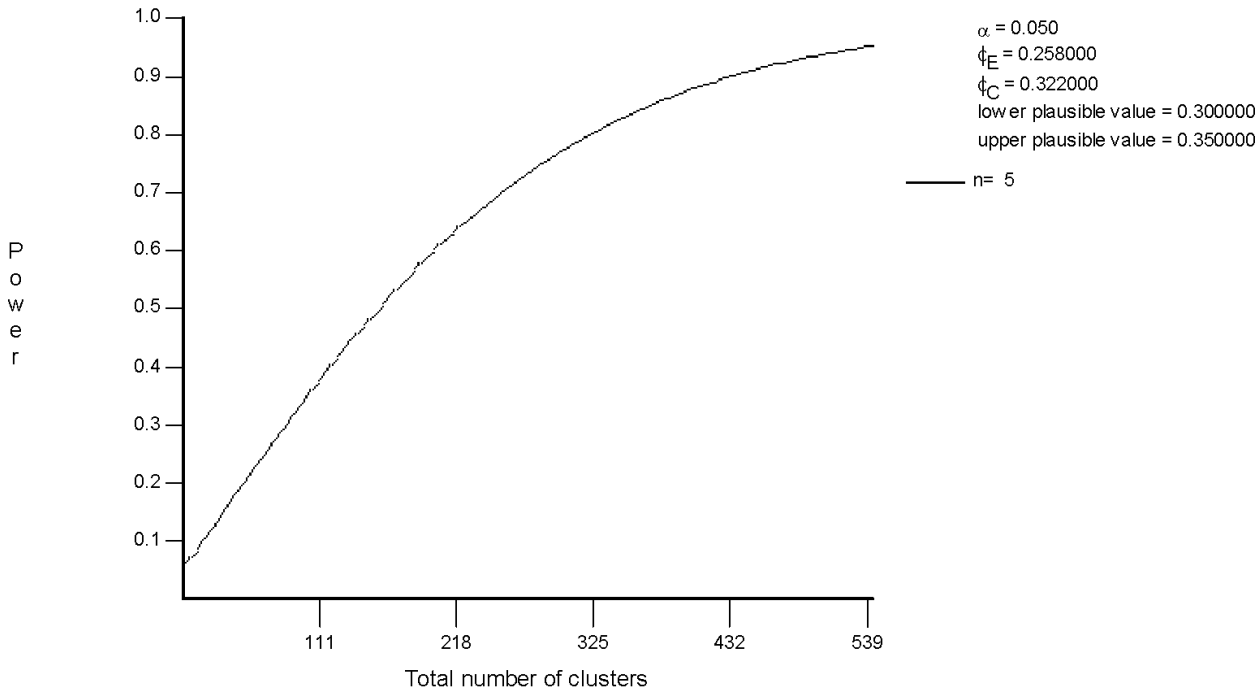


Figure 5. Multilevel associations with trade sex among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

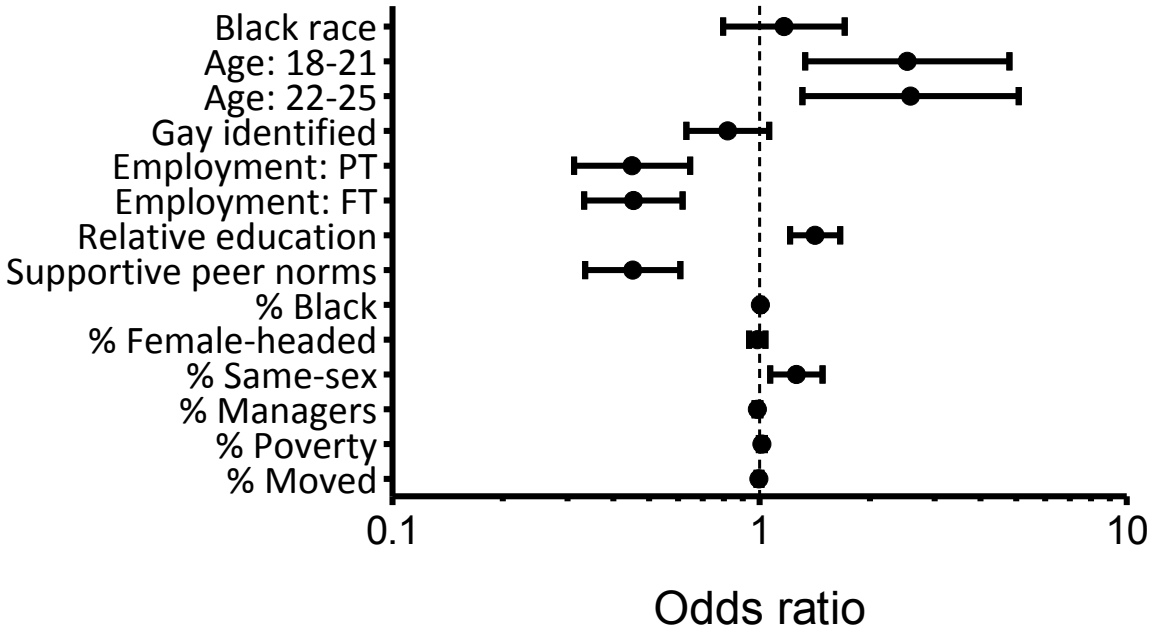


Figure 6. Required cluster size to detect racial differences with trade sex among young black and white MSM, ages 15–25

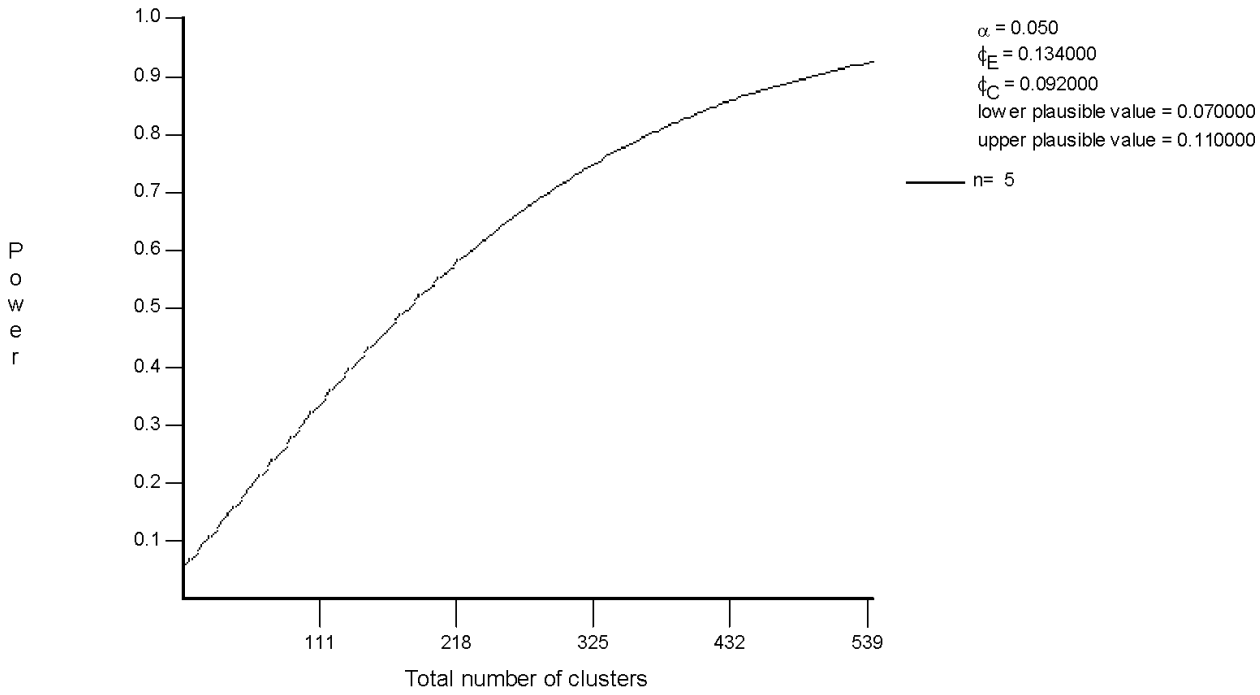


Figure 7. Required cluster size to detect racial differences in ever HIV testing among young black and white MSM, ages 15–25

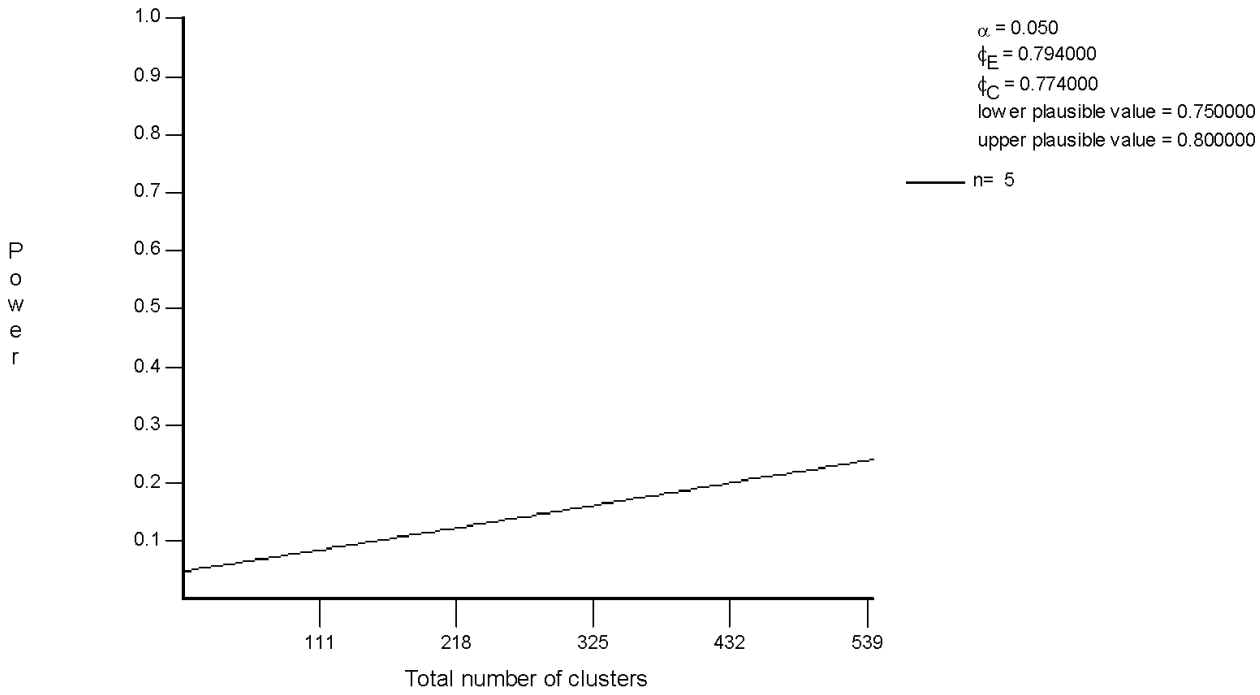


Figure 8. Multilevel associations with ever HIV testing among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

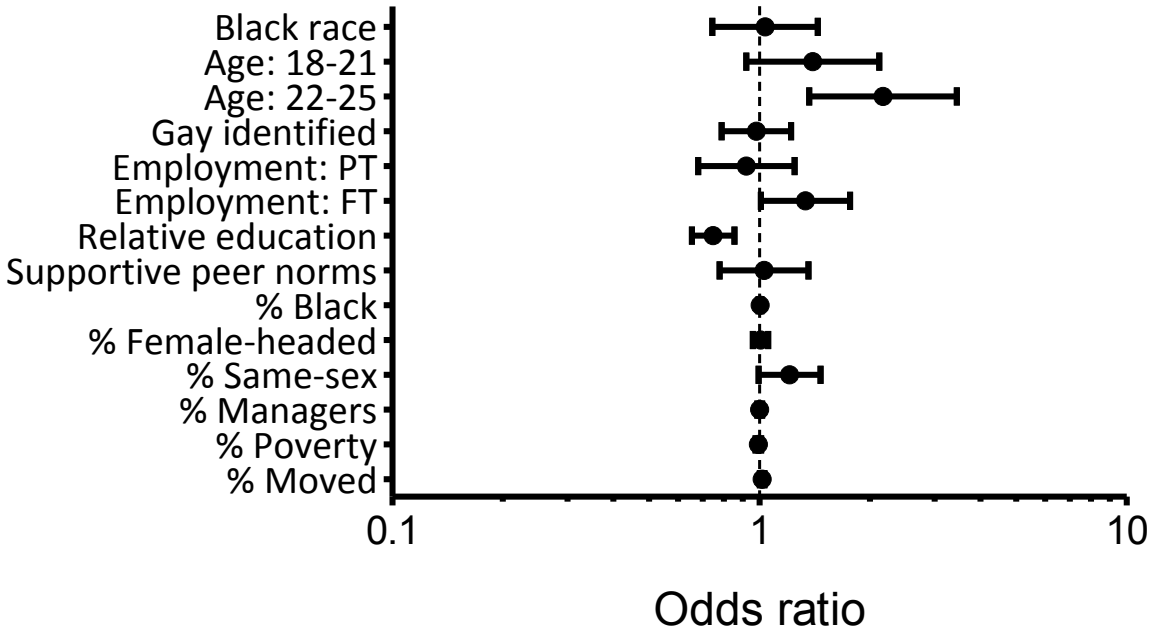


Figure 9. Required cluster size to detect racial differences in HIV testing in the past year among young black and white MSM, ages 15–25

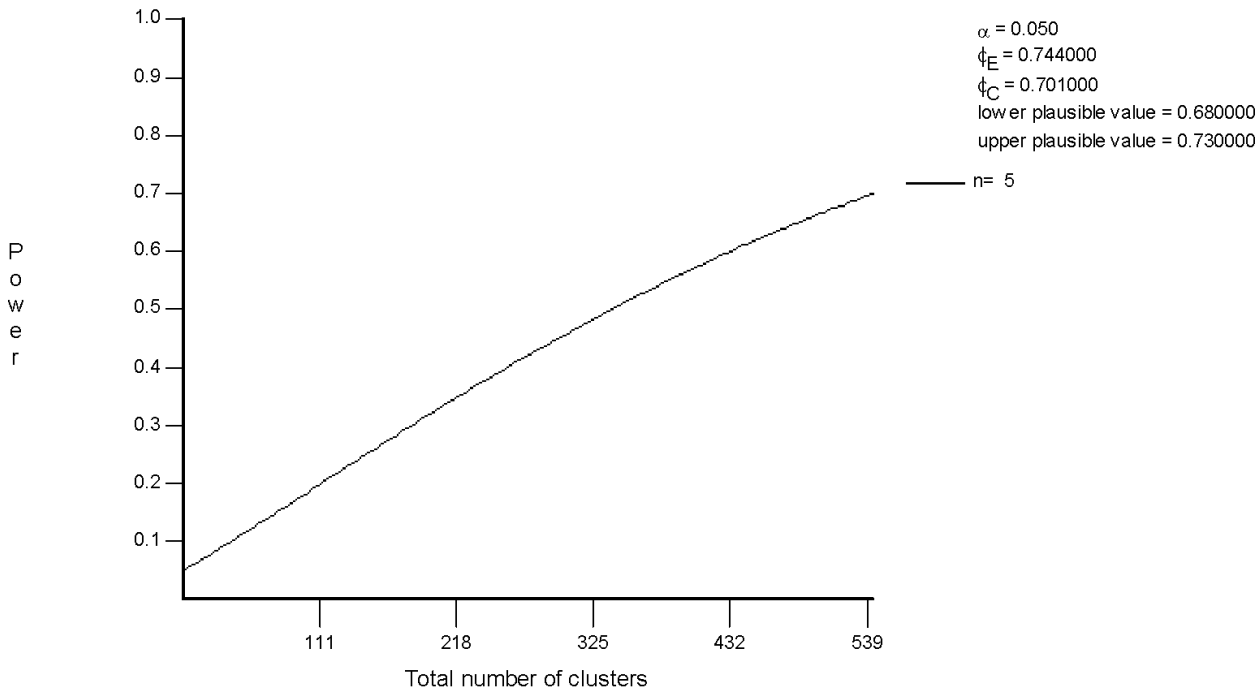


Figure 10. Multilevel associations with HIV testing in the past year among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

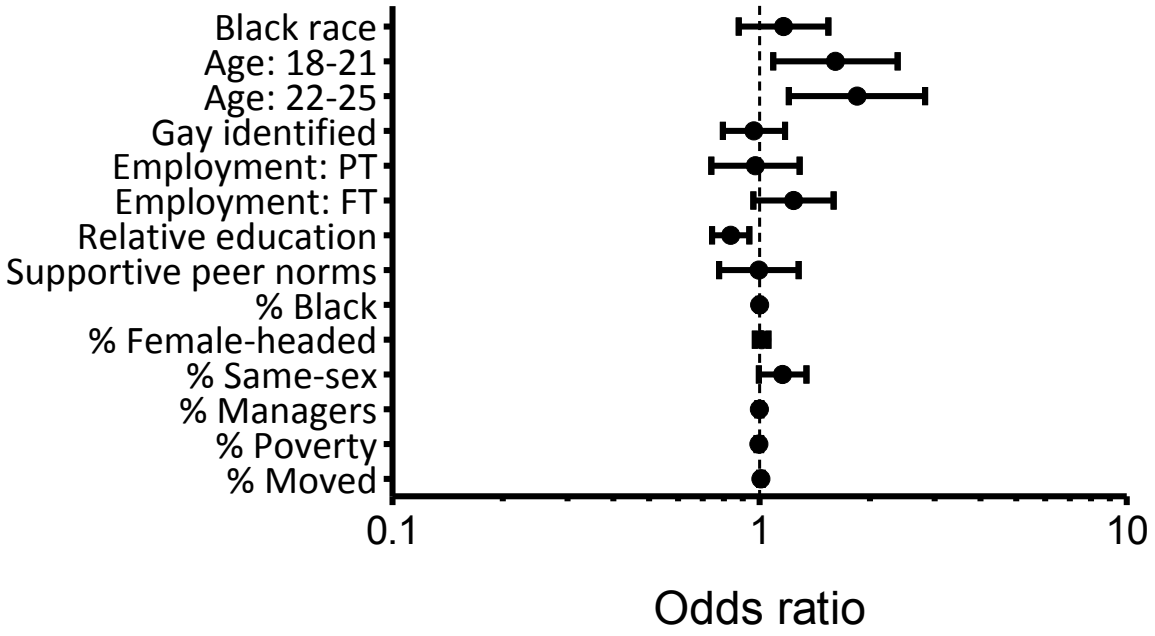


Figure 11. Multilevel associations with recent participation in HIV prevention activities among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

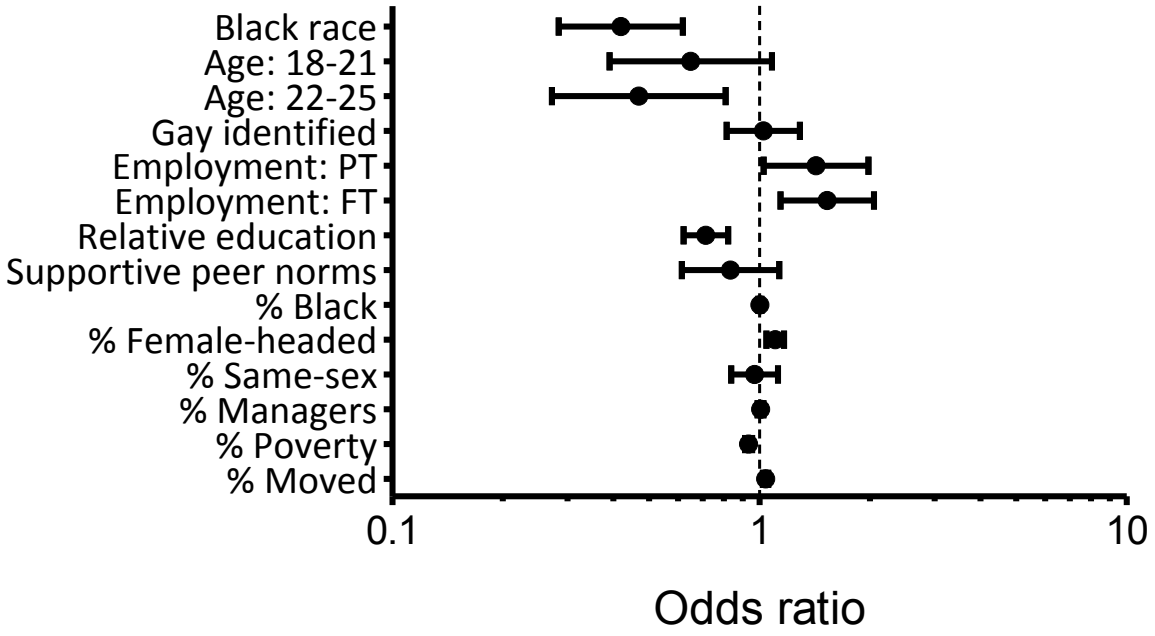


Figure 12. Required cluster size to detect racial differences in recent participation in HIV prevention activities among young black and white MSM, ages 15–25

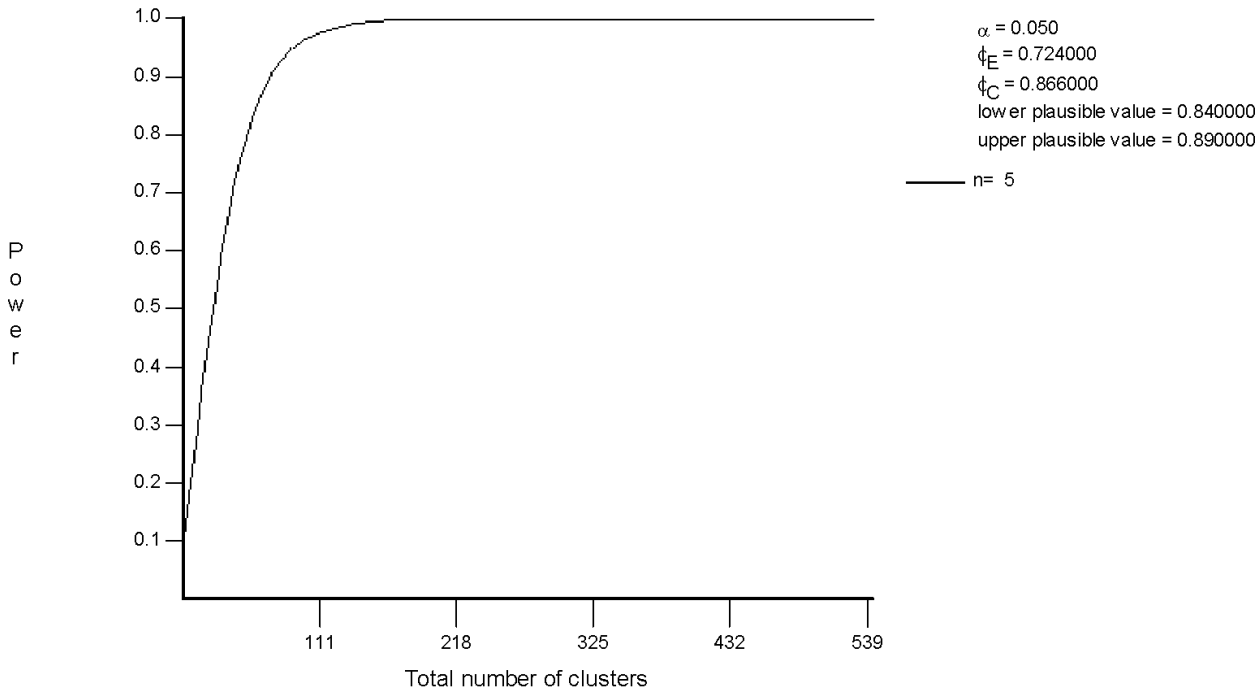


Figure 13. Multilevel associations with having heard of drugs used to treat HIV among young black and white MSM, ages 15–25 (adjusted odds ratios and 95% confidence intervals)

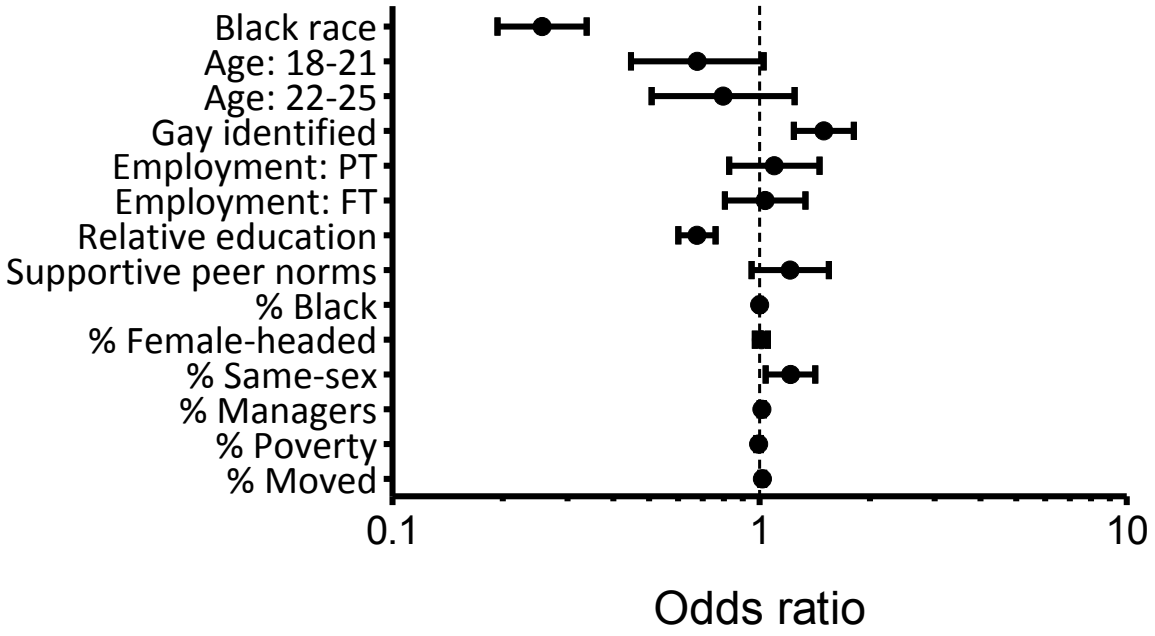
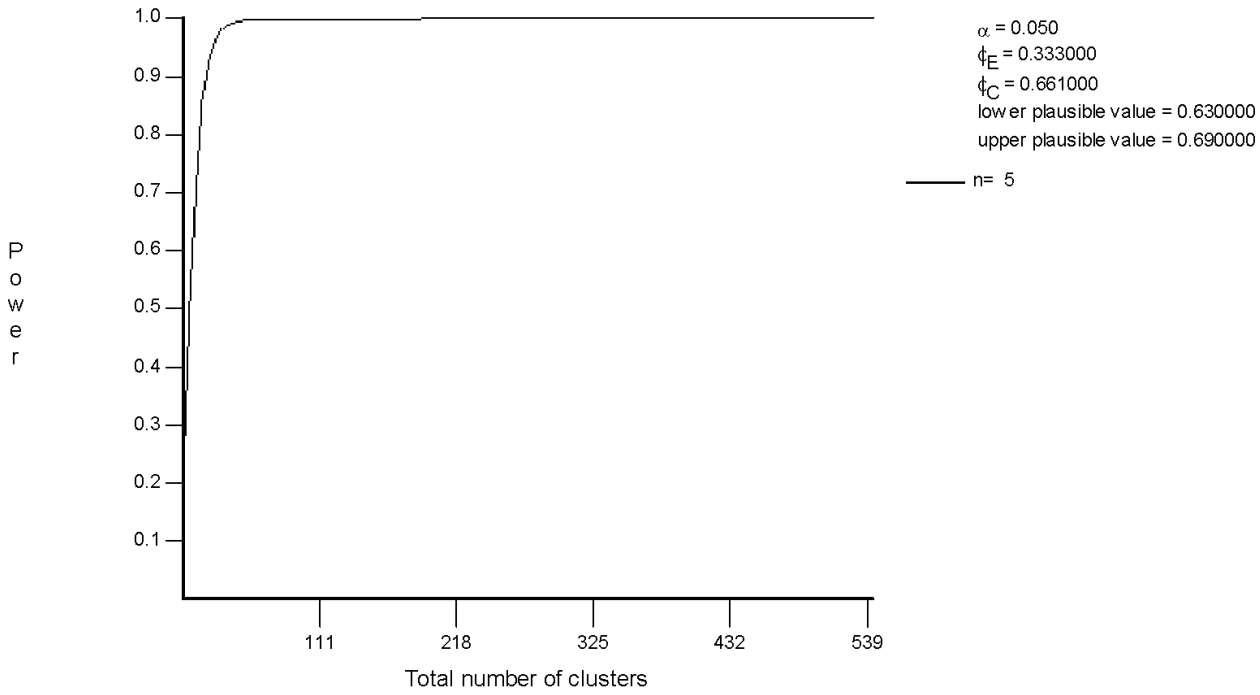


Figure 14. Required cluster size to detect racial differences with having heard of drugs to treat HIV among young black and white MSM, ages 15–25



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