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Correlates of Seroadaptation Strategies Among Black Men Who have Sex with Men (MSM) in 4 US Cities

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Abstract

We assessed associations of demographic, psychosocial, and substance use factors with seroadaptation strategies among 835 BMSM in four US cities. Seroadaptation strategies were practiced by 59.8 % of men, with 10.5 % practicing 100 % condom use, 26.5 % serosorting, 7.2 % condom serosorting, and 15.6 % seropositioning. In multivariable analyses, compared to men who used no seroadaptation strategies, serosorters were older, were less likely to be HIV infected, had fewer male sex partners, and had higher levels of social support and sexual self-efficacy. Condom serosorters had less psychological distress, were more likely to use methamphetamine, and had higher levels of sexual self-efficacy. Seropositioners were older, were less likely to be HIV infected, to have a main partner, and report alcohol/drug use with sex, while having higher levels of sexual self-efficacy. Seroadaptation practices among BMSM need to be considered to address perceived safer sex strategies and strengthen access to a broader reach of culturally-relevant prevention efforts.

Keywords

Black MSM; Serosorting; Strategic positioning; Substance use; Mental health

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Compliance with Ethical Standards

Conflicts of Interest No conflicts were declared.

Introduction

Black men who have sex with men (MSM) have significant disproportionate HIV infection burden, indicative of an urgent public health challenge in the United States (US) [1–5]. In 2013, black MSM constituted the highest proportion (39 %) of new HIV infection diagnoses as compared to Latino (24 %) and white (32 %) MSM [1]. A recent large-scale epidemiologic cohort study of black MSM in six US cities demonstrated a high overall annual HIV incidence rate of 3.0 %, with an elevated 5.9 % incidence rate observed among young black MSM [2]. Mayer et al. [6] found that compared with HIV-uninfected BMSM, newly diagnosed black MSM were younger in age (<30 years), unemployed, reported regular insufficient income, had a recent sexually transmitted infection (STI), and reported condomless receptive anal intercourse with sexual partners within the last 6 months. HIV behavioral research on MSM has demonstrated that condomless anal sex (CAS) with an HIV/STI-infected sexual partner has served as a key risk factor for HIV/STI transmission and/or co-infection [7].

As the significant increase in HIV infection rates among black MSM has been well substantiated in epidemiologic studies [1–3], a growing body of research has shown that MSM have utilized seroadaptation or sexual partner selection strategies as a form of HIV risk reduction [8–19], with prevalence rates of these practices ranging from 41 to 64 % [20–22]. Serosorting, the selection of a sexual partner based on HIV serostatus, and strategic positioning, the practice of engaging in a sexual position (insertive or receptive) during CAS based on a sexual partner's perceived or actual HIV serostatus and/or knowledge of lower transmission risk, have been identified as the most common seroadaptation strategies utilized by MSM [14]. Seroadaptation practices are contingent on requisite accurate knowledge and communication (e.g., HIV disclosure) about the HIV serostatus of sexual partners and informed by frequent HIV/STI testing [8]. Furthermore, decision-making processes related to engaging in seroadaptation practices occur within the context of biomedical strategies such as pre- and post-exposure prophylaxis (PrEP and PEP) and advanced HIV testing technologies (e.g., fourth-generation tests) as well as novel HIV testing approaches (e.g., HIV self-testing and couples testing) that provide increased access to knowledge about HIV serostatus that may inform the use of these strategies [23–25]. These sexual partner selection strategies may not be a precise or well-defined form of prevention among black MSM due to high undiagnosed HIV/STI infection rates, elevated HIV/STI prevalence within sexual networks, inadequate HIV/STI testing patterns, and acute HIV infection [26]. For example, the Centers for Disease Control and Prevention (CDC) has posited that MSM who engage in serosorting sexual behaviors, as compared to MSM who consistently use condoms, are more likely to demonstrate an increased vulnerability for acquiring and transmitting HIV/STIs [27].

Prior research on seroadaptation practices among MSM have differed in terms of the utility of these practices in modulating outcomes related to HIV incidence and HIV sexual risk behaviors [12, 28]. In a meta-analytic study of HIV-diagnosed MSM (n = 18,121), Crepaz et al. [29] found that CAS prevalence differed based on the sexual partner's serostatus (30 % with HIV positive, 16 % with HIV-unknown, and 13 % with HIV-negative partners). In a longitudinal study of HIV-negative MSM with casual partners, findings indicated that

serosorters demonstrated lower risk for HIV seroconversion as compared to MSM who engaged in CAS but showed higher likelihood of seroconversion than MSM who practiced consistent condom use [13]. Furthermore, while some studies have shown a protective role for the practice of seropositioning behaviors among MSM [10, 11], others have not found protective effects for seropositioning behaviors among this population [12]. However, Wolitski et al. [15] observed that HIV-positive MSM reported assuming the receptive role during anal intercourse as a risk-reduction strategy with their sexual partners.

A limited number of studies have examined the use of seroadaptation strategies by black MSM to reduce HIV risk, which have been conducted primarily based on examining racial/ethnic differences in community-based samples. In one large-scale cross-sectional study of MSM (n = 1199) in San Francisco, racial/ethnic differences were not found to be associated with seroadaptative behaviors [14]. Golden et al. [28] in a sample of 6694 MSM from STI clinics in Seattle found that using serosorting as a prevention strategy was less effective for black MSM as compared to white MSM in that higher HIV seroconversion rates were observed among black MSM. Moreover, among HIV-negative MSM in Atlanta, Eaton et al. [8] showed that black MSM, compared to white MSM, were less likely to report CAS with HIV-negative sexual partners and endorse serosorting and HIV disclosure beliefs; however, black MSM were more likely to practice CAS with HIV-unknown status sexual partners than white MSM. In contrast, in a study of black and Latino HIV-negative MSM (n = 724) from three US cities (New York City, Los Angeles, and Philadelphia), a higher prevalence in serosorting was noted among Latino MSM (64.1 %) than black MSM (39.2 %), and serosorting and strategic positioning were associated with a lower likelihood of unrecognized HIV infection (as compared to men who practiced CAS and did not report engaging in these seroadaptive behaviors) [21]. In a prospective cohort study of black HIV-negative MSM in 6 US cities (n = 1144), findings indicated that while seroprotection (defined as serosorting and strategic positioning) was associated with significant reductions in HIV acquisition when compared with CAS without seroprotection, no CAS was associated with the lowest HIV seroconversion risk [22]. As research on seroadaptation strategies among black MSM is emerging in the HIV prevention literature, further research is warranted in understanding potential HIV risk and protective factors associated with seroadaptation practices relevant to this population.

We sought to better understand the role of seroadaptation practices among black MSM in four US cities as a basis to address perceived safer-sex strategies and risk-reduction behaviors in a population that is severely impacted by the HIV epidemic. To date, there has been a significant void in HIV prevention research that focuses on within-group differences for black MSM related to seroadaptation strategies, including the incorporation of a sample with both HIV-negative and HIV-positive men. As seroadaptation practices often involve complex decision-making processes regarding the adoption of perceived safer sex behaviors [25], efforts to identify and understand factors associated with these sexual partner selection strategies among black MSM are critical domains for strengthening prevention strategies to reduce HIV transmission. These considerations are germane and work in collaboration with current national HIV prevention efforts for MSM that articulate the salience of communication with sexual partners regarding HIV testing, condom use, HIV serostatus, and biomedical prevention strategies (e.g., PrEP and PEP) [30]. First, we describe

seroadaptation strategies used by black MSM with their sexual partners. Second, we examine correlates of seroadaptation strategies among black MSM based on demographic, psychosocial, and substance-use factors. Building on previous research [14, 21], these factors were identified as a basis to contribute to our understanding of sexual behavior patterns that are used among black MSM with their sexual partners, which can inform the development and implementation of prevention strategies (e.g., sexual decision-making processes that may contribute to promoting safer-sex practices or facilitating possible risk behaviors).

Methods

This study was designed to conduct randomized trials of different HIV behavioral interventions for black MSM in four US cities: Baltimore, Chicago, Milwaukee, and New York City between 2008 and 2009. Each study site developed its own study protocol and intervention with consensus around eligibility criteria and questionnaire measures [31–33]. Men were eligible if they: were at least 18 years of age, identified as African American or black, had at least two sexual partners (male or female—one of whom must be male) in the past 3 months, reported CAS with a man in the past 3 months, and were willing to have an HIV antibody test [31, 32]. Black MSM were recruited at street and venue locations, by referrals from local organizations and study participants, through recruitment flyers and study cards placed in locations accessed by black MSM, and by advertisements placed in the local gay press and on websites.

At the baseline visit, eligibility was confirmed and written informed consent obtained. Participants completed a behavioral assessment using audio computer-assisted self-interview (ACASI) technology. Following completion of the assessment, all participants received HIV prevention risk-reduction counseling based on Project Respect [33]. A rapid HIV antibody test was conducted if participants self-reported being HIV-negative, or did not know their current HIV status. Participants who reported being HIV infected did not undergo HIV testing if they were able to provide documentation of their HIV-positive status. Preliminary positive rapid test results were confirmed by Western blot testing and if positive, participants were referred to medical and social services. All participants received HIV prevention counseling. The current analysis was based on data collected at the baseline visit prior to any intervention. The institutional review boards at the participating institutions and CDC approved study protocols.

Measures

Demographic Characteristics—Measures for age, years of education, employment, income, sexual identity, health insurance, living situation, resources for necessities, and HIV testing history were included.

Sexual Risk Behavior Measures—Participants were asked about number of male anal sex partners and number of condomless receptive and insertive anal intercourse male partners in the prior 3 months. Number of receptive and insertive anal intercourse episodes, condom use, and alcohol/drug use in conjunction with sex were asked for their two most recent partners (main or non-main), main partner (a man you felt committed to above

anybody else like a boyfriend or lover) and other non-main partners by partner HIV serostatus.

The seroadaptation variable was derived from the above questions and categorized based on previous research [14]: (1) 100 % condom use: condom use for all acts with all partners; (2) serosorting: all partners have the same serostatus as the participant with some CAS episodes; (3) condom serosorting: condomless anal sex with same serostatus partners, 100 % condom use with serodiscordant/unknown status partners; (4) seropositioning: condomless sex was exclusively insertive for HIV-negative men and condomless sex was exclusively receptive for HIV-positive men; (5) none of the above strategies. Of the 31 men not reporting their HIV status, 3 were categorized in the 100 % condom use group and the remaining in the no strategy group.

Alcohol and Drug Use [34]—Heavy alcohol use in the prior 3 months was defined as more than four drinks on at least 4 days a week or more than six drinks on a typical drinking day. Participants were also asked about use of marijuana, ecstasy, cocaine, crack cocaine, methamphetamines, poppers, and erectile dysfunction drugs in the prior 3 months.

Psychosocial Measures

Psychological Distress (10 Items) [35]: Participants rated items such as “In the last month, how often did you feel everything was an effort?” using a 5-point, Likert-type scale from “none of the time” to “all the time” ($\alpha = 0.91$).

Social Support (7 Items) [36]: Participants rated items such as “In the last 3 months, how often did you feel you lacked companionship?” based on a 4-point, Likert-type scale ranging from “never” to “always” ($\alpha = 0.90$).

Sexual Self-efficacy (7 Items) [37]: Participants rated items such as “I can choose safer sex with a man I have sex with regularly” based on a 5-point, Likert-type scale from “strongly disagree” to “strongly agree” ($\alpha = 0.86$).

Religiosity [38]: Participants responded to stand-alone questions assessing frequency of attending religious services, and prayer, as well as the importance of religion.

Perceived Personal Responsibility for Avoiding HIV Infection (5 Items) [39]: Participants rated items such as “It’s very important for me to use condoms to protect myself from HIV” based on a 5-point, Likert-type scale from “strongly disagree” to “strongly agree” ($\alpha = 0.86$).

Perceived Partner Responsibility (2 Items) [39]: Participants rated the statements: “When HIV-positive and HIV-negative men have sex with each other, they have an equal responsibility for being safe” based on a 5-point, Likert-type scale from “strongly disagree” to “strongly agree” ($\alpha = 0.71$).

Outness (3 Items) [40]: Participants were asked about how many people, family members and close friends know that they have sex with men with responses ranging from “none” to “all” based on a 5-point, Likert-type scale ($\alpha = 0.88$).

Internalized Homophobia (4 Items) [41]: Participants responded to statements such as “Sometimes I dislike myself for being sexually attracted to men” based on a 5-point, Likert-type scale ranging from “strongly disagree” to “strongly agree” ($\alpha = 0.91$).

Summed scores were constructed for the scale measures and these variables were analyzed as continuous measures.

Statistical Analysis

Bivariate associations between demographics, sexual risk behavior measures, alcohol/drug use and psychosocial measures, and the seroadaptation variable were conducted. χ^2 tests of association were used for categorical measures and linear models for overall tests of association for continuous measures. Measures that were statistically significant in the bivariate associations at p value <0.05 were selected for the inclusion in multivariate logistic regression models. Based on previous research [42], we used multivariate analysis to examine associations between groups of covariates listed above and seroadaptation practices as a basis to further inform prevention strategies that need to be considered for Black MSM. Final regression models were generated using backward elimination with P-value <0.05 used to retain measures in the model. Four separate regression models were run for each seroadaptation strategy outcome with the ‘No Strategy’ group serving as the comparisons for all models. Although the seroadaptation strategy measure does have an ordinal quality, rather than collapsing strategy groups, we examined four separate models to fully explore the possible associations for each of the seroadaptation strategies. To address the issue of conducting multiple comparisons between the various seroadaptation strategies and no strategy, Bonferroni adjustment, P-value of 0.0125 (0.05/4), was used. The Tukey–Kramer multiple comparison adjustment was conducted where indicated. The variance inflation factor (VIF) was calculated to assess multicollinearity of related measures with a value of greater than 10 as suggestive of multicollinearity. All analyses were conducted in SAS version 9.3 (SAS Institute Inc., SAS/Stat, NC, USA).

Results

Study Population

A total of 916 men completed baseline visits in the four cities. Of those, complete data were available for 851 (92.9 %). Another 16 men were excluded from the analysis since they did not report any anal intercourse in the prior 3 months, for a total of 835 men included in the final analysis.

The mean age of the men was 37.1 (*SD* = 11.0) years with 46.7 % having at least some college education, 48.1 % not currently working, 59.3 % with an income of <$10,000, and 23.7 % reporting that they did not have enough money for necessities at least fairly often (Table 1). Among the 790 men reporting a prior HIV test, 230 (29.1 %) had an HIV test in the prior 3 months, 106 (13.4 %) in the prior 6 months, 101 (12.8 %) in the prior year, and

353 (44.7 %) more than 1 year ago. Three participants did not report a test date and 11 had a test date during study visit so the time of prior HIV test was set to missing for these participants. Of the 804 reporting their HIV status, 52.0 % were HIV-positive. Among the 31 men not reporting their HIV status, 6 reported that their most recent test result was indeterminate or unclear and 25 did not get the results of their test. The mean number of male anal sex partners in the prior 3 months was 6.3 (SD = 11.2) and 60.2 % of men reported having a main partner (Table 2). The most common substances used in the prior 3 months were marijuana (54.9 %), crack cocaine (30.0 %), powder cocaine (20.7 %), and poppers (16.9 %). Two-thirds (66.3 %) of men reported using alcohol or drugs in conjunction with sex.

Seroadaptation strategies in the prior 3 months were reported by 59.8 % of men, with 10.5 % practicing 100 % condom use, 26.5 % serosorting, 7.2 % condom serosorting, and 15.6 % seropositioning. In bivariate analyses, seroadaptation strategies were significantly different by city, age group, sexual identity, and HIV status (Table 1). Men enrolled at the Baltimore site were more likely to practice 100 % condom use and seropositioning, while men enrolled at the Chicago and Milwaukee sites were more likely to practice serosorting. The men enrolled at the New York City site were more likely to practice condom serosorting (X^2 = 29.99, P = 0.003). The youngest men (18–24 years) were the most likely to use no seroadaptation strategy. The older men (35 years+) were most likely to report seropositioning. The 25–34 years old men were the most likely to practice 100 % condom use or condom serosorting (X^2 = 27.34, P = 0.007).

Seroadaptation strategies were also significantly different by select sexual behaviors and use of specific drugs (Table 2). The mean number of partners was highest among men who practiced no specific strategy (*F*-test = 7.88, P <0.001). Men who had a main partner were more likely to practice serosorting and use no strategy compared to men without a main partner (X^2 = 20.30, P < 0.001). Men who used crack cocaine or powder cocaine were more likely to practice seropositioning compared to men who did not use those substances (crack: X^2 = 11.25, P = 0.024, powder cocaine: X^2 = 10.89, P = 0.028); men who used powder cocaine also were more likely to use no strategy. Men who used methamphetamine were more likely to practice condom serosorting or seropositioning compared to men who did not use methamphetamine (X^2 = 10.49, P = 0.033). Men who used alcohol or drugs in conjunction with sex were more likely to practice no specific strategy (X^2 = 16.85, P = 0.002).

Several psychosocial measures differed by seroadaptation strategies (Table 3). The mean psychological distress score was highest (*F*-test = 7.27, P < 0.001) and mean social support score (*F*-test = 5.26, P = 0.0003) and mean sexual self-efficacy score (*F*-test = 9.64, P <0.001) was lowest among those who did not use a specific strategy. Mean social support score was highest among those practicing 100 % condom use (*F*-test = 5.26, P = 0.0003). Psychological distress and social support were highly inversely correlated (−0.64, P <0.001). The VIF was calculated to assess collinearity of the two measures, resulting in VIF values less than the 10, so both measures were included in the initial models. The mean score for personal responsibility to avoid HIV transmission was highest among men practicing condom serosorting and strategic positioning (*F*-test = 2.90, P = 0.021). The mean score for

level of outness was highest among men practicing condom serosorting (*F*-test = 7.30, P < 0.001).

In multivariate analysis (Table 4), compared to men who used no seroadaptation strategies, men who used condoms 100 % of the time were more likely to be from Baltimore [AOR 2.28 (95 % CI 1.16, 4.47)] but less likely to be from Chicago [AOR 0.42 (95 % CI 0.19, 0.93)] (vs. New York City) and less likely to be bisexual [AOR 0.34 (95 % CI 0.19, 0.60)] (vs. homosexual/queer), have higher levels of psychological distress [AOR 0.96 (95 % CI 0.92, 0.99)], and use alcohol and drugs in conjunction with sex [AOR 0.50 (95 % CI 0.28, 0.88)]. They also had a lower number of male partners [AOR 0.93 (95 % CI 0.88, 0.99)] and were more likely to have higher levels of sexual self-efficacy [AOR 1.04 (95 % CI 1.00, 1.09)]. Compared to men who used no seroadaptation strategy, serosorters were older (age group 18–24 vs 45+) [AOR 0.43 (95 % CI 0.23, 0.81)], less likely to be HIV infected [AOR 0.43 (95 % CI 0.27, 0.67)], had fewer male sex partners [AOR 0.90 (95 % CI 0.85, 0.94)], and higher levels of social support [AOR 0.94 (95 % CI 0.90, 0.98)] and sexual self-efficacy [AOR 1.05 (95 % CI 1.02, 1.09)]. Compared to men who did not use a specific seroadaptation strategy, men who used condom serosorting as their approach had less psychological distress [AOR 0.94 (95 % CI 0.89, 0.98)] but were more likely to use methamphetamine [AOR 1.68 (95 % CI 1.12, 2.51)] and reported higher levels of sexual self-efficacy [AOR 1.09 (95 % CI 1.03, 1.14)]. Men who used seropositioning as a strategy were older and more likely to be from Baltimore [AOR 2.08 (95 % CI 1.14, 3.83)]. They were also less likely to be HIV infected [AOR 0.31 (95 % CI 0.19, 0.50)], have a main partner [AOR 0.45 (95 % CI 0.28, 0.72)], and use alcohol or drugs in conjunction with sex [AOR 0.56 (95 % CI 0.34, 0.92)]. They also had higher levels of sexual self-efficacy compared to men who did not use a specific strategy [AOR 1.04 (95 % CI 1.01, 1.08]).

Discussion

In this sample of black MSM in four US cities, findings demonstrated that a high percent (59.8 %) of black MSM engaged in seroadaptation strategies. Among these men, the strategy used by most of the men was serosorting (26.5 %), followed by seropositioning (15.6 %). Only a small proportion of men (10.5 %) reported 100 % condom use. Our study findings are consistent with recent seroadaptation research that indicates that black MSM practice serosorting and strategic positioning behaviors at similar or higher percentages than those observed in larger samples of MSM [20–22, 43]. Our findings advance scientific research with a specific emphasis on describing seroadaptation strategies among black MSM and pose considerable implications for the development and implementation of HIV prevention strategies in this vulnerable population. For example, prior epidemiologic research has indicated that clinical and socio-structural factors have contributed to the disparate HIV infection rates among black MSM: higher prevalence of HIV and other STIs within sexual networks, acute HIV infection, irregular HIV testing patterns, undiagnosed and untreated HIV/STI infections, higher viral load, lower CD4 counts, lower income and inadequate access to health care and treatment (e.g., HIV antiretroviral medications) [5, 44–50]. Taken together, these studies provide a core basis to understanding the sexual contexts related to seroadaptation strategies that contribute to HIV risk behavior and facilitate HIV/STI acquisition and transmission among black MSM. In this regard, prevention efforts

must consider the role of communication with sexual partners regarding HIV serostatus (e.g., HIV disclosure), safer sex strategies, frequency of HIV testing, and condom use among black MSM. This represents a relevant component for HIV prevention with black MSM as serosorting and strategic positioning strategies must be based on accurate knowledge of the HIV serostatus of an individual and that of their sexual partner.

Notably, about half of our sample (44.7 %) did not test for HIV within the last year, as per current CDC HIV testing guidelines, which is disconcerting particularly since our findings observed the utilization of seroadaptation behaviors by a high percentage of black MSM. This finding suggests that some black MSM may be underestimating (seroguessing) their level of HIV risk, the need for regular or more frequent HIV testing, and inaccurately identifying their HIV serostatus [25]. It is also plausible that some black MSM may experience a perceived sense of protection during CAS in that seroadaptation practices have been shown to reduce HIV transmission anxiety based on a lower perception of HIV risk [8]. Our findings highlight the importance of strengthening access to a broader reach of innovative HIV testing and prevention services (e.g., self-testing, couples testing and counseling) for black MSM who practice seroadaptation behaviors to facilitate frequent HIV testing and promote HIV status knowledge [24]. Biomedical prevention strategies (e.g., PrEP) coupled with advanced HIV testing technologies (e.g., fourth generation tests) will be imperative for black MSM who engage in seroadaptation practices to reduce HIV transmission risk and identify individuals who may be HIV undiagnosed and within the acute HIV infection phase.

Geographic differences were also noted in seroadaptative practices. This finding suggests that seroadaptation prevention strategies need to consider the influence of how geographic contexts may foster perceptions about HIV risk behaviors among black MSM, particularly in cities where high rates of HIV transmission is observed [51, 52]. For example, seroadaptation practices may be influenced by messaging in some geographic regions such as New York, which has recently adopted a pre-exposure prophylaxis assistance program (PrEP-AP) for HIV-negative individuals demonstrating high HIV risk to access financial resources for out-of-pocket costs associated with PrEP. Furthermore, we found that older men tended to practice serosorting and seropositioning behaviors. Prevention emphasis needs to be placed on age considerations in the tailoring of seroadaptive interventions as young black MSM are less likely to disclose their HIV serostatus to sexual partners and be aware of the HIV serostatus of sexual partners [7]. In particular, prevention messaging about seroadaptation practices will be pertinent for Black MSM who have been shown to have limited health care access, higher unrecognized HIV serostatus awareness, and lower HIV testing rates [3]. These findings highlight the importance of developing messaging about these current gaps that facilitate the development of greater awareness of misconceptions about the perceived benefits and risks associated with seroadaptation practices.

Much of the HIV prevention research has demonstrated that substance use has had an impact on HIV sexual risk behavior in MSM [53, 54]. Yet, a paucity of studies has examined the role of substance use in connection with seroadaptation strategies among MSM [55]. Chen et al. [56] found that intention to serosort was associated with higher methamphetamine use among HIV-positive MSM and lower methamphetamine use among HIV-negative MSM. In

contrast, findings from a household probability study of MSM from Chicago demonstrated that serosorting was associated with reductions in drug and sexual risk behaviors [57]. To our knowledge, our study reflects one of the first empirical investigations to document the association of specific substance use patterns with seroadaptation strategies in a cohort of black MSM. For example, methamphetamine use was associated with condom serosorting, but seropositioners and those who used condoms 100 % of the time were less likely to use alcohol and drugs in conjunction with sex. These findings corroborate with a growing body of research that has demonstrated that situational contexts influence the convergence of HIV sexual and drug risk behaviors among black MSM [58]. These situational contexts need to be considered for substance-using black MSM who engage in seroadaptive behaviors as well as for men who do not use a seroadaptive strategy. Wilson et al. [59] found that individual and sex partner drug use was associated with increased HIV risk behaviors among black MSM. Research has also indicated that the sexual networks of black MSM who used crack cocaine, compared to other black MSM, were indicative of a higher proportion of HIV-infected, exchange, and combined drug and sex partners as well as a smaller proportion of networks that consistently used condoms with sexual partners [60].

Furthermore, our results regarding the association between condom serosorting and methamphetamine use are similar to studies that have shown that the use of club drugs (e.g., cocaine, crystal methamphetamine) influences sexual role (i.e., insertive or receptive) during anal sex among black and Latino MSM [61]. The use of drugs in combination with sex suggests that some black MSM may utilize substances to reduce inhibitions in facilitating male-to-male sexual behavior and cope with desire, intimacy, emotional connectedness, as well as stigma and marginalization related to sexuality [62–65]. For example, previous research has found that methamphetamine use and HIV sexual risk behavior among black MSM were related to stress indicative of stigmatization as situated in socio-structural contexts (e.g., racism, homophobia) [66]. These studies suggest that culturally relevant prevention strategies need to integrate how substance use influences situational contexts associated with seroadaptative practices among black MSM, while further research is warranted in this area. Our findings suggest the need for the implementation of programs to support substance-using black MSM with negotiation of condom use and the practice of sexual risk behaviors with their sexual partners. For example, previous research has indicated that drug use affects MSM's negotiation abilities to properly use condoms or to accurately determine the serostatus of sexual partners [54]. These prevention efforts need to focus on sexual decision-making processes and communication about sexual practices and HIV serostatus disclosure with sexual partners to reduce sexual and drug risk behaviors.

Our findings indicated that black MSM who practiced serosorting and strategic positioning were less likely to be HIV-infected as compared to men who used no seroadaptation strategy. Formative research on the role of serostatus in relation to seroadaptation strategies has varied in studies among black MSM. Golden et al. [28] reported higher HIV seroconversion rates among black MSM who practiced serosorting compared to white MSM. Marks et al. [21] found that the practice of serosorting and strategic positioning was associated with a lower likelihood of unrecognized HIV infection among black and Latino MSM. Compared to men who practiced CAS and did not report engaging in seroadaptation behaviors, Irvin et al. [22] reported that seroprotection was associated with lower HIV

seroconversion rates when compared with CAS without seroprotection; findings also showed that no CAS was associated with the lowest HIV acquisition risk. We also found that seropositioners were less likely to have a main partner, while serosorters had fewer male partners which has been observed in research on seroadaptation with racially/ethnically diverse samples of MSM [11, 28]. Taken together, these findings suggest that seroadaptation considerations need to be incorporated into HIV testing, counseling, and prevention services for black MSM (e.g., HIV disclosure, sexual agreements with partners) to promote HIV risk reduction. For example, while our findings pose relevant implications for the potential protective effects of the utilization of seroadaptation strategies among black MSM, this population has experienced increased vulnerabilities to HIV/STI infection within their sexual networks.

In terms of psychosocial factors, we also found that social support, sexual self-efficacy, and psychological distress were related to seroadaptation practices among black MSM. For example, higher social support was associated with serosorting, while higher sexual self-efficacy was related to serosorting, seropositioning, condom serosorting, and 100 % condom use among black MSM. Kurtz et al. [67] found that positive coping behaviors and coping self-efficacy were predictive of serosorting among HIV-positive MSM, and social engagement and coping self-efficacy were predictive of serosorting among HIV-negative MSM. These findings also corroborate with recent studies that have reported that social support promotes health care-seeking behaviors among black MSM [68]. One study of black and Latino MSM in three US cities found that men with higher social support were less likely to test HIV-positive, which was mediated by two behavioral pathways: men were more likely to have tested for HIV in the last 2 years prior to assessment, and less likely to have engaged in recent HIV sexual risk behavior with a partner [69]. Harawa et al. [62] found that black MSM articulated healthy condom use attitudes in the promotion of safer sex strategies, HIV disclosure, and HIV-related personal responsibility. We also found that psychological distress was associated with seroadaptation practices among black MSM. Prevention efforts focused of seroadaptive strategies need to address mental health concerns of black MSM in promoting optimal health (e.g., integration of brief screenings for psychological distress and provide social support to mitigate daily stressors) [3, 6]. These findings highlight the importance of promoting social support networks within black MSM communities in addition to integrating HIV prevention strategies that support sexual self-efficacy and optimal mental health in adopting safer sex behaviors when negotiating seroadaptation practices with sexual partners.

Limitations

Our findings from this study should be interpreted considering several limitations. First, the cross-sectional research design poses a limitation in that cause-and-effect relationships or temporal changes over a period of time cannot be assessed. However, for the purposes of this study, the cross-sectional design allowed for data collection from a large proportion of black MSM, a high-risk population, at one point in time across four US cities. Second, data were collected from a convenience sample of black MSM from 4 US cities which may limit generalizability of the study's findings to black MSM from other geographic regions. Third, the intention of seroadaptation practices among black MSM was not assessed in the survey

instrument. This construct may have provided relevant data to understand how behavioral intentions influence seroadaptation practices as a basis to reduce HIV risk. Notably, findings from one recent large-scale study found that seroconcordance was strongly related to UAI for HIV-positive MSM irrespective of intentions for seroadaptation [70]. Fourth, the self-report nature of the data, period of recall, and social desirable responses posed limitations for the study. Research has shown that there is considerable stigma associated with sexual and substance use behaviors, particularly related to HIV risk behaviors [65]. In addition, participants may not have been able to remember the number of instances that they engaged in sexual or substance use behaviors; consequently, they may have under-or over-reported these behaviors. However, studies have demonstrated that the use of ACASI in addition to a 3-month period of recall in the measurement of sexual and substance use behaviors increase the validity of self-report data in samples of black MSM [31].

Conclusions

This study provides a formative contribution to HIV prevention research on seroadaptation strategies among black MSM. Researchers have posited that a strength-based framework must be incorporated into HIV prevention strategies for MSM that build on resiliencies within gay men's communities [71]. Seroadaptation practices have emerged organically as prevention strategies within gay men's communities. As limited prevention interventions have focused on seroadaptation practices among black MSM [8], our findings suggest that HIV/STI prevention strategies need to consider the role of seroadaptation practices and build on core social support networks among black MSM to address perceived safer-sex strategies and risk-reduction behaviors. This remains paramount in the development and implementation of culturally relevant HIV prevention strategies with the objective of increasing regular HIV testing, promoting HIV disclosure, and addressing high rates of unrecognized HIV infections among black MSM. Further research needs to explore the role of social support in facilitating access to biomedical prevention strategies (e.g., PrEP), advanced HIV technologies, and HIV testing approaches (e.g., HIV self-testing) for black MSM who engage in sexual partner selection strategies. Future studies also need to address how social support mechanisms can be used to address stigma associated with the act of CAS when men are engaging in seroadaptation practices. This is particularly relevant as research has shown that anticipated HIV stigma influences delays in HIV testing behaviors [72] and HIV stigma serves as a barrier to HIV disclosure with sexual partners among black MSM [73]. To promote sexual health, a key emphasis needs to be placed on understanding core contextual factors related to how black MSM describe, understand, and experience seroadaptation practices within gay men's communities as well as dyadic primary and casual partner relationships (e.g., situational contexts and cultural and peer norms about seroadaptation practices). Furthermore, prevention strategies need to consider mental health and psychosocial concerns in addition to the intersection of drug use and seroadaptation practices among Black MSM. Prevention strategies are needed to support substance-using black MSM with decision-making about the importance of accurate HIV status knowledge of sexual partners, role that drugs influence on condom use, as well as sexual role during CAS. Future studies need to build on our formative research to assess temporal changes over time to examine longitudinal associations of seroadaptation strategies.

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Table 1

Seroadaptation practices by characteristics of Black men who have sex with men, Baltimore, Chicago, Milwaukee, and New York City (n = 835), 2008–2009

Characteristic	Total		100 % condom use		Serosorting		Condom serosorting		Sero-positioning		No strategy		X^2 test statistic (df), P-value
	N*	%	N	%	N	%	N	%	N	%	N	%	
Total	835	100.0	88	10.5	221	26.5	60	7.2	130	15.6	336	40.2	
City													X^2 (12) = 29.99, 0.003
Baltimore	176	21.1	31	17.6	43	24.4	13	7.4	33	18.8	56	31.8	
Chicago	212	25.4	10	4.7	62	29.3	16	7.6	27	12.7	97	45.8	
Milwaukee	134	16.1	12	9.0	42	31.3	4	3.0	22	16.4	54	40.3	
New York City	313	37.5	35	11.2	74	23.6	27	8.6	48	15.3	129	41.2	
Age group													X^2 = (12 df) 27.34, 0.007
18–24	157	19.5	8	5.1	52	33.1	9	5.7	20	12.7	68	43.3	
25–34	152	18.8	20	13.2	43	28.3	17	11.2	16	10.5	56	36.8	
35–44	265	32.8	30	11.3	54	20.4	13	4.9	47	17.7	121	45.7	
45+	233	28.9	28	12.0	64	27.5	19	8.2	40	17.2	82	35.2	
Sexual identity													X^2(8 df) = 27.98, 0.001
Homosexual/Queer	534	64.0	40	7.5	144	27.0	43	8.1	74	13.9	233	43.6	
Bisexual	245	29.3	40	16.3	63	25.7	17	6.9	41	16.7	84	34.3	
Heterosexual/straight/not sure/other	56	6.7	8	14.3	14	25.0	0	0.0	15	26.8	19	33.9	
Education													X^2(12 df) = 13.46, .337
<High school graduate	142	17.0	17	12.0	34	23.9	9	6.3	22	15.5	60	42.3	
High school graduate/GED	303	36.3	36	11.9	78	25.7	18	5.9	46	15.2	125	41.3	
Some college	289	34.6	28	9.7	84	29.1	18	6.2	46	15.9	113	39.1	
College degree+	101	12.1	7	6.9	25	24.8	15	14.9	16	15.8	38	37.6	
Employment													X^2(8 df) = 9.29, 0.318
Working full/part time	235	28.2	20	8.5	73	31.1	22	9.4	36	15.3	84	35.7	
Not working	401	48.1	43	10.7	99	24.7	25	6.2	67	16.7	167	41.7	
On disability	198	23.7	25	12.6	49	24.8	12	6.1	27	13.6	85	42.9	
Income													X^2(8 df) = 7.33, 0.502

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Characteristic	Total		100 % condom use		Serosorting		Condom serosorting		Sero-positioning		No strategy		X^2 test statistic (df), P-value
	N*	%	N	%	N	%	N	%	N	%	N	%	
<$10,000	492	59.3	59	12.0	123	25.0	32	6.5	77	15.7	201	40.9	
$10,000–29,999	243	29.3	19	7.8	68	28.0	16	6.6	40	16.5	100	41.2	
$30,000+	95	11.5	10	10.5	27	28.4	11	11.6	13	13.7	34	35.8	
Have health insurance													X^2(4 df) = 2.18, 0.703
No	268	32.1	25	9.3	78	29.1	19	7.1	38	14.2	108	40.3	
Yes	566	67.9	63	11.1	142	25.1	41	7.2	92	16.3	228	40.3	
Not enough money for necessities													X^2(12 df) = 17.54, 0.130
Never	280	33.5	26	9.3	88	31.4	26	9.3	37	13.2	103	36.8	
Once in a while	357	42.8	44	12.3	93	26.1	23	6.4	56	15.7	141	39.5	
Fairly often	127	15.2	12	9.5	25	19.7	9	7.1	21	16.5	60	47.2	
Very often	71	8.5	6	8.5	15	21.1	2	2.8	16	22.5	32	45.1	
Current living place													X^2(16 df) = 14.09, 0.592
Own home/apartment	420	50.3	43	10.2	105	25.0	34	8.1	67	16.0	171	40.7	
Family member’s home	161	19.3	18	11.2	53	32.9	6	3.7	22	13.7	62	38.5	
Someone else’s home	123	14.7	11	8.9	30	24.4	12	9.8	23	18.7	47	38.2	
Rooming/boarding/shelter	103	12.3	11	10.7	26	25.2	7	6.8	12	11.7	47	45.6	
On street/other	28	3.4	5	17.9	7	25.0	1	3.6	6	21.4	9	32.1	
Most recent HIV test result (self-report)**													X^2(4 df) = 34.02, < 0.001
Negative	386	48.0	39	10.1	130	33.7	20	5.2	78	20.2	119	30.8	
Positive	418	52.0	46	11.0	91	21.8	40	9.6	52	12.4	189	45.2	

P-value is for overall comparisons using Pearson χ^2 test statistic for categorical measures

*N may not total to 835 due to missing data;

**31 with indeterminate or no results excluded

Table 2

Seroadaptation practices by select sexual behaviors and substance use of Black men who have sex with men, Baltimore, Chicago, Milwaukee, and New York City

Characteristic	Total		100 % condom use		Serosorting		Condom serosorting		Sero-positioning		No strategy		X^2/*F*-test statistic (df), P-value
	N*	%	N	%	N	%	N	%	N	%	N	%	
Main partner													X^2(4 df) = 20.30, <0.001
No	332	39.8	43	12.9	71	21.4	21	6.3	70	21.1	127	38.3	
Yes	503	60.2	45	8.9	150	29.8	39	7.8	60	11.9	209	41.6	
Alcohol/drugs with sex													X^2(4 df) = 16.85, 0.002
No	281	33.7	39	13.9	88	31.3	20	7.1	46	16.4	88	31.3	
Yes	553	66.3	49	8.9	133	24.1	40	7.2	83	15.0	248	44.8	
	Mean	SD	Mena	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Number of male partners	6.3	11.2	4.1	5.5	3.9	4.1	6.4	6.7	5.4	6.2	8.8	16.4	F(4 df) = 7.88, <0.001
Heavy alcohol use													X^2(4 df) = 8.13, 0.087
No	753	90.4	85	11.3	201	26.7	57	7.6	112	14.9	298	39.6	
Yes	80	9.6	3	3.8	20	25.0	3	3.8	17	21.3	37	46.3	
Marijuana													X^2 = 5.97(4 df) 0.201
No	376	45.1	46	12.2	110	29.3	25	6.7	56	14.9	139	37.0	
Yes	457	54.9	42	9.2	111	24.3	35	7.7	73	16.0	196	42.9	
Crack cocaine													
No	582	70.0	64	11.0	162	27.8	47	8.1	76	13.1	233	40.0	X^2(4 df) = 11.25, 0.024
Yes	250	30.0	24	9.6	58	23.2	13	5.2	53	21.2	102	40.8	
Cocaine													X^2(4 df) = 10.89, 0.028
No	660	79.3	74	11.2	186	28.2	51	7.7	98	14.9	251	38.0	
Yes	172	20.7	14	8.1	34	19.8	9	5.2	31	18.0	84	48.8	
Poppers													X^2(4 df) = 6.44, 0.169
No	692	83.1	79	11.4	190	27.5	48	6.9	106	15.3	269	38.9	
Yes	141	16.9	9	6.4	31	22.0	12	8.5	23	16.3	66	46.8	
Erectile dysfunction drug													X^2(4 df) = 3.18, 0.528

Characteristic	Total		100 % condom use		Serosorting		Condom serosorting		Sero-positioning		No strategy		X^2/*F*-test statistic (df), P-value
	N*	%	N	%	N	%	N	%	N	%	N	%	
No	741	89.1	82	11.1	196	26.5	54	7.3	117	15.8	292	39.4	
Yes	91	10.9	6	6.6	24	26.4	6	6.6	12	13.2	43	47.3	
Ecstasy													X^2(4 df) = 2.74, 0.602
No	753	90.4	81	10.8	205	27.2	54	7.2	115	15.3	298	39.6	
Yes	80	9.6	7	8.8	16	20.0	6	7.5	14	17.5	37	46.3	
Heroin													X^2(4 df) = 4.96, 0.291
No	774	92.9	77	10.0	205	26.5	56	7.2	120	15.5	316	40.8	
Yes	59	7.1	11	18.6	16	27.1	4	6.8	9	15.3	19	32.2	
Methamphetamine													X^2(4 df) = 10.49, 0.033
No	791	95.1	87	11.0	213	26.9	53	6.7	120	15.2	318	40.2	
Yes	41	4.9	1	2.4	8	19.5	7	17.1	9	22.0	16	39.0	

Table 3

Seroadaptation practices by psychosocial determinants of Black men who have sex with men, Baltimore, Chicago, Milwaukee, and New York City

Characteristic	Total		100 % condom use		Serosorting		Condom serosorting		Sero- positioning		No strategy		X^2/*F*-test statistic (df), P-value
	N*	%	N	%	N	%	N	%	N	%	N	%	
Frequency of attending religious services													X^2(16 df) = 7.46, 0.963
Never	175	21.0	21	12.0	39	22.3	12	6.9	32	18.3	71	40.6	
1–2 times/year	208	24.9	23	11.1	56	26.9	16	7.7	33	15.9	80	38.5	
Every month	126	15.1	10	7.9	36	28.6	7	5.6	22	17.5	51	40.5	
1–2 times/month	148	17.7	16	10.8	41	27.7	11	7.4	23	15.5	57	38.5	
≥Every week	178	21.3	18	10.1	49	27.5	14	7.9	20	11.2	77	43.3	
Frequency of praying													X^2(8 df) = 9.35, 0.313
≤Every week	260	31.2	30	11.5	67	25.8	15	5.8	42	16.2	106	40.8	
More than once/week	160	19.2	13	8.1	41	25.6	20	12.5	23	14.4	63	39.4	
Every day	414	49.6	44	10.6	113	27.3	25	6.0	65	15.7	167	40.3	
Importance of religion/spirituality													X^2(8 df) = 3.80, 0.875
Not at all/somewhat	199	23.9	17	8.5	59	29.7	12	6.0	33	16.6	78	39.2	
Very	309	37.1	37	12.0	78	25.2	25	8.1	44	14.2	125	40.5	
Extremely	326	39.1	33	10.1	84	25.8	23	7.1	53	16.3	133	40.8	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Psychological distress (higher = higher distress)	20.0	7.4	18.30	6.55	18.76	6.63	18.08	6.23	20.66	7.56	21.43	7.97	F(4 df) = 7.27, <0.001
Social support (lower = more support)	14.1	4.9	13.10	4.65	13.26	4.60	13.40	3.70	14.76	5.66	14.81	4.89	F(4 df) = 5.26, 0.0003
Sexual self-efficacy (higher = higher efficacy)	24.3	7.0	25.58	6.88	25.86	7.07	26.00	6.64	24.18	6.62	22.61	6.76	F(4 df) = 9.64, <0.001
Personal responsibility to avoid HIV transmission (higher = more responsibility)	21.0	4.4	21.33	4.42	21.37	4.40	21.43	4.35	21.44	3.85	20.34	4.45	F(4 df) = 2.90, 0.021
Partner responsibility for safety (higher = more responsibility)	5.9	2.6	6.05	2.69	5.80	2.76	6.00	2.77	5.56	2.61	6.07	2.4	F(4 df) = 1.06, 0.376
Outness (higher = more out)	9.8	4.1	8.44	4.14	9.58	4.11	10.95	3.59	9.04	4.43	10.48	3.91	F(4 df) = 7.30, <0.001
Internalized homophobia (higher = higher internalized homophobia)	9.8	5.1	10.51	4.83	9.66	5.06	8.30	4.74	10.32	5.22	9.74	5.23	F(4 df) = 2.11, 0.078

Pearson χ^2 test statistic for categorical measures and ANOVA with Tukey multiple comparison adjustment for continuous measures

Table 4

Multivariate analysis of seroadaptation practices compared to no strategy among Black men who have sex with men, Baltimore, Chicago, Milwaukee, and New York City

Characteristic	100 % condom use (N = 375)		P-value	Serosorting (N = 505)		P-value	Condom serosorting (N = 349)		P-value	Seropositioning (N = 415)		P-value
	OR	95 % CI		OR	95 % CI		OR	95 % CI		OR	95 % CI	
City												
Baltimore	**2.28**	**1.16, 4.47**	**0.017**							**2.08**	**1.14, 3.83**	**0.018**
Chicago	**0.42**	**0.19, 0.93**	**0.034**							0.69	0.37, 1.28	0.241
Milwaukee	0.72	0.32, 1.64	0.439							1.03	0.52, 2.04	0.944
New York City	REF											
Age group												
18–24				**0.43**	**0.23, 0.81**	**0.009**	0.51	0.20, 1.27	0.148	**0.34**	**0.16, 0.72**	**0.004**
25–34				0.77	0.42, 1.42	0.404	1.56	0.70, 3.47	0.274	0.51	0.24, 1.09	0.083
35–44				**0.57**	**0.34, 0.95**	**0.031**	0.51	0.23, 1.13	0.950	0.73	0.41, 1.29	0.273
45+				REF			REF			REF		
Sexual identity												
Homosexual/Queer	REF											
Bisexual	**0.34**	**0.19, 0.60**	**0.0002**									
Heterosexual/straight/not sure/other	0.72	0.26, 2.00	0.523									
Most recent HIV test result (self-report)												
Negative				REF						REF		
Positive				**0.43**	**0.27, 0.67**	**0.0002**				**0.31**	**0.19, 0.50**	**<0.0001**
Crack cocaine												
Cocaine												
Methamphetamine							**1.68**	**1.12, 2.51**	**0.012**			
Psychological distress (higher = higher distress)	**0.96**	**0.92, 0.99**	**0.023**				**0.94**	**0.89, 0.98**	**0.005**			
Social support (lower = more support)				**0.94**	**0.90,0.98**	**0.004**						
Sexual self-efficacy (higher = higher efficacy)	**1.04**	**1.00, 1.09**	**0.046**	**1.05**	**1.02, 1.09**	**0.001**	**1.09**	**1.03, 1.14**	**0.001**	**1.04**	**1.01, 1.08**	**0.021**
Personal responsibility to avoid HIV transmission (higher = more responsibility)												
Outness (higher = more out)												

Characteristic	100 % condom use (N = 375)		P-value	Serosorting (N = 505)		P-value	Condom serosorting (N = 349)		P-value	Seropositioning (N = 415)		P-value
	OR	95 % CI		OR	95 % CI		OR	95 % CI		OR	95 % CI	
Main partner												
No										**REF**		
Yes										**0.45**	**0.28, 0.72**	**0.001**
Alcohol/drugs with sex												
No	**REF**									**REF**		
Yes	**0.50**	**0.28,0.88**	**0.017**							**0.56**	**0.34, 0.92**	**0.022**
Number of male partners	**0.93**	**0.88,0.99**	**0.023**	**0.90**	**0.85, 0.94**	**<0.001**						

N's in the models do not add up to the total strategy category N's due to missing data

Bold values indicate statistically significant results