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Black MSM and HIV Testing History Levels in the Clinical and Nonclinical Settings

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2020

Abstract

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by

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Black men who have sex with men (BMSM) are more likely unaware of their HIV status, are less likely to get tested annually, and prefer to use HIV testing services (HTS) in the nonclinical settings, compared to other MSM subgroups. Guided by the behavioral model for vulnerable populations and a cross-sectional quantitative design, three substudies were conducted using secondary data for 1189 BMSM, 18 years or older, from the HIV Prevention Trial Network 061 Study. Chi-square, multinomial logistic regression (MLR), and z-test methods were used to examine the association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months (never tested; tested once; tested more than once) between the clinical and nonclinical settings. Reported results showed no statistically significant difference between settings. However, HIV testing history levels in the past year were significantly associated with age (inversely) and positively with education attainment (predisposing factors) in both settings, and negatively with health insurance status (enabling factor) in the clinical setting. BMSM aged 18-28 were 75% more likely, the uninsured were 89% less likely, and those with some college were 10% less likely to use HTS in the nonclinical relative to the clinical setting. In bivariate MLR, the uninsured were less likely (OR = .67, p = .11) in the prior year to get tested more than once in the nonclinical setting compared to the clinical setting (OR = 1.28, p = .35). The positive social change impact of the revealed associations includes the potential to inform a combination of targeted and routine-based strategies to promote more frequent testing to help detect acute infections and reduce transmissions from those unaware of their status.

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Dedication

Firstly, this dissertation is dedicated to the participants who volunteer their precious time to support biomedical HIV clinical research trials. Secondly, I also dedicate this dissertation to researchers who spearhead the development, implementation, and conduct of biomedical HIV clinical research trials. Over the past 3 decades, the continued dedication from both volunteers and researchers to support biomedical HIV clinical research trials has significantly contributed to the pipeline of innovative and effective HIV prevention and treatment interventions.

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Part 1: Overview

Introduction

The human immunodeficiency virus (HIV) epidemic continues to be a global public health challenge, despite significant advancements in prevention, treatment, and care management (Joint United Nations Programme on HIV/AIDS [UNAIDS], 2019a). In the United States, HIV infections are unevenly distributed geographically and demographically. The Centers for Disease Control and Prevention [CDC] (2018, 2019b, 2020) reported that over 50% of new HIV diagnoses in 2017 and 2018 were accounted for by less than 50 counties, with a disproportionately high burden of infections in mostly rural areas in the southern United States and among minority population groups. According to the CDC (2019a, 2020), the annual HIV diagnoses remained steady in the United States from 2012-2016; however, men who have sex with men (MSM) represented over 60% of all new HIV diagnoses, with almost 40% were Black MSM (BMSM).

The delayed or infrequent use of HIV testing services (HTS) among BMSM contributes to the infrequent HIV testing history and disproportionately high undiagnosed infection, incidence, and prevalence rates (CDC, 2019a, 2019b, 2020). Although BMSM are more likely to use HTS compared to other MSM subgroups, they are less likely to get tested in the past 12 months (DiNenno et al., 2017; Liu et al., 2019; Patel et al., 2019). Efforts to address the high HIV incidence and prevalence rates among BMSM include the increased uptake of HTS to help detect early HIV infections, promote immediate linkage to antiretroviral therapy (ART), achieve viral suppression, and reduce HIV transmission

(Fauci, Redfield, Sigounas, Weahkee, & Giroir, 2019; Wejnert et al., 2018). The CDC recommends at least annual HIV testing for sexually active BMSM at higher risk for HIV since they will benefit from more frequent use of HTS (more than one HIV test) in the past 12 months (Branson, Handsfield, & Lampe, 2006; DiNenno et al., 2018). The provision of HTS (at test locations in either clinical and nonclinical settings) encompasses a broad range of comprehensive services, including pre- and post-HIV test counseling, testing, and linkage to prevention and treatment services (UNAIDS, 2017). Frequent testing in the past 12 months may help detect early and previously missed infections to a support robust HIV prevention and treatment continuum (UNAIDS**,** 2017).

Levy et al. (2014) and Sheehan et al. (2017) showed an association between delayed HIV diagnosis among MSM subgroups and individual and structural factors. The researchers reported that rural residence was a significant predictor of delayed HIV diagnosis for Black and Latino MSM, considering limited health system resources. Structural barriers and facilitators—including stigma, discrimination, and availability of health care resources—also impact access and utilization of HTS (Levy et al., 2014). Also, multilevel factors—including those associated with health system-related factors (such as provider attitudes and behaviors) and population characteristics (such as sociodemographic and health behaviors) in the clinical or nonclinical settings—impede or facilitate access and utilization of HTS (Geter, Herron, & Sutton, 2018; Elgalib, Fiedler, & Sabapathy, 2018; Leblanc, Flores, & Barroso, 2016). Provider-initiated HIV testing outcomes in different settings—urban and rural sites—were influenced by health system-related factors associated with attitudes about counseling HIV positive patients, judgment about referring patients for testing, limited resources to support comprehensive testing activities, and job dissatisfaction (Ahmed, Bärnighausen, Daniels, Marlink, & Roberts, 2016).

Reif, Safley, McAllaster, Wilson, and Whetten (2017) showed that health system-related factors in various settings (including clinical and nonclinical or nontraditional) contributed to the geographic and demographic disparities in HIV incidence and prevalence rates among key populations. These factors include provider attitudes (stigma), beliefs and behaviors (discrimination), institutional policies, cost of services and financing programs, and availability of community support and integrated services. Provider-related priorities associated with institutional responsibilities also influence the routine screening of HTS (Bares et al., 2016). These health system-related factors may affect the equitable provision of HTS in clinical and nonclinical settings (Beach et al., 2018; Elopre et al., 2018; Garfield, Damico, & Orgera, 2020; Simeone, Seal, & Savage, 2017).

Provider-related judgment about cost and cost-effectiveness of offering HTS (health system-related factor) based on health insurance status and ability to pay for HTS (population characteristic) influenced the provision of HTS (Rizza, MacGowan, Purcell, Branson, & Temesgen, 2012). The missed opportunities to offer HTS has significant implications on the HIV testing frequency in populations most impacted by the HIV epidemic. Therefore, BMSM population characteristics and the health system-related factors unique to the HIV testing location setting may also influence more frequent HIV testing history levels (defined as the number of HIV tests received in the past 12 months or year). Efforts to promote more frequent use of HTS should consider population characteristics and health system-related factors that may impede or facilitate more frequent use of HTS in both clinical and nonclinical settings among at-risk populations, such as BMSM (Branson et al., 2006; CDC, 2019b; DiNenno et al., 2017, 2018; US Preventive Services Task Force [USPSTF], 2019).

Overall Problem Statement

The annual number of new HIV diagnoses in the United States has remained relatively steady; however, there are geographic and demographic regional differences (CDC, 2019b). BMSM in the United States, especially those aged 25-34 years, have delayed or infrequent use of HTS, less frequent HIV testing history, and a high rate of undiagnosed infections (CDC, 2019a, 2019c, 2020; Liu et al., 2019). Despite the CDC recommendation that sexually active BMSM get screened at least once annually in clinical and nonclinical settings (DiNenno et al., 2017), they are less likely to have tested in the past 12 months and more likely to be unaware of their positive status and at increased risk of HIV transmission (Eisinger, Dieffenbach, & Fauci, 2019). Also, BMSM are more likely to be tested at nonclinical settings (nontraditional testing locations, such as community-based HIV street outreach programs) than clinical settings (such as facility-based primary care clinics) compared to other MSM subgroups (CDC, 2019b; Liu et al., 2019).

Marano et al. (2018) found that BMSM accounted for only 6% of all HIV tests and 36% of confirmed positive results at the CDC-funded nonclinical settings in the southern United States, thus underscoring the underutilization of HTS among BMSM who are at-risk for HIV. Health providers should offer more testing opportunities in clinical and nonclinical settings (Dailey et al., 2017) since BMSM can benefit from more frequent HIV testing history to help identify early and previously missed HIV infections. Health system-related factors, including provider and testing location attributes, were found to influence the provision of HIV prevention and treatment programs (Beach et al., 2018; Elgalib et al., 2018; James et al., 2019; Leblanc et al., 2016). Examining the broader health system-related factors is essential in informing interventions to increase more frequent use of HTS among impacted population groups.

DiNenno et al. (2018) shared findings from studies that examined the benefits of frequent screening and suggested further research to characterize and compare factors, including individual risk factors that enhance HIV acquisition, associated with more frequent use of HTS versus the annual frequency recommended by the CDC. Factors that affect HIV acquisition among BMSM include individual risk behaviors related to multiple sexual partners, sexually transmitted disease (STD) or sexually transmitted infections (STIs), syphilis, and substance use, drug, or alcohol use (Dailey et al., 2017). Health provider testing locations influence the use of HTS, considering the health-seeking behavior for STD or STI and substance use services, the perceived risk of HIV acquisition (with at-risk BMSM more likely to get tested), and the preference to receive HTS in clinical and nonclinical setting (Elopre, Kudroff, Westfall, Overton, & Mugavero, 2017; Levy et al., 2014; Marks et al., 2017; Reif et al., 2019). Other factors that impede or facilitate the use of HTS are age, education attainment, income level, health insurance status, and having a preferred provider (Lo, Runnels, & Cheng, 2018; Witzel et al., 2019).

As noted, researchers have examined factors that influence the use and benefits of HTS (Beach et al., 2018; Dailey et al., 2017; Elgalib et al., 2018 Elopre et al., 2017; Lo et al., 2018). However, there is a lack of information and understanding about how these factors—especially those associated with risk behaviors—impede or facilitate more frequent use of HTS (DiNenno et al., 2018). Previously mentioned studies did not examine the more frequent use of HTS by examining the number of HIV tests received in the past 12 months or year in the clinical and nonclinical settings. This study is unique because it investigated the correlates associated with more frequent use of HTS in the past 12 among BMSM at higher risk for HIV infections and compared associations in the clinical and nonclinical settings and between settings. Three HIV testing history levels—categorized as never tested, tested once, and tested more than once—measured the more frequent use of HTS in the past 12 months (in alignment with the CDC annual screening recommendation) in the clinical and nonclinical settings.

Purpose of the Study

This quantitative study utilized secondary data collected via automated self-reported and interviewer-led survey questionnaires from BMSM at higher risk for HIV infections. This study sought to address the literature gap on the lack of information and understanding about the correlates of more frequent use of HTS (more than one HIV test) in the past 12 months in the clinical and nonclinical settings and to compare associations between settings. This present study examined the associations between BMSM population characteristics—age, education attainment, income level, health insurance status, having a preferred provider, and health-seeking behavior for STD and substance use services—independent variables, and more frequent use of HTS defined by the HIV testing history levels in the past 12 months (dependent variable) in the clinical and nonclinical settings. Compared to previous studies that examined factors that influence the use of HTS, this study examined and compared associations with three HIV testing history levels in the past 12 months or year (never tested, tested once, and tested more than once) in the clinical and nonclinical settings.

Social Change Impact

An estimated 40% of new HIV infections among BMSM are accounted for by those unaware of their HIV positive status (CDC, 2019c; Eisinger et al., 2019; Li, Purcell, Sansom, Hayes, & Hall, 2019). More frequent HIV testing history levels in the past 12 months may increase the opportunity to identify new and previously undiagnosed HIV infections and reduce HIV transmission from those unaware of their HIV positive status (Fauci et al., 2019; USPSTF, 2019). The positive social change implication for this study's outcomes included the potential to help inform intervention strategies to improve the uptake of HIV testing, prevention, and treatment services. More frequent testing in the past 12 months may help address the delayed or infrequent use of HTS, influence HIV testing history, and help reduce the number of undiagnosed infections and HIV transmission.

Theoretical Framework

The Gelberg-Anderson behavioral model for vulnerable populations (ABM) underpinned this study (Gelberg, Andersen, & Leake, 2000). The ABM expands the behavioral model of health services use, initially developed by Andersen (1995) and extended by Gelberg et al. (2000), to include vulnerable groups' characteristics. BMSM experience vulnerabilities, such as discrimination and stigma, which contribute to their risk of HIV infection (Pellowski, Kalichman, Matthews, & Adler, 2013; Saleh, van den Berg, Chambers, & Operario, 2016; Singh, Song, Johnson, McCray & Hall, 2018). The fourth iteration of this behavioral model in Figure 1 encompasses four domains: healthcare system environment—clinical and nonclinical settings, population characteristics—predisposing, enabling, and need factors, health behavior—use of health services health outcomes.

The ABM posits that the utilization of health services (such as HTS) is influenced by factors attributed to the four domains to facilitate or impede use. Aday and Andersen (1974) also examined the interrelation between health system environment and population characteristics to explain further the difference between access to and use of health services. Health-related factors, including limited health resources in specific health settings, may challenge BMSM access to HTS (Geter, Herron, & Sutton, 2018). The need and enabling factors—identified as significant predictors of health service use—predisposing factors as characteristics, attitudes, values, and demographics, may also impact health services utilization. This study explored the healthcare system environment, population characteristics, and health behavior domains.

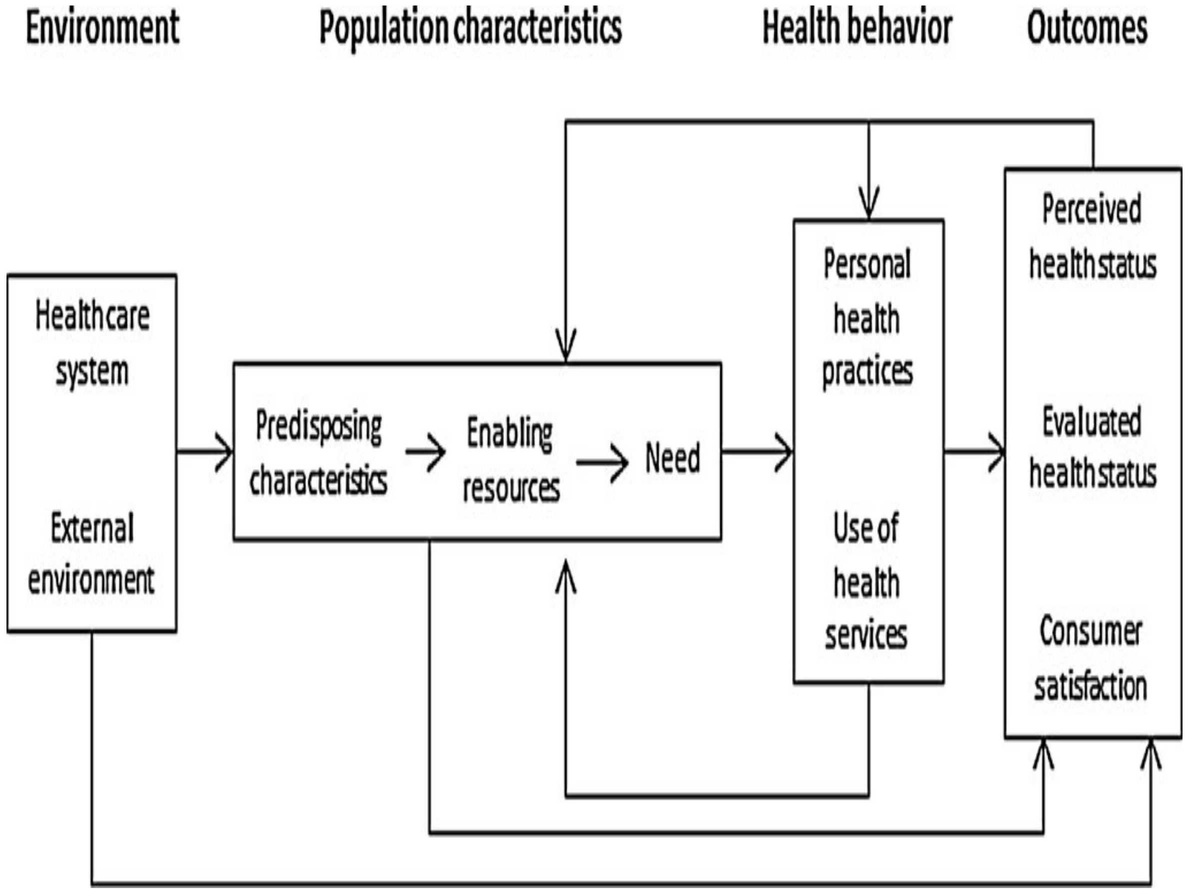

Figure 1. The behavioral model of health services use. Adapted from "Revisiting the behavioral model and access to medical care: Does it matter?" by R. M. Andersen, 1995, *Journal of Health and Social Behavior*, *36*(1), p. 1-10.

The ABM has been applied extensively by researchers in multiple health disciplines and population groups to explain the utilization of health services (Azfredrick, 2016; Doshi et al., 2013; Elopre et al., 2018; Lo et al., 2018; Sogarwal, Madge, Bishi, Woleng, & Garg, 2016; Von Lengerke, Gohl, & Babitsch, 2014). The qualitative study conducted by Doshi et al. (2013) among Black men in the southern United States generated in-depth information about the influence of health system environment, population characteristics, and health behavior in utilizing health services. The significance of having health insurance coverage—an enabling factor—in facilitating access and use of HIV testing services—STI testing—was also examined. The receipt of comprehensive quality services at a conveniently located facility, a health system environment, was also reported as a facilitator for health services. The health system environment or health system-related factors encompasses provider-level factors (Elopre et al., 2018).

Sogarwal et al. (2016) applied the ABM to identify risk factors related to the Hepatitis C virus (HCV) by examining the predisposing, enabling, and need factors associated with the use of HCV testing services among people who inject drugs (PWID). Predisposing factors (education), enabling factors (location of residence), and need factors (use of health services for substance use) facilitated the use of HCV testing services. Significant predictors identified by Sogarwal et al. included the location of residence or type of setting-specific differences and level of services offered at each setting. The ABM guided examination of the associations between population characteristics and reproductive health services among adolescent girls (Sogarwal et al., 2016). The findings reported from Sogarwal et al. showed that age (predisposing factor), type of reproductive health facility (enabling factor), and emotional condition (need factor) predicted the use of reproductive health services. The enabling and need factors were identified as significant predictors (Sogarwal et al., 2016).

This study applied the ABM to examine the association between population characteristics and more frequent use of HTS in the clinical setting, such as facility-based primary care clinics, and nonclinical or nontraditional setting, such as community-based HIV street outreach programs, among at-risk BMSM (CDC, 2016). The two types of HIV testing location settings—clinical and nonclinical settings— represent the health system-related factors associated with the health system environment domain. A systematic review by Babitsch, Gohl, and von Lengerke (2014) generated an extensive list of studies that utilized secondary data and applied the ABM and found significant variations in the operationalization of variables across the four domains. For this study, the ABM was the appropriate theoretical framework to guide and examine the associations between variables. The independent variables examined were predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behaviors for STD and substance use services) factors. The dependent variable was HIV testing history levels in the past 12 months—categorized as never tested, tested once, and tested more than once—among BMSM in the clinical or nonclinical settings.

Background

Highlights of the Global HIV Epidemic

Globally, by the end of 2018, an estimated 1.7 million people were newly diagnosed with HIV infections (UNAIDS, 2019b). About 37.9 million were people living with HIV (PLWH), 24.5 million linked to ART, and 770,000 AIDS-related deaths (UNAIDS, 2019b). Regional differences in the HIV epidemic burden are evident from the global statistics on PLWH and newly diagnosed HIV infections (UNAIDS, 2019b). Eastern and Southern African regions—with 20.6 million PLWH and 800,000 new infections—are the most impacted by the HIV epidemic, followed by the Western, Central Europe, and North America regions—with 2.2 million PLWH and 68,000 new infections. Although there has been significant progress in HIV treatment and care, with over 50% of PLWH worldwide now linked to ART, about 21% of PLWH are still unaware of their HIV positive status and hence at-risk of HIV transmissions (UNAIDS, 2019a, 2019b). There are also regional differences among key populations and various age groups. For instance, in South Africa, adolescent girls—aged 15-24 years—have the highest-burden of HIV infections (UNAIDS, 2019a, 2019b). Whereas in the United States, MSM aged 25-34 years are the most impacted population group (CDC, 2019c; UNAIDS, 2019b).

Improving access and utilization of HTS is a significant step towards detecting new and previously undiagnosed HIV infections and the initiation of HIV prevention and treatment services (UNAIDS, 2018a). Global efforts to end the HIV epidemic, including the Sustainable Development Goal 3 by 2030 (UNAIDS, 2015) and the UNAIDS (2014)

90-90-90 target goals by 2020, address the importance of improving access and utilization of HTS in populations most impacted by the HIV epidemic. Many countries have also enacted country-specific initiatives, including the United States (U.S.) department of health and human services (USDHHS) initiative, “Ending the HIV Epidemic: A Plan for the United States.” This initiative aims to reduce 75% of HIV infections in the United States within 5 years and 90% within 10 years (Giroir, 2020; Fauci et al., 2019). The first pillar of the USDHHS initiative underscores the importance of HIV testing, using innovative testing strategies to diagnose HIV infections among populations most impacted by the HIV epidemic (Fauci et al., 2019; UNAIDS, 2017; World Health Organization [WHO], 2019). Efforts toward addressing the HIV epidemic in the United States, considering the existing regional disparities, should include setting-specific, routine, and targeted intervention strategies focused on population characteristics, such as sociodemographic, health-indicators, and health behaviors, to promote more frequent use of HTS.

HIV Epidemic in the United States

The HIV epidemic in the United States is also unevenly distributed across the country, with more than 1 million PLWH and about 15% unaware of their HIV positive status (CDC, 2019c, 2020). The significant impact of the roll-out of effective HIV prevention and treatment interventions has contributed to the steady rate of annual HIV diagnoses from 2012-2016 and the improved health outcomes among PLWH (CDC, 2019a, 2019c). However, there are differences across population groups, as is evident from the disproportionate burden among MSM (CDC, 2019b). The reported rate of HIV diagnosis per 100,000 population from 2013-2018 across racial ethnic groups, age range at time of diagnosis, and HIV transmission categories was highest for Black African Americans, persons aged 25-34 years, and those engaging in male-to-male sexual contact, respectively (CDC, 2019c). The estimated incidence, prevalence, and undiagnosed rates reported from a national HIV surveillance dataset revealed higher percentages among BMSM, aged 25-34 (Singh et al., 2018).

During the 1980s, HIV/AIDS was considered a fatal disease; however, at present, it is regarded as a chronic disease as a result of the significant milestones achieved in prevention and treatment interventions over the last 3 decades (Tseng, Seet, & Phillips, 2015). The clinical evidence that there is a negligible risk of HIV transmission from virally suppressed persons with undetectable viral levels marked a pivotal contribution to HIV prevention and care continuum (UNAIDS, 2018b). However, multiple factors influence HIV prevention and treatment services; hence, requiring a multidisciplinary and multifaceted approach to address these challenges.

The underutilization of HTS by at-risk population groups is a significant challenge in addressing the HIV epidemic. For instance, the first step in accessing a wide range of HIV prevention and treatment interventions is to get tested, followed by potential offerings, including the linkage and sustained use of ART (for PLWH) towards achieving viral suppression. According to Pitasi et al. (2018), the increased annual HIV screening from high-risk populations enhances the opportunity to detect new HIV or previously missed infections, reduces the HIV morbidity and mortality rates, and improves overall health outcomes for PLWH. Kelly (2019) emphasized the need to promote more frequent testing among populations at higher risk for HIV, such as BMSM, towards achieving the USDHSS goal to end the United States HIV epidemic.

A systematic review conducted by DiNenno et al. (2017) revealed that less than half of MSM had tested within the past 12 months. Patel et al. (2019) examined the frequency of ever having tested for HIV and ever tested in the past 12 months among adult Blacks and those aged 25-34. Patel et al. found that Blacks were less likely to have to get tested in the past 12 months, although they had the highest trends in HIV testing from 2011-2016. The infrequent and delayed testing rates among persons at-risk for HIV— sexually active BMSM with risk factors for substance use and STD—contributes to the high undiagnosed incidence and prevalence rates (CDC, 2019a, 2019c, 2020).

BMSM are more likely to receive HTS in the nonclinical versus clinical settings and less likely to use HTS in the past 12 months compared to other MSM subgroups (CDC, 2019b; DiNenno et al., 2017). It is imperative to promote more frequent HIV testing history in the past 12 months among BMSM to help identify new and previously undiagnosed HIV infections by examining previously reported factors that influence the use of HTS in the clinical and nonclinical test locations. Developing innovative strategies to increase the frequent use of HTS among those at increased risk of HIV infections requires a systematic approach to guide efforts in examining the influence of multilevel facilitators and barriers that contribute to the delayed or infrequent use of HTS in the clinical and nonclinical settings.

Application of the Gelberg-Andersen Behavioral Model for Vulnerable Populations

A systematic approach guided by the ABM was employed in this present study to examine the population and health system environment characteristics (described in this study as the health system-related factors). The ABM depicts that population characteristics associated with predisposing (such as age), enabling (such as health insurance status and preferred primary provider), and need-related determinants (such as perceived or evaluated need for health services) impede or facilitate the use of health services (Andersen,1995; Gelberg et al., 2000). The outcomes reported by Stein, Andersen, and Gelberg (2007) underscore the rationale for employing the ABM as the theoretical framework for this study, considering that BMSM is a vulnerable population facing unique challenges.

The population-based factors examined by Stein et al. (2007) provided insights about the disadvantaged impact on White women and highlighted the impact of homelessness in influencing health service use (Stein et al., 2007). Study findings from Andersen et al. (2000) showed that the lack of enabling resources impacted the access and utilization of highly active antiretroviral therapy (HAART) for sexual minorities and African Americans living with HIV. The influence of predisposing (including age, partner status, employment status, and education level), enabling (health insurance status), and need (binge drinking coupled with depression and anxiety) factors on lifetime HIV testing across racial-ethnic groups was investigated by Lo et al. (2018) using the model of health care utilization.

Health system-related factors also play an essential role in further examining the use of health services. The findings reported by Sogarwal et al. (2016) highlights the setting-specific characteristics that may influence the use of HCV testing services among PWID in two unique settings in India. The testing setting with an extensive history servicing the PWID population and resources reported higher HCV testing services utilization. The challenges associated with integrating community health workers (CHW) in several communities to promote health services and care management included the lack of knowledge, concerns about maintaining confidentiality, and conflict with the community leader role (Rachlis et al., 2016). The researchers concluded that addressing the health system-related factors associated with CHW characteristics (such as lack of knowledge) was necessary to effectively integrate CHW into the health system environment and support their communities.

Therefore, the ABM is an appropriate theoretical framework to guide the systematic investigation of barriers and facilitators associated with population characteristics and health system-related factors that influence the underutilization of HTS among BMSM. Applying the ABM generated additional insights to inform strategies to promote more frequent use of HTS in the clinical and nonclinical settings.

Health System-Related Factors: Clinical and Nonclinical Health Settings

Health system-related factors—including provider attitudes, health practices, and availability of health resources—contribute to the disparities at the different types of provider settings, namely, clinical and nonclinical (Elgalib et al., 2018; Leblanc et al., 2016; Levy et al., 2014; Reif et al., 2017). According to the CDC (2019b, pp. 25-26), the two types of HIV testing locations are clinical settings ("private doctor's office, emergency department, hospital, community health center") and nonclinical settings ("HIV counseling and testing site, HIV street outreach program or mobile unit, needle exchange program, or home." BMSM compared to WMSM were more likely to get tested in a nonclinical setting (34.2% versus 24.7%) and less likely in a clinical setting (57.1% versus 70.3%), respectively (CDC, 2019b).

Offering both targeted, risk-based (in nonclinical settings) HTS strategies and routine, universal, non-risk-based (in clinical settings) HTS strategies will help provide the opportunity to increase the number of HIV tests received towards addressing the undiagnosed HIV testing rates (Branson et al., 2006; Miller et al., 2017). Targeted or tailored testing strategies at nonclinical settings, such as a community-based organization (CBO), identified more HIV infections among sexual minority youth of color than in clinical settings (Miller et al., 2017). The impact of structural barriers—including the availability of culturally competent, targeted strategies and reliable services associated with the broader health system environment—has significant implications for the access and utilization of HTS (Levy et al., 2014). The HIV testing patterns of MSM who frequently used the internet revealed the need for targeted testing approaches using innovative and nontraditional strategies to promote testing among at-risk MSM (Noble, Jones, Bowles, DiNenno, & Tregaer, 2017).

Factors that facilitate the use of HTS among MSM, analyzed from data generated from a large-scale HIV testing initiative at both clinical and nonclinical settings, revealed that targeted testing approaches improved the use of HTS among racially diverse ethnic groups (Clark et al., 2019). Contrary to previous studies, this study examined the associations between population characteristics and the more frequent utilization of HTS in the past 12 months among BMSM in the clinical and nonclinical settings.

HIV Testing Services in the Clinical and Nonclinical Settings

Underutilization of HTS—infrequent or delayed use—contributes to the undiagnosed HIV infections and delayed linkage to effective treatment interventions. HTS encompasses the comprehensive menu of services, including HIV testing, counseling, and link to HIV prevention interventions if HIV negative, and ART services, if HIV positive (UNAIDS, 2017). Innovative HTS strategies and models, including HIV self-testing, rapid point of care kits, and targeted approaches in the nonclinical settings, and routine testing methods in the clinical settings, have revolutionized the HIV field and enhanced the engagement of hard-to-reach populations (WHO, 2019). The importance of HIV testing as an access point for HIV prevention and treatment services underscores the essential need for HTS best practices at nonclinical settings, where same-day results support immediate provision for essential follow-up services (CDC, 2016). The enhanced quality of HTS and the reliability of reported results have implications for the HIV testing history levels for at-risk and hard-to-reach populations who are more likely to receive HTS at nonclinical testing locations (CDC, 2016).

Multilevel barriers and facilitators (setting-specific characteristics), including societal (financial challenges), organizational (facility procedural challenges), and provider behavior and attitudes, influence the provision of HTS in the clinical and nonclinical settings (Tan & Black, 2019). The HIV testing location or venue characteristics—health staff behaviors and attitudes at a specific location or testing setting—also influenced the provision of HTS (Frye et al., 2019). The analysis of HTS conducted at three venues among Blacks (study sample included BMSM) from clinical and nonclinical settings revealed overall lower cost outcomes per averted transmissions for targeted compared to routine -based approaches (Castel et al., 2015). The CBO (nonclinical setting) reported more new diagnoses for PLWH, unaware of their HIV positive status. According to Castel et al. (2015), the analysis of HTS conducted at both clinical (clinic and hospital facilities) and nonclinical (CBO) settings among blacks (including BMSM) revealed more testing events in the clinical setting.

A recent analysis by Essuon et al. (2020) elaborated on the importance of routine HIV testing in clinical settings to support efforts towards achieving the goals of ending the U.S. HIV epidemic. Testing in the primary physician office or clinic generated more routine testing events and averted transmissions than CBO and hospital-based facilities (Castel et al., 2015). Marcelin et al. (2016) showed that modifying health facility operations to align with the CDC screening recommendations improved the utilization of HTS at a clinic using an electronic alert system. Implementing an opt-out informed consent strategy rather than an opt-in and active choice approach increase uptake of HTS among emergency department (ED) patients (Montoy, Dow, & Kaplan, 2016). The perception about the accuracy of test results reported from private health care providers influenced the preference to seek STI testing, including HTS services, at private health clinical settings rather than at nonclinical HIV testing locations (Eaton et al., 2018).

Some of the factors that impede and facilitate the use of HTS at a testing location- emergency departments (EDs) and acute medical units (AMUs) include attitudes, behaviors, and knowledge on health system testing strategies (Elgalib et al., 2018). Although BMSM are more likely to get tested at nonclinical HIV testing locations in the southern United States and have high prevalence and incidence, the reported results from Marano et al. (2018) showed low HIV testing rates. These studies revealed that health system-related practices and characteristics influence access and utilization of HTS. Strategies that support integrating routine and targeted testing activities may offer innovative approaches to improve provider-initiated offerings for HTS. Therefore, it is imperative to consider the health system-related factors that impede or facilitate the use of HTS to inform routine and targeted HIV testing interventions in the clinical and nonclinical settings.

BMSM and HIV Testing History

BMSM are more likely to receive lifetime HIV testing compared to other MSM subgroups; however, they have delayed or infrequent HIV testing history and are less likely to have tested in the past 12 months (CDC, 2019c; Li et al., 2019; Liu et al., 2019; Patel et al., 2018). The vulnerabilities faced by BMSM, including stigma, discrimination, and poverty, increase their risk of HIV infection (Pellowski et al., 2013; Saleh et al., 2016; Singh et al., 2018). BMSM experience higher HIV incidence and prevalence rates compared to WMSM and are more likely to be unaware of their HIV positive status and hence at increased risk of HIV transmission (Li et al., 2019; Millet et al., 2011; UNAIDS, 2018a; Washington, Robles, & Malotte, 2013).

The CDC recommendation for routine HIV testing (Branson et al., 2006; DiNenno et al., 2017) encourages more frequent HIV testing among at-risk population groups. The HIV testing rate in 2016 from non-healthcare facilities (nonclinical settings) in 20 jurisdictions in the southern United States was lower for BMSM (6%), while the identified positive infections were 36% (Marano et al., 2018). The underutilization of HTS continues to be a problem among at-risk BMSM, based on the findings reported by Marano et al. (2018) and supports the need for improved targeted interventions to inform more frequent use of HTS in the nonclinical setting. The missed opportunities from the delayed and infrequent use of HTS challenges efforts to combat the U.S. HIV epidemic (Wejnert, Prejean, Hoots, Hall, McCray, & Mermin, 2018).

The correlates of infrequent HIV testing and late HIV diagnosis were examined among BMSM in six U.S. cities using a large sample size from a multisite cohort study. The results showed that an estimated 1 out of 5 were infrequent testers with no HIV testing within the prior year, and an estimated 1 out of 8 were nontesters with no previous testing history (Mannheimer et al., 2014). Patel et al. (2019) also showed that, despite the increased prevalence of routine testing in the United States among adults age 18-64 years, since the CDC recommendation on HIV screening in 2006, there are a significant number of adults in the United States who have never received an HIV test.

BMSM are more likely to get lifetime testing than other MSM groups but have infrequent HIV testing history within the past 12 months (Patel et al., 2019). Modeling analysis also showed that PLWH unaware of their positive status, and those who are aware but are not on ART, accounted for almost 80% of new HIV diagnoses (Li et al., 2019). Lo et al. (2018) reported interactions between population-level factors, racial-ethnic groups, and HIV testing. Blacks and sexual minorities, such as BMSM, were more likely to get tested—although later rather than earlier—explaining the poor outcomes among Black PLWH and the high HIV prevalence. BMSM HIV testing delays exceeded 12 months and increased with low perceived risk (Pitasi et al., 2018).

Population Characteristics Influencing HIV Testing History

Setting-specific disparities associated with individual and contextual level factors influence access and utilization of HTS. Logistic regression results generated from representative datasets collected from 2000-2014 showed a 27% delayed diagnosis (a decreasing trend from 2000) with the highest estimated adjusted odds ratio (AOR) reported for BMSM and lowest AOR for WMSM in rural testing versus urban settings locations (Sheehan et al., 2017). Rural settings had challenges in offering routine testing due to the individual (population characteristics) and structural barriers (health system-related factors).

It is imperative to examine the multilevel influencers, including population characteristics that may influence the HIV testing history levels in the past 12 months in the clinical and nonclinical settings among BMSM at higher risk for HIV infections. As posited by the ABM, this present study examined the associations between the population characteristics and the more frequent use of HTS (measured by the number of HIV tests received in the past 12 months). In this study, the frequency of HIV testing was operationalized as HIV testing history levels in the past 12 months. The population characteristics examined in the present study were, namely, predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors.

Analysis of the 2017 national HIV behavioral surveillance data for MSM across the 23 U.S states and territories revealed that WMSM were more likely to get tested for HIV compared to other MSM subgroups, including BMSM (CDC, 2019b). The analysis also showed that the likelihood of testing was associated with less than 40 years old, higher education attainment (college degree or more), income above federal poverty rate, having health insurance, and a recent visit to a health provider in the past 12 months. This study hypothesized that the population characteristics would influence more frequent use of HTS (more than one HIV test) in the past 12 months in the clinical and nonclinical settings among at-risk BMSM.

The study by Alemu, Ambaw, and Wilder-Smith (2017) examined the population-level factors (including income, age, education, place of residence, knowledge, and stigma about HIV attitudes and risk perceptions that influence the utilization of HTS among pregnant women. Although BMSM and pregnant women represent two different vulnerable population groups, similar factors influenced their use of HTS, including HIV risk perception, age, residence setting, proximity, access to health services, income level, and education status. The researchers found that those living in the rural residence (with further proximity to HTS), lower-income, older age, no formal education, and lack of HIV risk perception were less likely to get tested for HIV (Alemu et al., 2017). This present study examined the associations between age, education status, income level, type of health care setting, and more frequent use of HTS (more than one HIV test) in the past 12 months among at-risk BMSM.

Lo et al. (2018) examined the associations between population characteristics encompassing predisposing (demographic factors, such as age and gender) enabling (including health insurance coverage) and need factors (sexual minority) and lifetime HIV testing (measured as a dichotomous variable). The researchers aimed to identify factors that facilitate or impede the lifetime use of HTS compared across racial and ethnic groups. Across all racial groups, being female, older, and belonging to a sexual minority group (such as BMSM) predicted increased lifetime HIV testing. However, health insurance coverage (status) did not facilitate the use of HTS, contrary to other findings (Lo et al., 2018). Contrary to the variables examined in previous studies, including Lo et al. (2018), this study examined more frequent use of HTS by the number of HTS received in the past 12 months (defined as HIV testing history levels the past 12 months). As reported by DiNenno et al. (2018), BMSM will benefit from more frequent HIV testing in the past 12 months to help detect early and previously undiagnosed infections.

Mannheimer et al. (2014) also reported that health insurance was not independently associated with infrequent HIV testing, although outcomes from other studies showed that health insurance coverage increased access to HTS. Community-based testing locations (nonclinical settings) can improve the use of HTS among high-risk populations, such as BMSM, especially those without health insurance (Williams et al., 2016). Various health insurance coverage types provide HIV testing as a basic covered service at low-cost or free without health insurance coverage in facilities, such as community health centers and CBOs (Kaiser Family Foundation [KFF], 2019). There are gaps in health insurance coverage in settings with high HIV incidence and prevalence, especially in the southern United States (Garfield, Damico, & Orgera, 2020). This study further examined the association between health insurance status (coverage) and more frequent use of HTS in the past 12 months versus the annual use of HTS among BMSM at-risk for HIV infections.

HIV testing is required to initiate preexposure prophylaxis (PrEP) to determine initial HIV infection status and the periodic clinical monitoring of PrEP use. Hence, factors associated with PrEP use may also influence HTS use and HIV testing history levels. Population characteristics for predisposing, enabling, and need factors—including preferred provider and dedicated health service location—were identified to facilitate PrEP use (Elopre et al., 2017). The association between higher education status, having health insurance coverage, and being older among a young MSM population and the access and utilization of PrEP services (Marks et al., 2017). Young MSM living in the southern United States and Blacks were likely to be uninsured hence less likely to have access to HIV testing and PrEP services.

Male sex workers (MSWs) and MSM (non-MSWs) were recruited for a qualitative study to inform targeted strategies for PrEP roll-out (Underhill et al., 2014). The themes generated aligned with access to health care, unmet health care needs, HIV and STIs testing, and the use of preferred PrEP providers. MSWs exhibited higher risk behaviors and were more likely to identify as bisexual, injection drug users, unemployed, uninsured, not having a primary care provider, utilizing emergency health services, and being unaware of their HIV status. Although Underhill et al. (2014) did not perform analysis across racial groups to provide knowledge about racial disparities, their study findings affirmed the significance of need-based health-seeking factors in facilitating or impeding the use of health services.

The delay in HIV diagnosis was higher among Blacks (3.3 years) compared to Whites (2.2 years) and among the transmission category, male to male sexual contact was 3.0 years (Dailey et al., 2017). Over 50% of persons from each identified risk group, including those at-risk for STD and substance use, had not tested in the past 12 months but had seen a health care provider for other services (Dailey et al., 2017). The number of HIV tests received in the past 12 months was not examined as a dichotomous variable (Dailey et al., 2017). The present study examined more frequent testing across three HIV testing history levels measured by the number of HIV tests received in the past 12 months. Reported outcomes from the study conducted by Mannheimer et al. (2014) also showed that infrequent testers were more likely to be newly diagnosed and uninsured, not seeking medical services in the prior 6 months impeded frequent testing, and nontesters were more likely to be poor, uninsured, and unemployed with housing issues.

Factors associated with BMSM HIV testing history in the past 24 months between untested and tested groups was examined by Washington et al. (2013) among at-risk cohort in Los Angeles. The authors reported that BMSM with high-risk behavior, lower education attainment, limited HIV knowledge, and internet sex-seeking behavior were more likely to be associated with the untested group. Sheehan et al. (2017) showed that individual and contextual level factors related to social and structural challenges significantly influence access and utilization of HTS among BMSM in rural settings and suggested further research to explore the health-seeking behavior across settings for at-risk groups to inform strategies to improve the use of HTS. This study examined health-seeking behavior for STD and substance use services with more frequent use of HTS (more than one HIV test in the past 12 months) among BMSM in the clinical and nonclinical settings.

Summary of Background

Despite significant advances in HIV prevention, testing and treatment approach, access, and utilization of HTS among BMSM continue to be a challenge (Dailey et al., 2017; Elopre et al., 2017; Sheehan et al., 2017; Tseng et al., 2015). Promoting more frequent HIV screening (more than one HIV test) in the past 12 months among BMSM offers the opportunity to identify early infections and detect previously undiagnosed infections. More frequent testing may help decrease the number of undiagnosed HIV infections to reduce transmissions from those unaware of their HIV positive status. As previously discussed, researchers have examined the influence of population characteristics, including age, education level (attainment), income level, and health insurance coverage (status), that influence the use of HTS (defined as having received an HIV test or not).

There is a lack of information and understanding regarding the correlates of more frequent use of HTS among BMSM, defined by the HIV testing history levels in the past 12 months—categorized as never tested, tested once, and tested more than once—in the clinical and nonclinical settings and between settings. The setting-specific barriers and facilitators (including provider setting-specific characteristics) defined by the clinical and nonclinical settings also influence the use of HTS. Therefore, it is imperative to examine the correlates of more frequent HIV testing history levels in the past 12 months versus the annual HIV screening recommended by the CDC. This study is unique because it examined the frequency of HIV testing history levels in the past 12 months defined by the number of HIV tests received rather than the qualitative response indicating the use of HTS in the clinical and nonclinical settings. Findings from this study aimed to inform targeted and routine-based HTS strategies to increase the number of HIV tests received in the past 12 months among BMSM, especially those at higher risk for HIV infections in the clinical and nonclinical settings.

Overview of the Manuscripts

The multilevel facilitators and barriers that influence the use of HTS include population characteristics, namely predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors (Alemu et al., 2017; Elopre et al., 2017; Liu et al., 2019; Lo et al., 2018; Marks et al., 2017; Reif et al., 2017). These factors may also influence the more frequent use of HTS in the past 12 months at three unique HIV testing history levels in the clinical and nonclinical settings. More frequent use of HTS (more than one HIV test in the past 12 months) will benefit BMSM, especially those at higher risk for HIV, to help detect early and previously missed infections to help address the high undiagnosed infection rate.

The number of HIV testing events in the clinical setting was reported higher than in the nonclinical setting suggesting differences in the utilization of HTS across settings (Castel et al., 2015). Miller et al. (2017) reported on the unique HIV testing strategies offered in the clinical and nonclinical settings namely, targeted risk-based and routine non-risk-based approaches, respectively. It is imperative to further examine the factors that influence the more frequent use of HTS in the clinical and nonclinical settings. In alignment with the overall problem statement, purpose, theoretical framework, research design, and selected independent variables (IVs) and dependent variable (DV), three studies described by the proceeding manuscripts were conducted.

This quantitative study sought to address the gap in literature on the lack of information and understanding about the correlates of more frequent use of HTS in the past 12 months in the clinical and nonclinical settings, and the associations between settings. The overall purpose of this study was to examine the associations between population characteristics and more frequent use of HTS in the past 12 months defined by the HIV testing history levels (dependent variable) among BMSM in the clinical and nonclinical settings. The population characteristics examined were age, education attainment, income level, health insurance status, having a preferred provider, and health-seeking behavior for STD and substance use services (independent variables).

Previous studies have examined the influence of multilevel factors on the use of HTS (Dailey et al., 2017; Elopre et al., 2017, 2018; Lo et al., 2018; Liu et al., 2019; Mannheimer et al., 2014). However, this study, encompassing the three substudies described in this dissertation, is unique because it sought to examine and compare the influence of multilevel factors in promoting more frequent use of HTS. Whereby the more frequent testing is defined by three unique HIV testing history levels in the past 12 months, namely, never tested, tested once, and tested more than once in the clinical and nonclinical settings.

The first manuscript, “Black MSM Population Characteristics and HIV Testing History Levels in the Clinical Setting,” focused on the substudy that examined the association between population characteristics (predisposing, enabling and need factors) and HIV testing history levels in the past 12 months among BMSM in *clinical* settings. The association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months among BMSM in *nonclinical* settings was examined in another substudy presented in the second manuscript, “Black MSM Population Characteristics and HIV Testing History Levels in the Nonclinical Setting.”

Finally, the third substudy (presented in the third manuscript) examined and compared the association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months among BMSM between the *clinical and nonclinical* settings. The third manuscript is titled, “Black MSM Population Characteristics and HIV Testing History Levels in the Clinical and Nonclinical Settings.” The findings from these three substudies aimed to help inform interventions that may impede or facilitate the more frequent use of HTS in the clinical and nonclinical settings.

Manuscript 1: Black MSM Population Characteristics and HIV Testing History Levels in the Clinical Setting

Specific Problem

There is a lack of information and understanding regarding how correlates or factors (including those associated with HIV risk behaviors) impede or facilitate more frequent use of HTS (defined by the HIV testing history levels in the past 12 months) among BMSM in the clinical setting. Guided by the ABM, this quantitative cross-sectional study examined the association between the predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors (IVs) and more frequent use of HTS defined by the three HIV testing history levels in the past 12 months (DV). The three HIV testing history levels in the past 12 months among BMSM in the clinical settings are, namely, never tested, tested once, and tested more than once.

In this study, it was hypothesized that the population characteristics of BMSM at higher risk for HIV would influence more frequent use of HTS (more than one HIV test) in the past 12 months in the clinical settings. Previous studies have examined the influence of multilevel factors on the use of HTS, defined by lifetime testing or testing within the past 12 months (Dailey et al., 2017; Elopre et al., 2017, 2018; Lo et al., 2018; Liu et al., 2019; Mannheimer et al., 2014). This study examined the association between BMSM population characteristics and HIV testing history levels in the past 12 months in alignment with the annual HIV testing frequency recommended by the CDC in the clinical setting.

Research Question and Hypotheses

RQ1: Is there an association between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD, and substance use services) factors and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the clinical settings?

To test the association between the independent variables and the dependent variable, the following main (primary) hypotheses were examined.

H_O1: There is no association between predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months among BMSM in the clinical settings., while controlling for all other variables.

H_A1: There is an association between predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months among BMSM in the clinical settings, while controlling for all other variables.

To test the association between each of the independent variables and the dependent variable, the following secondary hypotheses were examined:

H_O1_a: There is no association between age and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{A}1_{a}$: There is an association between age and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{O}1_{b}$: There is no association between education attainment and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{A}1_{b}$: There is an association between education attainment and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{O}1_{c}$: There is no association between income level and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{A}1_{c}$: There is an association between income level and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{O}1_{d}$: There is no association between health insurance status and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{A}1_{d}$: There is an association between health insurance status and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{O}1_{e}$: There is no association between having a preferred provider and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

$H_{A}1_{e}$: There is an association between having a preferred provider and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

H_O1_f: There is no association between health-seeking behavior for STD services and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

H_A1_f: There is an association between health-seeking behavior for STD services and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

H_O1_g: There is no association between health-seeking behavior for substance use services and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

H_A1_g: There is an association between health-seeking behavior for substance use services and HIV testing history levels in the past 12 months among BMSM in the clinical settings.

Nature of Study and Design

This quantitative cross-sectional study utilized secondary data collected from the HIV Prevention Trials Network [HPTN] 061 (2009), a large feasibility and acceptability study conducted in six U.S. cities, among BMSM at higher risk for HIV, age 18 years or older. This study primarily examined the association between the IVs and DV for BMSM, who received testing in the clinical setting. The IVs are predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The DV is the HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once). A quantitative study design was appropriate for this study to test the research question and associated hypotheses aligned with the problem, purpose, and theoretical framework to examine the study variables (Creswell & Creswell, 2018; Newman & Covrig, 2013).

Source of Data

In alignment with the proposed quantitative design and study variables, both primary and secondary datasets, would have been suitable for this study (Creswell & Creswell, 2018). BMSM are a hard-to-reach and vulnerable population group; engaging this population to collect primary data may be challenging. Other potential data sources considered that provide data on MSM at high-risk for HIV infection include the Behavioral Risk Factor Surveillance System (BRFSS) and National HIV Behavioral Surveillance (NHBS) datasets (CDC, n.d.a., n.d.b.). However, using the HPTN 061 study data, a multisite dataset on high-risk BMSM mitigates the datasets' challenges from BRFSS and NHBS. BRFSS questionnaire collects no data on HIV testing history levels to measure the number of HIV tests received over time and whether the respondents ever tested for HIV in the past year. Although the NHBS questionnaire collects information on HIV testing history, the testing period is within the past 24 months instead of 12 months (which does not align with the CDC recommendation for annual HIV screening).

The secondary data from the HPTN 061study, one of the largest cohort studies conducted among BMSM at-risk for HIV infections in six U.S. sites, has been widely used over the years by multiple researchers. Recent studies that utilized the secondary data include Nelsen et al. (2016), Hickson et al. (2017), Latkin et al. (2017), Levy et al. (2017), and Hermanstyne et al. (2018), and Hermanstyne et al. (2019), to examine factors associated with HIV acquisition among BMSM. The secondary datasets from the HPTN 061 study have proven invaluable in answering key research questions to further explore and address the disparities in HIV incidence and prevalence among BMSM since 2013.

Ethical considerations. The secondary data from HPTN 061 is delimited, de-identified; hence this study did not recruit or engage any human subjects (Protection of Human Subjects, 2018). There are no conflicts of interest to disclose that may have biased this research study's conduct considering the secondary data request process, data analysis, and reporting of findings. The formal request to access the data included submitting a data use agreement obtained from HPTN (n.d.) and supporting documentation (Appendix A; Appendix B; Appendix C). The HPTN 061 study received institutional review board (IRB) approval from all recruitment sites (Koblin et al., 2013). The Walden IRB approved this study to ensure that potential benefits outweighed potential risks from the perspective of all entities associated with the HPTN 061 study, including the university, subjects, researchers, and stakeholders (Walden, n.d.a). See Appendix D for information on IRB approvals.

Sampling strategy. The HPTN 061 study successfully recruited and collected baseline data from 1,553 BMSM between 2009 and 2010 from six U.S. cities (Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington DC) with high HIV prevalence (Koblin et al., 2013). The HPTN 061 study sites utilized a sampling strategy consisting of community-based engagement and participant-based referral methods and collected baseline data via a validated computer-assisted self-interview (ACASI) system (Population Council, n.d.) and structured interview questions. The

ACASI questionnaire collected information on HIV testing history (defined as the number of HIV tests received in the past year or 12 months), health-seeking behavior for mental health, substance use, STD, and access to a preferred health service provider. Demographic data, collected via participant interviews, provided information on age at enrolment in years, education attainment (education status), income level, and health insurance coverage (status).

Clinical setting dataset. The HPTN 061 secondary data included baseline datasets on demographics, enrollment, and health care utilization. The datasets were exported from the HPTN 061 secured statistical and data management database as Microsoft Excel (2016) workbooks and imported into the statistical package for social sciences (SPSS) version 25 software (IBM, 2017; Wagner, 2016). The datasets were merged to generate a combined dataset. Using the CDC (2016, 2019b) designation for clinical and nonclinical HIV testing location settings, a new variable labeled "Setting" was created by linking each participant data to a clinical or nonclinical setting (coded as "1" and "2," respectively) based on the type of HIV testing location. The self-reported responses to the 16-level categorical variable to survey question (variable label "ACTSTWH"), "Where did you get your most recent HIV test?" provided the list of HIV testing locations.

The combined dataset was screened, non-study related variables excluded, preliminary descriptive statistics conducted and checked against the original HPTN 061 datasets to verify the accuracy of exported data. For this study, the split file command in SPSS provided subgroup analysis for the clinical setting and nonclinical settings. The statistical analysis results generated for the clinical setting dataset was utilized for this study. The designated response categories for the HIV testing locations in the clinical setting are presented in Table 1.

Table 1

Type of HIV Testing Location in the Clinical Setting

Designated Response Category	Designated Setting
Hospital outpatient clinic	Clinical
Adult HIV/AIDS or infectious disease clinic	Clinical
Sexually transmitted disease clinic	Clinical
Community health center/public health clinic/free clinic	Clinical
Family planning clinic	Clinical
Emergency room	Clinical
Private doctors office (including HMO)	Clinical

Note. Based on the CDC (2016, 2019b) classification of type of clinical and nonclinical settings.

Sample size and power analysis. This study utilized two methods to compute the estimated sample size. The minimum events per variable (EPV) approach—used the formula: $n = 100 + 50i$, where "i" is the number of independent variables—estimated 450 (Bujang, Sa'at, Sidik, & Joo, 2018). The second and preferred method, the G*Power calculator version 3.1, estimated 294 to 480 (Faul, Erdfelder, Buchner, & Lang, 2009, 2013). Parameters used for the G*Power estimation were an alpha of 0.05, both 80% and 95% power, and an effect size of 1.4 odds ratio. Effect size, a small to medium effect per Cohen (1998), was based on previous studies (Azfredrick, 2016; Lo et al., 2018; Marks et al., 2017). The G*Power a priori analysis summary for 95% power is displayed in Figure

2. The final sample size of 632 was more than the estimated range, and the post hoc power analysis confirmed adequate power > 95%.

```
z tests - Logistic regression

Options:    Large sample z-Test, Demidenko (2007) with var corr

Analysis:   A priori: Compute required sample size
Input:      Tail(s)                      =   Two
            Odds ratio                   =   1.4
            Pr(Y=1|X=1) H0               =   0.5
            α err prob                   =   0.05
            Power (1-β err prob)         =   0.95
            R² other X                   =   0
            X distribution               =   Normal
            X parm μ                     =   0
            X parm σ                     =   1
Output:     Critical z                   =   1.9599640
            Total sample size            =   480
            Actual power                 =   0.9500172
```

Figure 2. A priori analysis summary for 95% power using G*Power program.

Study Variables Definition and Measurements

The study variables from the clinical setting dataset, represented by seven clinical settings (shown in Table 1), were obtained from the merged data for demographic, enrollment, and health care utilization from participants from six U.S. sites (Koblin et al., 2013). In this study, the IVs were population characteristics, namely, predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The HIV testing history levels in the past 12 months (categorized as never tested, tested once, and tested more than once) was the DV. Confounders (shown in Table 1) were controlled in this study. All variables were categorical.

The study variables, including the definitions, values, and measurement levels for this study, are provided in Table 2. The definitions, values, and measurement levels for the variables from the original HPTN 061 Study (2009) secondary baseline data were maintained for this study except for age, education attainment, and income level (predisposing factors), and HIV testing history levels in the past 12 months. The categories for age, education attainment, and income level variables were modified because of the sparse data points and low to zero expected for categories across the three categories of the DV. During the preliminary data review and cleaning phase, after data access was granted by HPTN and final approval issued by Walden (IRB# 04-16-20-0446424), required modifications were identified.

Age in years. The categorical age groups provided in the original dataset were not used for this study. Instead the continuous age variable, also provided in the secondary HPTN 061 dataset, was transformed to four subcategories namely; "18-28," "29-39," "40-50," "51 or older."

Education attainment. The eight subcategories were transformed to four for this study. The "8th grade or equivalent or less" and "some high school" were merged to generate "some high school or less." The "finished college" and "masters or advanced degree" were merged to generate "college degree or more." The "vocational/trade/ technical school" and "N/A" were excluded from this study due to missing values.

Income level. The ten subcategories were transformed to seven by merging all categories from $50,000 to $80,000 to generate a "$50,000 or more" category.

HIV testing history levels in the past 12 months. This numeric scale variable "ACVTSTN" was transformed into a nominal variable with three categories, shown in Table 2. If the reported number of HIV tests received in the past year (12 months) was "0," "1" and "2 or more," then it was labeled as "never tested," "tested once" and "tested more than once" respectively.

Table 2

Description of Variables for the Clinical Setting Dataset

	Definition	Value and Measurement Level
Independent Variables		
Predisposing Factors		
Age in years	*Age group categories at time of survey completion* 18-20 21-30 31-40 41-50 51-60 More than 60	Ordinal, transformed from to four categories; coded 0, 1, 2, 3 respectively: 18-28 29-39 40-50 51 or older
Education attainment	*What is the highest grade or year of schooling you have completed?* Eight categories: 8th grade or equivalent or less some high school high school graduate or equivalent vocational/trade/ technical school some college or 2 year degree finished college masters or other advanced degree N/A	Ordinal, modified to four categories; coded 0, 1, 2, 3, respectively: some high school or less high school graduate or equivalent some college or 2 year degree college degree or more
Income level	*What was the total yearly income of your household before taxes were taken out?* 10 categories: less than $5,000 $5,000-$9, 999 $10,000-$19,999 $20,000-$29,999 $30,000-$39,999 $40,000-$49,999 $50,000-$59,999 $60,000-$69,999 $70,000-$79,999 $80,000 or more	Ordinal, modified to seven categories; coded 0, 1, 2, 3, 4, 5, 6 respectively: less than $5,000 $5,000-$9,999 $$10,000-$19,999 $20,000-$29,999 $30,000-$39,999 $40,000-$49,999 $50,000 or more

(*table continues*)

	Definition	Value and Measurement Level
Enabling Factors		
Health insurance status	*Do you currently have health care coverage, including health insurance, a health plan such as HMO or government plan such as Medicaid?* "No" or "Yes"	Nominal, dichotomous; coded 0, 1 respectively
Having a preferred provider	*Is there a particular place where you usually go when you are sick or are otherwise in need of health care?* "No" or "Yes"	Nominal, dichotomous; coded 0, 1 respectively
Need Factors		
Health-seeking behavior for STD services	*Has the participant ever been treated for syphilis*? "No" or "Yes" or "Don't Know." For this study, the "Don't Know" responses were excluded	Nominal, dichotomous; coded 0, 1 respectively
Health-seeking behavior for substance use services	*In the last 6 months, did you visit a substance abuse counselor, participate in a drug or alcohol treatment program, or participate in 12-step program for drug or alcohol use?* "No" or "Yes"	Nominal, dichotomous; coded 0, 1 respectively
Dependent Variable		
HIV testing history levels in the past 12 months	*How many times have you been tested for HIV in the past year (12 months)?* This numeric scale variable was transformed to a nominal variable for this study	Nominal, three categories "never tested," "tested once," "tested more than once"; coded 0, 1, 2 respectively
Confounders		
Type of HIV testing location	*Where did you get your most recent HIV test?* Sixteen categories; clinical and nonclinical settings	Nominal, seven categories were designated as clinical settings; *See Table 1*
Recruitment site city	*The U.S. city where the HPTN 061 study recruitment site was located;* Six categories	Nominal, six categories labeled as 1 to 6: Atlanta, New York City, Washington DC, Boston, Los Angeles, and San Francisco, respectively

Statistical Analysis

Using the clinical setting dataset, this study utilized Microsoft Excel (2016) and SPSS version 25 (IBM, 2017; Wagner, 2016) to test the associated hypotheses for the research question. The data for demographic, enrollment and health care utilization from the HPTN 061 study were exported from the HPTN statistical center for HIV/AIDS research and prevention (SCHARP) as excel workbooks and imported into SPSS and merged to support the data analysis for this study. The data was pre-cleaned by HPTN. However, preliminary screening was conducted to retain the clinical setting dataset's required study variables by removing non-study variables and missing data. In alignment with the theoretical framework and literature review, it was hypothesized that there is an association between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD, and substance use services) factors, and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the clinical settings.

This study's data analysis plan included descriptive and inferential (univariate, bivariate, and multivariate analysis) statistics (Mark & Peter, 2016; Osborne, 2015). Categorical variables were transformed into a series of dummy variables in SPSS, and HIV testing history level category, "never tested," was the designated outcome variable reference category in the multinomial logistic regression (MLR) analysis. The type of HIV testing location and recruitment site city were controlled in the multivariate model. An additional MLR analysis was conducted using the HIV testing history level category, "tested more than once," as the outcome variable reference category to examine the likelihood of getting tested once relative to tested more than once. This correlational study design of a cross-sectional nature using the clinical setting dataset and the logistic regression analysis aligns with the approach utilized by Alemu et al. (2017) and Lo et al. (2018). For this study, a significance level, *p*-value less than .05 ($p < .05$), was set for observed statistically significant differences in the associations between the IVs and DV. Using univariate analysis, the descriptive statistics for all variables were performed to examine the study variables' characteristics by calculating frequencies and percentage proportions.

Bivariate analysis. The bivariate analysis tested the secondary hypotheses and the examined characteristics and association between variables to determine how each of the IV impeded or facilitated the more frequent use of HTS in the past 12 months in the clinical setting and informed the multivariate analysis. The chi-squared test ($\chi 2$) of association was applied to examine and compare each IV and the DV associations. Descriptive statistics generated frequencies on all variables to compare information using cross-tabulations between BMSM population characteristics (predisposing, enabling, and need factors) and the HIV testing history levels in the past 12 months. The associations between type of HIV testing location setting and recruitment site city (treated as confounders were controlled for in the main multivariate MLR models) with HIV testing history levels in the past 12 months were examined. The significance value test used two different *p*-value computations: asymptotic and Exact test approaches based on the sample size and outcomes of the chi-square test assumptions (Mehta & Patel, 2012; McHugh, 2013).

The Exact method is the gold standard for testing the significance level since this option reduces the chance of incorrectly rejecting the null hypothesis (type 1 error) at the desired significance level (Mehta & Patel, 2012). The asymptotic approach is ideal when all assumptions for the chi-squared test of the association are met, including categorical variables, independence of observations, and cross-sectional sampling approach for data collection. Additionally, the assumption that the expected counts in at least 80% of contingency cells be five or more and no cell with less than one (Mehta & Patel, 2012; McHugh, 2013; Warner, 2013) were all examined. When the cross-tabulation results show scattered data with zero or low expected counts, the asymptotic *p*-value is not reliable, so the Exact method was preferred (Mehta & Patel, 2012).

The asymptomatic significance *p*-value was used to examine the significance of the association between the IVs and DV with one exception. The Exact method was applied to test the association between "health-seeking behavior for STD services" and "HIV testing history levels in the past 12 months" because of the small sample size and having one or more cells with zero expected counts. SPSS computed the significance level test by using the asymptotic and Exact methods (Mehta & Patel, 2012; McHugh, 2013).

Multinomial logistic regression. In alignment with the three-level categorical outcome variable, MLR was employed for the predictive analysis to test the hypotheses and examine the significance and strength of the association between each of the IV and

DV. Assumptions including the use of one or more ordinal or nominal categorical independent variables and nominal dependent variable with more than two categories, verification of independence of observations (mutually exclusive categories of the dependent variable), no significant outliers, and no multicollinearity between IVs, were all examined and met (Suri, Murty, & Athithan, 2019; Warner, 2013). Some assumptions were tested by reviewing the clinical setting dataset in the data view, and others checked by analyzing data in SPSS. Assessing multicollinearity between IVs involved the recoding of the categorical IVs in SPSS into dummy variables to examine multicollinearity via linear regression. The MLR results were reported as odds ratios with associated confidence intervals to provide information about the strength and direction of the association between each IV and DV.

Health-seeking behavior for STD services. Based on the recommended minimum number of events per variable (EPV) of 10-50, the small sample size for the "Health-seeking behavior for STD services" variable was appropriate for running the statistical analysis (Bujang, Sa'at, Tg, & Lim, 2018; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). However, this variable was excluded from the multivariate analysis due to the small sample size and zero counts for one or more levels of the outcome or dependent variable (DV). When included, the regression model was not reliable based on the error indicating that "unexpected singularities in the Hessian matrix are encountered" because of the expected count of zero in one or more of the cells (IBM, 2018).

Multivariate analysis. MLR was also employed to test the main hypotheses and examine the significance, strength, and direction of the association between the predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for substance use services) factors and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the clinical setting. This multivariate analysis using MLR provided information on the predictive effects of multiple predictors (independent variables) on the outcome (dependent variable) while controlling for the other predictors and confounders in the model (Hosmer, Lemeshow, & Sturdivan 2013; Pourhoseingholi, Baghestani, & Vahedi, 2012).

Manuscript 2: Black MSM Population Characteristics and HIV Testing History Levels in the Nonclinical Setting

Specific Problem

Researchers have shown from multiple studies that targeted approaches successfully engage hard-to-reach population groups, including BMSM (Clark et al., 2019). It is imperative to inform strategies that will promote more frequent and accurate HIV testing in the nonclinical setting (CDC, 2016) among BMSM—considering their preference to utilize testing locations in the nonclinical setting—to increase the opportunity to detect new and previously undiagnosed infections. Previous studies have examined the influence of multilevel factors on the use of HTS, defined by lifetime HIV testing or testing within the past 12 months (Dailey et al., 2017; Elopre et al., 2017, 2018; Lo et al., 2018; Liu et al., 2019; Mannheimer et al., 2014). It was hypothesized that population characteristics (predisposing, enabling, and need factors) would facilitate more frequent use of HTS (more than one HIV test) in the past 12 months in the nonclinical settings. However, there is a lack of understanding of how correlates or factors (including those associated with HIV risk behaviors) impede or facilitate more frequent use of HTS (defined by three unique HIV testing history levels) among BMSM in the nonclinical setting.

This quantitative cross-sectional study, guided by the ABM, examined the association between the predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors (IVs) and HIV testing history levels in the past 12 months (DV). The three levels are, namely, "never tested," "tested once," and "tested more than once" among BMSM in the nonclinical setting. This study sought to understand the association between IVs and DV, in alignment with the annual HIV testing frequency recommended by the CDC.

Research Question and Hypotheses

RQ2: Is there an association between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD, and substance use services) factors and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the nonclinical settings?

To test the association between the independent variables and the dependent variable, the following main (primary) hypotheses were examined:

H_O2: There is no association between predisposing, enabling, and need factors, and among BMSM in the nonclinical settings, while controlling for all other variables.

H_A2: There is an association between predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings, while controlling for all other variables.

To test the association between each of the independent variables and the dependent variable, the following secondary hypotheses were examined:

H_O2_a: There is no association between age and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_A2_a : There is an association between age and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_O2_b: There is no association between education attainment and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_A2_b: There is an association between education attainment and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_O2_c: There is no association between income level and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_A2_c: There is an association between income level and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_O2_d: There is no association between health insurance status and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_A2_d: There is an association between health insurance status and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_O2_e: There is no association between having a preferred provider and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_A2_e: There is an association between having a preferred provider and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_O2_f: There is no association between health-seeking behavior for STD services and HIV testing history levels in the past 12 months among BMSM in the nonclinical setting.

H_A2_f: There is an association between health-seeking behavior for STD services and HIV testing history levels in the past 12 months among BMSM in the nonclinical setting.

H_O2_g: There is no association between health-seeking behavior for substance use services and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

H_A2_g: There is an association between health-seeking behavior for substance use services and HIV testing history levels in the past 12 months among BMSM in the nonclinical settings.

Nature of Study and Design

This quantitative cross-sectional study utilized secondary data collected from the HPTN 061 (2009), a large feasibility and acceptability study conducted in six U.S. cities, among BMSM at higher risk for HIV, age 18 years or older. This study primarily examined the association between the IVs and DV for BMSM, who received testing in the nonclinical setting. The IVs are predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The DV is the HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once). A quantitative study design was appropriate for this study to test the research question and associated hypotheses aligned with the problem, purpose, and theoretical framework to examine the study variables (Creswell & Creswell, 2018; Newman & Covrig, 2013).

Source of Data

In alignment with the proposed quantitative design and study variables, both primary and secondary datasets, would have been suitable for this study (Creswell & Creswell, 2018). BMSM are a hard-to-reach and vulnerable population group; engaging this population to collect primary data may be challenging. Other potential data sources considered that provide data on MSM at high-risk for HIV infection include the BRFSS and NHBS datasets (CDC, n.d.a., n.d.b.). However, using the HPTN 061 study data, a multisite dataset on high-risk BMSM mitigates the datasets' challenges from BRFSS and NHBS. BRFSS questionnaire collects no data on HIV testing history levels to measure the number of HIV tests received over time and whether the respondents ever tested for HIV in the past year. Although the NHBS questionnaire collects information on HIV testing history, the testing period is within the past 24 months instead of 12 months (which does not align with the CDC recommendation for annual HIV screening).

The secondary data from the HPTN 061study, one of the largest cohort studies conducted among BMSM at-risk for HIV infections in six U.S. sites, has been widely used over the years by multiple researchers. Recent studies that utilized the secondary data include Nelsen et al. (2016), Hickson et al. (2017), Latkin et al. (2017), Levy et al. (2017), and Hermanstyne et al. (2018), and Hermanstyne et al. (2019), to examine factors associated with HIV acquisition among BMSM. The secondary datasets from the HPTN 061 study have proven invaluable in answering key research questions to further explore and address the disparities in HIV incidence and prevalence among BMSM since 2013.

Ethical considerations. The secondary data from HPTN 061 is delimited, de-identified; hence this study did not recruit or engage any human subjects (Protection of Human Subjects, 2018). There are no conflicts of interest to disclose that may have biased this research study's conduct considering the secondary data request process, data analysis, and reporting of findings. The formal request to access the data included submitting a data use agreement obtained from HPTN (n.d.) and supporting documentation (Appendix A; Appendix B; Appendix C). The HPTN 061 study received

IRB approval from all recruitment sites (Koblin et al., 2013). The Walden IRB approved this study to ensure that potential benefits outweighed potential risks from the perspective of all entities associated with the HPTN 061 study, including the university, subjects, researchers, and stakeholders (Walden, n.d.a). See Appendix D for information on IRB approvals.

Sampling strategy. The HPTN 061 study successfully recruited and collected baseline data from 1,553 BMSM between 2009 and 2010 from six U.S. cities (Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington DC) with high HIV prevalence (Koblin et al., 2013). The HPTN 061 study sites utilized a sampling strategy consisting of community-based engagement and participant-based referral methods and collected baseline data via the ACASI system (Population Council, n.d.) and structured interview questions. The ACASI questionnaire collected information on HIV testing history (defined as the number of HIV tests received in the past year or 12 months), health-seeking behavior for mental health, substance use, STD, and access to a preferred health service provider. Demographic data, collected via participant interviews, provided information on age at enrolment in years, education attainment (education status), income level, and health insurance coverage (status).

Nonclinical setting dataset. The HPTN 061 secondary data included baseline datasets on demographics, enrollment, and health care utilization. The datasets were exported from the HPTN 061 secured statistical and data management database as Microsoft Excel (2016) workbooks and imported into the statistical package for social sciences (SPSS) version 25 software (IBM, 2017; Wagner, 2016). The datasets were merged to generate a combined dataset. Using the CDC (2016, 2019b) designation for clinical and nonclinical HIV testing location settings, a new variable labeled "Setting" was created by linking each participant data to a clinical or nonclinical setting (coded as "1" and "2," respectively) based on the type of HIV testing location. The self-reported responses to the 16-level categorical variable to survey question (variable label "ACTSTWH"), "Where did you get your most recent HIV test?" provided the list of HIV testing locations.

The combined dataset was screened, non-study related variables excluded, preliminary descriptive statistics conducted and checked against the original HPTN 061 datasets to verify the accuracy of exported data. For this study, the split file command in SPSS provided subgroup analysis for the clinical setting and nonclinical settings. The statistical analysis results generated for the nonclinical setting dataset was utilized for this study. The designated response categories for the HIV testing locations in the nonclinical setting are presented in Table 3.

Table 3

Type of HIV Testing Location in the Nonclinical Setting

Designated Response Category	Designated Setting
HIV/AIDS street outreach program/Mobile Unit	Nonclinical
HIV counseling and testing site	Nonclinical
Needle exchange program	Nonclinical
Research site	Nonclinical
Drug treatment program	Nonclinical
Correctional facility (jail or prison)	Nonclinical
Military	Nonclinical
Home health care	Nonclinical

Note. Based on the CDC (2016, 2019b) classification of type of clinical and nonclinical settings

Sample size and power analysis. This study utilized two methods to compute the estimated sample size. The minimum EPV approach—formula: $n = 100 + 50i$, where "i" is the number of independent variables—estimated 450 (Bujang, Sa'at, Sidik, & Joo, 2018). The second and preferred method, the G*Power calculator version 3.1, estimated 294 to 480 (Faul, Erdfelder, Buchner, & Lang, 2009, 2013). Parameters used for the G*Power estimation were an alpha of 0.05, both 80% and 95% power, and an effect size of 1.4 odds ratio. Effect size, a small to medium effect per Cohen (1998), was based on previous studies (Azfredrick, 2016; Lo et al., 2018; Marks et al., 2017). The G*Power a priori analysis summary for 95% power is displayed in Figure 2. The final sample size of 557 was more than the estimated range, and the post hoc power analysis confirmed adequate power > 95%.

Study Variables Definition and Measurements

The study variables from the nonclinical setting dataset, represented by eight nonclinical settings (shown in Table 3), were obtained from the merged data for demographic, enrollment, and health care utilization from participants from six U.S. sites (Koblin et al., 2013). In this study, the IVs were population characteristics, namely, predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The HIV testing history levels in the past 12 months (categorized as never tested, tested once, and tested more than once) was the DV. Confounders (shown in Table 4) were controlled in this study. All variables were categorical.

The study variables, including the definitions, values, and measurement levels for this study, are provided in Table 4. The definitions, values, and measurement levels for the variables from the original HPTN 061 (2009) secondary baseline data were maintained for this study except for age, education attainment, and income level (predisposing factors), and HIV testing history levels in the past 12 months. The categories for age, education attainment, and income level variables were modified because of the sparse data points and low to zero expected for categories across the three categories of the DV. During the preliminary data review and cleaning phase, after data access was granted by HPTN and final approval issued by Walden (IRB# 04-16-20-0446424), required modifications were identified.

Age in years. The categorical age groups provided in the original dataset were not used for this study. Instead the continuous age variable, also provided in the secondary HPTN 061 dataset, was transformed to four subcategories namely; “18-28,” “29-39,” “40-50,” “51 or older.”

Education attainment. The eight subcategories were transformed to four for this study. The “8th grade or equivalent or less” and “some high school” were merged to generate “some high school or less.” The “finished college” and “masters or advanced degree” were merged to generate “college degree or more.” The “vocational/trade/ technical school” and “N/A” were excluded from this study due to missing values.

Income level. The ten subcategories were transformed to seven by merging all categories from $50,000 to $80,000 to generate a “$50,000 or more” category.

HIV testing history levels in the past 12 months. This numeric scale variable “ACVTSTN” was transformed into a nominal variable with three categories, shown in Table 4. If the reported number of HIV tests received in the past year (12 months) was “0,” “1” and “2 or more,” then it was labeled as “never tested,” “tested once” and “tested more than once” respectively.

Table 4

Description of Variables for the Nonclinical Setting Dataset

	Definition	Value and Measurement Level
Independent Variables		
Predisposing Factors		
Age in years	*Age group categories at time of survey completion* 18-20 21-30 31-40 41-50 51-60 More than 60	Ordinal, transformed from to four categories; coded 0, 1, 2, 3 respectively: 18-28 29-39 40-50 51 or older
Education attainment	*What is the highest grade or year of schooling you have completed?* Eight categories: 8th grade or equivalent or less some high school high school graduate or equivalent vocational/trade/ technical school some college or 2 year degree finished college masters or other advanced degree N/A	Ordinal, modified to four categories; coded 0, 1, 2, 3, respectively: some high school or less high school graduate or equivalent some college or 2 year degree college degree or more
Income level	*What was the total yearly income of your household before taxes were taken out?* 10 categories: less than $5,000 $5,000-$9, 999 $10,000-$19,999 $20,000-$29,999 $30,000-$39,999 $40,000-$49,999 $50,000-$59,999 $60,000-$69,999 $70,000-$79,999 $80,000 or more	Ordinal, modified to seven categories; coded 0, 1, 2, 3, 4, 5, 6 respectively: less than $5,000 $5,000-$9,999 $$10,000-$19,999 $20,000-$29,999 $30,000-$39,999 $40,000-$49,999 $50,000 or more

(*table continues)*

	Definition	Value and Measurement Level
Enabling Factors		
Health insurance status	*Do you currently have health care coverage, including health insurance, a health plan such as HMO or government plan such as Medicaid?* “No” or “Yes”	Nominal, dichotomous; coded 0, 1 respectively
Having a preferred provider	*Is there a particular place where you usually go when you are sick or are otherwise in need of health care?* “No” or “Yes”	Nominal, dichotomous; coded 0, 1 respectively
Need Factors		
Health-seeking behavior for STD services	*Has the participant ever been treated for syphilis*? “No” or “Yes” or “Don’t Know.” For this study, the “Don’t Know” responses were excluded	Nominal, dichotomous; coded 0, 1 respectively
Health-seeking behavior for substance use services	*In the last 6 months, did you visit a substance abuse counselor, participate in a drug or alcohol treatment program, or participate in 12-step program for drug or alcohol use?* “No” or “Yes”	Nominal, dichotomous; coded 0, 1 respectively
Dependent Variable		
HIV testing history levels in the past 12 months	*How many times have you been tested for HIV in the past year (12 months)?* This numeric scale variable was transformed to a nominal variable for this study	Nominal, three categories “never tested,” “tested once,” “tested more than once”; coded 0, 1, 2 respectively
Confounders		
Type of HIV testing location	*Where did you get your most recent HIV test?* Sixteen categories; clinical and nonclinical settings	Nominal, eight categories were designated as nonclinical settings; *See Table 3*
Recruitment site city	*The U.S. city where the HPTN 061 study recruitment site was located;* Six categories	Nominal, six categories labeled as 1 to 6: Atlanta, New York City, Washington DC, Boston, Los Angeles, and San Francisco, respectively

Statistical Analysis

Using the nonclinical setting dataset, this study utilized Microsoft Excel (2016) and SPSS version 25 (IBM, 2017; Wagner, 2016) to test the associated hypotheses for the research question. The data for demographic, enrollment and health care utilization from the HPTN 061 study were exported from the HPTN SCHARP as excel workbooks and imported into SPSS and merged to support the data analysis for this study. The data was pre-cleaned by HPTN. However, preliminary screening was conducted to retain the nonclinical setting dataset's required study variables by removing non-study variables and missing data. In alignment with the theoretical framework and literature review, it was hypothesized that there is an association between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD, and substance use services) factors, and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the nonclinical setting.

This study's data analysis plan included descriptive and inferential (univariate, bivariate, and multivariate analysis) statistics (Mark & Peter, 2016; Osborne, 2015). Categorical variables were transformed into a series of dummy variables in SPSS, and HIV testing history level category, "never tested," was the designated outcome variable reference category in the MLR analysis. The type of HIV testing location and recruitment site city were controlled in the multivariate model. An additional MLR analysis was conducted using the HIV testing history level category, "tested more than once," as the outcome variable reference category to examine the likelihood of getting tested once relative to tested more than once. This correlational study design of a cross-sectional nature using the nonclinical setting dataset and the logistic regression analysis aligns with the approach utilized by Alemu et al. (2017) and Lo et al. (2018). For this study, a significance level, *p*-value less than .05 ($p < .05$), was set for observed statistically significant differences in the associations between the IVs and DV. Using univariate analysis, the descriptive statistics for all variables were performed to examine the study variables' characteristics by calculating frequencies and percentage proportions.

Bivariate analysis. The bivariate analysis tested the secondary hypotheses and the examined characteristics and association between variables to determine how each of the IV impeded or facilitated the more frequent use of HTS in the past 12 months in the nonclinical setting and informed the multivariate analysis. The chi-squared test ($\chi 2$) of association was applied to examine and compare each IV and the DV associations. Descriptive statistics generated frequencies on all variables to compare information using cross-tabulations between BMSM population characteristics (predisposing, enabling, and need factors) and the HIV testing history levels in the past 12 months. The associations between type of HIV testing location setting and recruitment site city (treated as confounders were controlled for in the main multivariate MLR models) with HIV testing history levels in the past 12 months were examined. The significance value test used two different *p*-value computations: asymptotic and Exact test approaches based on the sample size and outcomes of the chi-square test assumptions (Mehta & Patel, 2012; McHugh, 2013).

The Exact method is the gold standard for testing the significance level since this option reduces the chance of incorrectly rejecting the null hypothesis (type 1 error) at the desired significance level (Mehta & Patel, 2012). The asymptotic approach is ideal when all assumptions for the chi-squared test of the association are met, including categorical variables, independence of observations, and cross-sectional sampling approach for data collection. Additionally, the assumption that the expected counts in at least 80% of contingency cells be five or more and no cell with less than one were all examined (Mehta & Patel, 2012; McHugh, 2013; Warner, 2013). When the cross-tabulation results show scattered data with zero or low expected counts, the asymptotic *p*-value is not reliable, so the Exact method was preferred (Mehta & Patel, 2012).

The asymptomatic significance *p*-value was used to examine the significance of the association between the IVs and DV with one exception. The Exact method was applied to test the association between "health-seeking behavior for STD services" and "HIV testing history levels in the past 12 months" because of the small sample size and having one or more cells with zero expected counts. SPSS computed the significance level test by using the asymptotic and Exact methods (Mehta & Patel, 2012; McHugh, 2013).

Multinomial logistic regression. In alignment with the three-level categorical outcome variable, MLR was employed for the predictive analysis to test the hypotheses and examine the significance and strength of the association between each of the IV and DV. Assumptions including the use of one or more ordinal or nominal categorical independent variables and nominal dependent variable with more than two categories, verification of independence of observations (mutually exclusive categories of the dependent variable), no significant outliers, and no multicollinearity between IVs, were all examined and met (Suri, Murty, & Athithan, 2019; Warner, 2013). Some assumptions were tested by reviewing the nonclinical setting dataset in the data view, and others checked by analyzing data in SPSS. Assessing multicollinearity between IVs involved the recoding of the categorical IVs in SPSS into dummy variables to examine multicollinearity via linear regression. The MLR results were reported as odds ratios with associated confidence intervals to provide information about the strength and direction of the association between each IV and DV.

Health-seeking behavior for STD services. Based on the recommended minimum EPV of 10-50, the small sample size for the "Health-seeking behavior for STD services" variable was appropriate for running the statistical analysis (Bujang, Sa'at, Tg, & Lim, 2018; Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). However, this variable was excluded from the multivariate analysis due to the small sample size and zero counts for one or more levels of the outcome or dependent variable (DV). When included, the regression model was not reliable based on the error indicating that "unexpected singularities in the Hessian matrix are encountered" because of the expected count of zero in one or more of the cells (IBM, 2018).

Multivariate analysis. MLR was also employed to test the main hypotheses and examine the significance, strength, and direction of the association between the predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for substance use services) factors and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the nonclinical setting. This multivariate analysis using MLR provided information on the predictive effects of multiple predictors (independent variables) on the outcome (dependent variable) while controlling for the other predictors and confounders in the model (Hosmer, Lemeshow, & Sturdivan 2013; Pourhoseingholi, Baghestani, & Vahedi, 2012).

Manuscript 3: Black MSM Population Characteristics and HIV Testing History Levels in the Clinical and Nonclinical Settings

Specific Problem

More frequent use of HTS (more than one HIV test) in the past 12 months will benefit BMSM to increase the opportunity to detect new and missed HIV diagnosis (DiNenno et al., 2017). There are population characteristics that influence the use of HTS. The CDC (2019b) analysis of the 2017 national behavioral surveillance survey data among MSM revealed that less than 40 years old, higher education attainment (college degree or more), income above poverty rate, being insured, and a recent visit to a health provider in the past 12 months are associated with the increased likelihood of getting tested for HIV. This study hypothesized that the population characteristics would influence more frequent use of HTS (more than one HIV test) in the past 12 months in the clinical and nonclinical settings.

Previous studies have examined the influence of multilevel factors on the use of HTS, defined by lifetime HIV testing or frequent testing within the past 12 months (Dailey et al., 2017; Elopre et al., 2017, 2018; Lo et al., 2018; Liu et al., 2019;

Mannheimer et al., 2014). There is a lack of understanding of how correlates or factors (including those associated with HIV risk behaviors) impede or facilitate more frequent use of HTS in the past 12 months (defined by the HIV testing history levels) among BMSM between the clinical and nonclinical settings. This quantitative cross-sectional study, guided by the ABM, examined and compared the associations between independent variables (IVs) and dependent variable (DV) between the clinical and nonclinical settings. The IVs are the predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The DV represents the HIV testing history levels ("never tested," "tested once," and "tested more than once") in the past 12 months.

Research Question and Hypotheses

RQ_3 : Is there a difference in the associations between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD, and substance use services) factors and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM between the clinical and nonclinical between settings?

To test the association between the independent variables and the dependent variable in the clinical and nonclinical settings, the following secondary hypotheses were examined:

H_O3: There is no association between predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months among BMSM in the clinical and nonclinical settings, while controlling for all other variables.

H_A3: There is an association between predisposing, enabling and need factors, and HIV testing history levels in the past 12 months among BMSM in the clinical and nonclinical settings, while controlling for all other variables.

To test the difference in the associations between the independent variables and the dependent variable between the clinical and nonclinical settings, the following main (primary) hypotheses were examined:

H_O3_a : There is no difference in the association between age and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_a : There is a difference in the association between age and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_O3_b : There is no difference in the association between education attainment and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_b : There is a difference in the association between education attainment and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_O3_c : There is no difference in the association between income level and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_c : There is a difference in the association between income level and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_O3_d : There is no difference in the association between health insurance status and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_d : There is a difference in the association between health insurance status and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_O3_e : There is no difference in the association between having a preferred provider and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_e : There is a difference in the association between having a preferred provider and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_O3_f : There is no difference in the association between health-seeking behavior for STD services and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_f: There is a difference in the association between health-seeking behavior for STD services and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_O3_g: There is no difference in the association between health-seeking behavior for substance use services and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

H_A3_g: There is a difference in the association between health-seeking behavior for substance use services and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings.

Nature of Study and Design

The Quantitative cross-sectional study utilized secondary data collected from the HPTN 061 (2009), a large feasibility and acceptability study conducted in six U.S. cities, among BMSM at higher risk for HIV, age 18 years or older. This study primarily examined the association between the IVs and DV for BMSM, who received testing in the clinical and nonclinical settings. The IVs are predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The DV is the HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once). A quantitative study design was appropriate for this study to test the research question and associated hypotheses aligned with the problem, purpose, and theoretical framework to examine the study variables (Creswell & Creswell, 2018; Newman & Covrig, 2013).

Source of Data

In alignment with the proposed quantitative design and study variables, both primary and secondary datasets, would have been suitable for this study (Creswell & Creswell, 2018). BMSM are a hard-to-reach and vulnerable population group; engaging this population to collect primary data may be challenging. Other potential data sources considered that provide data on MSM at high-risk for HIV infection include the BRFSS and NHBS datasets (CDC, n.d.a., n.d.b.). However, using the HPTN 061 study data, a multisite dataset on high-risk BMSM mitigates the datasets' challenges from BRFSS and NHBS. BRFSS questionnaire collects no data on HIV testing history levels to measure the number of HIV tests received over time and whether the respondents ever tested for HIV in the past year. Although the NHBS questionnaire collects information on HIV testing history, the testing period is within the past 24 months instead of 12 months (which does not align with the CDC recommendation for annual HIV screening).

The secondary data from the HPTN 061study, one of the largest cohort studies conducted among BMSM at-risk for HIV infections in six U.S. sites, has been widely used over the years by multiple researchers. Recent studies that utilized the secondary data include Nelsen et al. (2016), Hickson et al. (2017), Latkin et al. (2017), Levy et al. (2017), and Hermanstyne et al. (2018), and Hermanstyne et al. (2019), to examine factors associated with HIV acquisition among BMSM. The secondary datasets from the HPTN 061 study have proven invaluable in answering key research questions to further explore and address the disparities in HIV incidence and prevalence among BMSM since 2013.

Ethical considerations The secondary data from HPTN 061 is delimited, de-identified; hence this study did not recruit or engage any human subjects (Protection of Human Subjects, 2018). There are no conflicts of interest to disclose that may have biased this research study's conduct considering the secondary data request process, data analysis, and reporting of findings. The formal request to access the data included submitting a data use agreement obtained from HPTN (n.d.) and supporting documentation (Appendix A; Appendix B; Appendix C). The HPTN 061 study received IRB approval from all recruitment sites (Koblin et al., 2013). The Walden IRB approved this study to ensure that potential benefits outweighed potential risks from the perspective of all entities associated with the HPTN 061 study, including the university, subjects, researchers, and stakeholders (Walden, n.d.a). See Appendix D for information on IRB approvals.

Sampling strategy. The HPTN 061 study successfully recruited and collected baseline data from 1,553 BMSM between 2009 and 2010 from six U.S. cities (Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington DC) with high HIV prevalence (Koblin et al., 2013). The HPTN 061 study sites utilized a sampling strategy consisting of community-based engagement and participant-based referral methods and collected baseline data from the ACASI system (Population Council, n.d.) and structured interview questions. The ACASI questionnaire collected information on HIV testing history (defined as the number of HIV tests received in the past year or 12 months), health-seeking behavior for mental health, substance use, STD, and access to a preferred health service provider. Demographic data, collected via participant interviews, provided information on age at enrolment in years, education attainment (education status), income level, and health insurance coverage (status).

Clinical setting and nonclinical setting datasets. The demographics, enrollment, and health care utilization datasets were exported from the HPTN 061 secured database as Microsoft Excel (2016) workbooks and imported into the statistical package for social sciences (SPSS) version 25 software and merged (IBM, 2017; Wagner, 2016). The combined dataset was further sorted into two datasets (subgroups), namely clinical and nonclinical settings. A new variable (labeled "setting" and coded as "1" and "2" for "clinical setting" and "nonclinical setting," respectively) using the 16-level categorical variable that was generated from the self-reported responses to survey question (variable label "ACTSTWH"), "*Where did you get your most recent HIV test*?" The CDC (2016, 2019b) designation of a clinical and nonclinical HIV testing location setting was applied in sorting the merged data into two subgroups based on whether the most recent HIV test was received in the clinical or nonclinical settings.

The combined dataset was screened, non-study related variables excluded, preliminary descriptive statistics conducted and checked against the original HPTN 061 datasets to verify the accuracy of exported data. For this study, the split file command in SPSS provided subgroup analysis for the clinical setting and nonclinical settings. The statistical analysis results generated for both settings (subgroups) were utilized for this study. Table 5 shows the designated response categories for the HIV testing locations in the clinical and nonclinical settings.

Table 5

Type of HIV Testing Location in the Clinical and Nonclinical Settings

Designated Response Category	Designated Setting
Hospital outpatient clinic	Clinical
Adult HIV/AIDS or infectious disease clinic	Clinical
Sexually transmitted disease clinic	Clinical
Community health center/public health clinic/free clinic	Clinical
Family planning clinic	Clinical
Emergency room	Clinical
Private doctors office (including HMO)	Clinical
HIV/AIDS street outreach program/Mobile Unit	Nonclinical
HIV counseling and testing site	Nonclinical
Needle exchange program*	Nonclinical
Research site	Nonclinical
Drug treatment program	Nonclinical
Correctional facility (jail or prison)	Nonclinical
Military*	Nonclinical
Home health care*	Nonclinical

Note. Based on the CDC (2016, 2019b) classification of type of clinical and nonclinical settings.

* Data excluded from the multivariate analysis due to the low sample.

Sample size and power analysis. This study utilized two methods to compute the estimated sample size. The minimum EPV approach—formula: $n = 100 + 50i$, where "i" is the number of independent variables—estimated 450 (Bujang, Sa'at, Sidik, & Joo, 2018). The second and preferred method, the G*Power calculator version 3.1, estimated 294 to 480 (Faul, Erdfelder, Buchner, & Lang, 2009, 2013). Parameters used for the

G*Power estimation were an alpha of 0.05, both 80% and 95% power, and an effect size of 1.4 odds ratio. Effect size, a small to medium effect per Cohen (1998), was based on previous studies (Azfredrick, 2016; Lo et al., 2018; Marks et al., 2017). The G*Power a priori analysis summary for 95% power is displayed in Figure 2. The final sample size was 1189, more than the estimated range. The post hoc power analysis confirmed adequate power > 95%.

Study Variables Definition and Measurements

The study variables from the combined datasets (clinical and nonclinical), represented by fifteen settings (shown in Table 5), were obtained from the merged data for demographic, enrollment, and health care utilization from participants from six U.S. sites (Koblin et al., 2013). In this study, the IVs were population characteristics, namely, predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The HIV testing history levels in the past 12 months (categorized as never tested, tested once, and tested more than once) was the DV. Confounders (shown in Table 6) were controlled in this study. All variables were categorical.

The study variables, including the definitions, values, and measurement levels for this study, are provided in Table 6. The definitions, values, and measurement levels for the variables from the original HPTN 061 (2009) secondary baseline data were maintained for this study except for age, education attainment, and income level (predisposing factors), and HIV testing history levels in the past 12 months. The categories for age, education attainment, and income level variables were modified because of the sparse data points and low to zero expected for categories across the three categories of the DV. During the preliminary data review and cleaning phase, after data access was granted by HPTN and final approval issued by Walden (IRB# 04-16-20-0446424), required modifications were identified.

Age in years. The categorical age groups provided in the original dataset were not used for this study. Instead the continuous age variable, also provided in the secondary HPTN 061 dataset, was transformed to four subcategories namely; “18-28,” “29-39,” “40-50,” “51 or older.”

Education attainment. The eight subcategories were transformed to four for this study. The “8th grade or equivalent or less” and “some high school” were merged to generate “some high school or less.” The “finished college” and “masters or advanced degree” were merged to generate “college degree or more.” The “vocational/trade/ technical school” and “N/A” were excluded from this study due to missing values.

Income level. The ten subcategories were transformed to seven by merging all categories from $50,000 to $80,000 to generate a “$50,000 or more” category.

HIV testing history levels in the past 12 months. This numeric scale variable “ACVTSTN” was transformed into a nominal variable with three categories, shown in Table 6. If the reported number of HIV tests received in the past year (12 months) was “0,” “1” and “2 or more,” then it was labeled as “never tested,” “tested once” and “tested more than once” respectively.

Table 6

Description of Variables for the Clinical Setting and Nonclinical Setting Datasets

	Definition	Value and Measurement Level
Independent Variables		
Predisposing Factors		
Age in years	*Age group categories at time of survey completion* 18-20 21-30 31-40 41-50 51-60 More than 60	Ordinal, transformed from to four categories; coded 0, 1, 2, 3 respectively: 18-28 29-39 40-50 51 or older
Education attainment	*What is the highest grade or year of schooling you have completed?* Eight categories: 8th grade or equivalent or less some high school high school graduate or equivalent vocational/trade/ technical school some college or 2 year degree finished college masters or other advanced degree N/A	Ordinal, modified to four categories; coded 0, 1, 2, 3, respectively: some high school or less high school graduate or equivalent some college or 2 year degree college degree or more
Income level	*What was the total yearly income of your household before taxes were taken out?* 10 categories: less than $5,000 $5,000-$9, 999 $10,000-$19,999 $20,000-$29,999 $30,000-$39,999 $40,000-$49,999 $50,000-$59,999 $60,000-$69,999 $70,000-$79,999 $80,000 or more	Ordinal, modified to seven categories; coded 0, 1, 2, 3, 4, 5, 6 respectively: less than $5,000 $5,000-$9,999 $$10,000-$19,999 $20,000-$29,999 $30,000-$39,999 $40,000-$49,999 $50,000 or more

(*table continues)*

	Definition	Value and Measurement Level
Enabling Factors		
Health insurance status	*Do you currently have health care coverage, including health insurance, a health plan such as HMO or government plan such as Medicaid?* "No" or "Yes"	Nominal, dichotomous; coded 0, 1 respectively
Having a preferred provider	*Is there a particular place where you usually go when you are sick or are otherwise in need of health care?* "No" or "Yes"	Nominal, dichotomous; coded 0, 1 respectively
Need Factors		
Health-seeking behavior for STD services	*Has the participant ever been treated for syphilis*? "No" or "Yes" or "Don't Know." For this study, the "Don't Know" responses were excluded	Nominal, dichotomous; coded 0, 1 respectively
Health-seeking behavior for substance use services	*In the last 6 months, did you visit a substance abuse counselor, participate in a drug or alcohol treatment program, or participate in 12-step program for drug or alcohol use?* "No" or "Yes"	Nominal, dichotomous; coded 0, 1 respectively
Dependent Variable		
HIV testing history levels in the past 12 months	*How many times have you been tested for HIV in the past year (12 months)?* This numeric scale variable was transformed to a nominal variable for this study	Nominal, three categories "never tested," "tested once," "tested more than once"; coded 0, 1, 2 respectively
Confounders		
Type of HIV testing location	*Where did you get your most recent HIV test?* Sixteen categories; clinical and nonclinical settings	Nominal, fifteen categories were designated as clinical and nonclinical settings; *See Table 5*
Recruitment site city	*The U.S. city where the HPTN 061 study recruitment site was located;* Six categories	Nominal, six categories labeled as 1 to 6: Atlanta, New York City, Washington DC, Boston, Los Angeles, and San Francisco, respectively

Statistical Analysis

This study tested the research question's associated hypotheses using the clinical and nonclinical setting datasets and SPSS version 25 (IBM, 2017; Wagner, 2016) and Microsoft Excel (2016). The datasets for demographics, enrollment, and health care utilization from the HPTN 061 study were exported from the SCHARP database as excel workbooks into SPSS and merged to support this study's data analysis. The data was pre-cleaned by HPTN; however, preliminary screening was conducted to remove non-study variables and missing data.

In alignment with the theoretical framework and literature review, it was hypothesized that there is an association between variables in the clinical and nonclinical settings. The IVs are predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The DV is HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the clinical and nonclinical settings. This study compared the associations between settings. This correlational study design of a cross-sectional nature, using both the clinical and nonclinical setting datasets and logistic regression analysis, aligns with the approach utilized by Alemu et al. (2017) and Lo et al. (2018). The split file feature in SPSS was activated to analyze both the combined dataset.

This study's data analysis plan included descriptive and inferential (univariate, bivariate, and multivariate analyses) statistics (Mark & Peter, 2016; Osborne, 2015). The split file feature in SPSS was activated to analyze both the combined dataset. For this study, a significance level, *p*-value less than .05 ($p < .05$), was set for observed statistically significant differences in the associations between the IVs and DV. Descriptive statistics, using univariate analysis, determined the variables' characteristics by calculating frequencies and percentage proportions. Categorical variables were transformed into a series of dummy variables in SPSS, and the HIV testing history level category, "never tested," was the reference category outcome variable in the multinomial logistic regression (MLR) analysis. The type of HIV testing location and recruitment site city—confounding variables—were controlled in the multivariate model. An additional MLR analysis was conducted using the HIV testing history level category, "tested more than once," to examine the likelihood of getting "tested once" relative to "tested more than once." The univariate, bivariate, and multivariate analysis results were compared between variables in the clinical and nonclinical settings. The multivariate results were further analyzed using the z-test statistical analysis to examine and compare the associations' statistical significance between the settings.

Bivariate analysis. The bivariate analysis examined and compared the characteristics of the associations between variables to determine how each of the IVs impeded or facilitated the more frequent use of HTS in the past 12 months in the clinical and nonclinical settings. The results from the bivariate and informed the multivariate analysis. The chi-squared test ($\chi 2$) of association was applied to examine and compare each IV and DV associations. Descriptive statistics were conducted by running frequencies on all variables to compare information using cross-tabulations between BMSM population characteristics (predisposing, enabling, and need factors) and the HIV testing history levels in the past 12 months. The associations between type of HIV testing location setting and recruitment site city (treated as confounders and controlled for in the main multivariate MLR models) with HIV testing history levels in the past 12 months were examined. The bivariate analysis's significance value utilized asymptotic, Exact test, and Monte Carlo approaches based on the chi-square test assumptions' sample size and outcomes (Mehta & Patel, 2012; McHugh, 2013).

The Exact method is the gold standard for testing the significance level since this option reduces the chance of incorrectly rejecting the null hypothesis (type 1 error) at the desired significance level (Mehta & Patel, 2012). The asymptotic approach is ideal when all assumptions for the association's chi-squared test are met, including categorical variables, independence of observations, and cross-sectional sampling approach for data collection. Also, the requirement that the value of expected counts in at least 80% of contingency cells be five or more and no cell with less than one was examined (Mehta & Patel, 2012; McHugh, 2013; Warner, 2013). When the cross-tabulation results show scattered data with zero or low expected counts, the asymptotic *p-value* is not reliable, so alternatively, the Exact method is used for small size (less than 50), and the Monte Carlo method for large sample preferred (Mehta & Patel, 2012; McHugh, 2013).

For this study, the asymptomatic significance was used to examine association significance between the IVs and DV, with two exceptions. The Exact method for the significance of the association between "health-seeking behavior for STD services" and "HIV testing history levels in the past 12 months" because of the small sample size and having one or more cells with an expected count of zero. The Monte Carlo method to test the association between the type of HIV testing location setting with the outcome variable due to large size but low expected counts. The significance level test was computed in SPSS by using the asymptotic, Exact method, and Monte Carlo approaches (Mehta & Patel, 2012; McHugh, 2013).

Multinomial logistic regression. In alignment with the three-level categorical outcome variable, MLR was employed for the predictive analysis to examine the significance and strength of the association between each of the IVs and DV. Examined assumptions included the use of one or more ordinal or nominal categorical independent variables and nominal dependent variable with more than two categories, verification of independence of observations (mutually exclusive categories of the dependent variable), no significant outliers, and no multicollinearity between IVs, were all examined and met (Suri, Murty, & Athithan, 2019; Warner, 2013). Some assumptions were tested by reviewing data in the data view and others checked by analyzing data in SPSS. Assessing multicollinearity between IVs involved the recoding of the categorical IVs in SPSS into dummy variables to examine multicollinearity via linear regression. The MLR results were reported as odds ratios with associated confidence intervals to provide information about the association's strength and direction between IVs and DV and informed the multivariate MLR analysis.

Health-seeking behavior for STD services. Based on the recommended minimum number of events per variable (EPV) of 10-50, the small sample size for the "Health-seeking behavior for STD services" variable was appropriate for running the statistical analysis (Bujang, Sa'at, Tg, & Lim, 2018; Peduzzi, Concato, Kemper, Holford, &

Feinstein, 1996). However, this variable was excluded from the multivariate analysis due to the small sample size and zero counts for one or more levels of the outcome variable. When included, the regression model was not reliable based on the error indicating that "unexpected singularities in the Hessian matrix are encountered" because of the expected count of zero in one or more of the cells (IBM, 2018).

Multivariate analysis. MLR was also employed to test the secondary and main hypotheses to examine and compare the significance, strength, and direction of the associations between variables among BMSM in the clinical and nonclinical settings and between settings. The independent variables are predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for substance use services) factors. The dependent variable is HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the clinical and nonclinical setting. This multivariate analysis using MLR provided information on the predictive effects of multiple predictors (independent variables) on the outcome (dependent variable) while controlling for the other predictors and confounders in the model (Hosmer et al., 2013; Pourhoseingholi et al., 2012).

Comparison of the multivariate analysis results between the clinical and nonclinical settings (to test the main hypotheses) utilized an approach for comparing regression coefficients between two independent models using z-scores (Allison, 1999; Altman & Bland, 2003; Clogg, Petkova, & Haritou, 1995; Laerd Statistics, 2017). The revealed associations between the predictors (population characteristics) and HIV testing history levels in the past 12 months were compared between the clinical and nonclinical settings. The statistical significance of the difference in the revealed associations between settings was examined using the equation described by Clogg et al. (1995).

$$z = (\beta_{12} - \beta_{11}) \;/\; [SE^2(\beta_{12}) + SE^2(\beta_{11})]^{1/2}$$

The regression coefficient (the log transformation of the odds ratios explaining the direction and strength of association between predictors and outcome variables) is presented by β_{11} and β_{12} for the clinical and nonclinical MLR models (respectively), and SEβ_{11} and SEβ_{12} are the associated standard errors for the regression coefficients. The *z*-score test of statistical significance supported the decision rule to reject H_O ($\beta_{11} = \beta_{12}$) when estimated *z*-scores are between -1.96 and +1.96 and fail to reject H_O (H_A: $\beta_{11} \neq \beta_{12}$) when calculated *z*-scores are $-1.96 \geq z \geq 1.96$ for statistical significance (p=.05). The analysis was conducted in Microsoft Excel (2016). The excel workbook with the final output was password protected to maintain the accuracy and integrity of calculated *z*-scores.

Significance

This study, encompassing three substudies, sought to address the literature gap regarding the lack of understanding about the correlates of more frequent use of HTS in the past 12 months and their associations in the clinical and nonclinical settings and compared between settings. This study examined the associations between BMSM population characteristics, predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months in the clinical and nonclinical settings. This study intended to make an original contribution in filling the knowledge gap in the literature by generating findings to understand the correlates of more frequent HIV testing history levels in the past 12 months (more than one HIV) in the clinical and nonclinical settings, and between settings.

This study examined the influence of BMSM population characteristics among BMSM across the HIV testing history levels in the past 12 months, namely, never tested, tested once, and tested more than once. Insights from this study may help inform local health providers in both clinical and nonclinical settings in developing a routine and targeted intervention strategies to promote more frequent HIV testing history levels among at-risk BMSM (DiNenno et al., 2018; Pitasi et al., 2019). Health service delivery practices in both settings may employ routine or targeted or combination intervention strategies based on the barriers and facilitators associated with population characteristics. It is imperative to enhance the target population's engagement and help increase the number of HIV tests received annually. As previously indicated, BMSM (especially those at higher risk for HIV infections) will benefit from more frequent testing versus the annual frequency recommended by the CDC to help address the low HIV testing history levels in the past 12 months and the high undiagnosed infection rate among BMSM (DiNenno et al., 2018).

Summary

An overview of the background related to the global and U.S. HIV epidemic, and the population characteristics and health system-related factors that influence the frequent use of HTS in the clinical and nonclinical settings and between settings is discussed in Part 1. The research problem, identified gap, theoretical framework, background literature, study's significance, selection of the population characteristics, and the measure and definition of the HIV testing history levels in the past 12 months are also presented in Part 1. The rationale for the study's overall purpose was defined in Part 1 with supporting evidence to show the disproportionately high incidence and prevalence, the delayed or infrequent use of HTS, and high undiagnosed infection rates among BMSM.

This study, encompassing three studies, examined and compared the association between the IVs and more frequent utilization of HTS (DV)—-defined as HIV testing history levels in the past 12 months—in the clinical and nonclinical settings and between settings. An overview of the three substudies, including the specific research problem, methodology, and statistical analysis plan, is described in Part 1. This study sought to address a gap in the literature regarding the lack of understanding about the correlates of more frequent use of HTS (more than one HIV test) in the past 12 months among BMSM in both settings. In Part 2, each of the substudies is presented in their respective manuscript formats.

Part 2: Manuscripts

In Part 2, the manuscripts associated with the three substudies are described in detail. Each manuscript includes specific subsections—title page, abstract, introduction, methodology, results, discussion, conclusion, references, and acknowledgments—formatted according to the selected journal submission guidelines.

Manuscript 1: Black MSM Population Characteristics and HIV Testing History Levels in the Clinical Setting

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Outlet for Manuscript

Submission Guidelines for the Journal of "AIDS and Behavior"

The manuscript, "Black MSM Population Characteristics and HIV Testing History Levels in the Clinical Setting," will be submitted to "AIDS and Behavior," a peer-reviewed international journal (https://www.springer.com/journal/10461/aims-and-scope?IFA) that publishes on a broad range of topics on AIDS behavioral research including, research relating to strategies addressing multilevel factors that impact HIV prevention, treatment, and transmission. The manuscript topic aligns with the selected journal's subject matter area since it examined factors that may impede or facilitate the more frequent use of HIV testing services in the past 12 months. Outcomes from this present study may help inform the development of strategies or interventions to improve HIV testing history levels and support testing, prevention, and treatment strategies to reduce HIV transmission. This manuscript will be open access. The submission guidelines for AIDS and Behavior journal follow specific requirements including no word or page limits, a title page, an abstract (preferably no more than 150 words but can be more), keywords with about 4-5 words after the abstract, and with main text outline headings—Introduction, Methods, Results, Discussions, and Conclusions. Figures and tables—included on individual pages—must meet the required specifications.

The "Acknowledgments" section—including grant and financial assistance and disclaimers—should be provided on a separate page before the references. The in-text and reference citation style follows the American Medical Association (AMA) referencing style.

Black MSM Population Characteristics and HIV Testing History Levels in the Clinical Setting

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Abstract

Black men who have sex with men (BMSM) are more likely unaware of their HIV positive status, less likely to get tested in the past 12 months, and more likely to use HIV testing services (HTS) in the nonclinical setting, compared to other MSM subgroups. Guided by the behavioral model for the vulnerable populations, this cross-sectional quantitative study used secondary data for 632 at-risk BMSM aged 18 or older from HIV Prevention Trial Network 061. Chi-Square test and multinomial logistic regression methods were used to examine the association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) in the clinical setting. HIV testing history levels in the past 12 months were significantly associated, negatively with age and positively with education attainment (predisposing factors), and inversely with health insurance status (enabling factor). Compared to referents, BMSM age 18-28 years were 121% more likely, those with some college or 2-year degree were 49% less likely, and the uninsured were 94% more likely to use HTS more than once in the past 12 months compared to never tested. Positive social change impact of revealed associations includes the potential to inform routine-based HIV testing strategies to increase HIV testing history levels among at-risk BMSM in the clinical setting to help facilitate early HIV diagnosis and reduce HIV transmissions from those unaware of their positive status.

Keywords

HIV; HIV testing history levels; Predisposing, enabling, and need factors; Black men who have sex with men (BMSM); Clinical setting

Introduction

HIV Epidemic in the United States: Geographic and Demographic Trends

In the United States, over 50% of new human immunodeficiency virus (HIV) diagnoses in 2017 and 2018 were accounted for by less than 50 counties in mostly rural areas in the southern United States. and among minority and vulnerable populations.[1-4] Although the annual HIV diagnoses remained steady in the United States from 2012-2016, men who have sex with men (MSM) represented 66% of all new HIV diagnoses with almost 40% Black MSM (BMSM) and among persons aged 25-34 years.[5-6] The highest rates of HIV diagnosis per 100,000 population from 2013-2018 were reported among Black African Americans, persons aged 25-34 years, and persons engaged in male to male sexual contact compared to other racial-ethnic groups, the age range at the time of diagnosis, and HIV transmission categories, respectively.[2]

Despite the significant progress in HIV prevention, treatment, and care continua, about 15% of undiagnosed HIV infections accounted for over 40% of new infections.[1,5] Efforts to address the disproportionately high incidence and prevalence rates include the increased uptake of HIV testing services (HTS), which encompasses a broad range of comprehensive services.[7] The missed opportunities from the delayed or infrequent use of HTS challenges efforts to combat the U.S. HIV epidemic. Analysis of state HIV surveillance and national survey datasets from 2000-2014 reported a 27% delayed HIV diagnosis for BMSM compared to White MSM in rural settings.[8] Health providers should offer more testing opportunities in clinical settings[9] since BMSM can benefit from a more frequent HIV testing history to help identify more HIV infections and potentially reduce the number of undiagnosed infections.

HIV Testing History in the Clinical Settings

The CDC recommends routine at least annual HIV testing for sexually active populations at-risk for HIV in the clinical and nonclinical settings.[10] However, BMSM are more likely to get tested in the nonclinical setting compared to White MSM.[3] Whereby HIV testing locations in the clinical settings—include primary physician office or clinic, emergency department (ED), community center free clinic, and hospital-based facility and nonclinical settings—include community-based organization (CBO) facilities, HIV street outreach programs or mobile units, and HIV counseling and testing site.[10,3] The CDC recommendation addressed the importance of offering routine HIV testing, which is usually offered in the clinical health care settings.[12] BMSM preference for testing in a nonclinical setting is influenced by health system-related factors, including provider setting-specific characteristics.[13] The individual and contextual level factors associated with social and structural challenges which significantly impact the access and utilization of HTS among BMSM warrants further research to explore the health-seeking behavior of at-risk groups to inform strategies to improve the use of HTS.[3,8,14]

Health system-related factors contribute to the geographic and demographic disparities in HIV incidence and prevalence among key populations.[4] These factors include provider attitudes (stigma), beliefs and behaviors (discrimination), institutional policies, cost of services and financing programs, and availability of community support and integrated services.[15] The health system-related factors may influence the equitable provision of HTS in the clinical settings.[16-19] Testing in the primary physician office or clinic covered more routine test events and averted transmissions compared to community-based organization and hospital-based facility.[20] Modifying health facility operations to align with the CDC screening recommendations improved utilization of HTS at a clinic using an electronic alert system.[21] Also, the increased uptake of HTS among ED patients was observed using opt-out informed consent strategy compared to opt-in and active choice.[22] Perception about the accuracy of HIV test results was shown to contribute to the preference to seek testing for sexually transmitted infections (STIs) with private health care providers (clinical setting) rather than in a nonclinical setting.[23] HIV testing rates from jurisdictions especially in the southern United States show that underutilization of HTS among BMSM is low.[2,24]

Black MSM HIV Testing History

BMSM are more likely to receive lifetime testing versus annually testing (the CDC recommended testing frequency).[10,25-26] Modeling analysis revealed that individuals who are unaware of their status and those aware but not on antiretroviral therapy (ART) accounted for almost 80% of new HIV diagnoses.[27] Increased annual HIV testing enhances the opportunity to detect recent HIV or previously missed infections, reduces the HIV morbidity and mortality rates, improves overall health outcomes of people living with HIV (PLWH), and reduces HIV transmission.[28] More frequent testing also offers the opportunity to detect early HIV infections, promote immediate linkage and enhance the sustained use of ART towards viral suppression.[29]

The results from a large cohort study of BMSM on HIV testing history from six U.S. cities reported that an estimated 1out of 4 were infrequent testers with no HIV testing within the prior year, and an estimated 1 out of 8 were non-testers with no previous testing history.[30] The results from a systematic review of studies that examined the benefits of frequent HIV screening suggested further research to characterize and compare factors—including individual risk factors that enhance HIV acquisition—associated with more frequent versus annual utilization of HTS among BMSM.[25] It is imperative to examine factors that impede or facilitate the number of HIV tests received in the past 12 months among at-risk population groups, such as BMSM, to help inform strategies to improve the HIV testing history levels in the clinical settings. [3]

Influence of BMSM Population Characteristics on HIV Testing History

The utilization of health services is explained by the Gelberg-Anderson behavioral model for vulnerable populations (ABM).[31-32] For this study, the ABM posits that health system-related factors—associated with clinical and nonclinical setting—and population characteristics—associated with predisposing, enabling, and need factors—impede or facilitate the use of HTS. The predisposing factors are prior-existing characteristics including, sociocultural determinants, attitudes, values, and demographics. The need and enabling factors are identified as significant predictors of health service use.

Predisposing, enabling, and need factors are identified as significant influencers in facilitating or impeding the lifetime use of HTS (as a dichotomous variable to report if ever tested for HIV) compared across racial and ethnic groups. [33] The researchers also showed that across all racial groups, being female, older, and belonging to a sexual minority group predicted increased lifetime HIV testing, and health insurance coverage (status) was not shown to facilitate the use of HTS contrary to other findings. Health insurance was not independently associated with infrequent HIV testing,[30] although having insurance can increase access to HTS. Gaps in health insurance coverage in settings with high HIV incidence and prevalence have significant implications on access and the use of HTS, especially in the southern United States.[18] However, various types of health insurance coverage provide HIV testing as a basic covered service at low cost or free in facilities, such as community health centers and CBOs.[34]

Factors that influence preexposure prophylaxis (PrEP) also influence the use of HTS since the latter is critical in initiating and monitoring PrEP use. Some facilitators of PrEP use include having a preferred provider and a dedicated health service location.[35] Access and utilization of PrEP services were associated with higher education status, health insurance coverage, and being older among a young MSM population.[36] A systematic review using a national dataset revealed that less than half of MSM ever tested within the past 12 months.[10] The infrequent and delayed testing rates among persons at-risk for HIV, such as sexually active BMSM with risk factors including substance use and sexually transmitted diseases (STD), contribute to the high undiagnosed HIV infection, incidence, and prevalence rates.

Although researchers (previously discussed) have investigated factors that influence the use of HTS and HIV testing history, there is a lack of information and understanding regarding the association between population characteristics and HIV testing history levels in the past 12 months in the clinical setting. The preference for

BMSM to receive testing in a nonclinical setting compared to other MSM subgroups suggest unique trends in the association between population characteristics and HIV testing history among BMSM in the clinical setting. This study aimed to address the literature gap by applying the ABM to guide the systematic examination of the association between population characteristics and HIV testing history levels in the past 12 months among BMSM in the clinical setting. Population characteristics (independent variables) are predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors. The dependent variable is the HIV testing history levels (the number of HIV tests received in the past 12 months) in the clinical setting.

The proposed research question, Is there an association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months among BMSM in the clinical setting? It was hypothesized that there is an association between population characteristics and HIV testing history levels in the past 12 months (never tested; tested once; tested more than once) among BMSM in the clinical setting, while controlling for all other variables. The study outcomes include the potential to inform routine-based intervention strategies that target unique population characteristics to promote more frequent testing in the past 12 months among BMSM in the clinical setting. Increased utilization of HTS may help promote early detection of HIV infections, link those infected to ART to support viral suppression, and help reduce the rate of undiagnosed HIV infections and HIV transmissions.

Methods

Study Design and Source of Data

This quantitative cross-sectional study utilized secondary data collected from the HIV Prevention Trials Network [HPTN] 061 study, a large feasibility and acceptability study conducted among BMSM age 18 years or older.[37] This secondary data offered a unique dataset that included self-reported responses about the number of HIV tests received in the past 12 months, defined as the HIV testing history levels in the past 12 months. The HPTN 061 study dataset has been widely used over the years by multiple researchers to examine factors associated with HIV acquisition among BMSM.[38-43] The HPTN 061 dataset has proven invaluable in answering key research questions to further explore and address the disparities in HIV incidence and prevalence among BMSM since 2013. A quantitative study design was appropriate for this study, in alignment with the problem, purpose, and theoretical framework, to examine the association between population characteristics and HIV testing history levels among BMSM in the clinical setting.[44-45]

Ethical Considerations

The HPTN 061 study received all required regulatory approvals, including institutional review board (IRB) approval from study sites. The secondary dataset retrieved from the HPTN statistical center for HIV/AIDS research and prevention (SCHARP) secured website was delimited and de-identified. This study did not recruit or engage human subjects. The formal request to access the secondary data included the approval of the HPTN data use agreement. Walden University IRB issued final approval to access and commence data analysis.

Study Population and Sampling Strategy

The HPTN 061 study successfully recruited and collected baseline data from 1,553 BMSM between 2009 and 2010 at recruitment sites with high HIV incidence and prevalence rates, located in Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington DC.[46] The HPTN 061 sites utilized a sampling strategy consisting of community-based engagement and participant-based referral methods and collected baseline data via a validated audio computer-assisted self-interview (ACASI) system[47] and structured participant interviews questions. The clinical setting dataset utilized for this study was generated from the HPTN 061 secondary data. For this study, the estimated a priori sample size was computed from two methods. The minimum events per variable (EPV) approach formula (n = 100 + 50i, " i " is the number of independent variables)[48] estimated 450. The G*Power Software[49] using an alpha of 0.05, both 80% and 95% power and effect size of 1.4 odds ratio based on findings from previous studies[33, 36, 50] estimated 294-480. The final sample size of 632 was more than the estimated range, and the post hoc power analysis confirmed adequate power > 95%.

Clinical setting dataset. The demographics, enrollment, and health care utilization datasets for HPTN 061 were exported from the secured HPTN website, SCHARP, as Microsoft Excel workbooks (2016) and imported into the statistical package for social sciences (SPSS) version 25 software and merged.[51-52] The merged dataset was sorted based on the CDC designation for clinical and nonclinical settings[11, 3] and a new variable labeled "setting" was utilized to link each participant data to a clinical or nonclinical setting coded as "1" and "2" (respectively). The self-reported responses generated from the 16-level categorical variable for survey question, Where did you get your most recent HIV test? (variable label "ACTSTWH"), identified the type of HIV testing location per participant response. The combined dataset was screened, non-study related variables excluded, and preliminary descriptive statistics conducted and checked against the original HPTN 061 datasets to verify the accuracy of exported data. The clinical setting dataset was utilized for this study.

Variable Definitions, Values, and Levels of Measurement

The study variables namely, the predisposing (age, education attainment, and income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for STD and substance use services) population characteristics, and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) were all measured as categorical variables. The type of HIV testing location and recruitment site city were included as confounders. HIV testing history levels in the past 12 months, the dependent variable, was generated by transforming the numeric scale variable labeled as "ACVTSTN" that corresponded to the response to the survey question, How many times have you been tested for HIV in the last year? The variable was transformed into a nominal variable based on the reported number of HIV tests received in the past year (12 months) with "0," "1" and "2 or more" recoded "never tested," "tested once" and "tested more than once" respectively.

Statistical Analysis

This study utilized Microsoft Excel, and SPSS version 25.[52] Univariate, bivariate and multivariate analyses (descriptive and inferential statistical methods) were performed, including the chi-squared test of associations and multinomial logistic regression (MLR) to examine the characteristics and associations between variables.[53-55] It was hypothesized that there is an association between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors, and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the clinical setting.[56-57] The type of HIV testing location and recruitment site city were controlled in the multivariate MLR, and "Never tested" was the reference category for the outcome in the main MLR analysis. An additional MLR analysis was conducted using the HIV testing history level category, "tested more than once," as the outcome variable reference category to examine the likelihood of getting tested once relative to tested more than once.

The split file command in SPSS was activated to generate two subgroups, clinical setting, and nonclinical setting, and the statistical analysis was conducted on the subgroups independently without separating the combined dataset into two separate files. Some assumptions were tested by reviewing the clinical setting dataset in the data view, and others checked by analyzing data in SPSS. For this study, a significance level, *p*-value was set at less than .05 ($p < .05$). When the cross-tabulation results showed scattered data with zero or low expected counts, the Exact (for small sample size < 50), Monte Carlo (for large sample size) methods were utilized instead of the asymptotic method for assessing significance.[55,58-59] All required assumptions including verification of independence of observations (mutually exclusive categories of the dependent variable), no multicollinearity between IVs, and no significant outliers were all examined and met.[55, 58-60] Data output was exported from SPSS to excel (secured via password) for creating result Tables. Cohen's interpretation of effect size was employed to examine the strength of the revealed associations. [61]

Results Analysis

The HPTN 061 secondary data utilized for this study included demographics, enrollment, and health care utilization information for 632 participants and excluded participants who reported receiving testing in a nonclinical setting and those with missing data for the selected study variables. Sample descriptive statistics are presented in Table 7. Most participants were within age groups 18-28 (30%) and 40-50 (35%), and the minority age group was 51 or older (14%). Also, 83% of the study population had less than a college degree, over 50% of the participants reported income level below $20,000, 68% had health insurance coverage (either government, such as Medicaid or private insurance), and about 83% reported having a preferred provider where they usually go when they are sick. Almost 70% reported a history of STDs (syphilis), although the response rate was 7% for the corresponding survey question. Only 16% of study participants indicated visiting a substance use counselor in the past six months. Community health center clinic/public health/free clinic was the most visited type of HIV testing location (47%). Almost half of the participants (48.3%) reported getting tested more than once in the past 12 months.

Table 7

Descriptive Statistics of Population Characteristics, HIV Testing History Levels in the Past 12 Months, Type of HIV Testing Location Setting, and Recruitment Site City in the Clinical Setting

Characteristics	No.	%
Predisposing factors		
Age in years		
18-28	193	30.3
29-39	133	20.9
40-50	222	34.9
51 or older	89	14.0
	637	100.0
Education attainment		
some high school or less	97	15.2
high school graduate or equivalent	207	32.5
some college or 2 year degree	224	35.2
college degree or more	109	17.1
	637	100.0
Income level		
less than $5,000	137	21.5
$5,000-$9,999	76	11.9
$10,000-$19,999	123	19.3
$20,000-$29,999	87	13.7
$30,000-$39,999	76	11.9
$40,000-$49,999	42	6.6
$50,000 or more	96	15.1
	637	100.0
Enabling Factors		
Health insurance status		
No	212	33.3
Yes	425	67.7
	637	100.0
Having a preferred provider		
No	110	17.3
Yes	527	82.7
	637	100.0

(*table continues*)

Characteristics	No.	%
Need Factors		
Health-seeking behavior for STD services[a]		
No	14	30.4
Yes	32	69.6
	46	100.0
Health-seeking behavior for substance-use services		
No	536	84.1
Yes	101	15.9
	637	100.0
HIV testing history levels in the past 12 months[b]		
Never tested	93	14.7
Tested once	234	37.0
Tested more than once	305	48.3
	632	100.0
Type of HIV testing location in the clinical setting		
Adult HIV/AIDS or infectious disease clinic	46	7.2
Sexually transmitted disease clinic	40	6.3
Community health center/public health clinic/free clinic	297	46.6
Family planning clinic	24	3.8
Hospital outpatient clinic	128	20.1
Emergency room	26	4.1
Private doctors office (including HMO)	76	11.9
	637	100.0
Recruitment city		
Atlanta	113	17.7
Boston	122	19.2
Los Angeles	79	12.4
New York City	111	17.4
San Francisco	98	15.4
Washington DC	114	17.9
	637	100.0

Note. [a]There were missing values for this variable since less than 10% of study participants responded to the corresponding survey question. [b]There were missing data for some categories of the outcome variable hence overall study sample size reduced from 637-632.

Bivariate Analysis

The bivariate analysis examined the characteristics and association between the study variables to determine how each of the IVs impeded or facilitated the more frequent use of HTS in the past 12 months in the nonclinical setting. The MLR was employed to test the secondary hypotheses. The results from the bivariate analysis informed the multivariate analysis. The chi-squared test (χ^2) of association results in Table 8 show that only age (p = .002) and education attainment (p = .03) were statistically significantly associated with HIV testing history levels in the past 12 months in the clinical setting, with Cramer's V = .13 and .11 respectively. Suggesting that age and education attainment were weakly associated with HIV testing history levels in the past 12 months. The MLR model also revealed that, HIV testing history levels in the past 12 months was associated negatively with age, $\chi^2(6, N = 632) = 20.68$, $p = .002$, and positively with education attainment, $\chi^2(6, N = 632) = 14.40$, $p = .03$.

Across all age categories, the 18-28 age group were more likely to have tested for HIV more than once in the past 12 months, as shown in Table 8 and Table 9. However, age group 40-50 were 39% more likely to get tested once versus never tested but still lower than age group 18-28, who were 59% more likely to have tested once and 125% more likely to have tested more than once versus never tested. Compared to BMSM who had a college degree or more, those with some college or 2 year degree were less likely to get more frequent testing but more likely to get tested once versus more than once. Across all educational attainment levels, the study participants with some college level or 2 year degree had the least odds for more frequent testing.

Although the other predictors were not statistically significant, the reported ORs and CIs from the MLR generated information about the likelihood of getting tested once or more than once in the past 12 months. Except for income levels $10,000-$19,000 and $20,000-$29,999, higher-income increased the likelihood of getting tested more than once in the past 12 months. Those with income level between $20,000-$29,999 compared to $50,000 or more had the lowest odds of getting tested once (OR= .73) or more than once (OR = .46) rather than never tested in the past 12 months. However, BMSM in the aforementioned income level were 58% more likely to get tested once versus more than once. As shown in Table 8 and Table 9, although most of the participants were insured, the uninsured were more likely to have tested once or more than once versus never tested in the past 12 months in the clinical setting. Also, the uninsured were 13% more likely to get tested once versus more than once.

The odds of getting more than one HIV test in the past 12 months was lower for participants who reported not having a preferred provider; however, they had higher odds of getting tested once versus more than once. Study participants who reported not seeking substance use services in the last six months were less likely to have more frequent testing in the prior year. The chi-square test results suggested the increased likelihood for more frequent testing for participants who had previously used STD services. The bivariate results for "health-seeking behavior for STD services" were unreliable due to the small sample size and the error message that "unexpected singularities in the Hessian matrix are encountered,"[62] hence excluded from the multivariate MLR.

Table 8

Bivariate analysis Results of the Chi-Square Test of Association by HIV Testing History Levels in the Past 12 Months in the Clinical Setting

Characteristics		HIV testing history levels in the past 12 months: Never tested	Tested once	Tested more than once	χ^2 (*p*-value)
Predisposing factors	*Age in years*				
	18-28	18(19.4)	59(25.2)	116(38.0)	.002
	29-39	27(29.0)	49(20.9)	57(18.7)	
	40-50	33(35.5)	95(40.6)	89(29.2)	
	51 or older	15(16.1)	31(13.2)	43(14.1)	
	Education attainment				.03
	some high school or less	15(16.1)	34(14.5)	45(14.8)	
	high school graduate or equivalent	20(21.5)	84(35.9)	102(33.4)	
	some college or 2 year degree	47(50.5)	71(30.3)	105(34.4)	
	college degree or above	11(11.8)	45(19.2)	53(17.4)	
	Income level				
	less than $5,000	20(21.5)	49(20.9)	66(21.6)	.49
	$5,000-$9,999	9(9.7)	29(12.4)	37(12.1)	
	$10,000-$19,999	21(22.6)	48(20.5)	52(17.0)	
	$20,000-$29,999	19(20.4)	33(14.1)	35(11.5)	
	$30,000-$39,999	7(7.5)	26(11.1)	43(14.1)	
	$40,000-$49,999	4(4.3)	18(7.7)	20(6.6)	
	$50,000 or more	13(14.0)	31(13.2)	52(17.0)	
Enabling factors	*Health Insurance Status*				
	No	26(28.0)	84(35.9)	101(33.1)	.39
	Yes	67(72.0)	150(64.1)	204(66.9)	
	Having a preferred provider				
	No	17(18.3)	41(17.5)	52(17.0)	.96
	Yes	76(81.7)	193(82.5)	253(83.0)	
Need factors	*Health-seeking behavior for STD services*				
	No	0(0)	7(43.8)	7(31.8)	.09
	Yes	8(100)	9(56.3)	15(68.2)	
	Health-seeking behavior for substance-use services				
	No	79(84.9)	194(82.9)	260(85.2)	.75
	Yes	14(15.1)	40(17.1)	45(14.8)	

Note. Expected counts and % (in parentheses) within HIV testing history levels in the past 12 months.

Table 9

Bivariate Multinomial Logistic Regression Predicting HIV Testing History Levels in the Past 12 Months in the Clinical Setting from Predisposing, Enabling, and Need Factors

Population Characteristics	HIV testing history levels in the past 12 months											
	Tested once vs. Never tested				Tested more than once vs. Never tested				Tested once vs. Tested more than once			
	OR	95% CI		*p*	OR	95% CI		*p*	OR	95% CI		*p*
		LB	UB			LB	UB			LB	UB	
Predisposing factors												
Age in years												
18-28	1.59	.70	3.57	.27	2.25	1.04	4.85	.04	.71	.40	1.23	.22
29-39	.88	.40	1.91	.74	.74	.35	1.55	.42	1.19	.65	2.17	.56
40-50	1.39	.67	2.90	.38	.94	.46	1.91	.87	1.48	.86	2.55	.16
≥ 51 (ref.)												
Education attainment												
some high school or less	.55	.23	1.36	.20	.62	.26	1.49	.29	.89	.49	1.62	.70
high school graduate or equivalent	1.03	.45	2.33	.95	1.06	.47	2.37	.89	.97	.59	1.59	.90
some college or 2 year degree	.37	.17	.79	.01	.46	.22	.97	.04	.80	.48	1.31	.37
College degree above (ref.)												
Income levels												
less than $5,000	1.03	.45	2.36	.95	.83	.38	1.81	.63	1.25	.70	2.22	.46
$5,000-$9,999	1.35	.50	3.63	.55	1.03	.40	2.65	.95	1.31	.68	2.54	.42
$10,000-$19,999	.96	.42	2.19	.92	.62	.28	1.37	.23	1.55	.86	2.80	.15
$20,000-$29,999	.73	.31	1.72	.47	.46	.20	1.05	.07	1.58	.82	3.03	.17
$30,000-$39,999	1.56	.54	4.48	.41	1.54	.56	4.19	.40	1.01	.52	1.96	.97
$40,000-$49,999	1.89	.53	6.67	.32	1.25	.36	4.29	.72	1.51	.69	3.28	.30
≥ $50,000 (ref.)												
Enabling factors												
Health Insurance Status												
No	1.44	.85	2.44	.17	1.28	.76	2.13	.35	1.13	.79	1.62	.50
Yes (ref.)												
Having a preferred provider												
No	.95	.51	1.77	.87	.92	.50	1.68	.78	1.03	.66	1.62	.89
Yes (ref.)												
Need factors												
Health-seeking behavior for substance-use services												
No	.86	.44	1.67	.65	1.02	.53	1.96	.94	.84	.53	1.34	.46
Yes (ref.)												

Note. Odds Ratio (OR); Confidence Intervals (CI); Lower Bound (LB); Upper Bound (UB); Reference Category (ref.).

Multivariate Analysis

The MLR model tested the main hypotheses to explore the significance, strength, and direction of the association between multiple predictors' predictive effects while controlling for other variables (including confounders) in the model.[63] The multivariate analysis examined the association between predisposing (age, education attainment, and income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for substance-use services) with HIV testing history levels in the past 12 months. Potential differences in site-specific recruitment and setting-specific strategies may influence associations between predictor and outcome variables. The type of HIV testing location and recruitment site city were controlled in the multivariate MLR. The model presented 15.5% (Nagelkerke pseudo R^2) of the variance in HIV testing history levels in the past 12 months. The MLR results also indicated that participants recruited from the Atlanta site were 68% (p = .02) less likely to get tested more than once compared to never tested in the past 12 months in the clinical setting.

There was a predictive association between the variables in the model, χ^2(52, N = 632) = 91.14, p = .001. Table 10 shows the output from the multivariate MLR analysis. A statistically significant association between the overall effect of age, χ^2(6, N = 632) = 18.37, p = .005, and education attainment, χ^2(6, N = 632) = 15.50, p = .02 with HIV testing history levels in the past 12 months among BMSM in the clinical setting was revealed from the main model. Although the overall effect of health insurance status was not statistically significant (p = .08), compared to participants who had health insurance coverage, those who had no coverage were almost twice as likely to get tested once (p = .03) or more than once, (p = .04).

Compared to age group 51 or older, age 18-28 were likely to get more frequent testing—67% (p = .27) for tested once or 121% (p = .07) for more than once—versus never tested in the past 12 months, while controlling for other variables in the model. Also, BMSM in the age group 18-28 were 25% less likely to get tested once versus more than once. Aged 40-50 years were 42% more likely to get tested once versus never tested. Like the trends reported from the bivariate analysis, those with some college or 2 year degree were less likely to test frequent testing in the past 12 months.

All other predictors in the multivariate MLR were not significant, and results were similar to the bivariate MLR results. Although income level was not statistically significantly associated with outcome, $\chi^2(12, N = 632) = 13.04, p = .37$, income level between \$20,000-\$29,999 compared to \$50,000 or more, had higher odds for more frequent testing across all income categories. However, 58% more likely to get tested once and more than once versus never tested. The odds of getting more than one HIV test in the past 12 months was lower for participants who reported not having a preferred provider and not previously seeking substance use services in the last six months.

The primary (main) null hypothesis that there is no association between predisposing (age, education attainment, and income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for substance-use services) with HIV testing history levels in the past 12 months, while controlling for other variables in the model was rejected and the alternative accepted.

Table 10

Multivariate Multinomial Logistic Regression Predicting HIV Testing History Levels in the Past 12 Months in the Clinical Setting from Predisposing, Enabling, and Need Factors, Controlling for Type of HIV Testing Location Setting and Recruitment Site City

Population Characteristics	HIV testing history levels in the past 12 months											
	Tested once vs. Never tested				Tested more than once vs. Never tested				Tested once vs. Tested more than once			
	OR	95% CI LB	95% CI UB	*p*	OR	95% CI LB	95% CI UB	*p*	OR	95% CI LB	95% CI UB	*p*
Predisposing factors												
Age in years												
18-28	1.67	.67	4.12	.27	2.21	.93	5.29	.07	.75	.41	1.39	.36
29-39	.79	.34	1.83	.58	.60	.26	1.36	.22	1.32	.70	2.47	.39
40-50	1.42	.65	3.12	.38	.97	.45	2.09	.93	1.47	.83	2.61	.18
≥ 51 (ref.)												
Education attainment												
some high school or less	.47	.17	1.35	.16	.71	.25	2.00	.52	.67	.33	1.34	.25
high school graduate or equivalent	.98	.39	2.49	.97	1.37	.54	3.48	.51	.72	.40	1.27	.26
some college or 2 year degree	.35	.15	.82	.01	.51	.22	1.16	.11	.69	.40	1.21	.19
College degree above (ref.)												
Income levels												
less than $5,000	1.51	.56	4.06	.41	.90	.46	3.13	.81	1.25	.63	2.49	.52
$5,000-$9,999	2.20	.71	6.82	.17	1.28	.57	5.16	.64	1.28	.60	2.76	.52
$10,000-$19,999	1.45	.54	3.87	.46	.80	.37	2.52	.62	1.50	.74	3.01	.26
$20,000-$29,999	.87	.33	2.31	.78	.53	.21	1.43	.17	1.58	.77	3.26	.21
$30,000-$39,999	2.19	.70	6.89	.18	1.70	.78	7.12	.32	.93	.45	1.91	.85
$40,000-$49,999	2.53	.67	9.58	.17	1.43	.45	6.30	.58	1.50	.67	3.37	.32
≥ $50,000 (ref.)												
Enabling factors												
Health Insurance Status												
No	2.01	1.06	3.84	.03	1.94	1.02	3.68	.04	1.04	.67	1.61	.87
Yes (ref.)												
Having a preferred provider												
No	.98	.48	1.97	.95	.84	.42	1.69	.62	1.16	.70	1.92	.56
Yes (ref.)												
Need factors												
Health-seeking behavior for substance-use services												
No	.74	.36	1.54	.42	.80	.39	1.65	.55	.93	.56	1.54	.77
Yes (ref.)												

Note. Odds Ratio (OR); Confidence Intervals (CI); Lower Bound (LB); Upper Bound (UB); Reference Category (ref.).

Discussion

Despite the CDC recommendation that sexually active MSM get tested for HIV more frequently, BMSM at higher risk of HIV infection are less likely to get tested in the past 12 months.[3,10,25] BMSM have high undiagnosed infection rates and are disproportionately impacted by the HIV epidemic in the United States and are more likely to get tested in the nonclinical settings compared to other MSM subgroups.[3] Also, routine testing (usually offered in the clinical setting) generates more HIV testing events.[20] Therefore, it is imperative to promote more frequent routine testing (more than one HIV test) annually among BMSM in the clinical setting to help detect early and previously undiagnosed infections.

Previous studies have examined the influence of multilevel factors on the use of HTS, defined by lifetime or frequent testing.[9,17, 30, 33, 35, 66] Reported barriers to routine HIV testing include the fear of stigma and discrimination for being HIV positive, low-risk perception, and concerns about confidentiality and anonymity of HIV testing have implications in influencing the HIV testing history levels.[14,67] However, this study underpinned by the ABM defined the utilization of HTS by the number of HIV tests received in the past 12 months in the clinical setting. The outcomes from this study have implications for informing efforts to promote a combined approach, encompassing a targeted (risk-based) and routine strategies, to promote more frequent testing.[3, 25, 64-65] The multivariate analysis revealed that HIV testing history levels in the past 12 months were significantly associated, negatively with age and positively with education attainment (predisposing factors) and negatively with health insurance status (enabling factor) in the clinical setting. However, income level (predisposing factor), having a preferred provider (enabling factor), and health-seeking behavior for substance use services (need factor) were not.

Participants who were younger (aged 18-28) and had no health insurance were more likely, whereas those with some college or 2 year degree (less than a college degree) were less likely to get tested more than once rather than never tested in the past 12 months. The findings from this study provided additional information, explained by the ABM, about the associations between different age groups, education attainment levels, health insurance status, and more frequent use of HTS (the number of HIV tests received in the clinical setting) in the past 12 months. The present study's outcomes also suggested the need for further research to examine the associations between population characteristics and HIV testing history levels in the past 12 months in the nonclinical setting. The least likelihood of not getting tested more frequently in the clinical setting—among those with some college or 2 year degree—will be further examined in the nonclinical setting.

Similar findings have previously been reported on the influence of multilevel factors on the likelihood of more frequent HIV testing in the past 12 months. Being older and belonging to a sexual minority group (such as BMSM) increased lifetime HIV testing rather than more frequent testing.[30,33] The CDC reported that younger than 40, college degree or more, income above poverty level, health insurance status, and having a health provider in the past 12 months were all associated with the increased likelihood of getting tested for HIV.[3] This study confirmed findings from the CDC analysis except for the positive association with health insurance coverage, which contrasted the reported negative association. This study was unique from previous studies based on the measure of more frequent use of HTS, defined by the number of tests received in the past 12 months, and the examination of associations with population characteristics at a specific HIV testing location, namely clinical setting.

Multivariate analysis conducted by Mannheimer et al. used the HPTN 061 secondary data[30] and showed that health insurance coverage was not independently associated with HIV testing in the prior year, contrary to the negative statistically significant association observed in this study. However, results from the univariate analysis from Mannheimer et al. indicated a statistically significant association between health insurance coverage (insured vs. uninsured) and infrequent HIV testing, whereby the likelihood for infrequent testing was higher for those who were uninsured.[30] In this study, having health insurance coverage (posited by the ABM as a significant predictor of health service use) decreased the odds of getting tested once or more than once in the clinical setting.

Previous research findings and nationally analyzed data,[18,36] have shown that having insurance coverage facilitates access and the use of HIV services. The inverse association between health insurance coverage and HIV testing was also reported among Whites (statistically significant) and Blacks and Hispanics (not significant), similar to the negative association reported by this study among BMSM.[33] Considering that more Americans have health insurance coverage post-implementation of the 2010 Patient Protection and Affordable Care Act (ACA), the inverse association between health insurance coverage and HIV testing history levels in the past 12 months in the clinical setting have potentially negative implications for insured BMSM.

The long-term impact of not having health insurance was examined[57] among long-term uninsured residents in South Carolina, and the findings showed that having prior health insurance was positively associated with health service utilization. The implementation of major provisions of ACA occurred after the completion of the HVTN 061 study,[56] hence the association with health insurance status revealed from the HPTN 061 secondary data for this study may suggest a past indication. However, Atlanta (with disproportionately high incidence and prevalence of HIV among BMSM) is one of the states in the Southern United States who did not opt to expand Medicaid coverage under ACA. The significantly negative association revealed in this study between the Atlanta recruitment site and HIV testing history levels in the past 12 months suggests a critical need to continue efforts to address the underutilization of HTS. The current national initiative to end the HIV epidemic in the United States aims to address the underutilization of HTS among key population groups.[29]

The observed increased odds for more frequent testing for selected income levels were consistent with previous studies that reported an association between higher income and increased likelihood of getting tested.[3,30] Although not statistically significant, participants with income between $20,000-$29,999 were less likely to have more frequent testing in the past 12 months than income level $50,000 or more. Across all income levels (except $10,000 to $29,999 income levels), lower-income decreased the likelihood of more frequent testing in the past 12 months. The results from a univariate analysis conducted for a study that utilized the HPTN 061 dataset[30] revealed a statistically significant association between income level (< \$10,000 vs. ≥ \$10,000) and infrequent testing. The likelihood of infrequent testing among the sample of BMSM was higher for those who reported income < \$10,000.

The HPTN 061 study was conducted in 2009-2010 and the income level between \$20,000-\$29,999, depending on the household size and the 2009-2010 "federal poverty level" (FPL),[68] may have qualified participants for Medicaid health insurance coverage.[64] Therefore, having health insurance coverage may have contributed to the decreased odds of testing for participants who reported income level between \$20,000-\$29,999 in the clinical setting. The results from this study suggested that in the clinical setting, not having health insurance coverage increased the odds for more frequent testing in the past 12 months.

The association between income level and HIV testing history levels in the past 12 months will be further examined in the nonclinical setting to compare associations between settings. This future investigation may help understand why income level between \$20,000-\$29,999 was associated with the least odds of HIV testing history levels in the past 12 months across all the income levels examined for this study. Additionally, examining the HIV testing history levels in the past 12 months in the nonclinical setting may help investigate if participants represented in the income level \$20,000-\$29,999 were more likely to get tested in the nonclinical setting.[69] Were participants who reported income level between \$20,000-\$29,999 insured? Did they prefer to receive HTS in the nonclinical setting?

Provider related factors may also influence the preference to utilize HTS in clinical or nonclinical settings. About 83% of study participants indicated they had a preferred provider, although not significantly associated with HIV testing history levels in the past 12 months. Providers play a critical role in facilitating access and utilization of HIV prevention, treatment, and care services.[35-36,70] Engaging patients and forming trusted provider-patient relationship support improved care. Reported results suggested that more training for providers in the clinical setting is critical to promote efforts towards the increased engagement and education of sexually active BMSM about the benefits of more frequent HIV testing in the past 12 months.[10,25]

Similar to the decreased odds for more frequent testing in the past 12 months for not having a preferred provider, participants who reported not seeking treatment for substance use were less likely to report more frequent HIV testing history levels in the past 12 months in the clinical setting. Findings reported from a previous study[9] revealed that over 50% of persons identified at-risk for STD and substance use had not tested for HIV but had seen a health care provider for other services. Therefore, as posited by the ABM, seeking HTS in conjunction with other health services, such as substance use services (need factor), facilitates the more frequent use of HTS in the past 12 months.

This study generated outcomes to understand the correlates of more frequent testing in the past 12 months among BMSM in the clinical setting and identified some questions for further investigation. Although the findings from this study have informed the associations of population characteristics with HIV testing history levels in the past 12 months among BMSM in the clinical setting, it is prudent to interpret the results in light of the following limitations. Firstly, the noted limitations from the original HPTN 061 study also applied to this study, including the use of a cross-sectional study design, which impacted causality inferences about direction and associations.[71] The participant referral and other sampling strategies utilized at each recruitment site may have potentially introduced selection bias. Hence the recruitment site city and type of location setting were controlled in the multivariate MLR.[30,46]

Secondly, the variables utilized from the HPTN 061 secondary data were all self-reported using the validated ACASI system[47] (aimed to reduce social desirability bias). Therefore, concerns about over-reporting and on the reliability and validity of the self-reported data is another limitation.[72] Thirdly, the sample of BMSM included in this secondary analysis recruited participants from sites in six U.S. cities (with high HIV incidence and prevalence) using specific study eligibility criteria (including the requirement to recruit high-risk BMSM). Therefore, the study sample may not represent all BMSM in the U.S.; hence, the generalizability of this study's outcomes is limited. However, the participants' population characteristics in the HPTN 061 study were similar to the general population of high-risk BMSM in the United States who are disproportionately impacted by the HIV epidemic.[3,66,70]

This study utilized one of the largest secondary datasets collected from BMSM at-risk for HIV infections from six U.S. sites, and this dataset has been widely used over the years by multiple researchers, including recent studies[38-43] to examine factors associated with HIV acquisition among BMSM. This study primarily examined associations between the population characteristics and HIV testing history levels in the past 12 months using a cross-sectional design (considering the limitations previously mentioned) in the clinical setting. This study's findings established a baseline for further studies, including a study to examine the nonclinical setting associations and another study to compare and determine the significance of the difference in associations between settings.

Future research should examine additional correlates of more frequent HIV testing history levels considering recent challenges associated with health care reform and its implications on health insurance coverage, access, and utilization of health services and the current national efforts towards "ending the HIV" in the United States. The future research study should utilize a more recent country-level dataset, collected from multiple MSM subgroups (including transgender)[73] across multiple cities in the United States. The proposed national dataset should encompass high HIV incidence and prevalence population groups, multiple risk levels, type of HIV testing locations stratified across rural and urban settings and clinical and nonclinical settings, and multiple testing frequencies (every 3 months, 6 months, 12 months, 24 months, and lifetime testing). This future study should examine associations between a broad range of population characteristics (predisposing, enabling, and need factors) and HIV testing history levels to generate findings to inform on strategies to improve the more frequent use of HIV testing services to support the HHS initiative towards "Ending the HIV Epidemic" in the United States.[29]

Conclusion

Despite the aforementioned limitations, this study has generated information about the associations between BMSM population characteristics and HIV testing history levels in the past 12 months to inform efforts towards enhancing the more frequent use of HTS in the clinical setting. It was hypothesized that the population characteristics of BMSM at higher risk for HIV would be associated with more frequent use of HTS (more than one HIV test) in the past 12 months in the clinical setting. Also, as previously discussed, the preference for BMSM to utilize HTS in the nonclinical versus the clinical setting compared to other MSM subgroups suggest unique trends in the association between population characteristics and HIV testing history in the clinical setting.[3]

The present study revealed statistically significant associations between population characteristics, namely age, education attainment, and health insurance status with HIV testing history levels in the past 12 months. Younger age group (18-28), those with college degree and above, and those without health insurance coverage were more likely to get tested once or more than once in the clinical setting. The outcomes from this study have the potential to inform the development of interventions to improve targeted and routine-based strategies in the clinical setting, across different age groups, education attainment levels, and health insurance coverage status. Although the other population characteristics were not statistically significantly associated, the reported odds ratios provided information about the likelihood of these predictors impeding or facilitating the more frequent use of HTS in the past 12 months among BMSM. Higher-income level, having a preferred provider, and health-seeking behavior for substance use services increased the likelihood of getting more frequent testing. ore frequent testing (more than one HIV test in the past 12 months) offers the opportunity to detect early HIV infections, promote immediate linkage, and sustain the use of ART towards viral suppression. The positive social change impact of the revealed associations has the potential to reduce the HIV morbidity and mortality rates, improve overall health outcomes of PLWH, and reduce the HIV transmission from BMSM who are unaware of their positive status.[28-29]

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IRB Approvals, Informed Consent, and Human Subject Protection

Walden University Institutional Review Board (IRB) approval IRB # 04-16-20-0446424. The IRBs at all participating institutions (sites) approved the HPTN 061 study: Emory University IRB #2 - Biomedical IRB (Committee A), Fenway Community Health IRB #1, University of California, Los Angeles - South General Campus IRB, Columbia University Medical Center IRB, New York Blood Center IRB, San Francisco General Hospital Committee IRB #2, and George Washington University Medical Center IRB. Written informed consent was obtained from all study participants.

All procedures performed in this study involved the use of secondary data from HPTN 061 study that has been delimited and deidentified. No actual human participants were engaged or recruited. No animals were involved in this study.

Disclaimer

The author notes that this dissertation is hers alone and does not represent the views of the HPTN 061 study team, the HIV Prevention Trials Network or the study sponsor, the U.S. National Institutes of Health.

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Manuscript 2: Black MSM Population Characteristics and HIV Testing History Levels in the Nonclinical Setting

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Outlet for Manuscript

Submission Guidelines for the "AIDS Care" Journal

The manuscript, "Black MSM Population Characteristics and HIV Testing History Levels in the Nonclinical Setting," will be submitted to the "AIDS Care" (https://authorservices.taylorandfrancis.com/using-scholarone-manuscripts/), an international peer-reviewed journal that publishes on a broad range of topics in the HIV field, including issues related to HIV prevention, treatment, and care. Readers for this journal include medical practitioners, clinicians, nurses, and health educators. The manuscript topic aligns with the selected journal's subject matter area since this study examined population characteristics that impede or facilitate the more frequent use of HIV testing services in the past 12 months. Study outcomes aim to inform intervention strategies to improve HIV prevention and transmission outcomes. This manuscript will not opt for open access. Hence there are no associated publishing fees. The submission guidelines for AIDS Care follow specific requirements including a title page, an abstract (no more than 200 words), keywords with about 3-6 words, the main text outline should include "Introduction, Methods, Results, Discussions, Conclusions and References" section headings and no more than 5 figures and tables. The "Acknowledgments" (grant and financial assistance) should be provided after the references. The in-text and reference citation style follows the American Psychological Association (APA) referencing style.

Black MSM Population Characteristics and HIV Testing History Levels in the Nonclinical Setting

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Abstract

Black MSM (BMSM) are more likely unaware of their HIV status, less likely to get tested yearly, and prefer to use testing services in the nonclinical setting, compared to other MSM subgroups. Guided by the behavioral model for vulnerable populations, this cross-sectional quantitative study used secondary data for 557 at-risk BMSM age 18 or older from HIV Prevention Trial Network 061. Multinomial logistic regression analysis was used to examine the association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months (never tested; tested once; tested more than once) in the nonclinical setting. Results revealed significant associations, negatively with age and positively with education attainment (predisposing factors). Age group 18-28 years were 196% more likely and those with some college or 2 year degree were 38% less likely to get tested more than once compared to never tested. Positive social change impact of revealed associations includes the potential to inform targeted strategies to promote frequent testing (more than one HIV test annually) in the nonclinical setting (especially among at-risk BMSM with less than college degree and older) to help facilitate early diagnosis and reduce HIV transmissions from those unaware of their status.

Keywords

HIV; HIV testing history levels; Predisposing, enabling, and need factors; Black men who have sex with men (BMSM); Nonclinical setting; Behavioral model of health services use

Introduction

HIV Epidemic in the United States: Geographic and Demographic Trends

Geographic and demographic trends characterize the human immunodeficiency virus (HIV) epidemic in the United States. Over 50% of new diagnoses in 2017 and 2018 were accounted for by less than 50 counties in mostly rural areas in the southern United States and among minority and vulnerable populations (Center for Disease Control and Prevention [CDC], 2018, 2019b, 2020; Reif, Safley, McAllaster, Wilson, & Whetten, 2017). Although the annual HIV diagnoses remained steady in the United States from 2012-2016, men who have sex with men (MSM) represented 66% of all new HIV diagnoses with 40% Black MSM (BMSM) and among persons aged 25-34 years (CDC, 2019b). Despite the significant progress in HIV prevention, treatment, and care continua, about 15% of undiagnosed HIV infections accounted for over 40% of new infections (CDC, 2019c, 2020).

Efforts to address the high HIV incidence and prevalence rates include the increased uptake of HIV testing services (HTS), which encompasses a broad range of comprehensive services (Joint United Nations Programme on HIV/AIDS [UNAIDS], 2017b). The missed opportunities from the delayed or infrequent use of HTS challenge efforts to combat the United States HIV epidemic. Examining the challenges associated with the high incidence and prevalence in key population groups—includes exploring factors that influence underutilization or infrequent HIV testing by applying the Gelberg-Anderson behavioral model for vulnerable populations—supports a systematic approach to explaining the multilevel aspects (Andersen,1995; Gelberg, Andersen, & Leake, 2000).

The ABM posits that health system-related factors (associated with the type of HIV testing location setting, such as nonclinical setting) and population characteristics (associated with predisposing, enabling, and need factors) impede or facilitate the use of health services (such as HIV testing services). Whereby, the CDC (2016, 2019b, pp. 25-26) identified HIV testing locations, such as "private doctor's office, emergency department, hospital, community health center" as clinical settings and "HIV counseling and testing site, HIV street outreach program or mobile unit, needle exchange program," and community-based organization (CBO), as nonclinical settings.

Health-System Related Factors: Clinical and Nonclinical Settings

The CDC recommends that key populations at higher risk of HIV infection receive at least annual HIV testing in both clinical and nonclinical settings aims to encourage more frequent HIV testing (DiNenno et al., 2017, 2018; US Preventive Services Task Force [USPSTF], 2019). However, the HIV testing rates from jurisdictions, especially in the southern United States, show that underutilization of HTS among BMSM continues to be a problem in the nonclinical setting (Marano et al., 2018). Analysis of state HIV surveillance and national survey datasets from 2000-2014 reported a 27% delayed HIV diagnosis for BMSM compared to White MSM in the rural settings (Sheehan et al., 2017). Health providers should offer more testing opportunities in nonclinical setting (Dailey et al., 2017) since BMSM are more likely to get tested in nonclinical setting (CDC, 2019b) and hence can benefit from a more frequent HIV testing history to help identify more HIV infections and potentially reduce the number of undiagnosed infections.

HIV Testing Services in the Clinical and Nonclinical Settings

HTS at settings, such as community-based organization centers, HIV counseling and volunteer centers, and HIV outreach program sites, are examples of test locations in the nonclinical setting. Although BMSM were more likely to get tested in a nonclinical setting (34.2% versus 24.7%) compared to White MSM (CDC, 2019b) and have high prevalence and incidence (CDC, 2020; Sullivan et al. 2015), reported results from Marano et al. (2018) showed low testing rates. Routine testing generates more testing events and averted transmission in the clinical setting (primary physician office or clinic, ED, and community center free clinic). In contrast, targeted strategies in the nonclinical setting, such as community-based organization (CBO) facilities, HIV street outreach programs or mobile units, and HIV counseling and testing site, were shown to have overall cost-effectiveness and detected more new diagnosis from PLWH who were unaware of their positive status (Castel et al., 2015; CDC, 2019b). Some of the factors that impede and facilitate the use of HTS at a testing location include health-force fear, attitudes, behaviors, and knowledge on health system testing strategies (Elgalib, Fidler, & Sabapathy, 2018).

Therefore, it is necessary to examine the health system environment factors that impede or facilitate the use of HTS to inform routine and targeted HIV testing interventions that will promote more frequent HIV testing among BMSM to increase the opportunity to detect new and previously undiagnosed infections. There is a lack of understanding regarding how factors (including those associated with HIV risk behaviors) impede or facilitate the frequent use of HTS (defined by three unique HIV testing history levels) among BMSM in the nonclinical setting. The ABM, in alignment with the aims of this study, posits that health system-related factors (such as those associated with nonclinical settings) and population characteristics (associated with predisposing, enabling, and need factors) impede or facilitate the use of health services (such as HTS) in the nonclinical setting (Andersen,1995; Gelberg, Andersen, & Leake, 2000).

BMSM HIV Testing History

Blacks (including BMSM) were more likely to ever get tested compared to other racial-ethnic groups but have low HIV testing history within the past 12 months (CDC. 2019c; Li, Purcell, Sansom, Hayes, & Hall, 2019; Liu et al., 2019; Patel et al., 2018). Modeling analysis revealed that individuals who are unaware of their status and those aware but not on antiretroviral therapy (ART) accounted for 80% of new HIV diagnoses (Li et al., 2019). Increased annual HIV testing enhances the opportunity to detect recent HIV or previously missed infections, reduces the HIV morbidity and mortality rates, improves overall health outcomes of people living with HIV (PLWH), and reduces HIV transmission (Pitasi et al., 2018). More frequent testing also offers the opportunity to detect early HIV infections, promote immediate linkage, and sustained the use of ART towards viral suppression (Fauci, Redfield, Sigounas, Weahkee, & Giroir, 2019). The analysis results from a large cohort study of BMSM on HIV testing history from six U.S. cities reported that an estimated 1out of 5 were infrequent testers with no HIV testing within the prior year, and an estimated 1 out of 8 were non-testers with no previous testing history (Mannheimer et al., 2014).

A systematic review conducted on studies that examined the benefits of frequent screening suggested further research to characterize and compare factors (including individual risk factors that enhance HIV acquisition) associated with more frequent versus annual utilization of HTS among BMSM (DiNenno et al., 2018). It is imperative to examine factors that impede or facilitate the number of HIV tests received in the past 12 months among at-risk population groups, such as BMSM aged 25-34 years (CDC, 2019b), to help inform strategies to improve the HIV testing history levels among BMBM in the nonclinical setting.

Population Characteristics Influencing HIV Testing History

Predisposing, enabling, and need factors were significant influencers in facilitating or impeding the lifetime use of HTS compared across racial and ethnic groups (Lo, Runnels, & Cheng, 2018). Across all racial groups, being female, older, and belonging to a sexual minority group predicted increased lifetime HIV testing (measured as ever tested or not, rather than the number of HIV tests received). According to the CDC (2019b), less than 40 years old, college degree or more, income above poverty rate, health insurance coverage, and a visit to a health provider in the past 12 months were more likely to get tested. Mannheimer et al. (2014) also reported that health insurance was not independently associated with infrequent HIV testing, although having health insurance coverage has the potential to increase access to HTS.

Gaps in health insurance coverage in settings with high HIV incidence and prevalence have significant implications on access and the use of HTS, especially in the southern United States (Garfield, Damico, & Orgera, 2020). However, various types of health insurance coverage provide HIV testing as a basic covered service at low cost or free in facilities, such as community health centers and CBOs (Kaiser Family Foundation, 2019). This study examined the association of health insurance status (coverage) on annual versus frequent use of HTS. Factors that influence preexposure prophylaxis (PrEP) also influence the use of HTS since the latter is critical in initiating and monitoring PrEP use. Some facilitators of PrEP use include having a preferred provider and a dedicated health service location (Elopre, Kudroff, Westfall, Overton, & Mugavero, 2017). Access and utilization of PrEP services were associated with higher education status, health insurance coverage, and being older among a young MSM population (Marks et al., 2017).

A systematic review conducted by DiNenno et al. (2017) revealed that less than half of MSM ever tested within the past 12 months. The infrequent and delayed testing rates among persons at-risk for HIV, such as sexually active BMSM with risk factors including substance use and sexually transmitted diseases (STD), contribute to the high undiagnosed HIV infection, incidence, and prevalence rates. Researchers (previously discussed) have investigated factors that influence the use of HTS and HIV testing history. However, there is a lack of understanding regarding the association between population characteristics (independent variables), namely predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STDs and substance use services) factors across the three HIV testing history levels (the number of HIV tests received in the past 12 months). Also, as previously discussed, the preference for BMSM to receive testing in a nonclinical setting compared to other MSM subgroups suggest unique trends in the association between population characteristics and HIV testing history in the nonclinical setting.

This study sought to address the literature gap by applying the ABM to guide the systematic examination of the association between variables and proposed the research question, Is there an association between population characteristics and HIV testing history levels among BMSM in the nonclinical setting? It was hypothesized that there is an association between predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months (never tested; tested once; tested more than once) among BMSM in the nonclinical setting, while controlling for all other variables. The dependent variable defines three testing frequencies in the past 12 months and aligns with a more frequent HIV testing history recommended by the CDC (DiNenno et al., 2018).

Methods

Study Design and Source of Data

This quantitative cross-sectional study utilized secondary data collected from the HIV Prevention Trials Network [HPTN] 061 (2009), a large feasibility and acceptability study conducted in six U.S. cities (Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington DC) among BMSM age 18 years or older (Koblin et al., 2013). The secondary data offers a unique dataset that includes self-reported responses about the number of HIV tests received in the past 12 months, defined as the HIV testing history levels in the past 12 months. The HPTN 061 study dataset has been widely used over the years by multiple researchers to examine factors associated with HIV acquisition among BMSM (Hermanstyne et al., 2018, 2019; Hickson et al., 2017; Latkin et al., 2017; Levy et al., 2017; Nelsen et al., 2016). The HPTN 061 dataset has proven invaluable in answering key research questions to further explore and address the disparities in HIV incidence and prevalence among BMSM since 2013. A quantitative study design was appropriate for this study, in alignment with the problem, purpose, and theoretical framework, to examine the association between population characteristics and HIV testing history levels among BMSM in the nonclinical setting (Creswell & Creswell, 2018; Newman & Covrig, 2013).

Ethical Considerations

The HPTN 061 study received all required regulatory approvals, including institutional review board (IRB) approval from study sites. The secondary dataset retrieved from the HPTN statistics and data management center (SCHARP) secured website was delimited and de-identified. This study did not recruit or engage human subjects. The formal request to access the secondary data included the approval of the HPTN data use agreement. Walden University IRB issued final approval to access and commence data analysis.

Study Population and Sampling Strategy

The HPTN 061 sites utilized a sampling strategy consisting of community-based engagement and participant-based referral methods and collected baseline data via a validated audio computer-assisted self-interview (ACASI) system (Population Council, n.d.) and structured participant interviews questions from 1553 participants. For this study, the estimated a priori sample size was generated from two methods. The minimum events per variable (EPV) approach formula (n = 100 + 50i, where “i” is the number of independent variables) estimated 450 (Bujang, Sa'at, Sidik, & Joo, 2018). The G*Power Software (Faul, Erdfelder, Buchner, & Lang, 2013) using an alpha of 0.05, both 80% and 95% power and effect size of 1.4 odds ratio based on findings from previous studies (Azfredrick, 2016; Lo et al., 2018; Marks et al., 2017) estimated 294- 480. The final sample size of 538 (for multivariate analysis) and 557 (for bivariate analysis) were more than the estimated range, and the post hoc power analysis confirmed adequate power > 95%.

Nonclinical Setting Dataset. The demographics, enrollment, and health care utilization datasets for HPTN 061 were exported from the secured HPTN website, SCHARP, as Microsoft Excel workbooks (2016) and imported into the statistical package for social sciences (SPSS) version 25 software and merged (IBM, 2017; Wagner, 2016). The merged dataset was sorted based on the CDC designation for clinical and nonclinical settings (CDC (2016, 2019b) and a new variable labeled “setting” was utilized to link each participant data to a clinical or nonclinical setting coded as “1” and “2” (respectively). The self-reported responses generated from the 16-level categorical variable for survey question, Where did you get your most recent HIV test? (variable label “ACTSTWH”), identified the type of HIV testing location per participant response. The combined dataset was screened, non-study related variables excluded, and preliminary descriptive statistics conducted and checked against the original HPTN 061 datasets to verify the accuracy of exported data. The nonclinical setting dataset was utilized for this study.

Variable Definitions, Values, and Levels of Measurement

The study variables namely, the predisposing (age, education attainment, and income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for STD and substance use services) population characteristics, and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) were all measured as categorical variables. The type of HIV testing location and recruitment site city were included as confounders. The HIV testing history levels in the past 12 months was generated by transforming the numeric scale variable labeled as “ACVTSTN” into a nominal variable. The variable generated responses to the survey question, How many times have you been tested for HIV in the last year? and based on the number of HIV tests received in the past year (12 months), “0,” “1” and “2 or more” was recoded to “never tested,” “tested once” and “tested more than once,” respectively.

Statistical Analysis

Statistical analysis for this study utilized the Microsoft Excel (2016) and SPSS version 25 (IBM, 2017; Wagner, 2016). It was hypothesized that there is an association between predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and need (health-seeking behavior for STD and substance use services) factors, and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) among BMSM in the nonclinical setting. Univariate, bivariate, and multivariate analysis (descriptive and inferential statistical methods) were performed, including the chi-squared test of associations and multinomial logistic regression (MLR) to examine the characteristics of associations between variables (Mark & Peter, 2016; Osborne, 2015; Warner, 2013). The outcome variable category "Never tested" was selected in the main MLR analysis as the reference. An additional MLR analysis was conducted using the HIV testing history level category, "tested more than once," as the reference category to examine the likelihood of getting tested once relative to tested more than once. Type of HIV testing location and recruitment site city were controlled in the multivariate MLR model, considering site-specific recruitment and setting-specific strategies (Hosmer, Lemeshow, & Sturdivan, 2013; Pourhoseingholi, Baghestani, & Vahedi, 2012).

The split file command in SPSS generated two subgroups, clinical setting, and nonclinical setting, and the statistical analysis was conducted on the subgroups independently without separating the combined dataset into two separate files. Some assumptions were tested by reviewing the clinical setting dataset in the data view, and others checked by analyzing data in SPSS. For this study, a significance level, p-value was set at less than .05 ($p < .05$). When the cross-tabulation results showed scattered data with zero or low expected counts, the Exact (for small sample size < 50) method was utilized instead of the asymptotic method for assessing significance (Mehta & Patel, 2012; McHugh, 2013; Warner, 2013). All required assumptions—including verification of independence of observations, no multicollinearity between IVs, and no significant outliers—were all examined and met (Mehta & Patel, 2012; McHugh, 2013; Ranga, Murty, & Athithan, 2019; Warner, 2013). Data output was exported from SPSS to excel (secured via password) for creating result Tables.

Results Analysis

The HPTN 061 secondary data utilized for this study excluded participants who reported testing in a clinical setting and had missing data for the required variables. The final nonclinical setting dataset included demographics, enrollment, and health care utilization information for 557 (for the bivariate analysis) and 538 (for multivariate analysis) participants. The multivariate analysis utilized 538 participants, excluding 19 participants with low to zero counts for one or more categories of the outcome variable. Sample descriptive statistics are presented in Table 10. The dataset included over 50% of participants from New York, Los Angeles, and Atlanta. Participants were mostly in age groups 18 to 50 years, and 14% from age group 51 and older.

Almost 90 % of the study population had less than a college degree or more, over 60% of the participants reported income level below $20,000, 57% had health insurance coverage either government (such as Medicaid) or private insurance, and about 76% reported having a preferred provider where they usually go when they are sick. Although the response rate was less than 10% for the corresponding survey question, about 68% reported previously seeking health services for STDs (syphilis). About 80% of the participants also indicated seeking health services for substance use in the last six months. HIV/AIDS street outreach program/Mobile Unit was the most visited type of HIV testing location (47%). Most participants (48.3%) reported their HIV testing history levels as having tested more than once in the past 12 months.

Table 11

Descriptive Statistics of Population Characteristics, HIV Testing History Levels in the Past 12 Months, Type of HIV Testing Location Setting, and Recruitment Site City in the Nonclinical Setting

Characteristics	No.	%
Predisposing factors		
Age in years		
18-28	151	26.8
29-39	123	21.8
40-50	211	37.4
51 or older	79	14.0
	564	100.0
Education attainment		
some high school or less	101	17.9
high school graduate or equivalent	212	37.6
some college or 2 year degree	189	33.5
college degree or more	62	11.0
	564	100.0
Income level		
less than $5,000	141	25.0
$5,000-$9,999	70	12.4
$10,000-$19,999	139	24.6
$20,000-$29,999	79	14.0
$30,000-$39,999	50	8.9
$40,000-$49,999	31	5.5
$50,000 or more	54	9.6
	564	100.0
Enabling Factors		
Health insurance status		
No	243	43.1
Yes	321	56.9
	564	100.0
Having a preferred provider		
No	133	23.6
Yes	431	76.4
	564	100.0

(*table continues*)

Characteristics	No.	%
Need Factors		
Health-seeking behavior for STD services[a]		
No	14	33.3
Yes	28	66.7
	42	100.0
Health-seeking behavior for substance-use services		
No	449	79.6
Yes	115	20.4
	564	100.0
HIV testing history levels in the past 12 months[b]		
Never tested	81	14.5
Tested once	207	37.2
Tested more than once	269	48.3
	557	100.0
Recruitment site city		
Atlanta	108	19.1
Boston	74	13.1
Los Angeles	129	22.9
New York City	136	24.1
San Francisco	55	9.8
Washington DC	62	11.0
	564	100.0
Type of HIV testing location in the nonclinical setting[c]		
HIV/AIDS street outreach program/Mobile Unit	236	43.4
HIV counseling and testing site	161	29.6
Research site	36	6.6
Drug treatment program	35	6.4
Correctional facility (jail or prison)	76	14.0
	544	100.0

Note. [a] Missing values for this variable hence the small sample size due to low response rate for associated survey question. [b]Missing data points for some categories hence reduced overall nonclinical setting dataset sample size from 564-557. [c]Modified list excludes the participants who reported getting tested at Needle exchange program (4), Military (11), and Home health care (4) due to small sample size and low expected counts for some categories of the outcome for multivariate analysis.

Bivariate Analysis

The bivariate analysis examined the characteristics and associations to determine how each of the IVs impeded or facilitated the more frequent use of HTS in the past 12 months in the nonclinical setting. The MLR was employed to test the secondary hypotheses. The results from the bivariate analysis informed the multivariate analysis.

The chi-squared test (χ^2) of association results in Table 12 showed that only age (p = .01) was statistically significantly associated with HIV testing history levels in the past 12 months in the nonclinical setting, with Cramer's V = .13. The MLR model also revealed that HIV testing history levels in the past 12 months were negatively associated with age, χ^2(6, N = 557) = 18.18, p = .01. Across all age categories, the 18-28 age group were more likely to have tested for HIV more than once in the past 12 months, as shown in Table 12 and Table 13. Compared to 51 or more, age group 18-28 were 187% more likely to get tested more than once versus never tested in the past 12 months (Table 13).

As shown in Table 12, education attainment was not statistically significant, χ2(6, N = 557) = 10.568, p = .10, associated with HIV testing history levels in the past 12 months. However, compared to having a college degree or more, those with some college level or 2 year degree were less likely to get tested once (p = .04) versus never tested. Participants with some college or 2 year degree had the least odds of getting more frequent testing across all educational attainment levels (Table 13).

As shown in Table 12 and Table 13, the uninsured were less likely to have tested more than once versus never tested compared to the insured. The uninsured versus insured were 48% (p = .04) more likely to get tested once compared to more than once in the past 12 months (Table 13). Although other predictors were not statistically significant, the reported ORs and CIs from the MLR generated information about the likelihood of getting tested once or more than once in the past 12 months among BMSM in the nonclinical setting. Except for income between $20,000-$29,999 and greater than $40,000, participants with lower-income were less likely to get tested more than once in the past 12 months. Also, the odds of getting more than one HIV test in the past 12 months was lower for participants who reported not having a preferred provider. Previous utilization of substance use services increased the likelihood to have tested more than once versus never tested in the prior year.

The examined association between the health-seeking behavior for STD services and HIV testing history levels in the past 12 months generated unreliable results due to the small sample size. The chi-square test (Table 12), suggested that participants who did not previously use STD services were less likely to report more frequent HIV testing history levels in the past 12 months. Based on the small sample size and indicated error, the "health-seeking behavior for STD services" variable was excluded from the multivariate MLR analysis.

Table 12

Bivariate analysis Results of the Chi-Square Test of Association by HIV Testing History Levels in the Past 12 Months in the Nonclinical Setting

Characteristics		HIV testing history levels in the past 12 months			
		Never tested	Tested once	Tested more than once	χ^2 (*p*-value)
Predisposing factors	*Age in years*				
	18-28	11(13.6)	47(22.7)	92(34.2)	.01
	29-39	21(25.9)	45(21.7)	56(20.8)	
	40-50	37(45.7)	85(41.1)	86(32.0)	
	51 or older	12(14.8)	30(14.5)	35(13.0)	
	Education attainment				
	some high school or less	11(13.6)	34(16.4)	55(20.4)	.09
	high school graduate or equivalent	26(32.1)	82(39.6)	100(37.2)	
	some college or 2 year degree	37(45.7)	61(29.5)	89(33.1)	
	college degree or above	7(8.6)	30(14.5)	25(9.3)	
	Income level				
	less than $5,000	20(24.7)	50(24.2)	69(25.7)	.53
	$5,000-$9,999	13(16.0)	21(10.1)	35(13.0)	
	$10,000-$19,999	21(25.9)	53(25.6)	63(23.4)	
	$20,000-$29,999	7(8.6)	34(16.4)	37(13.8)	
	$30,000-$39,999	11(13.6)	20(9.7)	18(6.7)	
	$40,000-$49,999	2(2.5)	11(5.3)	18(33.1)	
	$50,000 or more	7(8.6)	18(8.7)	29(10.8)	
Enabling factors	*Health Insurance Status*				
	No	39(48.1)	99(47.8)	103(38.3)	.07
	Yes	42(51.9	108(52.2)	166(61.7)	
	Having a preferred provider				
	No	22(27.2)	46(22.2)	65(24.3)	.67
	Yes	59(72.8)	161(77.8)	204(75.8)	
Need factors	*Health-seeking behavior for STD services*				
	No	1(16.7)	9(45.0)	4(25.0)	.35
	Yes	5(83.3)	11(55.0)	12(75.0)	
	Health-seeking behavior for substance-use services				
	No	66(81.5)	163(78.7)	126(80.3)	.85
	Yes	15(18.5)	44(21.3)	53(19.7)	

Note. Expected counts and % (in parentheses) within HIV testing history levels in the past 12 months.

Table 13

Bivariate Multinomial Logistic Regression Predicting HIV Testing History Levels in the Past 12 Months in the Nonclinical Setting from Predisposing, Enabling, and Need Factors

Population Characteristics	HIV testing history levels in the past 12 months											
	Tested once vs. Never tested				Tested more than once vs. Never tested				Tested once vs. Tested more than once			
	OR	95% CI LB	95% CI UB	*p*	OR	95% CI LB	95% CI UB	*p*	OR	95% CI LB	95% CI UB	*p*
Predisposing factors												
Age in years												
18-28	1.71	.67	4.36	.26	2.87	1.16	7.10	.02	.60	.33	1.09	.09
29-39	.86	.37	2.00	.72	.91	.40	2.09	.83	.94	.50	1.75	.84
40-50	.92	.42	1.99	.83	.80	.37	1.70	.56	1.15	.65	2.04	.63
≥ 51 (ref.)												
Education attainment												
some high school or less	.72	.25	2.10	.55	1.40	.49	4.04	.53	.52	.26	1.02	.06
high school graduate or equivalent	.74	.29	1.87	.52	1.08	.42	2.76	.88	.68	.37	1.25	.22
some college or 2 year degree	.38	.15	.96	.04	.67	.27	1.69	.40	.57	.31	1.06	.08
College degree above (ref.)												
Income levels												
less than $5,000	.97	.35	2.68	.96	.83	.32	2.18	.71	1.17	.58	2.33	.66
$5,000-$9,999	.63	.21	1.91	.41	.65	.23	1.84	.42	.97	.43	2.15	.93
$10,000-$19,999	.98	.36	2.69	.97	.72	.28	1.89	.51	1.36	.68	2.71	.39
$20,000-$29,999	1.89	.57	6.23	.30	1.28	.40	4.05	.68	1.48	.70	3.13	.31
$30,000-$39,999	.71	.23	2.21	.55	.39	.13	1.20	.10	1.79	.75	4.26	.19
$40,000-$49,999	2.14	.37	12.20	.39	2.17	.41	11.63	.36	.98	.38	2.55	.97
≥ $50,000 (ref.)												
Enabling factors												
Health Insurance Status												
No	.99	.59	1.65	.96	.67	.41	1.10	.11	1.48	1.02	2.13	.04
Yes (ref.)												
Having a preferred provider												
No	.77	.43	1.38	.38	.85	.49	1.50	.58	.90	.58	1.38	.62
Yes (ref.)												
Need factors												
Health-seeking behavior for substance-use services												
No	.84	.44	1.62	.61	.93	.49	1.75	.81	.91	.58	1.42	.68
Yes (ref.)												

Note. Odds Ratio (OR); Confidence Intervals (CI); Lower Bound (LB); Upper Bound (UB); Reference Category (ref.).

Multivariate Analysis

The MLR model tested the main hypotheses to examine the significance, strength, and direction of the association between the predictors and outcome variables. The analysis provided information on the predictive effects of multiple predictors, predisposing (age, education attainment, income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for substance-use services) with HIV testing history levels in the past 12 months, while controlling for other predictors and confounders in the model. The type of HIV testing location and recruitment site city were controlled in the multivariate MLR. The model presented 15.7% (Nagelkerke pseudo R^2) of the variance in HIV test history levels in the past 12 months. The results are shown in Table 14.

There was a predictive association between the variables in the model, $\chi^2(48, N = 538) = 78.38$, $p = .004$. The overall effect of age, $\chi^2(6, N = 538) = 16.58$, $p = .01$, and education attainment , $\chi^2(6, N = 538) = 12.41$, $p = .05$, with HIV testing history levels in the past 12 months among BMSM in the nonclinical setting were statistically significant, all other predictors were not. Compared to those with college degree or above while controlling for other variables in the model, those with some college or 2 years were 71% less likely to get tested once in the past 12 months versus never tested in the nonclinical setting. Compared to those aged 51 or older, those aged 18-28 years were 196% (p =.04) more likely to get tested more than once versus never tested. Similar outcomes were generated for age and education attainment for the bivariate and multivariate models.

As shown in Table 14, although the association with income was not statistically significant, compared to those who reported income of $50,000 or more, those with income between $20,000-$29,999 were more likely to have tested once in the past 12 months while controlling for other variables in the model. MLR analysis that examined the HIV testing history levels in the past 12 months for tested once versus tested more than once revealed that those who reported income between $20,000-$29,999 were 40% more likely to get tested once compared to more than once. The bivariate analysis results showed that uninsured participants were less likely to get tested once versus never tested in the nonclinical setting (Table 13). However, in the multivariate model (Table 14), the likelihood of more frequent testing was associated (although not significant) with not having health insurance coverage. The uninsured were also 39% more likely to get tested once versus more than once in the past 12 months. Results also suggested that previous health-seeking behavior for substance use services increased the likelihood of getting tested once versus tested more than once.

The primary (main) null hypothesis that there is no association between predisposing (age, education attainment, income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for substance-use services) with HIV testing history levels in the past 12 months, while controlling for other variables in the model was rejected and the alternative accepted.

Table 14

Multivariate Multinomial Logistic Regression Predicting HIV Testing History Levels in the Past 12 Months in the Nonclinical Setting from Predisposing, Enabling, and Need Factors, Controlling for Type of HIV Testing Location and Recruitment Site City

Population Characteristics	HIV testing history levels in the past 12 months											
	Tested once vs. Never tested				Tested more than once vs. Never tested				Tested once vs. Tested more than once			
	OR	95% CI LB	95% CI UB	*p*	OR	95% CI LB	95% CI UB	*p*	OR	95% CI LB	95% CI UB	*p*
Predisposing factors												
Age in years												
18-28	1.79	.63	5.13	.28	2.96	1.06	8.25	.04	.61	.30	1.20	.15
29-39	.77	.30	2.01	.59	.88	.34	2.26	.78	.88	.44	1.76	.72
40-50	.82	.34	1.95	.65	.71	.30	1.70	.44	1.14	.60	2.17	.68
≥ 51 (ref.)												
Education attainment												
some high school or less	.54	.15	1.90	.34	1.51	.42	5.35	.53	.36	.16	.81	.01
high school graduate or equivalent	.50	.16	1.53	.22	1.06	.34	3.32	.92	.47	.23	.98	.04
some college or 2 year degree	.29	.10	.86	.03	.62	.21	1.86	.40	.47	.23	.98	.04
College degree above (ref.)												
Income levels												
less than $5,000	1.49	.44	5.01	.52	1.65	.52	5.28	.40	.90	.38	2.12	.81
$5,000-$9,999	.97	.26	3.55	.96	1.14	.33	3.92	.83	.85	.33	2.18	.73
$10,000-$19,999	1.74	.52	5.79	.37	1.36	.43	4.29	.61	1.29	.56	2.97	.56
$20,000-$29,999	3.31	.82	13.36	.09	2.36	.60	9.19	.22	1.40	.58	3.42	.46
$30,000-$39,999	1.03	.29	3.69	.96	.75	.22	2.60	.65	1.38	.53	3.61	.51
$40,000-$49,999	2.83	.45	17.92	.27	3.77	.62	22.95	.15	.75	.26	2.17	.60
≥ $50,000 (ref.)												
Enabling factors												
Health Insurance Status												
No	1.45	.75	2.80	.27	1.05	.55	2.00	.89	1.39	.88	2.19	.16
Yes (ref.)												
Having a preferred provider												
No	.71	.36	1.38	.31	.80	.42	1.55	.51	.88	.54	1.43	.60
Yes (ref.)												
Need factors												
Health-seeking behavior for substance-use services												
No	.70	.33	1.50	.36	.61	.29	1.30	.20	1.16	.68	1.96	.59
Yes (ref.)												

Note. Odds Ratio (OR); Confidence Intervals (CI); Lower Bound (LB); Upper Bound (UB); Reference Category (ref.).

Discussion

Despite the CDC recommendation that sexually active MSM get tested for HIV more frequently, BMSM at higher risk of HIV infection are less likely to get tested in the past 12 months (Dailey et al., 2017; Elopre et al., 2017, 2018; Lo et al., 2018; Liu et al., 2019; Mannheimer et al., 2014). BMSM have high undiagnosed infection rate and are disproportionately impacted by the HIV epidemic in the United States and are more likely to get tested in the nonclinical settings compared to other MSM subgroups (CDC, 2019b). It is imperative to promote more frequent testing (more than one HIV test) annually among BMSM in the nonclinical setting to help detect early and previously undiagnosed infections. Previous studies have examined the influence of multilevel factors on the use of HTS, defined by lifetime or frequent testing. However, this study, underpinned by the ABM, is unique because the utilization of HTS is defined by the number of HIV tests received in the past 12 months from the nonclinical setting.

The outcomes from this study have implications for informing efforts to promote targeted (risk-based) strategies to promote more frequent testing (Castel et al., 2015; Clark et al., 2019; Miller et al., 2017; Williams et al., 2016). The multivariate analysis revealed that HIV testing history levels in the past 12 months were significantly associated, negatively with age and positively with education attainment (predisposing factors) in the nonclinical setting. Whereas income level (predisposing factor), health insurance status, and having a preferred provider (enabling factors), and health-seeking behavior for substance use services (need factor) were not associated with more frequent testing in the past 12 months. Participants aged 18-28 (younger) were more likely to get tested more than once; those with some college or 2 year degree (lower education attainment level) were less likely to get tested more than once versus never tested in the past 12 months.

The findings from this study, explained by the ABM, provided information about the associations between different age groups and educational attainment levels, other predictors, and more frequent use of HTS (the number of HIV tests received in the nonclinical setting) in the past 12 months. The present study's outcomes also suggested further research to compare the associations between population characteristics and HIV testing history levels in the past 12 months in the clinical settings and between settings. The increased odds for those with some college or 2 year degree to get tested once or more than once in the nonclinical setting will be further examined in a subsequent study to compare associations between the clinical and nonclinical settings.

Similar findings have previously been reported on the influence of multilevel factors on the likelihood of more frequent HIV testing in the past 12 months. Reported results from Lo et al. (2018) also showed that being older and belonging to a sexual minority group (such as BMSM) increased lifetime HIV testing rather than more frequent testing. The CDC surveillance data analysis revealed that younger than 40, college degree or more, income above the poverty level, health insurance coverage, and having a health provider in the past 12 months were all associated with the increased likelihood of getting tested for HIV (CDC, 2019b). This study confirmed findings from the CDC analysis. As indicated earlier, this study measured and defined the more frequent use of HTS by the number of tests received in the past 12 months in the nonclinical setting.

Although not statistically significant, health insurance status and having a preferred provider—two enabling factors—are posited by the ABM as significant predictors of health service use. The bivariate analysis (not controlling for other predictors and confounders) revealed that uninsured participants were less likely to get tested once or more than once in the nonclinical setting. However, in the multivariate model (controlling for other variables), the more likelihood of getting tested more than once was associated with not having health insurance coverage. Also, the uninsured were more likely to get tested once versus more than once, suggesting alignment with the annual testing frequency recommended by the CDC. The revealed association reported for health insurance for this study similar to the results reported by Lo et al. (2018) suggest that health insurance coverage did not facilitate the use of HTS. However, Lo et al. (2018) did not examine the use of HTS in a specific HIV testing location setting; hence this study provides additional insight. Health insurance coverage potentially increases access to HTS; however, this study did not find a statistically significant association, similar to reported findings from Mannheimer et al. (2014). Health insurance was not independently associated with infrequent HIV testing in the multivariate model while controlling other predictors (Mannheimer, 2014).

The bivariate results suggest the need to improve health insurance coverage eligibility and access for populations that are disproportionately impacted by the HIV epidemic to support more frequent utilization of HTS in the nonclinical settings, The long-term impact of not having health insurance coverage was examined among long-term uninsured residents in South Carolina and the findings showed that having prior health insurance was statistically significantly and positively associated with health service utilization (Shi et al., 2019). The implementation of major provisions of the 2010 Patient Protection and Affordable Care Act (ACA) occurred after the completion of the HVTN 061 study. Hence the association with health insurance status revealed from the secondary data analysis of HPTN 061 may suggest a past indication (Gaudette et al., 2018). However, the revealed associations between the recruitment city site and HIV testing history levels in the past 12 months showed that participants in Atlanta were 73% and 67% less likely to get tested once or more than once in the past 12 months, respectively. Atlanta (with disproportionately high incidence and prevalence of HIV among BMSM) is one of the states in the Southern United States who did not opt to expand Medicaid coverage under ACA. Therefore, the findings from this study has current implications to inform efforts to address the underutilization of HTS among BMSM, one of the key aims of the national initiative to ending the HIV epidemic in the United States (Fauci et al., 2019).

The observed increased odds for more frequent testing for selected income levels were consistent with previous studies that reported the increased likelihood of getting tested with higher income (Alemu et al., 2017; CDC, 2019b; Mannheimer et al., 2014). Although not statistically significant, participants who reported income level between $20,000-$29,999 had higher odds of getting tested once or more than once versus never tested. Those with higher-income compared to $50,000 or more, were more likely to get annual rather than frequent testing in the past 12 months. Mannheimer et al. (2014) reported results from a univariate analysis using the HPTN 061 dataset that showed statistically significant associations between income level (< \$10,000 vs. ≥ \$10,000) and infrequent testing. The likelihood of infrequent testing among the sample of BMSM was higher for those who reported income < \$10,000. Many factors may have contributed to the reported higher odds observed for income level \$20,000-\$29,999.

The HPTN 061 study was conducted in 2009-2010 and the income level between \$20,000-\$29,999, depending on the household size and the 2009-2010 "federal poverty level" (FPL), may have qualified participants for Medicaid health insurance coverage (Assistant Secretary for Planning and Evaluation website [ASPE], n.d.). Therefore, having health insurance coverage may have contributed to the increased odds of testing for participants who reported income level between \$20,000-\$29,999 in the nonclinical setting. The bivariate MLR results (although not significant) suggested that having health insurance coverage in the nonclinical setting increased the odds for more frequent testing in the past 12 months.

The participants with income between \$20,000-\$29,999 may have preferred the targeted service delivery approach in the nonclinical setting, such as the HIV/AIDS street outreach program/Mobile Unit, where community health workers or advocates are employed (Hawkins & Groves, 2011). Community health workers and advocates are usually peers and members of the community who help mitigate concerns regarding discriminatory and stigmatizing attitudes and practices among health-care workers towards BMSM (Essuon et al., 2017; Saleh, van den Berg, Chambers, & Operario, 2016; Singh, Song, Johnson, McCray & Hall, 2018). The association between income level and HIV testing history levels in the past 12 months will be further examined in the clinical setting and compared between the clinical and nonclinical settings. This future investigation may help understand why income level between \$20,000-\$29,999 was associated with the higher odds of HIV testing history levels in the past 12 months. Additionally, examining the HIV testing history levels in the past 12 months in the clinical setting may help understand if participants with income level \$20,000-\$29,999 were less likely to get tested in the clinical setting.

Results also suggested that having a preferred provider increased the odds of getting more frequent HIV testing in the past 12 months in the nonclinical setting (not statistically associated). Over 70% of the BMSM in this study reported having a preferred provider. Providers play a critical role in facilitating access and utilization of HIV prevention, treatment, and care services (Marks et al., 2017; Elopre et al., 2017; Underhill et al., 2014). Engaging patients and forming trusted provider-patient relationships and providing targeted and patient-centered services foster improved access to HIV-related services. The results suggest that more training for providers in the nonclinical setting will further improve engagement and education of sexually active BMSM about the benefits of more frequent HIV testing in the past 12 months per the CDC recommendation to support increased use of HTS (DiNenno et al., 2017, 2018).

The participants who reported not seeking treatment for substance use were less likely to report more frequent HIV testing history levels in the past 12 months in the nonclinical setting (not statistically associated) but more likely to get annual testing (per CDC recommendation). Findings reported from Dailey et al. (2017) indicated that over 50% of persons identified at-risk for STD and substance use had not tested in the past 12 months but had seen a health care provider for other services. Therefore, as posited by the ABM, seeking HTS services in conjunction with other health services, such as substance use services (need factor), could facilitate the more frequent use of HTS (receiving more than one HIV test) in the past 12 months.

This study generated outcomes to understand the correlates of more frequent testing in the past 12 months among BMSM in the nonclinical setting and identified some questions for further investigation. Although the findings from this study have informed the association of population characteristics with HIV testing history levels in the past 12 months among BMSM in the nonclinical setting, it is prudent to interpret the results in light of the following limitations. Firstly, the original HPTN study's limitations also applied to this study, including the use of a cross-sectional study design that impacted causality inferences about direction and associations (Setia, 2016). The participant referral and other sampling strategies utilized at each recruitment site may have potentially introduced selection bias. Hence the recruitment site city and type of HIV testing location setting were controlled in the multivariate MLR (Koblin et al., 2013; Mannheimer et al., 2014).

Secondly, the variables utilized from the HPTN 061 secondary data were all collected via self-reporting using the validated ACASI system (Population Council, n.d.), aimed to reduce social desirability bias, and hence over-reporting and under-reporting of responses may have implications on the reliability and validity of self-reported data (Althubaiti, 2016). Thirdly, the sample of BMSM (from sites in six U.S. cities) included in this secondary analysis were recruited using specific study eligibility criteria (including the requirement to recruit high-risk BMSM). Therefore, the study sample may not represent all BMSM in the United States; hence, the generalizability of this study's outcomes is limited. However, the population characteristics of the participants who enrolled in the HPTN 061 study are similar to the general population of high-risk BMSM in the United States who are disproportionately impacted by the HIV epidemic (CDC, 2019b; Liu et al., 2019; Underhill et al., 2014).

This study utilized one of the largest secondary datasets collected from BMSM at-risk for HIV infections from six U.S. sites, and this dataset has been widely used over the years by multiple researchers, including Nelsen et al. (2016), Hickson et al. (2017), Latkin et al. (2017), Levy et al. (2017), Hermanstyne et al. (2018), and Hermanstyne et al. (2019). This study primarily examined associations between the population characteristics and HIV testing history levels in the past 12 months using a cross-sectional design (considering the limitations previously mentioned) in the nonclinical setting. This study's findings established a baseline to inform the need to examine further and compare the difference in associations between the clinical and nonclinical settings.

Future research should examine more correlates of frequent HIV testing history levels considering recent challenges associated with health care reform and its implications on health insurance coverage, access, utilization of health services, and the current national efforts towards "ending the HIV" in the United States. The future research study should utilize a more recent country-level dataset, collected from multiple MSM subgroups (including transgender) across multiple cities in the United States (Poteat, German, & Flynn, 2016). The proposed national dataset should encompass high

HIV incidence and prevalence population groups, multiple risk levels, multiple HIV testing location settings (across rural and urban settings and clinical and nonclinical settings), and multiple testing frequencies (within 12 months, 24 months, and lifetime testing). This future study should examine associations between a broad range of population characteristics (predisposing, enabling, and need factors) and HIV testing history levels to generate findings to inform strategies to improve the more frequent use of HIV testing services to support the HHS initiative towards “Ending the HIV Epidemic” in the United States (Fauci et al., 2019, Giroir, 2020).

Conclusion

Despite the aforementioned limitations, this study has generated information about the associations between BMSM population characteristics and HIV testing history levels in the past 12 months to inform efforts towards enhancing the more frequent use of HTS in the nonclinical setting. For this study, it was hypothesized that population characteristics of BMSM at higher risk for HIV would be associated with more frequent use of HTS (more than one HIV test) in the past 12 months in the nonclinical setting. Previous studies have shown that BMSM are more likely to receive lifetime testing but less likely to get tested more frequently in the past 12 months (Liu et al., 2019; Pitasi et al., 2018). Frequent testing may help detect new and previously missed and undiagnosed infections (DiNenno et al., 2017).

This study revealed a statistically significant association between population characteristics, namely age and education attainment levels, with HIV testing history levels in the past 12 months in the nonclinical setting, confirming findings from previous studies. The younger age group (18-28) were more likely, and those with less than college degree (some college or 2 year degree) were less likely to get tested once or more than once in the prior year in the nonclinical setting. Although the other population characteristics were not statistically significantly associated, the reported odds ratios provided information about the likelihood of these predictors in impeding or facilitating the more frequent use of HTS in the past 12 months among BMSM. Higher-income level, having a preferred provider, and health-seeking behavior for substance use services increased the likelihood of getting more frequent testing.

The revealed associations including the increased and decreased likelihood of testing reported from the examination between health insurance status and HIV testing history levels in the past 12 months for the bivariate and multivariate MLRs (respectively) have positive social change implications for the individual, societal, and policy levels. The outcomes presented have the potential to inform targeted strategies in the nonclinical setting to promote more frequent utilization of HTS in the past 12 months among BMSM across different age groups and education attainment levels. Policy level changes should support efforts to increase the provision of health insurance coverage to key population groups impacted by the HIV epidemic. Frequent testing (more than one HIV test in the past 12 months) offers the opportunity to detect early HIV infections, promote immediate linkage, and sustained use of ART to help reduce HIV transmission from those unaware of their HIV positive status (Fauci et al., 2019; Pitasi et al., 2018).

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IRB Approvals, Informed Consent, and Human Subject Protection

Walden University Institutional Review Board (IRB) approval IRB # 04-16-20-0446424. The IRBs at all participating institutions (sites) approved the HPTN 061 study: Emory University IRB #2 - Biomedical IRB (Committee A), Fenway Community Health IRB #1, University of California, Los Angeles - South General Campus IRB, Columbia University Medical Center IRB, New York Blood Center IRB, San Francisco General Hospital Committee IRB #2, and George Washington University Medical Center IRB. Written informed consent was obtained from all study participants.

All procedures performed in this study involved the use of secondary data from HPTN 061 study that has been delimited and deidentified. No actual human participants were engaged or recruited. No animals were involved in this study.

Disclaimer

The author notes that this dissertation is hers alone and does not represent the views of the HPTN 061 study team, the HIV Prevention Trials Network or the study sponsor, the U.S. National Institutes of Health.

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Manuscript 3: Black MSM Population Characteristics and HIV Testing History Levels in the Clinical and Nonclinical Settings

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Outlet for Manuscript

Submission Guidelines for the "Journal of Behavioral Medicine"

The manuscript, "Black MSM Population Characteristics and HIV Testing History Levels in the Clinical and Nonclinical Settings," will be submitted to "Journal of Behavioral Medicine" (https://www.springer.com/journal/10865/submission-guidelines). This journal publishes on a broad range of research topics focusing on understanding disease prevention (such as HIV/AIDS) and intervention strategies through behavioral research techniques. The manuscript topic aligns with the selected journal's subject matter area because it examined factors that impede or facilitate the more frequent use of HIV testing services in the past 12 months among BMSM in the clinical and nonclinical settings. Findings from this study may help inform strategies in the clinical and nonclinical settings to improve HIV prevention and treatment service delivery and overall health outcomes for those at-risk and living with HIV/AIDS. This manuscript will not opt for open access. The submission guidelines for the Journal Behavioral Medicine follow specific requirements including, a 25-30 page limit (excluding abstract and references), a title page, an abstract (no more than 250 words), keywords with about 3-5 words, and with main text section headings—Introduction, Methods, Results, Discussions, Conclusions, and References. No sub-readings are allowed in the Introduction and Discussion sections, and no more than five figures and tables. The "Acknowledgments" page, including information about the grant and financial assistance and disclaimers, follows immediately after the references. The in-text and reference citation style follows the American Psychological Association (APA) referencing style.

Black MSM population characteristics and HIV testing history levels in the clinical and nonclinical settings

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Abstract

Black MSM (BMSM) are more likely unaware of their HIV status, less likely to get tested annually, and prefer to use HIV testing services (HTS) in the nonclinical settings, compared to other MSM subgroups. Guided by the behavioral model for vulnerable populations, this quantitative cross-sectional study used secondary data for 1189 at-risk BMSM aged 18 or older from HIV Prevention Trial Network 061. Multinomial logistic regression (MLR) and z-test methods were used to examine the association between population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months (never tested; tested once; tested more than once) between the clinical and nonclinical settings. There was no statistically significant difference between settings. However, HIV testing history levels in the past year were significantly associated with age (inversely) and positively with education attainment (predisposing factors) in both settings, and negatively with health insurance status (enabling factor) in the clinical setting. Aged 18-28 were 75% more likely, the those with some college or 2 year degree were 10% less likely, and the uninsured were 89% less likely to use HTS more frequently at nonclinical relative to the clinical settings. In bivariate MLR, the uninsured versus insured were less likely to get tested more frequently in the nonclinical versus clinical settings. The positive social change impact of the revealed associations includes the potential to inform a combination of targeted and routine-based strategies to promote frequent testing to help detect recent infections and reduce transmissions from those unaware of their status.

Keywords

HIV testing; Predisposing, enabling, and need factors; Black men who have sex with men (BMSM); Nonclinical setting; Clinical setting

Introduction

Over 50% of new human immunodeficiency virus (HIV) diagnoses in 2017 and 2018 were accounted for by less than 50 counties in mostly rural areas in the southern United States (Center for Disease Control and Prevention [CDC], 2018, 2020). Key population groups, including Black men who have sex with men (BMSM), are disproportionately impacted by the HIV epidemic (CDC, 2019b; Reif, Safley, McAllaster, Wilson, & Whetten, 2017). Although the annual HIV diagnoses remained steady in the United States from 2012-2016, men who have sex with men (MSM) represented over 60% of all new HIV diagnoses with almost 40% BMSM (CDC, 2019a, 2019b). The highest rates of HIV diagnosis per 100,000 population from 2013-2018 were reported among Black African Americans, age 25-34 years, and those with male to male sexual contact (CDC, 2019c; Singh, Song, Johnson, McCray & Hall, 2018).

Significant milestones have been achieved in HIV prevention, treatment, and care over the past three decades, including the clinical evidence that there is negligible risk of transmission from persons with undetectable viral levels (Joint United Nations Programme on HIV/AIDS [UNAIDS], 2018b; Tseng, Seet, & Phillips, 2015). Despite the progress to date, undiagnosed HIV infections account for over 40% of new HIV infections underscoring the need for new strategies to improve HIV testing services (HTS) among key population groups (CDC, 2019b, 2019c, 2020). Health providers should offer more frequent testing opportunities annually in clinical and nonclinical settings by providing a broad range of comprehensive HIV services to help detect infections and reduce the transmission from PLWH (Dailey et al., 2017; Pitasi et al., 2018; UNAIDS, 2017). HIV testing locations in the clinical settings—include primary physician office or clinic, emergency department (ED), community center free clinic, and hospital-based facility and nonclinical settings—include community-based organization (CBO) facilities, HIV street outreach programs or mobile units, and HIV counseling and testing site (CDC, 2016, 2019b).

According to CDC (2019b), BMSM compared to other White MSM were more likely to get tested in a nonclinical setting (34.2% versus 24.7%) and less likely in a clinical setting (57.1% versus 70.3%). The clinical and nonclinical settings utilized unique testing strategies, namely, targeted risk-based and routine non-risk-based approaches. The targeted approach offered at the community-based setting (nonclinical setting) was reported to have identified HIV infections among sexual minority youth of color compared to the clinical setting (Miller et al., 2017). Also, the number of HIV testing events in the clinical setting was reported higher than the nonclinical setting suggesting differences in the utilization of HTS across settings (Castel et al., 2015). It is essential to promote improved access and utilization of HTS among diverse population groups in different settings by employing innovative strategies. Barriers to accessing and utilizing HTS include structural barriers, such as the availability of culturally competent, targeted, and reliable services associated with the broader health system environment (Levy et al., 2014). It is imperative to examine the influence of multilevel facilitators and barriers that contribute to the delayed or infrequent use of HTS among BMSM in the clinical and nonclinical settings.

Health system-related factors, such as provider-setting-specific characteristics including provider attitudes, health organization practices, and availability of resources contribute to the disparities in the utilization of HTS at the different types of provider settings, namely clinical and nonclinical (Leblanc, Flores, & Barroso, 2016; Elgalib, Fidler, & Sabapathy, 2018; Levy et al., 2014; Reif et al., 2017). The unique factors associated with HIV test location setting and testing strategy may also influence HIV testing history. The HIV testing patterns of MSM who frequently used the internet revealed the need for targeted testing approaches using innovative and nontraditional strategies to promote testing among at-risk MSM (Noble, Jones, Bowles, DiNenno, & Tregaer, 2017). Factors that facilitate the use of HTS among MSM, analyzed from data generated from a large-scale HIV testing initiative at both clinical and nonclinical settings, revealed that targeted testing approaches improved the use of HTS among racially diverse ethnic groups (Clark et al., 2019). Based on the previously discussed studies, it is prudent to examine the associations of population characteristics and the more frequent use of HTS among key population groups (such as BMSM) while considering the type of HIV test location setting (clinical and nonclinical settings).

The CDC recommends that key populations at higher risk of HIV infection receive at least annual HIV testing in the clinical and nonclinical settings to encourage more frequent HIV testing (DiNenno et al., 2017, 2018; US Preventive Services Task Force [USPSTF], 2019). However, in the southern United States, the underutilization of HTS among BMSM continues to be a problem (Marano et al., 2018). The vulnerabilities faced by BMSM, including stigma, discrimination, and poverty, increase their risk of

HIV infection (Pellowski, Kalichman, Matthews, & Adler, 2013; Saleh, van den Berg, Chambers, & Operario, 2016). BMSM experience higher HIV incidence and prevalence rates compared to White MSM and are more likely to be unaware of their HIV positive status hence at increased risk of HIV transmission (Li, Purcell, Sansom, Hayes, & Hall, 2019; Millet et al., 2011; Sullivan et al., 2015; UNAIDS, 2018a; Washington, Robles, & Malotte, 2013).

Blacks were more likely to ever get tested compared to other racial-ethnic groups but have low HIV testing history within the past 12 months (Liu et al., 2019). BMSM HIV testing delays exceeded 12 months and increased with low perceived risk (Pitasi et al., 2018). Modeling analysis also showed that individuals who are unaware of their status and those aware but not on antiretroviral therapy (ART) accounted for almost 80% of new HIV diagnoses (Li et al., 2019). More frequent testing offers the opportunity for early detection, promotes immediate linkage to ART, and enhances sustained use of ART towards viral suppression (Fauci et al., 2019). The correlates of infrequent HIV testing and late HIV diagnosis among BMSM in six U.S. cities were examined using data from a large multi-site cohort study HIV Prevention Trials Network (HPTN) 061, and the results showed that an estimated 1 out of 5 were infrequent testers with no HIV testing within the prior year, (Mannheimer et al., 2014). An estimated 1 out of 8 were non-testers with no previous testing history (Mannheimer et al., 2014). DiNenno et al. (2018) shared findings from studies that examined the benefits of frequent screening and suggested further research to characterize and compare factors (including individual risk factors that enhance HIV acquisition) associated with more frequent versus annual utilization of HTS among BMSM.

The Gelberg-Anderson behavioral model for vulnerable populations (ABM) underpins this study (Andersen,1995; Gelberg, Andersen, & Leake, 2000). ABM posits that health system-related factors (such as those associated with the clinical and nonclinical settings) and population characteristics (associated with predisposing, enabling, and need factors) impede or facilitate the use of health services (such as HTS). Predisposing, enabling, and need factors were significant influencers in facilitating or impeding the lifetime use of HTS compared across racial and ethnic groups (Lo, Runnels, & Cheng, 2018). Across all racial groups, being female, older, and belonging to a sexual minority group predicted increased lifetime HIV testing (measured as ever tested or not, rather than the number of HIV tests received). According to the CDC (2019b), less than 40 years old, college degree or more, income above the poverty rate, health insurance coverage, and a visit health provider in the past 12 months increased the likelihood of getting tested.

Mannheimer et al. (2014) also reported that health insurance was not independently associated with infrequent HIV testing, although having insurance has the potential to increase access to HTS. There are gaps in health insurance coverage in settings with high HIV incidence and prevalence, especially in the southern United States (Garfield, Damico, & Orgera, 2020). Some settings and health insurance coverage provide HIV testing as a basic covered service for low cost or free, without health insurance coverage, such as community health centers and CBOs (Kaiser Family Foundation, 2019).

Also, factors that influence preexposure prophylaxis (PrEP) also influence the use of HTS since the latter is critical in initiating and monitoring PrEP use. Having a preferred provider and dedicated health service location were identified as facilitators of PrEP use (Elopre, Kudroff, Westfall, Overton, & Mugavero, 2017), and access and utilization of PrEP services were found to be associated with higher education status, having health insurance coverage, being older among a population of young MSM (Marks et al., 2017).

A systematic review conducted by DiNenno et al. (2017) revealed that less than half of MSM have ever tested within the past 12 months. The delay in HIV diagnosis was higher among Blacks (3.3years) compared to Whites (2.2 years), and among the transmission category, male to male sexual contact was 3.0 years (Dailey et al., 2017). Over 50% of persons from each identified risk group, including those at-risk for STD and substance use, had not tested in the past 12 months but had seen a health care provider for other services (Dailey et al., 2017). The number of HIV tests received in the past 12 months was not examined by Dailey et al. (2017) but rather whether HTS was ever received in the past 12 months.

As previously discussed, researchers have examined the influence of population characteristics including age, education level (attainment), income level, health insurance coverage (status), preferred patient-provider association, and health system-related factors, such as provider setting-specific characteristics on the use of HTS, defined as having received an HIV test or not, rather than the number of HIV tests. Contrary to the variables examined in previous studies (Dailey et al., 2017; DiNenno et al., 2018; Lo et al., 2018; Patel et al., 2019; Pitasi et al., 2018), this study measured the more frequent use of HTS by the number of times HTS was received in the past 12 months. As reported by DiNenno et al. (2018), BMSM will benefit from more frequent testing in the past 12 months to help detect early and previously undiagnosed infections.

There is a literature gap regarding the lack of understanding about the correlates of more frequent use of HTS among BMSM, defined as HIV testing history levels (never tested, tested once, and tested more than once), between the clinical and nonclinical settings. Is there a difference in the association between population characteristics and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings? It was hypothesized that there is a difference in the association between population characteristics (predisposing, enabling, and need factors), and HIV testing history levels in the past 12 months among BMSM between the clinical and nonclinical settings, while controlling for all other variables.

Methods

Study Design and Source of Data

This quantitative study used a cross-sectional design and secondary data collected from HPTN 061 (2009), a large feasibility and acceptability study conducted among BMSM aged 18 or older from 2009 and 2010 (Koblin et al., 2013). The study sites, located in six U.S. cities with BMSM high HIV incidence and prevalence rates among BMSM, were Atlanta, Boston, Los Angeles, New York City, San Francisco, and Washington DC. This unique dataset included self-reported responses about the number of HIV tests received in the past 12 months. The HPTN 061 study dataset has been widely used by multiple researchers to examine factors associated with HIV acquisition among BMSM to further explore and address the disparities in HIV incidence and prevalence since 2013 (Hermanstyne et al., 2018, 2019; Hickson et al., 2017; Latkin et al., 2017; Levy et al., 2017; Nelsen et al., 2016). A quantitative study design was appropriate for this study to examine the association between variables (Creswell & Creswell, 2018; Newman & Covrig, 2013).

Ethical Considerations

The HPTN 061 study received all required regulatory approvals, including institutional review board (IRB) approval from study sites. The secondary dataset retrieved from the HPTN statistical center for HIV/AIDS research and prevention (SCHARP) secured website was delimited and de-identified. This study did not recruit or engage human subjects. The formal request to access the secondary data included the approval of the HPTN data use agreement. Walden University IRB issued final approval to access and commence data analysis.

Study Population and Sampling Strategy

The HPTN 061 sites utilized a sampling strategy consisting of community-based engagement and participant-based referral methods and collected data via a validated audio computer-assisted self-interview (ACASI) system (Population Council, n.d.) and structured participant interviews questions from 1553 participants. The estimated a priori sample size was 294 - 480 using two methods, the minimum events per variable (EPV) approach (Bujang, Sa'at, Sidik, & Joo, 2018) and G*Power Software (Faul, Erdfelder, Buchner, & Lang, 2013). The G*Power used an alpha of 0.05, both 80% and 95% power, and an effect size of 1.4 odds ratio based on previous studies' findings (Azfredrick, 2016; Lo et al., 2018; Marks et al., 2017). The final sample size of 1189 was within the estimated range, and the post hoc power analysis confirmed adequate power > 95%.

Clinical Setting and Nonclinical Setting Datasets. The demographics, enrollment, and health care utilization datasets for HPTN 061 were exported from the SCHARP secured website as Microsoft excel workbooks (2016) and imported into the statistical package for social sciences (SPSS) version 25 software and merged (IBM, 2017; Wagner, 2016). The merged dataset was sorted based on the CDC designation for clinical and nonclinical settings (CDC (2016, 2019b) and a new variable labeled “setting” was utilized to link each participant data to a clinical or nonclinical setting coded as “1” and “2” (respectively). The self-reported responses generated from the 16-level categorical variable for survey question, Where did you get your most recent HIV test? (variable label “ACTSTWH”), identified the type of HIV testing location per participant response. The combined dataset was screened, and non-study related variables were excluded. The statistical analysis results generated for this study utilized both the clinical setting and nonclinical setting datasets.

Variable Definitions, Values, and Levels of Measurement

The predictor variables in this study were the predisposing (age, education attainment, and income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for STD and substance use services) population characteristics. The outcome variable, HIV testing history levels in the past 12 months, was categorized as never tested, tested once, and tested more than once. All variables were categorical variables. The HIV testing history levels in the past 12 months was generated by transforming the numeric scale variable labeled as “ACVTSTN” into a nominal variable. The variable generated responses to the survey question, How many times have you been tested for HIV in the last year? and based on the number of HIV tests received in the past year (12 months), “0,” “1” and “2 or more” was recoded to “never tested,” “tested once” and “tested more than once,” respectively.

Statistical Analysis

Microsoft Excel (2016) and SPSS version 25 (IBM, 2017; Wagner, 2016) were used to analyze the data to examine and compare the associations between predisposing, enabling, and need factors, and HIV testing history levels in the past 12 months among BMSM in both settings. Although the HPTN 061 secondary data was precleaned, preliminary screening was conducted before data analysis. Univariate, bivariate, and multivariate analysis (descriptive and inferential statistical methods) were performed to examine the characteristics and associations between variables (Mark & Peter, 2016; Osborne, 2015; Warner, 2013). The split file option was selected in SPSS to conduct the subgroup analysis (clinical and nonclinical setting).

The chi-squared test of association, multinomial logistic regression (MLR), and z-test statistical tests were conducted, and all applicable assumptions were checked (Mehta & Patel, 2012; McHugh, 2013; Ranga, Murty, & Athithan, 2019; Wagner, 2016; Warner, 2013). The multivariate MLR and z-test statistical tests were conducted to test the main hypotheses to examine the predictive effects of multiple predictors while controlling for other variables in the model (Hosmer, Lemeshow, & Sturdivan, 201; Laerd Statistics, 2017). The outcome variable category “Never tested” was selected in the main MLR analysis as the reference. An additional MLR analysis was conducted using the HIV testing history level category, “tested more than once,” as the reference category to examine the likelihood of getting tested once relative to tested more than once. The type of HIV test location and recruitment site city were included as confounders and controlled in the multivariate MLR model, considering site-specific recruitment and setting-specific strategies (Pourhoseingholi, Baghestani, & Vahedi, 2012). Results exported from SPSS to excel supported the generation of result tables and z-test statistical analysis.

The statistical significance of the differences in associations (between the population characteristics and HIV testing history levels in the past 12 months) between the clinical and nonclinical settings were examined using the equation described by Allison (1999), Clogg, Petkova, and Haritou (1995), and Altman and Bland (2003).

$$z = (\beta_{12} - \beta_{11}) \;/\; [SE^2(\beta_{12}) + SE^2(\beta_{11})]^{1/2}$$

Whereby β_{11} and β_{12} represent the coefficient of regression for the MLR models (clinical and nonclinical settings, respectively) and $SE\beta_{11}$ and $SE\beta_{12}$, the associated standard errors. The z-scores were calculated in excel using the equation. The critical values for significance ($p < .05$) and the decision rule for rejecting H_O: $\beta_{11} = \beta_{12}$ were “$-1.96 \geq z$ or $z \geq 1.96$” for a 95% probability (Laerd Statistics, 2017).

Results Analysis

Out of 1553 samples, only 632 (clinical setting) and 557 (nonclinical setting) had no missing values for the outcome variable, and about 23% had missing values for some of the predictors, hence limiting the available sample size to 1189. The multivariate analysis used 1170 samples, which excluded 19 samples from HIV testing locations in the nonclinical setting with a low sample sizes. The descriptive statistics for the variables are presented in Table 15 and 16. For both settings, over 40% of the participants were less than 40 years old. However, there were more participants aged 18-28 years in the clinical setting. More than 80% had less than college degree in both settings, the percentage was higher in the nonclinical setting. Although most participants were insured (either government, such as Medicaid, or private insurance) and had a preferred provider in both settings, but the percentages were higher in the clinical setting (respectively).

Less than 10% of participants responded to the survey question regarding health-seeking behavior for STD services, about 70% and 67% in the clinical and nonclinical settings, respectively. Suggesting increased health-seeking behavior for STDs (syphilis) services among BMSM who received HTS in the clinical setting. Also, over 80% reported not visiting a substance use counselor in the past six months. Table 16 shows that 48% of participants from each setting reported getting tested more than once. Most testing events were reported from the community health center/free clinic for the clinical settings and HIV/AIDS street outreach program/Mobile Unit for the nonclinical setting.

Table 15

Descriptive Statistics for Population Characteristics in the Clinical and Nonclinical Settings

Population Characteristics		Clinical Setting		Nonclinical Setting	
		No.	%	No.	%
Predisposing factors	*Age in years*				
	18-28	193	30.3	151	26.8
	29-39	133	20.9	123	21.8
	40-50	222	34.9	211	37.4
	51 or older	89	14.0	79	14.0
	Total	637	100.0	564	100.0
	Education attainment				
	some high school or less	97	15.2	101	17.9
	high school graduate or equivalent	207	32.5	212	37.6
	some college or 2 year degree	224	35.2	189	33.5
	college degree or more	109	17.1	62	11.0
	Total	637	100.0	564	100.0
	Income level				
	less than $5,000	137	21.5	141	25.0
	$5,000-$9,999	76	11.9	70	12.4
	$10,000-$19,999	123	19.3	139	24.6
	$20,000-$29,999	87	13.7	79	14.0
	$30,000-$39,999	76	11.9	50	8.9
	$40,000-$49,999	42	6.6	31	5.5
	$50,000 or more	96	15.1	54	9.6
	Total	637	100.0	564	100.0
Enabling Factors	*Health insurance status*				
	No	212	33.3	243	43.1
	Yes	425	67.7	321	56.9
	Total	637	100.0	564	100.0
	Having a preferred provider				
	No	110	17.3	133	23.6
	Yes	527	82.7	431	76.4
	Total	637	100.0	564	100.0
Need Factors	*Health-seeking behavior for STD services* [a]				
	No	14	30.4	14	33.3
	Yes	32	69.6	28	66.7
	Total	46	100.0	42	100.0
	Health-seeking behavior for substance-use services				
	No	536	84.1	449	79.6
	Yes	101	15.9	115	20.4
	Total	637	100.0	564	100.0

Note. [a] Small sample size due to low response to associated survey question; variable excluded in multivariate analysis.

Table 16

Descriptive Statistics for HIV Testing History Levels in the Past 12 Months, Type of HIV Testing Location Setting (modified list), and Recruitment Site City in the Clinical and Nonclinical Settings

Characteristics	Clinical Setting		Nonclinical Setting	
	No.	%	No.	%
HIV testing history levels in the past 12 months[a]				
Never tested	93	14.7	81	14.5
Tested once	234	37.0	207	37.2
Tested more than once	305	48.3	269	48.3
Total	632	100.0	557	100.0
Type of HIV testing location				
Hospital outpatient clinic	128	20.1		
Adult HIV/AIDS or infectious disease clinic	46	7.2		
Sexually transmitted disease clinic	40	6.6		
Community health center/public health clinic/free clinic	297	46.6		
Family planning clinic	24	3.8		
Emergency room	26	4.1		
Private doctors office (including HMO)	76	11.9		
HIV/AIDS street outreach program/Mobile Unit			236	43.4
HIV counseling and testing site			161	29.6
Research site			36	6.6
Drug treatment program			35	6.4
Correctional facility (jail or prison)			76	14.0
Military[b]			11	2.0
Home health care[b]			5	.9
Needle exchange program[b]			4	.7
Total	637	100.0	544	100.0
Recruitment site city				
Atlanta	113	17.7	108	19.1
Boston	122	19.2	74	13.1
Los Angeles	79	12.4	129	22.9
New York City	111	17.4	136	24.1
San Francisco	98	15.4	55	9.8
Washington DC	114	17.9	62	11.0
Total	637	100.0	564	100.0

Note. [a]Missing data points reduced sample size from 637 to 632 and 564-557 for clinical and nonclinical settings (respectively). [b]Small sample sizes for selected test locations in the nonclinical setting so excluded to generate a modified list that was included as a control variable in the multivariate analysis.

Bivariate Analysis

The bivariate analysis examined the characteristics and associations to determine how each of the IVs impeded or facilitated the more frequent use of HTS in the past 12 months in the nonclinical setting. The MLR was employed to test the secondary hypotheses. The results from the bivariate analysis (shown in Table 17 and Table 18) informed the multivariate analysis.

The chi-squared test (χ^2) of association results in Table 17 showed that HIV testing history levels in the past 12 months was statistically associated with age in both settings, but only with education attainment in the clinical setting. Revealed associations also reported Cramer's V values < .20 (Cohen, 1988). The MLR model also revealed a negative association between age and HIV testing history levels in the past 12 months. Age 18-28 age group were more likely to have tested for HIV more than once in the past 12 months compared to the other age groups for both settings, as shown in both Table 18. The MLR the parameter estimates indicated a statistically significant association between the outcome variable and education attainment level category "some college or 2 year degree" (p = .04) in the nonclinical setting (Table 18). For both settings, participants who had some college or 2 year degree were more likely to have never tested in the past 12 months. However, the likelihood of not getting tested more than once was higher for participants tested in the clinical setting compared to the nonclinical setting (54% vs. 33%). Also, the likelihood of annual testing was lower in the clinical versus the nonclinical setting.

Although other predictors were not statistically significant, as shown in Table 17, the reported ORs and CIs from MLR results generated information about the likelihood of getting tested once or more than once in the past months among BMSM in both settings. Table 18 excludes MLR results for income level. Participants who reported income level between \$20,000 -\$29,999 compared to those who had income level between \$50,000 or more, were less likely in the clinical setting (OR= .46, 95% CI = .20, 1.05, p = .07) and more likely in the nonclinical setting (OR= 1.28, 95% CI = .40, 4.05, p = .68) to get tested more than once in the past 12 months rather than never tested. Although most of the participants were insured (Table 15), chi-square test and MLR results presented in Table 18 show that the uninsured were 28% more likely and 33% less likely to have tested more than once in the past 12 months versus never tested in the clinical and nonclinical setting, respectively. However, the uninsured were more likely to get tested once rather than more than once in the nonclinical setting. For both settings, the odds of getting more than one HIV test in the past 12 months versus never tested were lower for participants who reported not having a preferred provider and not seeking substance use services in the past six months.

Health-seeking behavior for STD services. Table 17 shows no statistically significant associations in both settings for participants who had previously used STD services. The model fit's validity was not reliable due to the small sample size and low expected counts (IBM, 2018). This predictor was excluded from the multivariate analysis and the overall interpretation of study outcomes.

Table 17

Bivariate analysis for Selected Population Characteristics by HIV Testing History Levels in the Past 12 Months in the Clinical and Nonclinical Settings

Population Characteristics	Clinical Setting				Nonclinical Setting			
	Never tested	Tested once	Tested more than once	χ^2 *p*-value	Never tested	Tested once	Tested more than once	χ^2 *p*- value
Predisposing factors								
Age in years								
18-28	18(19.4)	59(25.2)	116(38.0)	.002	11(13.6)	47(22.7)	92(34.2)	.01
29-39	27(29.0)	49(20.9)	57(18.7)		21(25.9)	45(21.7)	56(20.8)	
40-50	33(35.5)	95(40.6)	89(29.2)		37(45.7)	85(41.1)	86(32.0)	
51 or older	15(16.1)	31(13.2)	43(14.1)		12(14.8)	30(14.5)	35(13.0)	
Total	93(100)	234(100)	305(100)		81(100)	207(100)	269(100)	
Education attainment								
some high school or less	15(16.1)	34(14.5)	45(14.8)	.03	11(13.6)	34(16.4)	55(20.4)	.09
high school graduate or equivalent	20(21.5)	84(35.9)	102(33.4)		26(32.1)	82(39.6)	100(37.2)	
some college or 2 year degree	47(50.5)	71(30.3)	105(34.4)		37(45.7)	61(29.5)	89(33.1)	
college degree or above	11(11.8)	45(19.2)	53(17.4)		7(8.6)	30(14.5)	25(9.3)	
Total	93(100)	234(100)	305(100)		81(100)	207(100)	269(100)	
Enabling factors								
Health insurance status								
No	26(28.0)	84(35.9)	101(33.1)	.39	39(48.1)	99(47.8)	103(38.3)	.07
Yes	67(72.0)	150(64.1)	204(66.9)		42(51.9)	108(52.2)	166(61.7)	
Total	93(100)	234(100)	305(100)		81(100)	207(100)	269(100)	
Need factors								
Health-seeking behavior for substance use services								
No	79(84.9)	194(82.9)	260(85.2)	.75	66(81.5)	163(78.7)	126(80.3)	.85
Yes	14(15.1)	40(17.1)	45(14.8)		15(18.5)	44(21.3)	53(19.7)	
Total	93(100)	234(100)	305(100)		81(100)	207(100)	269(100)	

Note. Expected counts and % within HIV testing history levels in the past 12 months in parentheses

Table 18

Bivariate Multinomial Logistic Regression Results for Selected Population Characteristics Predicting HIV Testing History Levels in the Past 12 Months in the Clinical and Nonclinical Settings

	Tested once vs. Never tested				Tested more than once vs. Never tested				Tested once vs. Tested more than once			
	Clinical Setting		Nonclinical Setting		Clinical Setting		Nonclinical Setting		Clinical Setting		Nonclinical Setting	
	p	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*	*P*	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*
Predisposing factors												
Age in years vs. ≥51 years (ref.)												
18-28	.27	1.59	.26	1.71	.04	2.25	.02	2.87	.22	.71	.09	.60
		.70 3.57		*.67 4.36*		*1.04 4.85*		*1.16 7.10*		*.40 1.23*		*.33 1.09*
29-39	.74	.88	.72	.86	.42	.74	.83	.91	.56	1.19	.84	.94
		.40 1.91		*.37 2.00*		*.35 1.55*		*.40 2.09*		*.65 2.17*		*.50 1.75*
40-50	.38	1.39	.83	.92	.87	.94	.56	.80	.16	1.48	.63	1.15
		.67 2.90		*.42 1.99*		*.46 1.91*		*.37 1.70*		*.86 2.55*		*.65 2.04*
Education attainment vs. college degree or above(ref.)												
some high school or less	.20	.55	.55	72	.29	.62	.53	1.40	.70	.89	.06	.52
		.23 1.36		*.25* 2.10		*.26 1.49*		*.49* 4.04		*.49 1.62*		*.26 1.02*
high school graduate or equivalent	.95	.1.03	.52	.74	.89	1.06	.88	*1.08*	.90	.97	.22	.68
		.45 2.33		*.29* 1.87		*.47 2.37*		*.42* 2.76		*.59 1.59*		*.37 1.25*
Some college or 2 year degree	.01	.37	.04	.38	.04	.46	.40	*.67*	.37	.80	.08	.57
		.17 .79		*.15* .96		*.22 .97*		*.27* 1.69		*.48 1.31*		*.31 1.06*
Enabling factors												
Health insurance status vs. Yes (ref.)												
No	.17	1.44	.96	.99	.35	1.28	.11	.67	.50	1.13	.04	1.48
		.85 2.44		*.59* 1.65		*.76 2.13*		*.41 1.10*		*.79 1.62*		*1.02 2.13*
Having a preferred provider vs. Yes (ref.)												
No	.87	.95	.38	.77	.78	.92	.58	.85	.89	1.03	.62	.90
		.51 1.77		*.43 1.38*		*.50 1.68*		*.49 1.50*		*.66 1.62*		*.58 1.38*
Need factors												
Health-seeking behavior for substance use services vs. Yes (ref.)												
No	.65	.86	.61	.84	.94	1.02	.81	.93	.45	1.67	.22	2.45
		.44 1.67		*.44 1.62*		*.53 1.96*		*.49 1.75*		*.44 6.33*		*.59 10.30*

Note. Odds Ratio (OR); Confidence Intervals (CI); Lower Bound (LB); Upper Bound (UB); Reference Category (ref.)

Multivariate Analysis

The MLR model tested the main hypotheses to examine the significance, strength, and direction of the association between the predictors and outcome variables. The analysis provided information on the predictive effects of multiple predictors, predisposing (age, education attainment, income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for substance-use services) with (HIV testing history levels in the past 12 months), while controlling for other variables in the model. The type of HIV testing location and recruitment site city were controlled in the multivariate MLR.

Comparing associations in the clinical and nonclinical settings

Each of the multivariate MLR models (clinical and nonclinical settings) presented about 16% (Nagelkerke pseudo R^2) of the variance in HIV test history levels in the past 12 months. The results are presented in Table 19. Also, the MLR results indicated that participants recruited from the Atlanta site were 68% (p = .02) and 67% (p = .07) less likely to get tested more than once compared to never tested once in the past 12 months in the clinical and nonclinical settings (respectively). The MLR models revealed predictive association between the variables in the clinical setting, χ^2(52, N = 632) = 91.14, p = .001, and nonclinical setting, χ^2(48, N = 538) = 78.38, p = .004. Table 19 displays the MLR output.

In the clinical setting, overall statistically significant associations were revealed for age, χ^2(6, N = 632) = 18.37, p = .005, and education attainment, χ^2(6, N = 632) = 15.50, p = .02, with HIV testing history levels in the past 12 months among BMSM.

Also, the overall effect of health insurance status was not statistically significant *(p* = .08). However, Table 19 shows that compared to participants who had insurance coverage, those who had no coverage were almost twice as likely to get tested once (p = .03) or more than once (p = .04). Therefore, health insurance status was statistically associated with the HIV testing history levels in the past 12 months in the clinical setting.

In the nonclinical setting, an overall statistically significant association was indicated for age,χ^2(6, N = 538) = 16.58, p = .01, and education attainment , χ^2(6, N = 538) = 12.41, p = .05, with HIV testing history levels in the past 12 months among BMSM. The results from the bivariate analysis revealed that participants who were uninsured, were less likely to get tested once versus never tested in the nonclinical setting (Table 18). However, in the multivariate model (Table 19), the likelihood of more frequent testing was associated (although not significant) with not having health insurance coverage.

As shown in Table 18 and Table 19, similar outcomes were generated for age and education attainment for the bivariate and multivariate models. Compared to age 51 or older, age group 18-28 were more likely to get tested more than once compared to never tested in both settings, with a higher likelihood in the nonclinical setting. Participants with some college or 2 year degree were less likely to have tested more than once relative to never tested in the past 12 months in both settings. Also, additional MLR analysis showed that those with some college or 2 year degree were less likely to get tested once versus more than once in the both settings, with a lower likelihood in the nonclinical setting. The uninsured were more likely to get tested frequently in the clinical versus the nonclinical setting. MLR analysis with "tested more than once" as referent showed that age group 18-28 was less likely to get tested once, suggesting more frequent testing in both settings.

Income level was not statistically significantly associated, $\chi 2(12, N = 632) = 13.04$, $p = .37$, with HIV testing history levels in the past 12 months (MLR results are not presented in Table 19). Participants who reported income level between \$20,000-\$29,999 compared to income level \$50,000 or more, were 45% less likely versus 136% more likely to have tested more than once relative to never tested in the past 12 months in the clinical and nonclinical setting (respectively) while controlling for other variables in the model. Having a preferred provider and health-seeking behavior for substance use increased the odds for more frequent testing for both settings. Also, having a preferred provider increased odds for annual testing versus more than once in the clinical relative to the nonclinical setting.

Based on the results from the multivariate MLR analysis for the clinical and nonclinical settings, the secondary (null hypothesis) that there is no association between predisposing (age, education attainment, income level), enabling (health insurance status, and having a preferred provider), need (health-seeking behavior for substance-use services), and HIV testing history levels in the past 12 months, while controlling for other variables in the model was rejected and the alternative accepted.

Comparing significance of associations between settings

The calculated z-scores are displayed in Table 19 and referenced as “*z*.” There were no significant differences in the associations between the population characteristics and HIV testing history levels in the past 12 months between settings. None of the reported values fell within the critical values for statistical significance at $p < .05$, for z-score $\geq +1.96$ or ≤ -1.96 (Laerd Statistics, 2017b; McLeod, 2019). Although the reported z-score for health insurance status ($z = -1.33$) between settings was not significant (tested more than once vs. never tested), it was the value closest to the critical value "-1.96."

Based on the reported z-scores in Table 19, the main null hypothesis that there is no difference in the associations between predisposing (age, education attainment, income level), enabling (health insurance status, and having a preferred provider), and need (health-seeking behavior for substance-use services) and HIV testing history levels in the past 12 months among BMSM between settings, while controlling for other variables in the model, failed to be rejected.

Table 19

Comparing Multivariate Multinomial Logistic Regression Results Predicting HIV Testing History Levels in the Past 12 Months and the Significance of the Difference in the Associations between the Clinical and Nonclinical Settings, Controlling for Type of HIV Testing Location and Recruitment Site City

	HIV testing history levels in the past 12 months														
	Tested once vs. Never tested					Tested more than once vs. Never tested					Tested once vs. Tested more than once				
	Clinical Setting		Nonclinical Setting			Clinical Setting		Nonclinical Setting			Clinical Setting		Nonclinical Setting		
	p	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*	*z*	*p*	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*	*z*	*p*	OR 95% CI *LB UB*	*p*	OR 95% CI *LB UB*	*z*
<u>Predisposing factors</u>															
Age in years vs .≥51 years (ref.)															
18-28	.27	1.67	.28	1.79	*.10*	.07	2.21	.04	2.96	*.42*	.36	.75	.15	.61	*-.46*
		.67 4.12		*.63 5.13*			*.93 5.29*		*1.06 8.25*			*.41 1.39*		*.30 1.20*	
29-39	.58	.79	.59	.77	*-.03*	.22	.60	.78	.88	*.60*	.39	1.32	.72	.88	*-.84*
		.34 1.83		*.30 2.01*			*.26 1.36*		*.34 2.26*			*.70 2.47*		*.44 1.76*	
40-50	.38	1.42	.65	.82	*-.93*	.93	.97	.44	.71	*-.51*	.18	1.47	.68	1.14	*-.58*
		.65 3.12		*.34 1.95*			*.45 2.09*		*.30 1.70*			*.83 2.61*		*.60 2.17*	
Education attainment vs. college degree or above (ref.)															
some high school or less	.16	.47	.34	.54	*.16*	.52	.71	.53	1.51	*.90*	.25	.67	.01	.36	*-1.13*
		.17 1.35		*.15 1.90*			*.25 2.00*		*.42 5.35*			*.33 1.34*		*.16 .81*	
high school graduate or equivalent	.97	.98	.22	.50	*-.91*	.51	1.37	.92	1.06	*-.34*	.26	.72	.04	.47	*-.87*
		.39 2.50		*.16 1.53*			*.54 3.48*		*.34 3.32*			*.40 1.27*		*.23 .98*	
some college or 2 year degree	.01	.35	.03	.29	*-.25*	.11	.51	.40	.62	*.29*	.19	.69	.04	.47	*-.81*
		.15 .82		*.10 .86*			*.22 1.16*		*.21 1.86*			*.40 1.21*		*.23 .98*	
<u>Enabling factors</u>															
Health insurance status vs. Yes (ref.)															
No	.03	2.01	.27	1.45	*-.70*	.04	1.94	.89	1.05	*-1.33*	.87	1.04	.16	1.39	*.91*
		1.05 3.84		*.75 2.80*			*1.02 3.68*		*.55 2.00*			*.67 1.61*		*.88 2.19*	
Having a preferred provider vs. Yes (ref.)															
No	.95	.98	.31	.71	*-.65*	.62	.84	.51	.80	*-.09*	.56	1.16	.60	.88	*-.78*
		.48 1.97		*.36 1.38*			*.42 1.69*		*.42 1.55*			*.70 1.92*		*.54 1.43*	
<u>Need factors</u>															
Health-seeking behavior for substance use services vs. Yes (ref.)															
No	.42	.74	.36	.70	*-.10*	.55	.80	.20	.61	*-.51*	.77	.93	.59	1.16	*.58*
		.36 1.54		*33 1.50*			*.39 1.65*		*.29 1.30*			*.56 1.54*		*.68 1.96*	

Note. Odds Ratio (OR); Confidence Interval (CI); Reference category *(ref.)*; *p*-value (*p*); z-score (z), Significant *z*-scores are $z \leq -1.96$, and $z \geq 1.96$.

Discussion

Despite the CDC recommendation that sexually active MSM should be tested at least annually, BMSM at higher risk of HIV infection are less likely to get tested in the past 12 months (DiNenno et al., 2018; CDC, 2019b). It was hypothesized that a combined approach encompassing routine (non-risk-based) and targeted (risk-based) testing strategies in the clinical and nonclinical settings would help promote more frequent testing history levels among BMSM (Clark et al., 2019; Miller et al., 2017; Williams et al., 2016). Sexually active BMSM will benefit from more frequent testing to help detect early infections and reduce the rate of undiagnosed HIV infections among BMSM who are unaware of their HIV positive status (Branson et al., 2006; DiNenno et al., 2017, 2018; Liu et al., 2019; Noble et al., 2017). This study's outcomes, underpinned by the ABM, revealed associations between BMSM population characteristics and the HIV testing history levels in the past 12 months in both settings. The ABM posited that population characteristics (predisposing, enabling, need factors) and health system-related or environmental factors (such as clinical and nonclinical settings) impede or facilitate the use of HTS.

The multivariate analysis results, while controlling for other variables in the model, revealed statistically significant associations with age and education attainment (predisposing factors) in both settings and health insurance status (enabling factor) in the clinical setting with HIV testing history levels in the past 12 months. Participants aged 18-28 (younger) were more likely and those with some college or 2 year degree (less than college degree or above) were less likely to get tested once or more than once compared to never tested in the past 12 months for both settings. In both settings, those aged 18-28 years and with some college or 2 year degree were more likely to get annual testing versus more frequent testing. Also, health insurance was found to be negatively associated with more frequent testing. Being uninsured in both settings increased the likelihood of more frequent testing, although more likely in the clinical versus nonclinical settings. However, in the nonclinical setting, the bivariate analysis revealed a non-significant association between health insurance and HIV testing history levels. Results suggested that the insured were more likely to get tested in the nonclinical setting. When compared between settings, there was an increased likelihood of annual testing in the clinical versus nonclinical settings. The reported results helped address the research gap by expanding previous research findings. This study's findings helped understand the correlates of more frequent testing, defined by the HIV testing history levels in the past 12 months. Both significant and non-significant associations between the outcome and predictor variables may inform new HIV testing strategies.

The multivariate MLR analysis also showed that the participants recruited from the Atlanta site reported lower odds for getting tested more than once in the prior year in both settings. Atlanta, one of the southern states, has disproportionately high HIV incidence and prevalence among BMSM, who experience multilevel barriers to HIV testing (Reif et al., 2017). The reported odds for getting tested once or more than once at the Atlanta site has major implications for ongoing efforts towards “Ending the HIV Epidemic in the United States” HHS initiative (Giroir, 2020; Fauci et al., 2019). The inclusion of Atlanta on the list of key geographic sites under the HHS initiative reiterates the critical importance of developing strategies to barriers that impede frequent testing among BMSM (Levy et al., 2014; Rizza, MacGowan Purcell, Branson, & Temesgen, 2012).

The findings from this study confirmed outcomes from previous studies. Reported results from Lo et al. (2018) reiterated the less likelihood for more frequent HIV testing in the past 12 months by indicating that being older and belonging to a sexual minority group (such as BMSM) increased lifetime HIV testing rather than more frequent testing. HIV diagnoses among MSM age 50 or older years have decreased or remained stable from 2014-2018. However, they are more likely to experience more severe AIDS-related outcomes based on delayed diagnoses, up to 4-5 years (CDC, 2020). Factors that impact infrequent or delayed testing include stigma, discrimination, and low perceived risk. The CDC (2019b) reported that younger than 40, college degree or more, income above poverty level, and health insurance status, and having a health provider in the past 12 months were all associated with increased testing. This study confirmed the previous research findings; however, the negative association between health insurance and HIV testing history levels confirmed outcomes from Lo et al. (2018) but contrasted the CDC findings.

The ABM posited health insurance coverage (an enabling factor) as a significant predictor for health service use. This study also suggested that not having health insurance coverage was associated with more frequent testing in both settings but more likely in the clinical setting. Findings from this study provide new insight and nuance to the outcome reported by Lo et al. (2018). Lo et al. 's study did not examine the consideration of getting tested in a specific HIV testing location setting. Health insurance coverage potentially increases access to HTS; however, this study found a negative statistically significant association in the clinical setting.

Reported findings from Mannheimer et al. (2014), using the HPTN 061 data, indicated that health insurance was not independently associated with infrequent HIV testing in the multivariate model while controlling for other correlates. This study conducted subgroup analysis by HIV testing location setting or the number of HIV tests received (HIV testing history levels in the past 12 months). The inverse association between health insurance coverage and outcome may also be attributed to the fear of disclosing status to the employer for using employer-sponsored insurance (ESI). Hence the reason for indicating no insurance status to receive HIV services to avoid loss of employment, stigma, and discrimination (Cramer, Colbourn, Gemberlin, Graham, & Stroud, 2015; Global Network of People Living With HIV, 2018).

The results also suggested the need to improve health insurance coverage eligibility and access for populations that are disproportionately impacted by the HIV epidemic to support more frequent utilization of HTS in nonclinical settings (Garfield, Damico, & Orgera, 2020; Garfield, Rudowitz, & Damico, 2020; Tolbert, Orgera, Singer, & Damico, 2019). The bivariate results reported less likelihood of more frequent testing in the nonclinical setting for those with no health insurance coverage. For BMSM, who prefer to test in the nonclinical setting, this finding could have major implications on the access and utilization of HTS. The long-term impact of not having health insurance was examined among long-term uninsured residents in South Carolina, and the findings showed that having prior health insurance was positively and significantly associated with health service utilization (Shi et al., 2019). The implementation of major provisions of the 2010 Patient Protection and Affordable Care Act (ACA) occurred after the completion of the HVTN 061 study. Hence the association with health insurance status revealed from this study may suggest a past indication (Gaudette et al., 2018; HIV.gov, 2020). Analysis of the recent dataset collected after full implementation of ACA may provide further insight.

The observed increased odds for more frequent testing for selected income levels were consistent with previous studies that higher income increased the likelihood of getting tested (Alemu et al., 2017; CDC, 2019b; Mannheimer et al., 2014). Although not statistically significant, compared to the referent, participants who reported income level between $20,000-29,999 in the nonclinical setting had higher odds of getting tested once or more than once in the past 12 months compared to the clinical settings. Also, compared to participants in the clinical setting, those with the income level between $20,000-29,999 were more likely to receive annual testing rather than more frequent testing in the past 12 months in the nonclinical setting. Mannheimer et al. (2014) reported results from a univariate analysis using the HPTN 061 dataset and revealed statistically significant associations between income level (<$10,000 vs. ≥ $10,000) and infrequent testing. The likelihood of infrequent testing among the sample of BMSM was higher for those who reported income < $10,000.

There may be multiple reasons for the contradicting observed associations between the clinical and nonclinical settings. The HPTN study was conducted in 2009-

2010, so based on the income level, and household size, and the 2009-2010 "federal poverty level" (FPL) income range, income level $20,000-$29,999 may have had implications on the eligibility for Medicaid health insurance coverage (Assistant Secretary for Planning and Evaluation website [ASPE], n.d.). Hence, considering the bivariate results from the nonclinical setting, the insured may have preferred to receive testing in the nonclinical setting. Participants in this income level may have preferred the targeted service delivery approach in the nonclinical setting. For instance, the HIV/AIDS street outreach program/Mobile Unit, where community health workers are often utilized to help mitigate concerns regarding discriminatory and stigmatizing attitudes and practices among health-care workers towards BMSM (Essuon et al., 2017; Saleh, van den Berg, Chambers, & Operario, 2016; Singh, Song, Johnson, McCray & Hall, 2018).

This study results also showed that having a preferred provider decreased the odds of getting more frequent HIV testing in the past 12 months in both settings (not statistically associated). Providers play a critical role in facilitating access and utilization of HIV prevention, treatment, and care services (Marks et al., 2017; Elope et al., 2017; Underhill et al., 2014). Engaging patients and forming trusted provider-patient relationships and providing routine and targeted patient-centered services fosters improved access to HIV-related services. The results suggest that more training for providers in both settings will further improve engagement and education of sexually active BMSM about the benefits of more frequent HIV testing in the past 12 months per the CDC recommendation to support increased use of HTS (DiNenno et al., 2017, 2018).

The participants who reported not seeking treatment for substance use were less likely to report more frequent HIV testing history levels in the past 12 months in both settings (not statistically associated). Dailey et al. (2017) reported that over 50% of persons identified at-risk for STD and substance use had not tested in the past 12 months but had seen a health care provider for other services. Therefore, as posited by the ABM, seeking HTS services in conjunction with other health services, such as STD and substance use services (need factors), could facilitate the more frequent use of HTS (receiving more than one HIV test) in the past 12 months.

As previously discussed, this study's outcomes confirmed findings from previous studies and generated new information to help understand the correlates of more frequent testing in the clinical and nonclinical settings. This study is unique because the number of tests measured using HTS received in the past 12 months and BMSM HIV testing history levels in the prior year were examined and compared between two HIV testing location settings. Although the findings from this study have informed the association of population characteristics and HIV testing history levels in the past 12 months among BMSM in the clinical and nonclinical settings, there were no statistically significant differences in the associations revealed between settings. The computed z-score values indicate no extreme significant differences between the associations between the clinical and nonclinical settings. The critical value for health insurance status ($z = -1.33$) was the only z-score closest to the critical value limit for z-score ≤ -1.96, comparing tested more than once versus never tested. Future research should further examine the statistical significance between settings using a larger dataset.

Although the findings from this study have informed the associations of population characteristics with HIV testing history levels in the past 12 months among BMSM in the clinical and nonclinical settings, it is prudent to interpret the results in light of the following limitations. Several limitations may have impacted the study's internal validity (Patino & Ferreira, 2018). Firstly, the limitations of the original HPTN study also apply to this study. The use of a cross-sectional design impacts the causal inferences about direction and associations (Setia, 2016). The recruitment strategy using participant referral and other sampling methods may have introduced selection bias (Koblin et al., 2013; Mannheimer et al., 2014).

Secondly, the variables utilized from the HPTN 061 secondary data were all collected via self-reporting using the ACASI system (Population Council, n.d.) and interviews. Although using ACASI aimed to reduce social desirability bias, the potential for over-reporting and under-reporting may have impacted the reliability and validity of the self-reported responses (Althubaiti, 2016). Thirdly, the sample of BMSM included in this secondary analysis was recruited from sites in six U.S. cities (with high HIV incidence and prevalence) that used specific study eligibility criteria (including the requirement to recruit high-risk BMSM). Therefore, the generalizability of the outcomes of this study may be limited. However, the population characteristics of the participants who enrolled in the HPTN 061 study are consistent with the population of high-risk BMSM in the United States who are disproportionately impacted by the HIV epidemic (CDC, 2019b; Liu et al., 2019; Underhill et al., 2014).

This study utilized one of the largest secondary datasets collected from BMSM at-risk for HIV infections from six U.S. sites to primarily examine associations between the population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months (using a cross-sectional design) in the clinical and nonclinical settings. The findings from this study established a baseline for further research. A future study using a recent country-level dataset should further examine a broader range of characteristics with more frequent testing to understand the implications of health care challenges, including the uncertainty of ACA and its impact on health insurance coverage, access, and utilization of health services. Efforts will support ending the HIV epidemic (Garfield, Damico, & Orgera, 2020; Garfield, Rudowitz, & Damico, 2020; HIV.gov, 2019).

The suggested dataset should encompass multiple MSM subgroups (including transgender) across multiple U.S. cities (Poteat, German, & Flynn, 2016). The dataset should consider the low and high HIV incidence and prevalence population groups, multiple risk levels, types of HIV testing locations, across rural and urban settings, and clinical and nonclinical settings, and multiple testing frequencies (every 3 months, through 24 months, and lifetime testing). Future research should examine associations to inform strategies to improve the more frequent use of HIV testing services (especially in key population groups). Supporting the HHS initiative towards “Ending the HIV Epidemic” require innovative strategies, considering current and potential challenges in the provision of HIV services with the high demand for health services to compact the COVID-19 pandemic (Fauci et al., 2019; Sanchez, Zlotorzynska, Rai, & Baral, 2020).

Conclusion

For this study, it was hypothesized that there is an association between BMSM population characteristics and the more frequent use of HTS (more than one HIV test) in the past 12 months in both settings. As posited by the behavioral model for vulnerable populations, the population characteristics examined in this study revealed associations that suggested the increased or decreased likelihood of never getting tested, tested once, or more than once in the prior year.

This study revealed information about the correlates of more frequent testing (for both significant and non-significant predictors) in the past 12 months in the clinical and nonclinical settings. Younger aged (18-28 years), those with college degree and above, and the uninsured were more likely to get tested once or more than once in both settings. However, the associations with some age groups, education attainment levels, and health insurance status were different across settings. There was no statistically significant difference between settings.

The revealed associations from this study have the potential to inform intervention efforts to promote routine and targeted strategies in both settings to enhance more frequent utilization of HTS (tested once or tested more than once) in the past 12 months among BMSM (Clark et al., 2019; Miller et al., 2019). The outcomes have the potential to impact positive social change on the individual-level (may help identify target population to help improve the provision and access of HTS among BMSM) and societal-level (combined approach to help reduce the stigma and discrimination that some BMSM may experience at certain HIV testing location settings). Policy-level social change implications may support efforts to increase the provision of health insurance coverage to key population groups impacted by the HIV epidemic. More frequent testing offers the opportunity to detect early HIV infections, promote immediate linkage to ART, and enhance the sustained use of ART towards viral suppression to help reduce HIV transmission. Interventions informed by a combined approach may help reduce the rate of undiagnosed HIV infections among BMSM who are unaware of their HIV positive status.

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IRB Approvals, Informed Consent, and Human Subject Protection

Walden University Institutional Review Board (IRB) approval IRB # 04-16-20-0446424. The IRBs at all participating institutions (sites) approved the HPTN 061 study: Emory University IRB #2 - Biomedical IRB (Committee A), Fenway Community Health IRB #1, University of California, Los Angeles - South General Campus IRB, Columbia University Medical Center IRB, New York Blood Center IRB, San Francisco General Hospital Committee IRB #2, and George Washington University Medical Center IRB. Written informed consent was obtained from all study participants.

All procedures performed in this study involved the use of secondary data from HPTN 061 study that has been delimited and deidentified. No actual human participants were engaged or recruited. No animals were involved in this study.

Disclaimer

The author notes that this dissertation is hers alone and does not represent the views of the HPTN 061 study team, the HIV Prevention Trials Network or the study sponsor, the U.S. National Institutes of Health.

Part 3: Summary of Study

Introduction

In the United States, BMSM are disproportionately impacted by the HIV epidemic. BMSM accounted for almost 40% of new HIV diagnoses among MSM, and about 15% are unaware of their HIV positive status (CDC, 2019a, 2019b, 2020). Although the CDC recommends that those at higher risk for HIV get tested at least annually, sexually active BMSM are less likely to get tested in the past 12 months (DiNenno et al., 2017, 2018; CDC, 2019c; Li et al., 2019; Liu et al., 2019; Patel et al., 2018). Also, BMSM are more likely to use HIV testing services (HTS) in the nonclinical relative to the clinical setting than other MSM subgroups (CDC, 2019b). Whereby HIV testing locations, such as hospital emergency department and community health center are considered clinical settings, and HIV counseling and testing site and HIV street outreach program are types of nonclinical settings (CDC, 2016, 2019b).

As posited by the Gelberg-Anderson behavioral model for vulnerable populations [ABM] (Andersen, 1995; Gelberg et al., 2000), the health system environment and population characteristics impede and facilitate the more frequent use of HTS. In this study, the health system environment attributes were defined by the type of HIV testing location setting. Guided by the ABM, this study examined the associations between population characteristics namely, predisposing (age, education attainment, and income level), enabling (health insurance status and having a preferred provider), and HIV testing history levels in the past 12 months (never tested, tested once, and tested more than once) in the clinical and nonclinical settings. The more frequent use of HTS was defined as the

HIV testing history levels in the past 12 months and measured by the number of HIV tests received in the clinical and nonclinical settings.

The present study sought to address the gap in literature regarding the lack of information about the correlates of more frequent HIV testing history in the prior year among BMSM in the clinical and nonclinical settings. Secondary data analysis included a total of 1189 from HPTN 061 for at-risk BMSM age 18 years or older. In alignment with the problem, gap, and main research question, this study (made up of three substudies) examined the population characteristics (predictors) and HIV testing history levels in the past 12 months (outcome) in the clinical setting, nonclinical setting, and between settings. The three substudies are described in the manuscripts entitled “Black MSM Population Characteristics and HIV Testing History Levels in the Clinical Setting,” “Black MSM Population Characteristics and HIV Testing History Levels in the Nonclinical Setting,” and “Black MSM Population Characteristics and HIV Testing History Levels in the Clinical and Nonclinical Settings.”

Summary of Findings

The predictor, “health-seeking behavior for STD services,” was excluded from the multivariate MLR analyses for the three substudies. The exclusion was necessary because of the small sample size and zero expected counts for one or more categories of the outcome variable. The low or missing values generated unreliable output for the bivariate MLR based on the poor model fit. The type of test location setting and recruitment site city were included as confounders and controlled in the multivariate MLR analysis, considering the recruitment site- and setting-specific differences (Pourhoseingholi et al., 2012). This multivariate analysis generated information about the predictive effects of the population characteristics on the HIV testing history levels in the past 12 months while controlling for the other predictors and confounders in the model (Hosmer et al., 2013). The referents for the multinomial MLR were age 51 or older, college degree or above, income level $50,000 or more, being insured, participants with a preferred provider, and prior history of seeking treatment for substance use. The sample sizes for the multivariate MLR analysis for the three substudies were 623, 538, and 1170 for the clinical, nonclinical, and between settings, respectively. The nonclinical setting's sample size was reduced from 557 to 538 based on low to zero values for one or more categories of the outcome variable. The predictors included in the multivariate MLR models for both settings explained about 16% variance in HIV testing history levels in the past 12 months. Significant findings were obtained from both bivariate (chi-square test and MLR methods) and multivariate analysis (MLR and z-test methods).

The reported findings from the clinical setting and nonclinical setting indicated that more frequent testing (more than one HIV test) in the prior year was associated with age 18-28 years and some college or 2 year degree (predisposing factors). A significant and negative association was revealed in the clinical setting between health insurance status (enabling factor) and HIV testing history levels in the past 12 months. Compared to referent, BMSM age 18-28 years were more likely to get tested more than once versus never tested in the past 12 months in both settings but with a higher likelihood in the nonclinical setting. Also, in both settings participants in age group 18-28 were less likely to get tested once versus more than once. Participants with some college or 2 year degree were less likely to use HTS once in the past 12 months; however, with lower odds in the nonclinical setting. The uninsured were more likely to get tested more than once in the past 12 months in the clinical relative to the nonclinical setting. However, the bivariate MLR conducted for the clinical and nonclinical settings suggested that the uninsured were less likely to use HTS in the past 12 months in the nonclinical setting (OR = .67, p = .11) compared to the clinical setting (OR = 1.28 p = .35). The multivariate MLR results indicated that the participants recruited from the Atlanta site in Georgia were less likely to get tested once or more than once in the past 12 months in both settings.

The reported odds ratios revealed trends about the likelihood of more frequent testing in both settings for the predictors that were not statistically significantly associated with HIV testing history levels in the past 12 months. Having a preferred provider and prior health-seeking behavior for substance use services in the past six months increased the likelihood of more frequent testing in the past 12 months in both settings. The multivariate MLR analysis revealed contradicting results for the associations between income level \$20,000-\$29,000 and HIV testing history levels in the past 12 months for the clinical and nonclinical settings. Participants who reported income level between \$20,000-\$29,999 were less likely (OR = .53, p = .17) to get more frequent testing in the past 12 months in the clinical setting. However, participants with income level between \$20,000-\$29,999, were more likely (OR = 2.36, p = .22) to get tested more than once in the past 12 months in the nonclinical setting.

In the third substudy, the difference in the association between settings—for the revealed association between the predictors and outcome variables—examined by testing the null hypothesis (H_O: $\beta_{11} = \beta_{12}$). Whereby β_{11} and β_{12} represented the regression coefficient for the multivariate MLR models for the clinical and nonclinical settings, respectively. Using the approach described by Allison (1999), Altman and Bland (2003), and Clogg et al. (1995), the calculated z-scores for each of the predictors did not reveal any statistically significant results for the associations between settings, for significance the reported z-score must be $1.96 \geq z$ or $z \geq 1.96$.

Interpretation of Findings

The less likelihood for BMSM to get tested more frequently (more than one HIV test) in the past 12 months and their preference to use HTS in the nonclinical setting (HIV testing location) compared to other MSM subgroups underscores the aims of this study (CDC, 2019b; DiNenno et al., 2017, 2018). As posited by the ABM, the population characteristics (predisposing, enabling, and need factors) impeded or facilitated the use of health services. The application of the ABM guided the systematic approach for conducting and interpreting the findings from this study. The predisposing factors were identified as the preexisting sociodemographic and underlining factors and the enabling and need factors as significant predictors that influence the use of HTS.

The logistic regression models for each setting explained about 16% (Nagelkerke pseudo R2) of the variance in HIV testing history levels in the past 12 months for the included predictors suggesting a low to medium effect (Cohen, 1988). The bivariate and multivariate analysis generated similar outcomes for age and education attainment (predisposing factors). Age and education attainment were statistically significantly associated with HIV testing history levels in the past 12 months. The significant association between health insurance status (enabling factor) and HIV testing history levels in the past 12 months was only observed in the multivariate MLR in the clinical setting. However, the nonsignificant bivariate MLR results in both settings showed that the uninsured were more likely to get tested in the clinical setting—the insured were more likely to use HTS services in the past 12 months in the nonclinical setting. Also, results from both the bivariate and multivariate MLR showed that participants recruited from the Atlanta site were less likely to get tested in the prior year than all the other recruitment sites. The other predictors, income level (predisposing factor), having a health care provider (enabling factor), and seeking services for substance use (need factor) were not significantly associated with HIV testing history levels in the past 12 months in the clinical and nonclinical settings.

The findings generated from this study confirmed results from previous studies. Unlike the previous studies, this study conducted subgroup analysis across HIV testing location settings. It examined more frequent use of HTS defined by the number of HIV tests received in the past 12 months. The observed negative association with age and positive association with education attainment were consistent with the findings reported by Mannheimer et al. (2014), Lo et al. (2018), CDC (2019b). Older BMSM were less likely to get tested frequently in the past year, and those with college degrees and above were more likely to use HTS (more than one test) in both settings.

However, the negative statistically significant association between health insurance status and HIV testing history levels in the past 12 months in the clinical setting confirmed findings from Lo et al. (2018) but contrasted with results from the national analysis conducted by CDC (2019b) and the multivariate results from Mannheimer et al. (2014). As an enabling factor, not having health insurance facilitated more frequent use of HTS in both settings but in the bivariate analysis (although not statistically significant), not having health insurance coverage decreased the likelihood of getting tested more than once in the nonclinical setting. The higher odds for the insured to get tested more than once in the nonclinical were consistent with the CDC's outcomes (2019b) and Mannheimer et al. (2014).

Current challenges facing key provisions of the ACA may have significant implications for states like Georgia (GA), a non-expansion state for Medicaid coverage (Garfield, Damico, & Orgera, 2020: Garfield, Rudowitz, & Damico, 2020; HIV.gov, 2020; Kaiser Family Foundation, 2020; Tolbert, Orgera, Singer, & Damico, 2019). Over 50% of Georgians (based on a 2014 analysis) were covered under employer-sponsored health insurance (ESI). With increasing unemployment, many may lose their ESI coverage (GA Department of Public Health, 2016). The recent unprecedented unemployment rate in the United States due to COVID-19 pandemic increases the likelihood of decreased ESI health insurance coverage (Gangopadhyaya & Garrett, 2020). Therefore, loss of ESI and no Medicaid coverage may significantly impact the provision of HTS for BMSM—considering that BMSM are more likely to get tested in the nonclinical setting compared to other MSM subgroups. If health insurance coverage increases the likelihood of testing in the nonclinical setting, then there will be lower odds for uninsured BMSM to get tested once or more than once in the past 12 months in the nonclinical setting.

For the predictors that were not significantly associated with HIV testing history levels in the past year, the observed trends from the reported odds ratio provided information to understand the influence of these factors in impeding or facilitating more frequent use of HTS. Comparing the outcomes from both settings, income level $20,000 - $29,999 revealed contradicting results. Participants who reported income level between $20,000 -$29,999 were more likely to get tested in the nonclinical and vice versa in the clinical setting. One of the suggested explanations for the observed opposing results was that participants with income $20,000 -$29,999 were more likely insured, hence less likely to use HTS in the clinical setting. Having a health care provider and seeking services for substance use were not significantly associated with HIV testing history levels in the past 12 months in the clinical and nonclinical settings. Consistent with previous studies, having a preferred health care provider (enabling factor) and seeking services for substance use (need factor) and higher income levels (predisposing factor) increased the likelihood of more frequent testing in the past 12 months. Reiterating the health provider's significance in facilitating or impeding the use of HTS (Marks et al., 2017; Elopre et al., 2017; Underhill et al., 2014). HTS may be utilized more frequently if combined with other health services, such as substance use treatment services.

There was no significant difference between the associations reported in both settings. However, the calculated z-score for health insurance status (an enabling factor) indicated a score that was closest to the critical limit "-1.96." Future studies should further explore the significance of the association between health insurance status and the HIV testing history levels between settings. Although the comparison of findings between settings was not statistically significant, the trends between the predictors and outcome in each setting (both significant and non-significant) provided baseline information about the correlates of more frequent HIV testing history levels in the past 12 months in both settings.

Limitations of the Study

Despite the notable significance reported in this study, some limitations should be considered in the context of potential implications on the validity (measuring accuracy) and reliability (measuring consistency) of study outcomes. The cross-sectional design employed in this study limits the assertions of causal inferences (Setia, 2016). Selection bias resulting from the site-specific variation in implementing the recruitment strategy and the participant referral sampling methods (Koblin et al., 2013; Mannheimer et al., 2014; Stewart & Hitchcock, 2016). The inadequate response to the survey question, Has the participant ever been treated for syphilis? impacted the validity of strength and direction of the association between the predictor variable ("health-seeking behavior for STD services") and the outcome. This limitation resulted in excluding this predictor in the multivariate MLR and the overall interpretation of study outcomes.

The impact of response bias during data collection via self-reporting is another limitation. Social desirability bias has implications for under-reporting or over-reporting survey responses (Cox, 2016). However, the use of the validated ACASI system (Population Council, n.d.) aimed to mitigate social desirability bias and to ensure anonymous and private reporting of survey responses (Althubaiti, 2016). The HPTN 061 study eligibility criteria, including the requirement to enroll only sexually active BMSM at sites located in six U.S. cities, limited the generalizability of study outcomes. However, the study participants' population characteristics were similar to the target population of BMSM impacted by the HIV epidemic in the United States (CDC, 2019b; Liu et al., 2019; Underhill et al., 2014).

Implications for Positive Social Change

Modeling estimates revealed that about 80% of newly diagnosed infections are attributed to those aware, unaware, and those on ART or not. It is imperative to reach target populations, increase the detection of new infections, and promote prompt linkage and consistent ART use to achieve viral suppression (CDC, 2019c; Eisinger et al., 2019; Li et al., 2019). Achieving viral suppression for PLWH is critical to ending HIV infections in the United States (Fauci et al., 2019; USPSTF, 2019). Despite the limitations addressed in this study, the revealed significant associations between selected population characteristics namely, age and education (predisposing factors) and health insurance status (enabling factor) with HIV testing history levels in the past 12 months have implications for positive social change on the individual, societal, and policy levels.

The reported odds for getting tested once or more than once in the clinical and nonclinical settings across different age groups, education attainment levels, and health insurance status have the potential to inform intervention efforts. Improved routine-based and targeted strategies are essential to enhance engagement strategies to help identify BMSM in the clinical and nonclinical settings with less likelihood to get tested once or more than once in the past 12 months. This study's findings may also inform recruitment strategies to identify participants for future studies to explore further the baseline associations generated from this study to support prediction and causal inference (Gagliardi, 2009).

Individual-Level

The implication for positive social change impact on the individual level pertains to the potential to improve engagement and recruitment strategies (Scott et al., 2018). Improved efforts will help identify target populations to influence more frequent HIV testing history levels in the past 12 months. Targeted efforts may help address challenges associated with social determinants of health (lack of insurance, poverty, and lower education attainment) that may impede access to HTS (De Jesus & Williams, 2018). Promoting more testing events may help reduce the number of undiagnosed infections, increase prevention efforts (including the use of PrEP for those at high-risk), support immediate linkage to treatment, and improve overall health outcomes for PLWH.

Societal-Level

The implication for positive social change impact on the societal level includes the potential to inform efforts to develop routine-based and targeted HIV testing strategies in the clinical and nonclinical settings to help reduce the undiagnosed HIV infection rate among at-risk BMSM. Also, to reduce the transmission virus to their sexual partners unknowingly. Challenges associated with stigmatization and discrimination against those disproportionately impacted by the HIV epidemic also prevents BMSM from accessing HTS (Campbell, Lippman, Moss, & Lightfoot, 2018). An integrated HIV testing approach encompassing routine-based and targeted strategies may help inform interventions to increase testing events by engaging hard to reach populations who continue to be stigmatized and discriminated against (Clark et al., 2019; Miller et al., 2017).

Policy-Level

The implication for positive social change impact on the policy level includes the potential to inform efforts to improve health insurance coverage to support increased access and utilization of HTS in the clinical and nonclinical settings. The significance of health insurance status (coverage) in impeding or facilitating the use of HTS is an important finding in light of the current challenges faced by the ACA (Garfield, Damico, & Orgera, 2020: Tolbert et al., 2019). Although this study provided baseline findings to support further studies, the outcomes suggested that health insurance status (coverage) is a significant predictor in the clinical setting. Also, the bivariate analysis revealed (not significant) that being uninsured decreased the likelihood of more frequent testing in the past 12 months in the nonclinical settings.

Recommendation for Action

The reported associations between age, education attainment (predisposing factors), and health insurance status (enabling factor) from this study have the potential to inform recommendations for action towards facilitating more frequent HIV testing history levels in the past 12 months in the clinical and nonclinical settings among BMSM. Employing targeted (risk-based) and routine (non-risk-based) strategies will help promote the provision of HTS by health care providers (Clark et al., 2019; Miller et al., 2017).

Predisposing Factors: Demographic Characteristics

Demographic Characteristics

According to reported findings from Hall et al. (2017), BMSM, who have transgender sexual partners (TGP), were not likely to identify as MSM, mostly older, less likely to disclose TGP to their health care provider. BMSM were also more likely to have multiple sexual partners and condomless sex, and even more likely to have economic, legal, and social challenges (Nelson et al., 2016). Recent BRHSS data analysis by the CDC showed that MSM who are older and have less than college degree reported infrequent testing history (CDC, 2019b). These challenges may also impede healthcare providers' efforts to deliver targeted interventions to support the increased use and provision of more frequent HIV testing and prevention services among BMSM. The revealed associations between sociodemographic characteristics and HIV testing history levels in the past 12 months in both settings suggest the need to increase engagement efforts among BMSM 28 years or older and those with less than college degree.

Enabling Factor: Health Insurance

The higher odds of more frequent testing in the past 12 months without insurance coverage in both settings has advantages and disadvantages (Tolbert et al., 2019). Most uninsured are seeking health services later than sooner when HIV-related health outcomes are severe, and most likely unaware of their HIV positive status. The undiagnosed HIV infection rate and transmission of the virus from those unaware of their HIV positive status are major public health issues. One key advantage for the uninsured is the ability to seek health services without health insurance coverage, as suggested by the study findings. However, for participants who preferred to seek services in the nonclinical settings (especially for BMSM), there is less likelihood of getting more frequent testing for those without health insurance. Study findings also suggested that participants were less likely to get tested once or more than once if from any of the six U.S. recruitment sites, especially Atlanta, Georgia. This study outcome may inform actions toward ending the HIV epidemic in the United States considering the current health challenges associated with ACA and the COVID-19 pandemic. Based on reported health insurance coverage for non-elderly adults before ACA from 2011-2012, over 50% of Georgians were covered by ESI, and nearly 50% of uninsured Georgians were Black African American (GA DPH, 2016; KFF, 2014).

Due to the unprecedented unemployment during the COVID-19 pandemic, loss of ESI is a concern, especially in Georgia and similar states who opted out of Medicaid expansion under ACA (Garrett & Gangopadhyaya, 2020). Recommendation for action includes the consideration to expand Medicaid coverage beyond the current eligibility requirements. This action will potentially allow the provision of essential benefits under ACA to cover certain recommended preventive services, including HIV testing for aged 15 to 65 years (HIV.gov, 2019). Especially in the nonclinical setting, where BMSM prefers to get tested compared to other MSM subgroups, considering that no health insurance coverage at the nonclinical setting may decrease the likelihood of getting tested once or more than once versus never tested.

Recommendation for Further Research

This study utilized one of the largest secondary datasets collected from BMSM at-risk for HIV infections from six U.S. sites. The secondary dataset has been widely used by multiple researchers since 2013 (Hermanstyne et al., 2018, 2019; Mannheimer et al., 2014). This study utilized the HPTN 061 dataset to primarily examine the potential associations between the population characteristics (predisposing, enabling, and need factors) and HIV testing history levels in the past 12 months among BMSM in the clinical, nonclinical, and between settings using a cross-sectional quantitative design. However, further research is needed, building on the baseline findings from this study to examine the associations between a broader range of population characteristics and HIV testing history level frequencies in multiple settings. Future research may offer insights from the ongoing challenges from health insurance coverage, access, and utilization of health services, and associated implications from the COVID-19 pandemic towards improving more frequent use of HTS among BMSM (Menza, Garai, Ferrer, & Hecht, 2020; McIntyre, & Song, 2019; Sanchez, Zlotorzynska, Rai, & Baral, 2020).

A longitudinal mixed study design (both qualitative and quantitative) should also be explored to gain a deeper understanding, using a convergence design approach. A mixed study design should include the quantitative predictive associations and participant perspectives related to their individual experiences and challenges in utilizing services in the clinical and nonclinical settings (Creswell & Creswell, 2018). The suggested dataset for the proposed future research should include multiple MSM subgroups (including transgender) across multiple cities in the U.S. (Poteat, German, & Flynn, 2016) to increase the generalizability of findings. Also, the inclusion of rural and urban settings, and a quantifiable measure of HV testing history levels in the past 12 months (including more recent frequencies, such as 3-6 months) rather than the self-reported responses that are subject to recall bias (Althubaiti, 2016). The proposed future research aims are to generate findings (using a generalizable sample, compared across different settings, testing frequencies, and a broader population group). The outcomes from the proposed research study may inform strategies to improve the more frequent use of HTS to potentially support the HHS initiative towards "Ending the HIV Epidemic" in the United States (Fauci et al., 2019; Kukull & Ganguli, 2012).

Conclusion

Guided by the ABM, this quantitative cross-sectional study utilized secondary data from at-risk BMSM aged 18 or older to examine and compare the association between population characteristics and HIV testing history levels in the past 12 months in the clinical, nonclinical, and between settings. Considering BMSM preference to get tested in the nonclinical versus clinical setting and that the population characteristics, as posited by the ABM, impede and facilitate HTS, it was hypothesized that there is an association between variables in both settings. Despite the previously stated limitations that may have implications on study outcomes, this study revealed statistically significant associations with age (inversely) and positively with education attainment (predisposing factors) for both settings, and negatively with health insurance status (enabling factor) for the clinical setting. Although other study predictors were not statistically significant, the reported odds ratios from the bivariate and multivariate analysis indicated trends to inform the potential correlates of more frequent testing (tested once or more than once vs. never tested in the past 12 months) in the clinical and nonclinical settings.

Younger age (18-28 years), those with college degree and above, and those without health insurance coverage were more likely to get tested once or more than once in the clinical and nonclinical settings. However, contradicting trends were revealed between settings for income level \$20,000-\$29,999, with more frequent testing reported in the nonclinical setting. Also, the contradicting results revealed between settings for the bivariate analysis for health insurance status, with more frequent testing reported among the insured in the nonclinical setting. The revealed associations from this study have provided information to fill the literature gap regarding the lack of information about the correlates of more frequent testing (more than one HIV test in the past 12 months) among BMSM in the clinical, nonclinical, and between settings.

Increased efforts using a combination of targeted and routine-based strategies to engage older BMSM, those with less than college degree, and the uninsured in both the clinical and nonclinical settings may help promote more frequent testing. More frequent testing offers the opportunity to detect early HIV infections, reduce the high undiagnosed HIV rate, promote immediate linkage, and sustain ART use to achieve viral suppression. Improved access and utilization of HTS will also help to reduce HIV transmission from those aware or unaware of their HIV positive status (Campbell et al., 2018; Crepaz, Dong, Wang, Hernandez, & Hall, 2018; Fauci et al., 2019; Pitasi et al., 2018).

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Appendix A: HPTN 061 Study Secondary Data Use Agreement

USAGE AGREEMENT FOR INVESTIGATORS REQUESTING ACCESS TO HPTN 061 DATA BUT NOT WORKING WITH A 061 TEAM MEMBER OR BLACK CAUCUS REPRESENTATIVE

[Naana Cleland] (hereafter known as RECIPIENT) at *[Walden University]* (hereafter known as INVESTIGATOR'S INSTITUTION) is requesting access to HPTN 061 data, to use for analysis or data inquiry.

RECIPIENT hereby acknowledges that, if RECIPIENT is provided with access to HPTN 061 data, the conditions for use of this research material are governed by the policies and procedures of the HIV Prevention Trials Network (HPTN), by the Institutional Review Board (IRB) or Ethics Committee at the PROPOSING INVESTIGATOR's INSTITUTION and by the IRBs at the relevant study sites, in accordance with the U.S. Department of Health and Human Services regulations at 45 CFR 46.

RECIPIENT hereby acknowledges that RECIPIENT has reviewed the consent form of the HPTN 061 study (found in the appendix to the study protocol available here) and that RECIPIENT'S proposed use of the data is consistent with this consent.

RECIPIENT will work with a member of the HPTN 061 study team and/or a member of the HPTN Black Caucus to receive orientation to the study background and dataset.

RECIPIENT will not provide any HPTN 061 data to any other party, other than those working under the RECIPIENT's direct supervision on the proposed analysis and who have current GCP and human subjects protections training and have met any other institutional requirements to engage in human subjects research. At the completion of the analysis, it will be the RECIPIENT'S responsibility to ensure that data are not further disseminated and that all staff have expunged the data from their computing devices and portable media. Any additional use of the requested MATERIALS requires prior review and approval by the HPTN and by the IRB at the PROPOSING INVESTIGATOR's INSTITUTION, which must be convened under an Office for Human Research Protections (OHRP) approved Assurance, where applicable.

RECIPIENT will neither sell the data nor use for commercial purposes.

RECIPIENT will take no action, either directly or indirectly, that could allow the identity of study participants who provided any of these data to become known to RECIPIENT or to any other individual or organization. RECIPIENT will inform SCHARP (the HPTN Statistical and Data Management Center) of any disclosure of participant identity.

RECIPIENT remains participant to applicable Country, State, or local laws or regulations and institutional policies which provide additional protections for human participants.

If RECIPIENT violates this Usage Agreement, the HPTN's response may include punitive action as determined by the HPTN Executive Committee and reporting to funding and regulatory agencies or entities as applicable.

The RECIPIENT agrees to acknowledge the HPTN, including appropriate funding sources, in any publications or presentations resulting from this work, using template language provided to the RECIPIENT by the HPTN 061 study team. This language will make it clear that this work is not a product of the HPTN Study Team nor is it endorsed by the HPTN.

The RECIPIENT will Inform the 061 Study Team of the outcome of the product(s) produced from the HPTN 061 data (journal or grant submission, publication, grant award, etc.) and provide copy of final product(s) to 061 study team.

NCleland	04/11/2019
Signature of RECIPIENT	Date
NAANA CLELAND	Student Researcher (PHD Candidate
RECIPIENT's printed or typed name	RECIPIENT's Title

When complete, submit to sgriffith@fhi360.org

Appendix B: HPTN 061 Study Funding Sources

HPTN 061 grant support was provided by the National Institute of Allergy and Infectious Disease (NIAID), National Institute on Drug Abuse (NIDA) and National Institute of Mental Health (NIMH): Cooperative Agreements UM1 AI068619, UM1 AI068617, and UM1 AI068613. Additional site funding –Fenway Institute CRS: Harvard University CFAR (P30 AI060354) and CTU for HIV Prevention and Microbicide Research (UM1 AI069480); George Washington University CRS: District of Columbia Developmental CFAR (P30 AI087714); Harlem Prevention Center CRS and NY Blood Center/Union Square CRS: Columbia University CTU (5U01 AI069466) and ARRA funding (3U01 AI069466-03S1); Hope Clinic of the Emory Vaccine Center CRS and The Ponce de Leon Center CRS: Emory University HIV/AIDS CTU (5U01 AI069418), CFAR (P30 AI050409) and CTSA (UL1 RR025008); San Francisco Vaccine and Prevention CRS: ARRA funding (3U01 AI069496-03S1, 3U01 AI069496-03S2); UCLA Vine Street CRS: UCLA Department of Medicine, Division of Infectious Diseases CTU (U01 AI069424).

Appendix C: Disclaimer

The author notes that this dissertation is hers alone and does not represent the views of the HPTN 061 study team, the HIV Prevention Trials Network or the study sponsor, the U.S. National Institutes of Health.

Appendix D: Approvals

Institutional Review Board approval (IRB)

Walden University Institutional Review Board (IRB) approval (IRB # 04-16-20-0446424) was issued for this study.

HPTN 061 study was reviewed and approved by IRBs from recruitment sites. The original study underwent an IRB review at all participating institutions approved the study: Emory University IRB #2 - Biomedical IRB (Committee A), Fenway Community Health IRB #1, University of California, Los Angeles - South General Campus IRB, Columbia University Medical Center IRB, New York Blood Center IRB, San Francisco General Hospital Committee IRB #2, and George Washington University Medical Center IRB.

Informed Consent

A written informed consent was obtained from all study participants in the HPTN 061 Study.

Human Subject Protection

All procedures performed in this study involved the use of secondary data from HPTN 061 Study that has been delimited and deidentified. No actual human participants were engaged or recruited. No animals were involved in this study.