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A Cross-National Analysis of the Human Papillomavirus, Sexually Transmitted Infections, and Sexual Behavior among Men

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A Cross-National Analysis of the Human Papillomavirus, Sexually Transmitted Infections, and Sexual Behavior among Men

by

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Abstract

There is a paucity of research on the risk for sexually transmitted infections (STIs) and sexual behavior among general populations of men. Research with male populations predominantly has focused on those subgroups considered to be at high risk of disease transmission, such as gay and bisexual men, injection drug users, and adolescents/young adults. Considerably fewer studies have examined factors among men, in general, and heterosexual men, specifically. Therefore, I conducted analyses with a cross-national sample of adult, sexually active men in Brazil, Mexico, and the United States to investigate sexual behaviors and risk factors associated with the human papillomavirus (HPV) and other STIs. The research questions were: 1) How does sexual risk differ among men residing in Brazil, Mexico, and the US by age cohort?; 2) Do men's sexual behaviors change after being tested for HPV and other STIs?; and 3) Do men's sexual behaviors change after being informed of diagnosis with HPV and other STIs? These research questions were explored through a quantitative assessment of secondary data collected through a risk factor questionnaire administered using computer assisted self-interviewing. The study findings underscore the need for public health interventions to address STI risk and transmission among men across the lifespan. Additionally, this study revealed the potential of STI testing as an effective strategy to reduce sexual risk-taking

among men. While this research identifies key issues of importance in improving men's sexual health, additional research is needed to provide an enhanced contextual understanding of socio-cultural, interpersonal, and community level factors that affect sexual behaviors and decision-making among men.

Section One:

Introduction

Dissertation Format

This dissertation is presented in a manuscript-style format. Instead of the traditional format of chapters featuring an introduction, literature review, methods, results, and discussion, this dissertation is divided into sections. The first section provides the Introduction, which is similar to the traditional chapter one, including a problem statement, statement of the study purpose, research questions, and significance of the study. However, the following two sections – sections two and three – represent discrete manuscripts, each of which includes introduction, methods, results, and discussion sections. The final section is a synthesis of the findings, discussion, and conclusions. Although the dissertation is structured as two separate manuscripts, they serve as phases of one comprehensive study.

Statement of the Problem

With the recent launch of vaccines from two different pharmaceutical companies for the most common oncogenic strains of the Human Papillomavirus (HPV) (American Cancer Society, 2007; Barr & Tamms, 2007; Bharadwaj, Hussain, Nasare & Das, 2009; Giuliano & Salmon, 2008; World Health Organization Information Centre on HPV and Cervical Cancer, 2007a, 2007b;

World Health Organization, 2006), the infection and its related disease in women, cervical cancer, have garnered much notoriety (Calloway, Jorgensen, Saraiya & Tsui, 2006). In light of these advancements, within the last decade, numerous studies have been conducted on HPV and cervical cancer among women to investigate knowledge, beliefs, and attitudes regarding HPV and cervical cancer, HPV vaccine acceptance, barriers and intentions for cervical cancer screening, and risk factors associated with HPV and cervical cancer (Austin, Ahmad, McNally & Stewart, 2002; Basu et al., 2006; Bazargan, Bazargan, Farooq & Baker, 2004; Blomberg, Ternestedt, Törnberg & Tishelman, 2008; Bradley et al., 2006; Byrd, Peterson, Chavez & Heckert, 2004; Castellsagué, Schneider, Kaufmann & Bosch, 2009; Chew-Graham, Mole, Evans & Rogers, 2006; Fiebig, Haas, Hossain, Street & Viney, 2009; Frega et al., 2003; Guilfoyle, Franco & Gorin, 2007; Jennings-Dozier & Lawrence, 2000; Maissi et al., 2004; Maissi et al., 2005; Merchant, Gee, Bock, Becker & Clark, 2007; Moreira, de Oliveira, Ferraz et al., 2006; Moreira, de Oliveira, Neves et al., 2006; Mortensen & Adeler, 2010; Oscarsson, Wijma & Benzein, 2008; Philips, Johnson, Avis & Whynes, 2003; Pitts & Clarke, 2002; Pitts, Dyson, Rosenthal & Garland, 2007; Stark et al., 2008; Swancutt, Greenfield & Wilson, 2008; Tiro, Meissner, Kobrin & Chollette, 2007; Vanslyke et al., 2008). However, the impact of HPV on men's health and factors associated with HPV infection among men are not widely understood. While there is a growing interest in the issue of HPV among men, it remains relatively unexplored (Daley, Marhefka, Buhi, Vamos, Hernandez & Giuliano,

2010; Daley et al., 2011; Dunne, Nielson, Stone, Markowitz & Giuliano, 2006; Giuliano, 2007; Giuliano, Tortolero-Luna et al., 2008).

HPV is a sexually transmitted virus that is passed to other persons through skin-to-skin and genital contact (Centers for Disease Control and Prevention, 2010). It is estimated that at least half of all people who have had sex will acquire an HPV infection at some point in their lifetime (Centers for Disease Control and Prevention, 2010; Vetter & Geller, 2007). HPV infection is considered the most common sexually transmitted infection, with an estimated 6.2 million persons newly infected annually in the United States (Colon-Lopez, Ortiz & Palefsky, 2010; Dunne et al., 2006; Liddon, Hood, Wynn & Markowitz, 2010; Nielson et al., 2007; Nielson et al., 2010). According to the World Health Organization, the global prevalence of HPV infection is estimated to be between nine and thirteen percent, which is equivalent to approximately 630 million people (Colon-Lopez et al., 2010). HPV infections are largely asymptomatic and transient among both men and women (Dunne et al., 2009; Giuliano, 2007; Nielson et al., 2007), as most HPV infections spontaneously vanish within 2-4 years (Thun, DeLancey, Center, Jemal & Ward, 2010). Consequently, individuals may unknowingly transmit HPV to their sexual partners (Giuliano, 2007).

To date, there are over 100 known types of HPV (American Cancer Society, 2006; Bharadwaj et al., 2009; Calloway et al., 2006; Centers for Disease Control and Prevention, 2007; Colon-Lopez et al., 2010; Donovan, 2004; Dunne et al., 2006; Mortensen & Larsen, 2010b; Schiffman & Castle, 2003). Of these

known HPV strains, approximately 30 are associated with anogenital cancer and are considered high-risk strains (Bharadwaj et al., 2009), whereas 60 are known to infect the genital tract (Nielson et al., 2007). Additionally, roughly 15 strains may potentially cause cervical tumors (Lowy, Solomon, Hildesheim, Schiller & Schiffman, 2008). Due to the numerous strains that infect shared regions, concurrent infection with multiple types of HPV is common (Nielson et al., 2009). A population-based study detected multiple HPV types in approximately 20 to 30% of HPV-positive women (Herrero et al., 2000), whereas 27.4% of men in a multi-site study were observed to have more than one HPV type (Nielson, Harris et al., 2009).

HPV is strongly associated with the development of invasive cervical, vulvar, oropharyngeal, and anal cancers in women and penile, oropharyngeal, and anal cancers in men (Castellsagué, Bosch & Muñoz, 2003; Chaturvedi, 2010; Colon-Lopez et al., 2010; Giuliano, Lazcano-Ponce et al., 2008; Giuliano & Salmon, 2008; Giuliano, Tortolero-Luna et al., 2008; "Human papillomavirus infection in men residing in Brazil, Mexico, and the USA," 2008; Lowy et al., 2008; Lu et al., 2009; Nielson et al., 2007; Parkin & Bray, 2006; Thun et al., 2010). An estimated 5.2% of cancers worldwide are attributable to infection with some type of HPV (Chaturvedi, 2010; Colon-Lopez et al., 2010; Parkin & Bray, 2006). Of these cases, the majority (71.8%) is attributable to HPV type 16 and HPV type 18 (Donovan, 2004; Parkin & Bray, 2006). Epidemiological studies examining penile and anal HPV infection and cancers in men have shown that prevalence rates may vary by multiple factors, including country, population

studied, and area of the genitalia sampled (Colon-Lopez et al., 2010; Hernandez, Wilkens, Zhu, McDuffie et al., 2008).

HPV is universally recognized as the primary cause of cervical cancer (American Cancer Society, 2006, 2007; Barr & Tamms, 2007; Bosch, 2003; Centers for Disease Control and Prevention, 2008; Clifford, Smith, Plummer, Muñoz & Franceschi, 2003; Cox, 2006; Donovan, 2004; Franco, Duarte-Franco & Ferenczy, 2001; Nielson, Harris et al., 2009; Pan American Health Organization, 2007; Sankaranarayanan, Budukh & Rajkumar, 2001; Vetter & Geller, 2007; Walboomers et al., 1999; World Health Organization Information Centre on HPV and Cervical Cancer, 2007a, 2007b; World Health Organization, 2006). Approximately 99.7% of cervical cancers are due to infection with some strain of HPV (Pan American Health Organization, 2004; Walboomers et al., 1999). Two specific HPV strains, HPV type 16 and HPV type 18, account for more than two-thirds of cervical cancer cases worldwide (American Cancer Society, 2006; Calloway et al., 2006; Centers for Disease Control and Prevention, 2007; Cox, 2006; Lowy et al., 2008; Vetter & Geller, 2007; World Health Organization Information Centre on HPV and Cervical Cancer, 2007a, 2007b; World Health Organization, 2006).

HPV prevalence rates among men are a significant public health concern. A recent systematic literature review found that the HPV prevalence in men was between 1.3% and 72.9% in studies in which multiple anatomic sites or specimens were evaluated; more than half (56%) of the studies reported HPV prevalence of 20% or higher (Dunne et al., 2006). The broad range in

prevalence may be attributable to the variance in populations of men studied (e.g., university students, men in the military, partners of women with cervical dysplasia, STI clinic attendees) and/or differing methodologies for specimen collection and testing (Dunne et al., 2006). Most studies of HPV seroprevalence report information on HPV type 16. Two studies of representative samples of men in the US reported HPV-16 seroprevalence of 5.1% (95% CI: 4.3-6.1) (Dunne et al., 2009; Markowitz, Sternberg, Dunne, McQuillan & Unger, 2009) and 7.9% (95% CI: 6.4-9.8) (Stone et al., 2002). Additionally, assessments of seropositivity of other common types of HPV in men have recently been published, asserting rates of 6.3% for HPV-6, 2.0% for HPV-11, and 1.5% for HPV-18 (Dunne et al., 2009; Markowitz et al., 2009). In an assessment of genital warts between 1999-2004 in the United States, the prevalence was about 4.0% among sexually active men aged 18-59 years old (Colon-Lopez et al., 2010). Previous studies have found that HPV infection is highest among younger women, less than 30 years, and decreases with escalating age (Baseman & Koutsky, 2005; Chin-Hong et al., 2004). However, minimal research has unearthed age-specific information regarding HPV in men.

Sexual behavior has been identified as the primary factor associated with HPV infection and seropositivity in men across multiple studies (Dunne et al., 2006; Giuliano, Lazcano-Ponce et al., 2008; Vaccarella et al., 2006). More specifically, lifetime number of sex partners, number of recent sex partners, age at first sexual intercourse, condom use, and sexual frequency are significantly associated with HPV infection in men (Baseman & Koutsky, 2005; Dunne et al.,

2006; Lu et al., 2009; Nielson et al., 2007). Other identified risk factors for HPV infection include smoking status, age, educational level, and race/ethnicity (Lu et al., 2009; Nielson et al., 2007; Nielson et al., 2010). Consistent condom use has been strongly associated with lower HPV prevalence in men (Nielson et al., 2010). Additionally, the prevalence of anal HPV infection has been found to be lower in heterosexual men in their 30s, as compared to younger men (Nyitray et al., 2008).

HPV infection has frequently been found to co-occur with other sexually transmitted infections (STIs), such as chlamydia, gonorrhea, syphilis, and herpes (Kjaer et al., 1997; Soong et al., 2011; Souza, Miller, Nery, Andrade & Asensi, 2009; Trottier & Franco, 2006; Vaccarella et al., 2006). STIs are caused by various biological organisms that can result in no symptoms, mild or transient symptoms, or severe, long-term symptoms, including infertility, premature mortality, and cervical, anal and penile cancers (De Schryver & Meheus, 1990; Genuis & Genuis, 2004; Gerbase, Rowley, Heymann, Berkley & Piot, 1998; Mayaud & Mabey, 2004; Mayaud & McCormick, 2001; World Health Organization, Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). Global estimates for bacterial STIs (e.g., chlamydia, gonorrhea, syphilis) are greater than 340 million new cases each year (Gerbase et al., 1998; World Health Organization, Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). Due to the adverse outcomes associated with STIs, as well as their impact on quality of life, STIs are

a critical public health concern (Glasier, Gulmezoglu, Schmid, Moreno & Van Look, 2006; Low et al., 2006).

Unlike other factors associated with increased risk for HPV, male circumcision has been revealed to be protective for HPV infection (Almonte et al., 2008; Castellsagué et al., 2002; Castellsagué et al., 2003; Colon-Lopez et al., 2010; Drain, Halperin, Hughes, Klausner & Bailey, 2006; Giuliano et al., 2009; Giuliano & Salmon, 2008; Hernandez, Wilkens, Zhu, McDuffie et al., 2008; Lu et al., 2009; Mcintosh, Sturpe & Khanna, 2008; Murthy & Mathew, 2000; Nielson et al., 2007; Nielson, Schiaffino, Dunne, Salemi & Giuliano, 2009; Schiffman & Brinton, 1995; Schiffman & Castle, 2003; Thun et al., 2010; Waller, McCaffery, Forrest & Wardle, 2004). A recent study reported that circumcised men were three times more likely to clear infection with any type of HPV (Lu et al., 2009). Additionally, several studies have reported male circumcision to be associated with a reduced risk for HPV infection and cervical cancer among female sexual partners (Almonte et al., 2008; Castellsagué et al., 2003; Drain et al., 2006; Hernandez, Wilkens, Zhu, McDuffie et al., 2008; Mcintosh et al., 2008; Murthy & Mathew, 2000; Nielson, Schiaffino et al., 2009; Schiffman & Brinton, 1995; Schiffman & Castle, 2003; Waller et al., 2004). Another protective factor for HPV is condom use; however, sexual transmission is still possible through skin-to-skin contact in the genital area (Colon-Lopez et al., 2010; Mortensen & Larsen, 2010b).

Previous research has indicated that men are an important link in the epidemiological chain between HPV and cervical cancer among women

(Agarwal, Sehgal, Sardana, Kumar & Luthra, 1993; Almonte et al., 2008; Bosch et al., 1996; Campion et al., 1988; Giuliano, 2007; Giuliano, Lazcano-Ponce et al., 2008; Giuliano & Salmon, 2008; "Human papillomavirus infection in men residing in Brazil, Mexico, and the USA," 2008; Kyo et al., 1994; Lu et al., 2009; Muñoz & Bosch, 1997; Schiffman & Brinton, 1995; Schiffman & Castle, 2003; Waller et al., 2004). Multiple studies have shown that a high proportion of the male sexual partners of HPV positive women were also HPV positive (M C Bleeker et al., 2002; Kyo et al., 1994; Mbulawa et al., 2009; Nicolau et al., 2005). Initial evidence of the male sexual partner's influence in cervical cancer and HPV transmission was unearthed through studies of marital clusters that showed that the wives of men with penile cancer were more likely to develop cervical cancer (Castellsagué et al., 2003; Franco et al., 2001). Furthermore, research has shown that male sexual partners of women with cervical neoplasia had higher prevalence rates of penile HPV infection and lesions, as compared to women without cervical cancer (M C Bleeker et al., 2002; Campion et al., 1988; Campion, Singer, Clarkson & McCance, 1985; Castellsagué et al., 1997; Mbulawa et al., 2009; Rombaldi et al., 2006). Although men with HPV infection are largely asymptomatic, men are considered to be the conduit for sustained HPV transmission to their female partners (Mbulawa et al., 2009). Consequently, men who are carriers of HPV may be vectors for high-risk HPV types, placing their female partners at risk of developing cervical cancer (Agarwal et al., 1993; Bosch et al., 1996; Giuliano, Lazcano-Ponce et al., 2008; Hernandez, Wilkens, Zhu, Thompson et al., 2008; Muñoz & Bosch, 1997; Schiffman & Castle, 2003).

Studies examining HPV concordance among sexual partners, in which partners are both HPV-positive and share one or more of the same strain of HPV, have been mixed, with results ranging from 22.7% to 65% (Baken et al., 1995; M C Bleeker et al., 2005; Burchell, Tellier, Hanley, Coutlée & Franco, 2010; Giovannelli et al., 2007; Hippelainen et al., 1994; Parada et al., 2010).

Women's risk to the human papillomavirus and cervical cancer is dependent on the sexual behaviors and practices of their male partners (Agarwal et al., 1993; Almonte et al., 2008; Bosch et al., 1996; Castellsagué et al., 2003; de Sanjosé, Bosch, Muñoz & Shah, 1997; Giuliano, 2007; Giuliano, Lazcano-Ponce et al., 2008; Giuliano & Salmon, 2008; "Human papillomavirus infection in men residing in Brazil, Mexico, and the USA," 2008; Lu et al., 2009; Nielson, Schiaffino et al., 2009). In previous analyses of behavioral characteristics of male sexual partners, there was an increased risk of cervical cancer among women whose husbands or male partners had significantly more sexual partners (Almonte et al., 2008; Castellsagué et al., 2003; Schiffman & Brinton, 1995; Waller et al., 2004). Furthermore, male partners of patients with cervical cancer were also more likely to report histories of sexually transmitted infections, whereas those of control subjects reported more frequent condom usage (Schiffman & Brinton, 1995).

Previous Research

Recently, research has been published to determine factors associated with HPV in men. A prominent study that has yielded critical information on the

natural history of HPV infection is the HIM (HPV Infection in Men) Study. Spearheaded by Dr. Anna Giuliano, this research undertaking has involved a cross-national sample of men aged 18 to 70 recruited from Brazil, Mexico, and the US. This prospective, longitudinal study collects biologic samples and behavioral data from the same cohort of men on a biannual basis (i.e., every six months) for a period of four years. Study recruitment in Brazil is facilitated through media advertising and a center for urogenital care in Sao Paulo, while in Mexico, participants are recruited through the public health system, local factories, and military personnel in Cuernavaca. In the US, recruitment efforts involve print and radio advertising within a local university, as well as in the greater metropolitan area of Tampa, Florida. The HIM study is the parent study for this dissertation research.

Multiple epidemiological studies have been conducted through the HIM study, resulting in significant findings that help elucidate pathways to HPV infection among men. A recent publication reported that circumcision (assessed by clinical examination) was associated with reduced risk of HPV detection, whereas risky sexual practices, such as having 50 or more lifetime sexual partners, was associated with a nearly six-fold increase in likelihood of having any type of HPV (Giuliano et al., 2009). Other collaborative publications have examined prevalence of HPV infection in men, as well as associated risk factors, among self-identified heterosexual men (Giuliano, Lazcano-Ponce et al., 2008; Nyitray et al., 2010). Across the different sites, variances in HPV prevalence and type-specific rates have been reported (Giuliano, Lazcano-Ponce et al., 2008;

Nyitray et al., 2010). The overall prevalence of HPV based on genotyping was 50.5%, with rates of 62.3% in Brazil, 48.4% in Mexico, and 41.3% in the US (Giuliano, Lazcano-Ponce et al., 2008). Oncogenic strains of HPV were highest among Brazilian men (36.1%), followed by Mexican men (30.4%) and US men (23.3%) (p=0.002), whereas nononcogenic strains were found in half of the sample of Brazilian men (50.5%) and about one-third of Mexican and US men (35.1% and 30.3%, respectively) (p<0.0001) (Giuliano, Lazcano-Ponce et al., 2008). Furthermore, within this multi-site study population, statistically significant associations for infection with any oncogenic type of HPV were found with marital status and ever having sex with a man (Nyitray et al., 2010). Married men had 47% decreased odds of having an oncogenic strain of HPV, compared to single, never married men (OR=0.53, 95% CI=0.30-0.96), and men who reported ever having oral or anal sex with a man had a two-fold increased likelihood of testing positive for an oncogenic type of HPV (OR=2.16, 95% CI=1.10-4.21) (Nyitray et al., 2010). Race-specific analysis revealed that Asian/Pacific Islanders within the study population had the lowest HPV prevalence of 42.2%, compared to black participants (66.2%), and white participants (71.5%) (Akogbe et al., 2011).

Most recently, results of incidence and clearance of type-specific genital HPV infection in men from the HIM study were published in the journal, *Lancet* (Giuliano et al., 2011). In a sub-sample of 1,159 study subjects across all three sites, the overall rate of infection with any type of HPV was 50% (Giuliano et al., 2011). For oncogenic strains, the overall prevalence was 30%, whereas the prevalence of non-oncogenic strains was 38% (Giuliano et al., 2011). Infection

with an oncogenic HPV type was associated with a high number of lifetime female sexual partners, as well as number of male sexual partners (Giuliano et al., 2011). Interestingly, the risk for acquiring HPV among male participants appears to remain stable throughout their lifetimes, whereas it has been found that women's risk declines with age (Giuliano et al., 2011).

Overall, the HIM study has been in the forefront of public health research to gain further understanding of the natural history of HPV in men, as well as the risk and protective factors associated with this disease in men. As the first international study to examine HPV in a general population of men, the HIM study provides rich data that can yield new insights regarding the regional impact of HPV and subsequent cancer risk. This information may prove beneficial in the development and implementation of policies and interventions that may be enacted on the regional and local level to improve health outcomes.

Theoretical Framework: Social Ecological Model

Public health research on sexual behavior and risk has documented the influence factors that operate on several levels within society. Therefore, the utilization of the Social Ecological Model (SEM) as the core organizing framework for the interpretation of the outcomes of this research is critical in understanding its implications and potential applications in public health (McLeroy, Bibeau, Steckler & Glanz, 1988; Reifsnider, Gallagher & Forgione, 2005). SEM is an overarching model that consists of multiple interrelated principles and concepts that aid in the understanding of diverse personal and environmental factors on

health and wellness (McLeroy et al., 1988; Stokols, 1996, 2000). SEM is ideal for this study because, unlike many health education and behavior theories and models, it moves beyond the intrapersonal and interpersonal levels to explore the dynamic interaction of people with groups and their physical and socio-cultural environment (National Cancer Institute, 2005; Stokols, 1992, 1996). This perspective "emphasizes the interaction between, and interdependence of, factors within and across all levels of a health problem" (National Cancer Institute, 2005, p. 10).

SEM is inherently multidisciplinary, emerging during the 1960s and 1970s in the disciplines of sociology and psychology and being applied to the field of public health, anthropology, and medicine (Sallis & Owen, 1997; Stokols, 1992, 1996, 2000). However, it stems from the field of ecology, which examines relationships between organisms and the environment (Sallis & Owen, 1997; Stokols, 1992, 1996, 2000). Unlike its predecessor, social ecology incorporates the social, cultural, and institutional context of behaviors with the analysis of the environment (Heise, 1998; Panter-Brick, Clarke, Lomas, Pinder & Lindsay, 2006; Stokols, 1992, 1996, 2000). Consequently, within health, these multiple dimensions interact to result in a range of health outcomes, affecting agency (Panter-Brick et al., 2006; Stokols, 1996).

The Social Ecological Model draws largely from Systems Theory (Coreil, Bryant & Henderson, 2001; Stokols, 1996, 2000). Concepts from Systems Theory, such as interdependence, homeostasis, and negative feedback, are incorporated into SEM to explain the dynamic relationship between people and

their environments (Stokols, 1996, 2000). The systems framework, in its simplest terms, suggests “the whole is greater than the sum of its parts” (Hecker, Mims & Boughner, 2003, p. 40). The focus of systems theory is the interaction between objects within a system, which is any set of elements that coexist or mutually relate to one another (Coreil et al., 2001; Hecker, Mims & Boughner, 2003). Systems theory is grounded in four basic assumptions: (1) systems elements are interrelated; (2) systems can only be fully understood in their entirety; (3) all systems act reciprocally with the environment; and (4) systems are not reality (White & Klein, 2002).

Urie Bronfenbrenner is credited with the conceptualization of the basic tenets of the Social Ecological Model, as they are known today (Cairns & Cairns, 2005). Central to SEM is the argument that “the social development of individuals cannot be divorced from the social networks in which they are embedded” (Cairns & Cairns, 2005, p. 17). Segmented analysis of individuals and groups is insufficient and may be misleading, as it does not consider the interdependence of social status and structure and excludes the reciprocal nature of behavior and biology (Cairns & Cairns, 2005; Foster-Fishman, Salem, Allen & Fahrbach, 1999; Stokols, 1992, 1996). Instead, the SEM examines integrated systems through social and physical relationships among different levels in society (Coreil et al., 2001).

An assumption of the Social Ecological Model is the interdependent nature of human behavior and the physical, social, and cultural contexts (Foster-Fishman et al., 1999; McLeroy et al., 1988; National Cancer Institute, 2005; Sallis

& Owen, 1997; Stokols, 1992, 1996, 2000). Interactions between people and the environment are deemed to be mutually influential, in which physical and social settings affect individual and group health outcomes (Sallis & Owen, 1997; Stokols, 2000). Behaviors and attitudes are influenced by the community context in which people live and work (Foster-Fishman et al., 1999; Stokols, 1992). Environmental settings encompass multiple physical and social components that influence a wide range of health outcomes, such as physical health status, emotional wellness, and social cohesion (Stokols, 1996, 2000). Overall, the SEM underscores the importance of addressing interpersonal, organizational, community, and public policy factors to support and maintain healthy behaviors (McLeroy et al., 1988).

SEM recognizes the interplay between personal and environmental conditions (Foster-Fishman et al., 1999; McLeroy et al., 1988; National Cancer Institute, 2005; Sallis & Owen, 1997; Stokols, 1992, 1996, 2000). Human behavior is not only affected by environmental or situational conditions, but also personal attributes, such as character, values, norms, and genetic factors (Foster-Fishman et al., 1999; Stokols, 1992, 1996, 2000). The SEM posits that appropriate changes in the social environment will produce individual level change (McLeroy et al., 1988). However, individuals may respond differently to the same environmental conditions, making one's personal compatibility with the environment a key predictor of well-being (Stokols, 1996). Furthermore, health initiatives should not address separate environmental features but the cumulative and interactive nature of diverse personal and social conditions that may affect

health and well-being (Stokols, 1996, 2000).

Structural level factors are described within SEM as part of the physical and social environment in which behavior takes place. According to Cohen and colleagues (2000), there are four different categories of structural factors that can influence and explain behavior: (1) availability of protective or harmful consumer products; (2) physical structures; (3) social structures and policies; and (4) media and cultural messages. While consumer products, physical entities, and social policies may either facilitate or constrain behavior, media may influence behavior by changing knowledge, attitudes, and beliefs, as well as norms, regarding behavior (Cohen, Scribner & Farley, 2000).

The Social Ecological Model requires multiple levels of analysis and diverse methods to assess the complexities of environments, groups, and individuals (National Cancer Institute, 2005; Sallis & Owen, 1997; Stokols, 1996, 2000). Transactions among people are examined within their social and physical environments, over time and across multiple levels of analysis (Panter-Brick et al., 2006). From this perspective, health promotion programs and interventions may be more effective when acting on different levels (Stokols, 2000). The different levels of influence utilized within public health are intrapersonal factors (e.g., knowledge, attitudes, and behaviors); interpersonal factors (e.g., peers, social networks); institutional or organizational factors (e.g., access to services); community factors (e.g., social norms, relationships between organizations); and public policy factors (e.g., local, state, and national laws and policies) (Gregson et al., 2001; National Cancer Institute, 2005; Sallis & Owen, 1997) (A diagram

depicting the multiple levels of influence in the Social Ecological Model is available in Figure 1.1.). While a basic assumption from the ecological perspective is that a single level of influence cannot explain or predict behavior and health outcomes (Bronfenbrenner, 1979), the use of the SEM in research and interventions may address all levels within the SEM or only focus one or two levels of influence.

Applications of Social Ecological Model

Overall, the value and relevance of the Social Ecological Model to explain and understand health behavior is widely acknowledged (McLeroy et al., 1988; Sallis & Owen, 1997). Ecological frameworks have been applied in the examination of a variety of public health issues, including eating behavior (Sallis & Owen, 1997), physical activity (Sallis & Owen, 1997), homelessness (Toro, Trickett, Wall & Salem, 1991), and violence against women (Heise, 1998). More specifically, ecological approaches have been applied to the investigation of various cancer related issues, including breast cancer and survivorship (Ashing-Giwa et al., 2004; Revenson & Pranikoff, 2005), diet and different types of cancer (Cai, Yu, Ye & Yi, 2000; Nagata, 2000; Sasaki, Horacsek & Kesteloot, 1993; Stoneham, Goldacre, Seagroatt & Gill, 2000; Taioli, Nicolosi & Wynder, 1991; Tominaga & Kuroishi, 1997), psychosocial issues in childhood cancer, (Etherington, Pheby & Bray, 1996), hormone replacement and mammography (Verkooijen et al., 2008), and risk communication in cancer (Patrick, Intille & Zabinski, 2005). Additionally, this framework has been used to examine various

dimensions of sexual behavior research, such as contextual influences on contraception and condom use among women (Bull & Shlay, 2005), STI risks and sexual behaviors in adolescents (Corcoran, 2000; DiClemente, Salazar & Crosby, 2007; Mandara, Murray & Bangi, 2003; Salazar et al., 2010; Voisin, DiClemente, Salazar, Crosby & Yarber, 2006), substance abuse-related sexual behavior (Elkington, Bauermeister & Zimmerman, 2011; Tubman & Langer, 1995), factors that influence condom use among female sex workers (Larios et al., 2009), aspects of sexual identity change (i.e., "coming out") (Hollander & Haber, 1992), and the impact of sexual assault on women (Campbell, Dworkin & Cabral, 2009; Heise, 1998; Messman-Moore & Long, 2003; Neville & Heppner, 1999). However, minimal research on the human papillomavirus, sexually transmitted infections, and sexual behaviors within adult male populations has utilized ecological perspectives.

The examination of HPV, as well as other sexually transmitted infections, within the cultural context may be achieved more effectively through the application of an ecological perspective, incorporating an assessment of the environment, interpersonal factors, political issues, and individual variables (Granda-Cameron, 1999). Additionally, the use of the social ecological model may be valuable in the design and development of culturally appropriate, culturally compelling public health interventions (Panter-Brick et al., 2006). This is achieved by examining psychosocial variables as they are embedded within social and physical contexts and in micro and macrolevels of support and resources (Panter-Brick et al., 2006). Therefore, from a social ecological

perspective, effective approaches to reduce sexual risk behaviors enhance individual level knowledge, attitudes, and behaviors, influence interpersonal relationships that affect decision-making regarding sexual behavior, and affect structural determinants of sexual relationships and behaviors.

Methodological Approach: Social Epidemiology

The design and methodology of this dissertation research is guided by a social epidemiological approach, which complements the social ecological model. Social epidemiology is defined as the systematic and comprehensive study of health and well-being within the context of social and environmental factors (Cwikel, 2006; Krieger, 2001, 2002). The overarching goal of social epidemiology is to conceptualize, define, and assess the relationship between different aspects of the social environment and the health of the community (Kawachi, 2002). It builds on epidemiological concepts and integrates social science approaches to yield greater understanding of diseases and their determinants, as well as associated social conditions or problems (Cwikel, 2006; Krieger, 2001, 2002). Simply stated, social epidemiology combines epidemiology, which is the study of disease distribution and determinants in human populations, with concepts and techniques from the social and behavioral sciences (Cwikel, 2006). The underlying premise for social epidemiology is incorporation of societal-level, contextual determinants of risk into investigations of individual risk factors (Cohen, Wilson & Aiello, 2007). This integrative approach aids in the development of interventions, policies, and institutions that

may reduce the extent, impact, or incidence of a health condition or social problem and enhance overall health (Cwikel, 2006).

Inherent within social epidemiology is the equal importance of psychosocial and biological determinants of disease and wellness (Berkman, Glass, Brissette & Seeman, 2000; Cohen et al., 2007; Cwikel, 2006). The importance of sociocultural and socioeconomic factors in multiple health outcomes has been described (Berkman et al., 2000; Cohen et al., 2007; Krieger, 1994; Link & Phelan, 1995; Phelan, Link, Diez-Roux, Kawachi & Levin, 2004). From a social epidemiological perspective, disease is considered to be the product of both biological and social processes and mechanisms (Cohen et al., 2007; Krieger, 2002). The investigation of determinants of disease and health outcomes within communities and populations with consideration of social conditions that are intrinsically linked to these issues enhances the relevance and applicability of the research findings (Cwikel, 2006). Consequently, a critical strategy within social epidemiology is the focus on social conditions rather than on specific health outcomes (Cohen et al., 2007; Kawachi, 2002; Poundstone, Strathdee & Celentano, 2004). Furthermore, social epidemiology considers what is known regarding risk factors for a particular condition to enhance and maintain optimal health and wellness (Cwikel, 2006).

Three main approaches have been utilized within social epidemiology, all of which help elucidate principles capable of explaining social determinants in heath (Krieger, 2001):

1. Psychosocial theory;

2. Social production of disease (also known as political economy of health); and
3. Ecosocial theory and related multi-level dynamic frameworks.

Psychosocial Theory links vulnerability to disease to both physical and psychological stress, highlighting behavioral and biological responses to human interactions (Krieger, 2001, 2002). Historically, the determination of the etiology of disease was grounded in the "germ theory," which hypothesized that people exposed to germs associated with a disease become infected (Cassel, 1964; Krieger, 2001). However, when it was observed that not all exposed persons develop disease, it was recognized that the germ theory only provides partial knowledge regarding the causation of disease (Cassel, 1964; Krieger, 2001). In response, the etiological framework for disease was expanded to encompass the environment (Diez-Roux, 1998; Krieger, 1994, 2001). This perspective was further broadened to incorporate psychosocial factors to explain the disproportionate burden of diseases (Cassel, 1976; Krieger, 1994, 2001). Consequently, the psychosocial theory of social epidemiology moves beyond the agent-host framework for disease transmission to incorporate the environment, which is inclusive of social, political, and economic factors (Krieger, 2001).

Social Production of Disease, which is also known as the *political economy of health*, refers to economic and political determinants of health and disease outcomes, as well as structural barriers, within and across societies (Krieger, 2001, 2002). Instead of focusing on individual choices and responsibilities, this approach broadly examines determinants of health in

relation to costs and benefits of specific policies and practices; in other words, who benefits and at whose cost (Krieger, 2001)? However, biological factors are not readily addressed within the perspective of the social production of disease (Krieger, 2001). In cross-national analysis, the focus is on health inequities by class within and between countries (Krieger, 2001). The underlying hypothesis is that economic and political institutions produce and perpetuate economic and social privilege and inequality, which are the fundamental causes of disparities in health (Krieger, 2001, 2002). Consequently, individuals are not solely responsible for their health status (Krieger, 2001).

Ecosocial Theory is a multi-level framework that fosters the analysis of current and changing population patterns of health, disease, and wellness in relation to biological, ecological, and social factors (Krieger, 2001). In this approach, evolving patterns of health, disease, and wellness are analyzed within each level of biological, ecological, and social organization (Krieger, 2001). In short, ecosocial theory posits that disease is the result of interactions between biological organisms and their social environment (Krieger, 1994, 2001). Furthermore, information on evolving patterns of health can be uncovered through the examination of the dynamic socioecological context in which people live their lives (Krieger, 2005). The ecosocial approach incorporates a social production of disease perspective with biological and ecological analysis (Krieger, 2001). Historical and ecological perspectives are integrated into this approach to gain insights into the determinants and distribution of disease over time and evolving social inequalities in health (Krieger, 2002).

Applications of Social Epidemiology

Historically, public health has been more heavily focused on biological and medical determinants of disease and well-being (Cassel, 1964; Krieger, 1994, 2001). However, it is becoming increasingly more common for public health programs, policies, and research to encompass physiological factors, as well social determinants. It has been well-established that a broader, multi-level examination of the causes of diseases is important, as individually-based risk factors must be contextualized, and social factors are likely to affect multiple disease outcomes (Cassel, 1964; Cohen et al., 2007; Cwikel, 2006; Krieger, 1994; Link & Phelan, 1995; Phelan et al., 2004). Examples of such integrative approaches can be found within the public health initiatives addressing obesity, violence, substance use, chronic diseases, and sexually transmitted infections, which have been associated with individual-level factors (e.g., knowledge, attitudes, behaviors), as well as community and institutional level factors (e.g., poverty, access to resources, media, economy) (Cwikel, 2006). These public health issues are viewed as complex social problems that benefit from multidisciplinary approaches to intervention development and research (Cwikel, 2006).

Although recent public health investigations have begun to move beyond the former focus on individual-level factors to examine social conditions in which individual risk factors may be experienced, few studies have actively utilized a social epidemiological framework, isolating contextual conditions in relation to

health outcomes. A recent literature review spanning four decades (1966-2005) explored articles on three frequently used public health search engines (i.e., MEDLINE, PsycINFO, and ISI Web of Science) to unearth publications containing the term “social epidemiology” (Cohen et al., 2007). A total of 137 articles were found that addressed the social epidemiology of various health outcomes (Cohen et al., 2007). Most of the identified studies focused on neuropsychiatric disorders (i.e., substance-related disorders, mental disorder), chronic diseases (e.g., heart diseases, neoplasms, cerebrovascular disorders, pulmonary disease, digestive system diseases), sexually transmitted infections (e.g., HIV/AIDS, hepatitis B), or infectious diseases (i.e., malaria, tuberculosis, measles, diphtheria, pertussis, tetanus, respiratory tract infections) (Cohen et al., 2007).

Minimal research has been conducted that actively utilizes a social epidemiology framework to examine factors associated with cancer (Cohen et al., 2007; Graham & Gibson, 1972; Graham & Schneiderman, 1972; Kaufman, 1999; Wardle, McCaffery, Nadel & Atkin, 2004). However, the epidemiologic study of social factors associated with various forms of cancer has gained prominence, particularly with the identification of multiple socially mitigated exposures that increase the likelihood of cancer, including tobacco use and exposure, nutrition, and physical activity (Kaufman, 1999). Similarly, racial/ethnic identity and socioeconomic status have been determined to be key factors associated with many exposures that are relevant to cancer research (Kaufman, 1999). With HPV and its related cancers, sexual behaviors have emerged as an important

risk factor, particularly among men. Sexual behaviors are strongly influenced by the interplay of sociocultural, economic, and community factors. Therefore, social epidemiology is an appropriate framework to utilize in this study.

Purpose of the Study

The purpose of this research is two-fold: 1) to provide further understanding of factors associated with HPV among men from the social epidemiological perspective; and 2) to assess the impact of HPV testing and reporting on sexual risk taking among men. The long-term goal is to expand the knowledge base regarding HPV and sexual behavior among men to enhance service provision and intervention development to reduce the rates of HPV.

Research Questions

The overall purpose of this study is to increase understanding of factors associated with the human papillomavirus (HPV) and other sexually transmitted infections (STIs) among heterosexual men, including sexual behaviors and sociodemographic factors associated with men's behavioral responses to testing and diagnosis. This purpose is achieved through the following specific aims and research questions:

Specific Aim 1: To identify the most salient correlates of sexual behaviors among men residing in Brazil, Mexico, and the US.

Research Question 1.1: How does sexual risk differ among men residing in Brazil, Mexico, and the US by age cohort?

Specific Aim 2: To assess the impact of testing and knowledge of diagnosis with human papillomavirus and/or other sexually transmitted infections on sexual behavior among men.

Research Question 2.1: Do men's sexual behaviors change after being tested for HPV and other STIs?

Research Question 2.2: Do men's sexual behaviors change after being informed of diagnosis with HPV and other STIs?

These research questions were explored through a quantitative assessment of secondary data collected through a risk factor questionnaire among a cross-national study population using computer assisted self-interviewing (CASI). This research was conducted by the H. Lee Moffitt Cancer Center and Research Institute in Tampa, Florida, in partnership with the Ludwig Institute for Research on Cancer in São Paulo, Brazil and the Instituto Nacional de Salud Pública in Cuernavaca, Mexico.

Data Source for the Study

To address the research questions, a secondary data analysis was conducted. The data source is the dataset from the HPV in Men (HIM) study. Participants for the HIM study were recruited from the cities of Sao Paulo, Brazil;

Cuernavaca, Mexico; and Tampa, Florida (US), and their surrounding areas. The study population consisted of men who met the following inclusionary criteria: (a) ages 18 to 70 years; (b) residents of one of three target sites; (c) reported no prior diagnosis of penile or anal cancers; (d) have never been diagnosed with genital or anal warts; (e) currently report no symptoms of a sexually transmitted infection or treatment for a sexually transmitted infection; (f) not participating in an HPV vaccine study; (g) no history of HIV or AIDS; (h) no history of imprisonment, homelessness, or drug treatment during the past 6 months; and (i) willing to comply with 10 scheduled visits every 6 months for 4 years with no plans to relocate within the next four years.

The HIM Study protocol includes a pre-enrollment visit, a baseline (enrollment) visit, and nine additional visits after enrollment, each of which is scheduled six (6) months apart. For this analysis, the data from the baseline visit and three subsequent visits were utilized. Data include results from a Risk Factor Questionnaire, which assess sociodemographic characteristics, sexual and contraceptive history, condom use practices, and alcohol and tobacco use. The questionnaire was self-administered using computer assisted self-interviewing (CASI) and was provided in the primary language of the region (i.e., Portuguese in Brazil, Spanish in Mexico, or English in the US). Additionally, biological samples were collected from the external genitalia of participants, including the glans penis/coronal sulcus, the penile shaft, and the scrotum and combined to produce a single clinical specimen, which is used for HPV testing

and STI testing. The results of the HPV and STI tests at each visit were included in the dataset.

A test-retest reliability study has been conducted of the CASI instrument among men recruited in Brazil, Mexico, and the US in 2005 and 2006 (Nyitray et al., 2009). This study was designed to assess the consistency of participant responses between two time points, approximately three weeks apart. Overall, the reliability coefficients for each study site and the combined population for sexual health history and sexual behavior items were acceptable (κ = 0.61-0.80) (Nyitray et al., 2009).

Overview of Study Methodology

A secondary data analysis was conducted using the HPV in Men (HIM) dataset (described above). This analysis utilized data from the baseline assessment and two subsequent visits (at six month intervals), consisting of data over a two-year period for each participant. Descriptive statistics (e.g., frequencies, measures of central tendency and variability, and bivariate correlation by country of residence, age cohort, and by HPV status) were computed to summarize the sample characteristics, to explore relationships among variables, and to guide development of the repeated measures models. Three age cohorts were constructed for this study: 18-30 years, 31-44 years, and 45-70 years. HPV and STI status were dichotomous variables ('yes' or 'no'), and country of residence was limited to three countries (i.e., Brazil, Mexico, and United States). Other sociodemographic variables included: race/ethnicity;

marital status; educational level; circumcision status; and smoking status. Factors related to sexual behavior included: age at first vaginal sex; previous oral sex; previous anal sex; paying for sexual intercourse; number of lifetime sexual partners; and condom use within the last six months. Data reduction techniques were used to eliminate variables with low or no predictive power and to combine variables into meaningful indices and scales with good psychometric properties to obtain relatively parsimonious sets of predictors.

In the first manuscript, logistic regression was used to assess the association between sociodemographic factors and sexual risk by age cohort. Adjusted odds ratios and 95% confidence intervals were calculated using the standard errors from the corresponding logistic regression models. However, repeated measures analysis was conducted using GLIMMIX in the second manuscript to compute estimates of the longitudinal relationship between sexual behaviors, HPV and STI testing, and the knowledge of HPV and STI diagnoses among study participants. SAS (SAS Institute, Inc., Cary, North Carolina, version 9.2) was used for data management and for all data manipulations. All tests of hypotheses were two-tailed with a type 1 error rate of 5%. Details regarding the statistical analyses for each manuscript are provided in the respective Methods sub-sections for each manuscript in Sections Two and Three.

Limitations

There are some limitations to the research design. As this study is structured within an existing research study that is being conducted by the H. Lee

Moffitt Cancer Center and Research Institute (Moffitt) and the University of South Florida (USF) College of Public Health, the research questions and methodology must fall within this existing framework. The results of the secondary data analysis may not be generalizable to all men in the United States, Brazil, and Mexico, as the sampling process was not randomized and was conducted through community settings. Given the differences in the recruitment strategies utilized at each of the study sites, the sub-populations within this cross-national study are intrinsically different. Additionally, the socio-cultural norms of the three study sites may differentially affect factors that influence sexual behaviors, as well as sexual behaviors themselves. Therefore, the study findings may not be uniformly applicable to men across each of the study sites.

Since much of the research relied on self-reported data, particularly regarding practices and behaviors, there is a possibility of social desirability bias, which may affect the validity of the data utilized in this study. The individuals who voluntarily agreed to participate in the study may be inherently different from those who choose not to participate, which may affect the results of the study.

Because the quantitative data utilized in this study was collected using instruments developed for a separate study, the variables may not be the most appropriate to elucidate the information desired to address the research questions. As the study originated in the US, the items included in the Risk Factor Questionnaire were initially constructed in English by US-based researchers. Therefore, although the survey instrument was later translated into the primary language of each of the study sites (i.e., Portuguese in Sao Paulo,

Brazil; Spanish in Cuernavaca, Mexico) and back-translated to English, the appropriateness and relevance of some socially constructed items (e.g., race/ethnicity) may be questionable. However, since this is a secondary analysis, the study was limited to the analysis of the available data.

Organization of the Dissertation

While this is a cohesive study exploring the multiple factors associated with the human papillomavirus and sexually transmitted infections among men, the results of this study were grouped and developed in two distinct manuscripts for publication, which coincide with each of the two specific aims, as follows:

Manuscript 1: *"Age-related variation in sexual behaviors among heterosexual men residing in Brazil, Mexico, and the United States";* and

Manuscript 2: *"The impact of testing and diagnosis for the human papillomavirus and other sexually transmitted infections on sexual behavior in a cross-national sample of men."*

The first manuscript, provided in Section Two, is titled *"Age-related variation in sexual behaviors among heterosexual men residing in Brazil, Mexico, and the US."* This manuscript presents the descriptive findings of an analysis of age cohorts and their respective sexual behaviors within the study population. The intended audiences for these results are public health providers who work

with at-risk male populations and develop interventions and programs to improve sexual health outcomes. Therefore, the study findings may be appealing to the readers of the *Archives of Sexual Behavior* (2010 Impact factor: 3.66), which is committed to the dissemination of information in the field of sexual science.

The second manuscript, provided in Section Three, is titled *"The impact of testing and diagnosis for the human papillomavirus and other sexually transmitted infections on sexual behavior in a cross-national sample of men."* This paper explores the relationship between HPV and STI testing and subsequent sexual behaviors among the cohort of men followed as part of the HIM study in the three study sites of Brazil, Mexico, and the United States. The findings of this manuscript may be of interest with public health professionals who develop policies, as well as interventions, regarding STI prevention. This manuscript may be suitable for the *American Journal of Public Health* (2010 Impact Factor: 3.85), which is the official journal of the American Public Health Association. Each month, this journal publishes articles on a wide range of cross-cutting public health issues that encompass policy and practice.

Section Four of the dissertation provides the comprehensive, synthesized findings and discussion of the dissertation. Furthermore, this section includes recommendations for future research, strengths and limitations, and public health implications. Because of the nature of the dissertation format, the information in this final section highlights the results and conclusions reported in the previous sections as part of the three separate manuscripts.

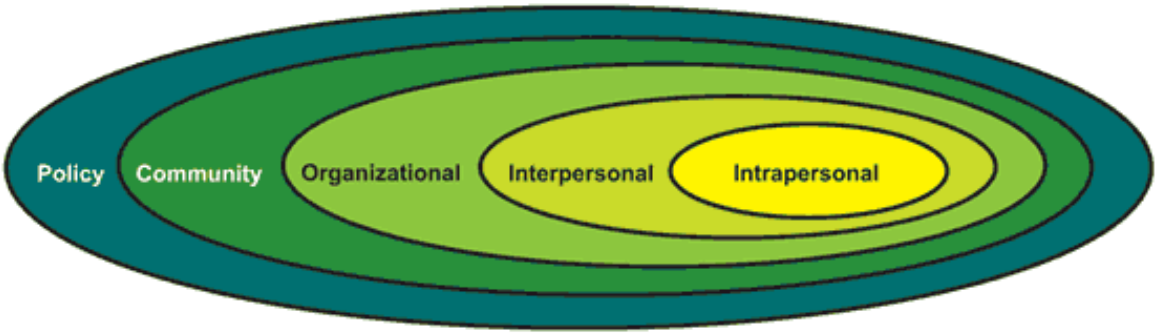

Figure 1.1: Social Ecological Model

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Section Two:

Manuscript One

Age-related variation in sexual behaviors among heterosexual men residing in Brazil, Mexico, and the United States

JOURNAL: Archives of Sexual Behavior

Introduction

Most research on the prevalence of risky sexual behaviors has focused on sub-groups of men thought to be at high risk for sexually transmitted infections (STIs), including men who have sex with men and substance using males (Aidala et al., 2006; Dworkin, 2005; Exner, Gardos, Seal & Ehrhardt, 1999; Seal & Ehrhardt, 2004). Due to this focus, research examining factors associated with heterosexual men's acquisition of STIs has been limited (Aidala et al., 2006; Campbell, 1995; Dworkin, Fullilove & Peacock, 2009; Exner et al., 1999; Flood, 2003; Higgins, Hoffman & Dworkin, 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004). Furthermore, studies assessing sexual behaviors among heterosexuals have focused primarily on women (Aidala et al., 2006; Campbell, 1995; Dworkin et al., 2009; Exner et al., 1999; Flood, 2003; Higgins et al., 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004). Thus, there is a need for research on STI risk factors for heterosexual men who do not belong to groups thought to be at "high risk."

Similarly, while numerous studies have investigated sexual behavior by gender and race/ethnicity, most research on men's sexual risk practices has focused on younger populations, including adolescents and young adults (Chopra et al., 2009; Harrison, Cleland, Gouws & Frohlich, 2005; Makenzius, Gadin, Tyden, Romild & Larsson, 2009; Mooney-Somers & Ussher, 2008; O'Donnell, O'Donnell & Stueve, 2001; Sandfort, Orr, Hirsch & Santelli, 2008). The focus on younger adults may be attributed to the higher prevalence and incidence of STIs, as well as higher rates of disease transmission, within this population (LaBrie, Pedersen, Thompson & Earleywine, 2008; Noar, Morokoff & Redding, 2001; Tan, Wong & Chan, 2006). However, in recent years, HIV/AIDS cases among older adults have been on the rise (Casau, 2005; Coleman & Ball, 2007; Goodroad, 2003; Kohli et al., 2006; Savasta, 2004). Furthermore, sexual risk-taking has been found to be frequent within older age cohorts (Bruhin, 2003; Kohli et al., 2006; Rogstad & Bignell, 1991; Stall & Catania, 1994).

Overall, there is a paucity of data on sexual risk-taking among various age cohorts of heterosexual men, including middle-aged and older men. In this study, we examined the prevalence and correlates of sexual behaviors by age cohort within a cross-national sample of adult, heterosexual, sexually active men in Brazil, Mexico, and the United States. The purpose of this study was two-fold: (1) to compare the prevalence of different demographic characteristics and sexual behaviors across age groups and (2) to estimate the significance of multiple demographic and behavioral variables in predicting sexual risk by age cohort.

Methods

Study Design and Sample. This is a cross-sectional analysis of baseline data collected within a cohort study. The study sample was drawn from men who were enrolled in the *HPV in Men (HIM) Study* from June 2005 to December 2009 (N=4,074). The HIM Study is a cross-national, natural history study that explores factors associated with HPV prevalence and incidence among men in Sao Paulo, Brazil, Cuernavaca, Mexico, and Tampa, Florida in the United States (US). Data collected from this study were used to investigate sexual risk behavior across the lifespan.

To ensure the inclusion of a broad range of men, participants for the parent study were recruited from the general population. In Brazil, study recruitment was facilitated through media advertising and a center for urogenital care. In Mexico, beneficiaries of the public health system, factory employees, and officials of the Mexican army living and working in the geographic community around the study site were enrolled. Recruitment efforts in the US involved flyers and media advertising at a local university and in the greater metropolitan area. Prior to enrollment in the study, all participants provided written informed consent.

The study population for the parent study consisted of men who met the following inclusion criteria: a) aged 18 to 70 years; b) residents of one of the three study sites; c) no reports of prior diagnosis with penile or anal cancers; d) no report of symptoms of or treatment for an STI; e) not currently participating in

an HPV vaccine study; f) no history of HIV/AIDS; g) no history of imprisonment, homelessness, or drug treatment during the past six months; and h) willingness to comply with ten scheduled study visits conducted every six months over a four year period with no plans to relocate during study implementation. For the present analysis, we restricted the study population to heterosexual men, excluding any men who reported prior sexual activity with a male partner, including oral and/or anal intercourse (n=596). We also excluded men who were not sexually active (n=431), defined as those who did not report ever experiencing vaginal intercourse. This resulted in a final sample size of 3,047 men. The elimination process that resulted in our study population is depicted in Figure 2.1.

Risk Factor Questionnaire. A comprehensive sexual history and health questionnaire was administered to study participants at enrollment. This instrument assesses socio-demographic characteristics, alcohol and tobacco use, sun exposure, history of STIs, circumcision status, sexual history, and contraceptive practices. The original survey instrument was written in English and was later translated into the primary language of each of the survey sites (i.e., Portuguese in Sao Paulo, Brazil; Spanish in Cuernavaca, Mexico) and back-translated to English to ensure accuracy in the assessment process. A test-retest reliability study of the instrument was previously conducted in all three languages utilized in the study and yielded high reliability coefficients for all variables (intraclass correlation coefficient (ICC) ≥ 0.85) (Nyitray et al., 2009). The questionnaire required approximately 20 minutes to complete and was

administered using Computer-Assisted Self-Interviewing (CASI). For each survey item, participants were given the option to refuse to answer. These responses were treated as missing observations, as the values are unknown.

Testing for Sexually Transmitted Infections. Upon study enrollment, men who provided consent for participation underwent a clinical examination. At the time of survey administration, participants were tested for chlamydia, gonorrhea, herpes simplex virus 2 (HSV2; also known as genital herpes), and syphilis. Urine specimens (20-30 mLs) were collected in urine collection cups free of any preservatives for testing to detect gonorrhea and chlamydia RNA, TMA. A 2 mL urine specimen was transferred into the GenProbe specimen transport tube within 24 hours of collection before being assayed. Sera were tested for syphilis infection by Rapid Plasma Reagin (RPR). Positive results were confirmed with the more specific FTA-ABS. A reactive FTA-ABS test confirms the presence of treponemal antibodies but does not indicate the stage or presence of active infection. Sera were also tested for HSV2 by Immunoassay with the IgG Type Specific Antibody (HerpeSelect) test. All STI assays were performed by Quest Laboratories, Tampa, Florida, US. Participants with positive test results were offered treatment at no cost.

Variables. We compared participants by age cohort on a range of demographic variables and sexual behaviors found to affect the likelihood of STI transmission, based on biologic plausibility and a review of the literature. The age cohorts were defined as 18 to 30 years, 31 to 44 years, and 45 to 70 years (i.e., young adults, middle-aged adults, and older adults, respectively).

Demographic variables included in the analysis were: country of residence (Brazil, Mexico, US); self-identified race (White, Black, Asian/Pacific Islander, American Indian, Mixed); Hispanic (Yes, No); marital status (single, married, cohabitating, divorced/separated/widowed); educational level (<12 years, 12 years, 13 to 15 years, 16 years, ≥17 years); self-reported circumcision status (Yes, No); and current smoking status (Yes, No). All men included in the sample were defined as heterosexual (i.e., no reported history of sexual intercourse with men) with a history of sexually activity (i.e., ever experiencing vaginal sexual intercourse).

Multiple variables regarding men's sexual behaviors were incorporated in the analysis, including history of anal and oral sexual activity, age at first vaginal sex, lifetime number of female sexual partners, if they had ever paid for sexual intercourse (i.e., exchanged sex for money or drugs), and condom use within the recent past (i.e., up to six months preceding survey administration). Self-reported data on previous diagnoses of multiple sexually transmitted infections by a health care provider were also considered, including genital herpes, chlamydia, gonorrhea, syphilis, non-gonococcal urethritis, hepatitis B, hepatitis C, and HIV.

The primary outcome of interest in this study was sexual risk. While a standardized means of assessing sexual risk has not been established in the literature, the prevalence and occurrence of STIs have been identified as critical outcome measures of sexual risk (Beck, McNally & Petrak, 2003; Kirby, Laris & Rolleri, 2007; Slaymaker, 2005). Therefore, sexual risk was quantified through

the composite variable for STI test results. This composite variable was constructed to denote a positive test result for the presence of at least one of the four STIs tested for in this study (i.e., chlamydia, gonorrhea, genital herpes, and syphilis). The composite variable for sexual risk excluded HPV, as its prevalence is much higher relative to other STIs; within the study population, approximately half of the men are positive for HPV. Therefore, the exclusion of HPV ensured that the study assessed risky behavior associated with general STI prevalence, rather than HPV prevalence (which has previously been published as part of the parent study) (Akogbe et al., 2012; Nyitray et al., 2011; Nyitray et al., 2010).

Statistical Analysis. Since all variables were categorical, differences in the distribution of demographic characteristics and sexual behaviors were examined by age cohort were tested using the chi-square test. Logistic regression was conducted to examine the association between demographic factors and sexual behaviors and the likelihood of testing positive for an STI. Odds ratios, along with their corresponding 95% confidence limits, were generated to assess the association of the predictor variables and sexual risk. We also stratified the regression analyses by age cohort to evaluate group differences. Variables included in the multivariate model were those found to be statistically significant in the bivariate analysis.

All tests of hypotheses were two-tailed with a Type I error rate set at 5%. SAS (version 9.2) was used for data management and for all data manipulations (SAS Institute, Cary, NC, USA). This investigation was approved by the Institutional Review Board of the University of South Florida.

Results

The study sample consisted of 3,047 men, aged 18 to 70 years, with a mean age of 32.3 years (standard deviation [SD] ±11.1; median=31.0 years). A comparison of selected demographic characteristics by age cohort is presented in Table 2.1. The study sample consisted predominately of young adult men, with half being between the ages of 18 and 30 years (n=1,523; 50.0%) and more than one-third aged 31 to 44 years (n=1,131; 37.1%). Roughly one-third of the sample resided in each of the three study sites, Brazil (29.1%), Mexico (35.0%), and the US (35.6%). Most of the study sample in Brazil and Mexico consisted of middle-aged adults (31 to 44 years; Brazil=37.1%; Mexico=43.3%), whereas nearly half (47.8%) of the US participants were young adults (18 to 30 years). Regardless of age cohort, the study sample was predominantly self-identified as white (43.7%) and Hispanic (46.7%). Young adult males were more likely to be single, whereas middle-aged and older adults (45 to 70 years) were more likely to be married. Younger and older males were more likely to have some advanced/college level education, but middle-aged males were more likely to have lower levels of education. Although the majority of men in the study sample were uncircumcised (60.7%), the levels varied by age cohort, with young adults having the highest proportion of circumcision (47.1%) and middle-aged adults having the lowest (28.0%).

Table 2.2 provides information on the participants' self-reported sexual behaviors with women by age cohort. The majority of men (43.8%), across age

cohorts, reported their first experience of vaginal intercourse between the ages of 15 and 17 years. The mean age of the men's first experience of vaginal sexual intercourse was 16.9 years (SD±3.2; median=17.0 years). The majority of men (90.0%) reported ever having performed and/or experienced oral sex, and half (49.7%) reported ever having insertive anal sex. The frequency of oral sex was observed to decrease with increasing age (18 to 30: 92.9%; 31 to 44: 89.3%; 45 to 70: 80.9%). However, men within the middle-aged category reported the highest rates of anal intercourse (57.3%). Middle-aged adults also reported the highest proportion of experiences exchanging sexual intercourse for money or drugs (13.9%). When asked about condom use with vaginal intercourse during the three to six month period prior to the survey, the most frequent response across age cohorts was "never" (36.9%). The absence of condom use with vaginal sex increased with increasing age, with approximately one-fourth of young men (24.4%) reporting never using them compared to more than half of older men (55.7%).

In the study sample, the mean number of lifetime female sexual partners was 18.8 (SD±104.7; median=7.0). Further information regarding the number of sexual partners reported by participants is provided in Table 2.2. Overall, the largest proportion of participants reported 2 to 9 lifetime female sexual partners (45.3%); however, the variance in numbers varied by age cohort, with reported lifetime numbers being more concentrated in this range among young adults and being more widely distributed among middle-aged and older adults.

Table 2.3 provides information on prior diagnoses with a sexually transmitted infection (STI), as reported by the participants. When asked about whether they had ever been diagnosed with any STI by a physician or health care provider, more than one-fourth (26.0%) of older adults, aged 45 to 70 years, responded affirmatively compared to 7.8% of young adults and 17.4% of middle-aged adults. Similarly, older adults reported the highest proportions of gonorrhea, syphilis, non-gonococcal urethritis, and hepatitis C, compared to other age cohorts; however, the reported occurrence of genital herpes in the study sample was similar among middle-aged and older adults.

When examining the results for STI tests given at the same time of survey administration, genital herpes, chlamydia, and syphilis showed significant variation by age cohort (Table 2.4). Of these STIs, the most prevalent was genital herpes, with 17.7% of men testing positive. The largest proportion of genital herpes and syphilis cases occurred among older men (32.3% and 1.8%, respectively), whereas younger men had the highest percentage of chlamydia cases (2.6%). Overall, 19.7% of the study sample tested positive for at least one of the four STIs observed, with prevalence increasing with age.

The risk estimates for the model of association with a positive test for an STI in this study sample by age cohort are presented in Table 2.5. Relative to the oldest cohort of men, young adult men and middle-aged men both have reduced odds for a positive STI test (AOR=0.29, 95% CI=0.20-0.40 and AOR=0.74, 95% CI=0.55-0.98, respectively). Overall, Brazilian men had the highest risk of testing positive for an STI (AOR=3.00, 95% CI=2.14-4.20). Black

men in the study sample were nearly 1.5 times more likely to test positive for an STI (AOR=1.50, 95% CI=1.15-1.96), relative to white participants. Men who were divorced, separated, or widowed were also 1.5 times more likely to test positive for an STI, as compared to married men (AOR=1.46, 95% CI=1.04-2.06). Men who did not complete secondary education were at increased sexual risk, relative to men with advanced levels of education (AOR=1.62, 95% CI=1.01-2.59). Additionally, early age of sexual debut was associated with a more than two-fold heightened risk for a positive STI test (AOR=2.15, 95% CI=1.43-3.23). Experiences exchanging sex for money or drugs was found to elevate sexual risk in the general study sample (AOR=1.35, 95% CI=1.01-1.80). Higher numbers of lifetime sexual partners intensified the risk of a positive STI test in the study sample (20-49 partners: AOR=1.48, 95% CI=1.02-2.16; ≥50 partners: AOR=2.07, 95% CI=1.31-3.28).

Within the youngest cohort (18 to 30 year olds), Brazilian men had a more than seven-fold risk for testing positive for an STI (AOR=7.47, 95% CI 3.90-14.28), compared to men in the US. Advanced levels of education were found to be protective for testing positive for an STI among young men (16 years: AOR=0.37, 95% CI=0.15-0.92), whereas young men with larger numbers of lifetime sexual partners had a two to four-fold increased risk (20-49 partners: AOR=2.06, 95% CI=1.04-4.13; ≥50 partners: AOR=4.33, 95% CI=1.74-10.76).

Multiple variables amplified sexual risk for middle-aged men (31 to 44 years) (Table 2.5). Black men in this age group had 64% increased odds of testing positive for an STI (AOR=1.64, 95% CI=1.10-2.42), whereas men in the

study population who were divorced, separated, or widowed had a 91% elevated risk (AOR=1.91, 95% CI=1.21-3.02). Both a lower and a higher level of formal education (<12 years: AOR=3.04, 95% CI=1.53-6.06; 13-15 years: AOR=2.85, 95% CI=1.43-5.68) were found to amplify sexual risk by nearly three times. Similarly, early and older ages at sexual initiation (≤14 years: AOR=2.37, 95% CI=1.34-4.18; 18-20 years: AOR=1.80, 95% CI=1.05-3.07) were associated with a higher likelihood of STI positivity.

Within the study's oldest cohort (45 to 70 years old), men living in Brazil (AOR=2.25; 95% CI=1.03-4.89) and those who reported previously exchanging sex for money or drugs (AOR=2.30, 95% CI=1.05-5.04) had a more than two-fold increased risk of testing positive for an STI. Furthermore, older men who first had sexual intercourse at the age of 14 or younger had a nearly four-fold elevated sexual risk (AOR=3.75, 95% CI=1.45-9.74).

Discussion

Our study found that STI positivity varied significantly by age group among heterosexual men. In younger men, having higher educational levels had a protective effect, whereas higher numbers of sexual partners elevated the risk for STIs. Middle-aged men who were black and divorced/separated/widowed had an increased risk for a positive STI test. However, inconsistencies regarding risk associated with education and age of sexual initiation were observed among men within this age cohort. Middle-aged men with less than a secondary level education (<12 years) and some college education (13 to 15 years) were found

to have elevated sexual risk, and those who had an early age of sexual debut (≤14 years) and young adult onset of sexual activity (18 to 20 years) had higher risk estimates for a positive STI test. For older men, a younger age at first vaginal sexual encounter and a history of exchanging sex for money or drugs heightened sexual risk.

Our study has important public health implications. Most research studies examining sexual behavior have been conducted with adolescents and young adults (Chopra et al., 2009; Harrison et al., 2005; Makenzius et al., 2009; Mooney-Somers & Ussher, 2008; O'Donnell et al., 2001; Sandfort et al., 2008); however, sexual risk-taking and STI transmission among older adults is now recognized as a growing public health problem (Bruhin, 2003; Coleman & Ball, 2007; Goodroad, 2003; Kohli et al., 2006; Rogstad & Bignell, 1991; Savasta, 2004; Stall & Catania, 1994). Therefore, our examination of risk and protective factors for sexual risk by age cohort, inclusive of men aged 18 to 70 years, fills an important gap in the literature. Furthermore, few sexual research studies have investigated factors related to heterosexual men (Aidala et al., 2006; Campbell, 1995; Dworkin et al., 2009; Exner et al., 1999; Flood, 2003; Higgins et al., 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004). Consequently, our study provides information that may be beneficial for interventions to prevent and reduce the heterosexual transmission of STIs across age groups. More specifically, our results suggest that age cohort is a key factor in the development and implementation of targeted approaches for STI prevention among men.

In our analysis, we identified multiple protective and risk factors for STIs among heterosexual men that reinforce previous research findings. Numerous studies have consistently shown that paid sex increases the risk for HIV and other STIs (Chen et al., 2007; Mimiaga, Reisner, Tinsley, Mayer & Safren, 2009; Patterson et al., 2009). This study provides further evidence of this assertion, as there was a 35% increased risk for STIs among men who reported ever exchanging sex for money or drugs. Our study also found that young men with higher numbers of lifetime sexual partners had a two to four-fold heightened risk for a positive STI test. Similarly, previous research has observed a relationship between an increasing number of sexual partners and the risk of STIs (Dunne, Nielson, Stone, Markowitz & Giuliano, 2006; Lu et al., 2009; Nielson et al., 2007). Additionally, early sexual debut was associated with a more than two-fold elevated risk of STIs in our study sample, which was amplified among middle-aged and older adult males. Likewise, our findings support those from multiple studies that have determined that young age at sexual initiation increases likelihood of HIV and STI transmission among men (Dunne et al., 2006; Harrison et al., 2005; Kahn, Rosenthal, Succop, Ho & Burk, 2002; Lu et al., 2009; Nielson et al., 2007; O'Donnell et al., 2001; Sandfort et al., 2008); however, most of these prior studies were conducted with adolescents or young adults.

Although many of our results support those of earlier studies, some of our findings are somewhat counterintuitive, underscoring the need for further investigation. For example, educational level within the study population of young men showed that advanced education was protective for STI risk;

however, among middle-aged men, those with 13 to 15 years of education had a nearly three-fold increased risk of a positive STI test (relative to men with 17 or more years of education). Additionally, older age at initiation of sexual activity (18 to 20 years) was found to increase sexual risk among middle-aged men, in contrast to previous findings of heightened risk with early sexual debut (Dunne et al., 2006; Harrison et al., 2005; Kahn et al., 2002; Lu et al., 2009; Nielson et al., 2007; O'Donnell et al., 2001; Sandfort et al., 2008). As there is no clear explanation for these findings, mixed methods approaches that incorporate qualitative methodologies may prove beneficial in the determination of underlying factors that may explain these contradictions within our findings.

There are some potential limitations in this study. First, as we utilized an existing dataset, we were restricted in the variables considered in the examination of sexual behaviors and risk among heterosexual men. Within this secondary dataset, some of the variables considered in this analysis were based on self-reported data, which may be affected by recall bias. Particularly because this study addresses highly sensitive information and practices (i.e., sexual behaviors and history), there is a possibility of social desirability bias in the manner in which participants responded to survey items. However, the use of Computer-Assisted Self-Interviewing (CASI) has been shown to decrease the possibility of biased information being collected and improving the validity of study findings, particularly in sexual behavior research (Fenton, Johnson, McManus & Erens, 2001; Ghanem, Hutton, Zenilman, Zimba & Erbelding, 2005; Kissinger et al., 1999; Kurth et al., 2004). It is important to mention that socio-

cultural factors may have affected the validity of findings, as cultural expectations for men in their sexual relationships may affect reporting on key variables, such as the number of sexual partners and age of sexual initiation. For example, in Latin American countries, such as Mexico and Brazil, cultural expectations that closely associate multiple partners and early sexual debut with conceptualizations of virility and machismo may lead respondents to over-report the number of partners (Falicov, 2010; Parker, 1996; Perez-Jimenez, Seal & Serrano-Garcia, 2009; Villarruel & Rodriguez, 2003; Wallace, 2011). In spite of this potential bias, we have previously found that the utilization of CASI in the data collection process for the parent study (i.e., HIM Study) demonstrated high reliability in response to sensitive sexual behavior questions (Nyitray et al., 2009).

It is noteworthy that recruitment strategies varied in the three study sites (i.e., Brazil, Mexico, and the US), which may have affected our findings. For example, because the US site had concentrated activities on a university campus, the study participants from this site were more likely to be younger. However, in Brazil and Mexico, recruitment strategies included centers devoted to urogenital care and worksite promotion, resulting in more effective identification of middle-aged to older adult participants. Additionally, our findings may underscore socio-cultural factors that influence sexual risk outcomes by age. For example, our analysis found that Brazilian men had a heightened risk for STI positivity, which varied by age cohort. Further research may elucidate the role of socio-cultural factors in the association between STI risk and age cohort.

Despite these limitations, this study has some noteworthy strengths. The study sample size is sufficient to offer substantial power for the detection of group variances in the analysis. Although we cannot exclude the possibility of residual confounding due to unmeasured variables, we controlled for several potential confounders in our statistical analysis. The sub-analysis conducted by age cohort yields important information on the age-related variances in sexual behaviors and risk.

Due to the dearth of studies on sexual risk among heterosexual men, continued research is needed regarding sexual behaviors within this population, particularly among older age groups. Our study findings highlight the need for added public health efforts to reduce STI risk and transmission among heterosexual men beyond the adolescent period. Determining which male sub-populations have an increased risk of STI infection and understanding trend patterns over time is helpful in allocating resources for effective prevention, treatment, and management necessary for curtailing STI transmission. Moreover, information on the prevalence of sexual behaviors by socio-demographic characteristics is beneficial in the development and implementation of relevant policies and interventions to reduce STI prevalence, increase awareness, and improve quality of life.

Table 2.1: Demographic characteristics by age cohort [a]

	TOTAL N=3,047 n (%)	18-30 years N=1,523 n (%)	31-44 years N=1,131 n (%)	45-70 years N=393 n (%)	P-value
Country of Residence					<.0001
Brazil	888 (29.1)	352 (23.1)	419 (37.1)	117 (29.8)	
Mexico	1,075 (35.0)	443 (29.1)	490 (43.3)	142 (36.1)	
United States	1,084 (35.6)	728 (47.8)	222 (19.6)	134 (34.1)	
Race					<.0001
White	1,330 (43.7)	723 (47.5)	428 (37.8)	179 (45.6)	
Black	425 (14.0)	202 (13.3)	160 (14.2)	63 (16.0)	
Asian/Pacific Islander	87 (2.9)	70 (4.6)	16 (1.4)	1 (0.3)	
American Indian/ Alaskan	55 (1.8)	20 (1.3)	28 (2.5)	7 (1.8)	
Mixed	1,002 (32.9)	415 (27.3)	450 (39.8)	137 (34.9)	
Unknown/Refused	148 (4.9)	93 (6.1)	49 (4.3)	6 (1.5)	
Hispanic					<.0001
Yes	1,423 (46.7)	633 (41.6)	616 (54.5)	174 (44.3)	
No	1,599 (52.5)	881 (57.9)	501 (44.3)	217 (55.2)	
Unknown/Refused	25 (0.8)	9 (0.6)	14 (1.2)	2 (0.5)	
Marital Status					<.0001
Single	1,303 (42.8)	1,063 (69.8)	200 (17.7)	40 (10.2)	
Married	1,082 (35.5)	244 (16.0)	611 (54.0)	227 (57.8)	
Cohabitating	380 (12.5)	168 (11.0)	174 (15.4)	38 (9.7)	
Divorced/Separated/ Widowed	273 (9.0)	42 (2.8)	143 (12.6)	88 (22.4)	
Unknown/Refused	9 (0.3)	6 (0.4)	3 (0.3)	0 (0.0)	
Educational Level					<.0001
<12 years	650 (21.3)	231 (15.2)	314 (27.8)	105 (26.7)	
12 years	808 (26.5)	415 (27.3)	322 (28.5)	71 (18.1)	
13-15 years	813 (26.7)	556 (36.5)	169 (14.9)	88 (22.4)	
16 years	584 (19.2)	270 (17.7)	227 (20.1)	87 (22.1)	
≥17 years	184 (6.0)	47 (3.1)	97 (8.6)	40 (10.2)	
Unknown/Refused	8 (0.3)	4 (0.3)	2 (0.2)	2 (0.5)	
Circumcision Status					<.0001
Yes	1,197 (39.3)	718 (47.1)	317 (28.0)	162 (41.2)	
No	1,850 (60.7)	805 (52.9)	814 (72.0)	231 (58.8)	
Current Smoking Status					0.3758
Yes	713 (23.4)	356 (23.4)	275 (24.3)	82 (20.9)	
No	2,328 (76.4)	1,162 (76.3)	855 (75.6)	311 (79.1)	
Unknown/Refused	6 (0.2)	5 (0.3)	1 (0.1)	0 (0.0)	

[a] *Percentages may not total to 100 due to rounding.*

Table 2.2: Self-reported sexual behaviors by age cohort [a]

	TOTAL N=3,047 n (%)	18-30 years N=1,523 n (%)	31-44 years N=1,131 n (%)	45-70 years N=393 n (%)	P-value
Age at first vaginal sex					<.0001
≤14 years	551 (18.1)	265 (17.4)	203 (18.0)	83 (21.1)	
15-17 years	1,335 (43.8)	722 (47.4)	455 (40.2)	158 (40.2)	
18-20 years	816 (26.8)	427 (28.0)	286 (25.3)	103 (26.2)	
≥21 years	317 (10.4)	100 (6.6)	172 (15.2)	45 (11.5)	
Unknown/Refused	28 (0.9)	9 (0.6)	15 (1.33)	4 (1.02)	
Ever had oral sex					<.0001
Yes	2,743 (90.0)	1,415 (92.9)	1,010 (89.3)	318 (80.9)	
No	304 (10.0)	108 (7.2)	121 (10.7)	75 (19.1)	
Ever had anal sex					<.0001
Yes	1,514 (49.7)	674 (44.3)	648 (57.3)	192 (48.9)	
No	1,513 (49.7)	840 (55.2)	475 (42.0)	198 (50.4)	
Unknown/Refused	20 (0.7)	9 (0.6)	8 (0.7)	3 (0.8)	
Ever exchanged sex for money or drugs					0.0001
Yes	328 (10.8)	134 (8.8)	157 (13.9)	37 (9.4)	
No	2,707 (88.8)	1,384 (90.9)	971 (85.9)	352 (89.6)	
Unknown/Refused	12 (0.4)	5 (0.3)	3 (0.3)	4 (1.0)	
Condom use with vaginal sex in recent past					<.0001
No vaginal sex in recent past	221 (7.3)	114 (7.5)	57 (5.0)	50 (12.7)	
Never	1,123 (36.9)	372 (24.4)	532 (47.0)	219 (55.7)	
Sometimes	1,054 (34.6)	654 (42.9)	342 (30.2)	58 (14.8)	
Always	610 (20.0)	368 (24.2)	189 (16.7)	53 (13.5)	
Unknown/Refused	39 (1.3)	15 (1.0)	11 (1.0)	13 (3.3)	
Number of Lifetime Female Sexual Partners					<.0001
1	283 (9.3)	201 (13.2)	69 (6.1)	13 (3.3)	
2-9	1,381 (45.3)	804 (52.3)	455 (40.2)	122 (31.0)	
10-19	546 (17.9)	236 (15.5)	229 (20.3)	81 (20.6)	
20-49	492 (16.2)	180 (11.8)	211 (18.7)	101 (25.7)	
≥50	179 (5.9)	44 (2.9)	92 (8.1)	43 (10.9)	
Unknown/Refused	166 (5.5)	58 (3.8)	75 (6.6)	33 (8.4)	

[a] *Percentages may not total to 100 due to rounding.*

Table 2.3: Self-reported prior diagnosis with an STI by age cohort [a]

	TOTAL N=3,047 n (%)	18-30 years N=1,523 n (%)	31-44 years N=1,131 n (%)	45-70 years N=393 n (%)	P-value
Genital Herpes					<.0001
Yes	67 (2.2)	15 (1.0)	39 (3.5)	13 (3.3)	
No	2,898 (95.1)	1,459 (95.8)	1,067 (94.3)	372 (94.7)	
Don't Know	77 (2.5)	46 (3.0)	23 (2.0)	8 (2.0)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Chlamydia					0.9336
Yes	59 (1.9)	29 (1.9)	23 (2.0)	7 (1.8)	
No	2,873 (94.3)	1,439 (94.5)	1,060 (93.7)	374 (95.2)	
Don't Know	110 (3.6)	52 (3.4)	46 (4.1)	12 (3.1)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Gonorrhea					<.0001
Yes	193 (6.3)	22 (1.4)	103 (9.1)	68 (17.3)	
No	2,776 (91.1)	1,451 (95.3)	1,006 (89.0)	319 (81.2)	
Don't Know	73 (2.4)	47 (3.1)	20 (1.8)	6 (1.5)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Syphilis					<.0001
Yes	30 (1.0)	2 (0.1)	14 (1.2)	14 (3.6)	
No	2,941 (96.5)	1,475 (96.9)	1,094 (96.7)	372 (94.7)	
Don't Know	71 (2.3)	43 (2.8)	21 (1.9)	7 (1.8)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Non-gonococcal Urethritis					<.0001
Yes	40 (1.3)	16 (1.0)	9 (0.8)	15 (3.8)	
No	2,902 (95.2)	1,453 (95.4)	1,081 (95.6)	368 (93.6)	
Don't Know	100 (3.3)	51 (3.4)	39 (3.5)	10 (2.5)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Hepatitis B					0.2016
Yes	44 (1.4)	17 (1.1)	18 (1.6)	9 (2.3)	
No	2,880 (94.5)	1,440 (94.6)	1,069 (94.5)	371 (94.4)	
Don't Know	118 (3.9)	63 (4.1)	42 (3.7)	13 (3.3)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Hepatitis C					0.0468
Yes	21 (0.7)	6 (0.4)	9 (0.8)	6 (1.5)	
No	2,905 (95.3)	1,454 (95.5)	1,079 (95.4)	372 (94.7)	
Don't Know	116 (3.8)	60 (3.9)	41 (3.6)	15 (3.8)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	

Table 2.3 (Continued)

HIV					0.9322
Yes	7 (0.23)	3 (0.2)	3 (0.3)	1 (0.3)	
No	2,957 (97.1)	1,476 (97.0)	1,100 (97.3)	381 (97.0)	
Don't Know	78 (2.6)	41 (2.7)	26 (2.3)	11 (2.8)	
Unknown/Refused	5 (0.2)	3 (0.2)	2 (0.2)	0 (0.0)	
Any STI					<.0001
Yes	418 (13.7)	119 (7.8)	197 (17.4)	103 (26.0)	
No	2,543 (83.6)	1,353 (88.8)	907 (80.2)	283 (72.0)	
Don't Know	83 (2.7)	49 (3.2)	27 (2.4)	78 (1.8)	
Unknown/Refused	3 (0.1)	2 (0.1)	0 (0.0)	1 (0.3)	

[a] *Percentages may not total to 100 due to rounding.*

Table 2.4: Results of STI tests by age cohort [a]

	TOTAL N=3,047 n (%)	18-30 years N=1,523 n (%)	31-44 years N=1,131 n (%)	45-70 years N=393 n (%)	P-value
Genital Herpes					<.0001
Positive	540 (17.7)	121 (7.9)	292 (25.8)	127 (32.3)	
Negative	2,504 (82.2)	1,401 (92.0)	837 (74.0)	266 (67.7)	
No Result	3 (0.1)	1 (0.1)	2 (0.2)	0 (0.0)	
Chlamydia					0.0004
Positive	52 (1.7)	40 (2.6)	10 (0.9)	2 (0.5)	
Negative	2,995 (98.3)	1,483 (97.4)	1,121 (99.1)	391 (99.5)	
Gonorrhea					0.2127
Positive	9 (0.3)	7 (0.5)	2 (0.2)	0 (0.0)	
Negative	3,037 (99.7)	1,516 (99.5)	1,128 (99.7)	393 (100.0)	
No Result	1 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	
Syphilis					0.0011
Positive	16 (0.5)	5 (0.3)	4 (0.4)	7 (1.8)	
Negative	3,027 (99.3)	1,515 (99.5)	1,126 (99.6)	386 (98.2)	
No Result	4 (0.1)	3 (0.2)	1 (0.1)	0 (0.0)	
Composite STI: Positive for one of any of the four above STIs tested					<.0001
Positive	601 (19.7)	165 (10.8)	305 (27.0)	131 (33.3)	
Negative	2,446 (80.3)	1,358 (89.2)	826 (73.0)	262 (66.7)	

[a] *Percentages may not total to 100 due to rounding.*

Table 2.5: Adjusted estimates of the likelihood of a positive test for a sexually transmitted infection by age cohort [a]

	TOTAL N=3,047 AOR (95% CI) [b]	18-30 years N=1,523 AOR (95% CI) [b]	31-44 years N=1,131 AOR (95% CI) [b]	45-70 years N=393 AOR (95% CI) [b]
Age				
18-30 years	**0.29 (0.20-0.40)**	[c]	[c]	[c]
31-44 years	**0.74 (0.55-0.98)**			
45-70 years	Referent			
Country of Residence				
Brazil	**3.00 (2.14-4.20)**	**7.47 (3.91-14.30)**	**1.75 (1.03-2.95)**	**2.25 (1.03-4.89)**
Mexico	0.55 (0.27-1.14)	0.71 (0.21-2.41)	0.36 (0.13-1.03)	1.09 (0.14-8.31)
United States	Referent	Referent	Referent	Referent
Race				
White	Referent	Referent	Referent	Referent
Black	**1.50 (1.15-1.96)**	1.07 (0.67-1.72)	**1.64 (1.10-2.42)**	1.48 (0.76-2.87)
Asian/Pacific Islander	0.81 (0.38-1.74)	0.47 (0.13-1.67)	1.67 (0.51-5.43)	[d]
American Indian/ Alaskan	0.80 (0.43-1.48)	0.63 (0.21-1.87)	1.20 (0.53-2.72)	0.23 (0.04-1.40)
Mixed	1.30 (0.67-2.50)	1.67 (0.55-5.09)	1.24 (0.49-3.10)	0.65 (0.10-4.33)
Marital Status				
Single	0.93 (0.69-1.25)	1.00 (0.58-1.73)	0.96 (0.63-1.47)	1.73 (0.74-4.08)
Married	Referent	Referent	Referent	Referent
Cohabitating	1.06 (0.77-1.46)	1.15 (0.61-2.19)	0.93 (0.61-1.43)	1.34 (0.59-3.07)
Divorced/ Separated/ Widowed	**1.46 (1.04-2.06)**	1.68 (0.61-4.62)	**1.91 (1.21-3.02)**	0.83 (0.43-1.62)
Educational Level				
<12 years	**1.62 (1.01-2.59)**	0.53 (0.20-1.38)	**3.04 (1.53-6.06)**	1.03 (0.39-2.72)
12 years	1.25 (0.79-1.96)	0.44 (0.18-1.07)	1.85 (0.95-3.59)	1.33 (0.50-3.55)
13-15 years	1.25 (0.79-1.99)	0.41 (0.17-1.02)	**2.85 (1.43-5.68)**	1.07 (0.42-2.70)
16 years	1.15 (0.72-1.82)	**0.37 (0.15-0.92)**	1.82 (0.92-3.62)	0.88 (0.34-2.25)
≥17 years	Referent	Referent	Referent	Referent
Age at first vaginal sex				
≤14 years	**2.15 (1.43-3.23)**	1.24 (0.55-2.79)	**2.37 (1.34-4.18)**	**3.75 (1.45-9.74)**
15-17 years	1.11 (0.76-1.62)	0.67 (0.31-1.44)	1.28 (0.76-2.14)	1.42 (0.60-3.37)
18-20 years	1.28 (0.87-1.89)	0.81 (0.37-1.79)	**1.80 (1.05-3.07)**	1.08 (0.44-2.68)
≥21 years	Referent	Referent	Referent	Referent
Ever exchanged sex for money or drugs				
Yes	**1.35 (1.01-1.80)**	1.01 (0.59-1.72)	1.18 (0.78-1.78)	**2.30 (1.05-5.04)**
No	Referent	Referent	Referent	Referent

Table 2.5 (Continued)

Number of Lifetime Female Sexual Partners				
1	Referent	Referent	Referent	Referent
2-9	1.04 (0.75-1.46)	1.19 (0.67-2.11)	1.13 (0.68-1.90)	0.65 (0.29-1.49)
10-19	1.02 (0.70-1.49)	0.77 (0.37-1.60)	1.14 (0.65-2.00)	0.80 (0.33-1.90)
20-49	**1.48 (1.02-2.16)**	**2.06 (1.04-4.06)**	1.48 (0.83-2.63)	0.47 (0.20-1.13)
≥50	**2.07 (1.31-3.28)**	**4.33 (1.74-10.76)**	1.34 (0.68-2.65)	1.04 (0.38-2.84)

[a] *Outcome is composite STI variable: testing positive for at least one of the following STIs – genital herpes, chlamydia, gonorrhea, and/or syphilis.*
Model is adjusted for the following variables: country of residence, race, ethnicity/Hispanic, marital status, educational level, circumcision status, age at first vaginal sex, previous oral sex and anal sex activity, condom use, and number of lifetime female sexual partners. Ethnicity/Hispanic, circumcision status, previous oral and anal sex activity, and condom use are not included in the table due to lack of significant findings.
[b] *AOR=Adjusted Odds Ratio, 95% CI=95% Confidence Intervals; Significant values in bold font.*
[c] *Not applicable.*
[d] *Insufficient cell size.*

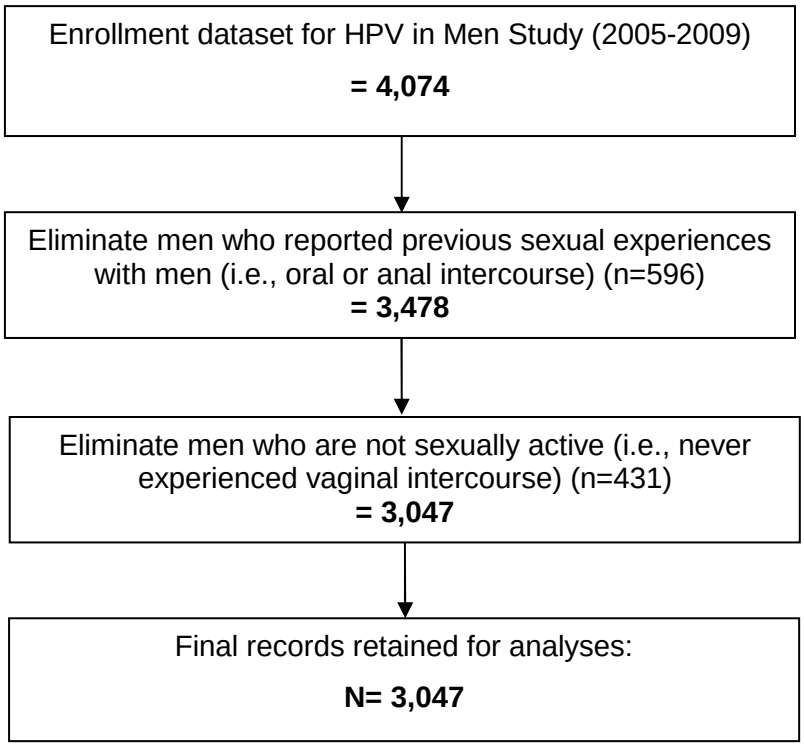

Figure 2.1: Flow chart of exclusion process for the study

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Section Three:

Manuscript Two

The impact of testing and diagnosis for the human papillomavirus and other sexually transmitted infections on sexual behavior in a cross-national sample of men

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Introduction

Despite scientific and medical advances to minimize their reach and impact, sexually transmitted infections (STIs) continue to threaten the health and well-being of individuals and communities (Gerbase, Rowley, Heymann, Berkley & Piot, 1998; World Health Organization, Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). STIs are caused by diverse bacterial organisms and viral agents that can result in no symptoms, mild, transient symptoms, or severe, long-term sequelae, such as infertility, premature mortality, and cervical, anal, and penile cancers (De Schryver & Meheus, 1990; Genuis & Genuis, 2004; Gerbase et al., 1998; Mayaud & Mabey, 2004; Mayaud & McCormick, 2001; World Health Organization, Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). It is estimated that more than 340 million new cases of bacterial STIs (e.g., chlamydia, gonorrhea, syphilis) occur annually worldwide (Gerbase et al., 1998;

World Health Organization, Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). As the most common STI, HPV will affect more than half of all sexually active individuals at some point in their lifetime (Centers for Disease Control and Prevention, 2010; Genuis & Genuis, 2004; Vetter & Geller, 2007).

Unfortunately, with the advent of HIV/AIDS more than 25 years ago, other STIs have increasingly been neglected (World Health Organization, 2007). While reducing HIV infection is highly ranked on the international policy agenda and is noted as one of the Millennium Development Goals, the prevention of other STIs are not prioritized (Low et al., 2006; United Nations, 2000). Instead, measures to reduce other STIs have been generally taken as a means to reduce HIV infections, as they have been found to facilitate HIV transmission (Low et al., 2006; Mayaud & McCormick, 2001; Wasserheit, 1992; World Health Organization, Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). Given the potential adverse outcomes and impact on quality of life, STIs are an important public health concern, regardless of their association with HIV (Glasier, Gulmezoglu, Schmid, Moreno & Van Look, 2006; Low et al., 2006).

Overall, diagnosis and treatment have been prioritized as an important strategy for the prevention and treatment of STIs (World Health Organization, 2007). It is widely believed that learning one's STI status contributes to safer sexual behavior (Thornton, 2008; World Health Organization, Joint United Nations Programme on HIV/AIDS; UNICEF, 2009). Additionally, the identification

of those who are infected is an essential first step for treatment (World Health Organization, Joint United Nations Programme on HIV/AIDS; UNICEF, 2009). Therefore, knowledge of one's disease status constitutes an important public health strategy because it allows for fundamental actions that can prevent the spread of infection and provide infected individuals with necessary services (World Health Organization, Joint United Nations Programme on HIV/AIDS; UNICEF, 2009). However, previous empirical research has provided mixed evidence regarding the role of HIV testing on sexual behaviors (Denison, O'Reilly, Schmid, Kennedy & Sweat, 2008; Marks, Crepaz, Senterfitt & Janssen, 2005; Sherr et al., 2007; Weinhardt, Carey, Johnson & Bickham, 1999; Wolitski, MacGowan, Higgins & Jorgensen, 1997).

Given the lack of information on the impact of STI testing and diagnosis on subsequent sexual behavior, as well as the ongoing policy recommendations regarding knowledge of one's status for enhanced prevention and treatment, we analyzed the impact of testing and learning one's HPV and STI status on subsequent sexual behavior within a cross-national sample of sexually active, adult men in Brazil, Mexico, and the United States. There is a dearth of studies that examine the impact of STI testing among men, as research on testing services has historically been conducted with high-risk populations (e.g., men who have sex with men, injection drug users) or special populations (e.g., pregnant women) (Denison et al., 2008; Marks et al., 2005; Wolitski et al., 1997). The present study addresses this gap with the utilization of data collected from a general population of men to describe the consequences of STI testing on sexual

behavior. In this study, we sought to assess whether men's sexual behaviors change following HPV and STI testing and whether men's sexual behaviors change upon notification of HPV and/or STI diagnosis.

Methods

Study Design and Sample. This is a prospective cohort analysis utilizing data from a cross-national, HPV, natural history study in men. The parent study – the *HPV in Men (HIM) Study* – explores factors associated with HPV prevalence and incidence among men in Sao Paulo, Brazil, Cuernavaca, Mexico, and Tampa, Florida in the United States (US) (Giuliano et al., 2008; Giuliano et al., 2011). A complete description of the protocols and procedures for the *HIM Study* has previously been published (Giuliano et al., 2008; Giuliano et al., 2011).

Diverse recruitment strategies were utilized to identify eligible men for study participation from the general population. In Brazil, study recruitment was facilitated through media advertising and a center for urogenital care in Sao Paulo, while in Mexico, participants were recruited through the public health system, local factories, and military personnel in Cuernavaca. In the US, recruitment efforts involved print and radio advertising within a local university, as well as in the greater metropolitan area of Tampa, Florida. Prior to enrollment in the study, all participants provided written informed consent.

The study sample was drawn from men who were enrolled in the *HIM Study* from June 2005 to December 2009 (N=4,072). The *HIM Study* protocol includes a pre-enrollment visit, a baseline/enrollment visit, and nine additional

visits following enrollment, scheduled every six months. To encourage compliance with follow-up, men received compensation for their participation. For the present analysis, we included men who participated in the baseline assessment (Visit 1) and remained in the study for two follow-up visits (Visits 2 and 3), each of which was conducted at six-month intervals (Figure 3.1). At each study visit, men completed a risk factor questionnaire via Computer-Assisted Self-Interviewing (CASI) and were tested for HPV and other STIs, including chlamydia, gonorrhea, syphilis, and genital herpes. HPV and STI test results from the baseline visit (Visit 1) were used in this analysis. Men were informed of their HPV and STI diagnoses at the first follow-up visit (Visit 2). Self-reported data on men's sexual behavior were collected at the ensuing follow-up visit (Visit 3).

For the parent study, the study population consisted of men who met the following inclusion criteria (N=4,072): a) aged 18 to 70 years; b) residents of one of the three study sites; c) no reports of prior diagnosis with penile or anal cancers; d) no report of symptoms of or treatment for an STI; e) not currently participating in an HPV vaccine study; f) no history of HIV/AIDS; g) no history of imprisonment, homelessness, or drug treatment during the past six months; and h) willingness to comply with ten scheduled study visits conducted every six months over a four year period with no plans to relocate during study implementation. For this study, the sample was restricted to men who were sexually active, excluding any men who reported no prior experience with vaginal, anal, or oral intercourse (n=453). We further eliminated men who did not

return for their HPV and STI test results at first follow-up visit (Visit 2; n=570) and those who did not remain in the study subsequent to the receipt of their test results (Visit 3; n=701). The overall study sample totaled 2,351 men. The elimination process that resulted in our study sample is depicted in Figure 3.2.

Risk Factor Questionnaire. The risk factor questionnaire is administered at baseline/enrollment (Visit 1) and at all follow-up visits. This instrument consists of socio-demographic characteristics, alcohol and tobacco use, sun exposure, history of STIs, circumcision status, sexual history, and contraceptive practices. While the original survey instrument was developed in English, it was later translated into the primary language of each of the survey sites (i.e., Portuguese in Sao Paulo, Brazil; Spanish in Cuernavaca, Mexico) and back-translated into English to ensure accuracy and cross-cultural understanding. A test-retest reliability assessment of the instrument was conducted in all three languages and yielded high reliability coefficients for all variables (intraclass correlation coefficient (ICC) ≥ 0.85) (Nyitray et al., 2009). The questionnaire required approximately 20 minutes to complete via CASI. For each survey item, participants were given the option to refuse to answer, which were treated as missing observations.

Testing for HPV and STIs. Upon study enrollment (Visit 1), men who provided consent underwent a clinical examination. Additionally, participants were tested for HPV and other STIs, including chlamydia, gonorrhea, syphilis, and herpes simplex virus 2 (HSV2; also known as genital herpes). Biological samples were collected from all of the participants from the external genitalia,

including the coronal sulcus, the gland penis, and shaft of the penis, for HPV testing. Prior to DNA extraction, the three samples were combined to produce one DNA extract per participant to maximize HPV detection. HPV testing was conducted using polymerase chain reaction (PCR) and the Linear Array HPV genotyping test. Urine specimens (20-30 mLs) were collected in collection cups free of any preservatives for testing to detect gonorrhea and chlamydia RNA, TMA. A 2 mL urine specimen was transferred into the GenProbe specimen transport tube within 24 hours of collection before being assayed. Sera were tested for syphilis infection by Rapid Plasma Reagin (RPR). Positive results were confirmed with the more specific FTA-ABS, which confirms the presence of treponemal antibodies but does not indicate the stage or presence of active infection. Sera were also tested for HSV2 by Immunoassay with the IgG Type Specific Antibody (HerpeSelect) test. Participants with positive test results were offered treatment at no cost.

Variables. HPV and STI diagnoses were categorized in the following mutually exclusive groups: positive for HPV and other STIs; positive for HPV only; positive for other STIs only; or negative for both HPV and other STIs. Due to the high prevalence of HPV compared to other STIs (Centers for Disease Control and Prevention, 2010; Genuis & Genuis, 2004; Vetter & Geller, 2007), HPV diagnosis was not grouped with the other STIs examined in this study (i.e., chlamydia, gonorrhea, syphilis, herpes). Multiple sexual behaviors served as the outcomes of interest in this study, including vaginal or oral sex, exchanging sex for money or drugs (i.e., paid sex), condom use with vaginal sex, and number of

new sexual partners in the past six months.

Covariates included in the analysis were based on biologic plausibility and a review of the literature. Demographic variables included in the analysis were: age (18-30 years, 31-44 years, 45-70 years); country of residence (Brazil, Mexico, US); self-identified race (White, Black, Asian/Pacific Islander, American Indian, Mixed); Hispanic (Yes, No); marital status (single, married, cohabitating, divorced/separated/widowed); educational level (<12 years, 12 years, 13 to 15 years, 16 years, ≥17 years); sexual orientation (heterosexual, homosexual, bisexual); self-reported circumcision status (Yes, No); and current smoking status (Yes, No). Additionally, behavioral factors included age at first vaginal sexual encounter (≤14 years, 15-17 years, 18-20 years, ≥21 years) and number of lifetime sexual partners (1, 2-9, 10-19, 20-40, ≥50).

Statistical Analysis. Baseline descriptive statistics (e.g., frequencies and measures of central tendency and variability) for demographic and behavioral characteristics were computed by HPV and STI status using the chi-square test to summarize sample characteristics, to explore relationships among variables, and to guide development of the repeated measures models. Preliminary analyses were conducted with McNemar's test to assess differences in self-reported sexual behaviors by visit (i.e., baseline/Visit 1, Visit 2, and Visit 3) within correlated data. These analyses were conducted within the overall study sample and were further stratified by HPV and STI status. Effect sizes were also assessed for dichotomous outcomes. SAS (version 9.2) was used for data management and for all data manipulations. All tests of hypotheses were two-

tailed with a type 1 error rate of 5%.

Proc GLIMMIX in SAS (SAS Institute, Inc., Cary, North Carolina, version 9.2) was used to analyze longitudinal trends in sexual behavior. Regression models were developed for each of the sexual behavior outcomes and condom use variables. To assess differential trends in behavior over follow-up time, interactions between covariates and follow-up time were evaluated. Furthermore, interaction terms were added to the models to determine whether the effects by visit were moderated by HPV and STI diagnosis (i.e., time by group). Prior to implementation, this investigation was approved by the Institutional Review Board of the University of South Florida.

Results

A comparison of selected demographic and behavioral characteristics at baseline (Visit 1) by HPV and STI status within the study sample is presented in Table 3.1. The study sample consisted of 2,351 men, aged 18 to 70 years, with a mean age of 32.8 years (standard deviation [SD] ±11.5; median=31.0 years). Of the men in the study sample, nearly half (46.3%) were diagnosed with only HPV, while 16.8% were diagnosed with HPV and other STIs (i.e., chlamydia, gonorrhea, syphilis, or herpes), and 6.1% were positive for at least one of the other tested STIs (excluding HPV). The highest exposure category across all observed covariates was positivity for HPV only. In this cross national sample, Mexicans had the lowest frequency of infection, with 65% testing positive for HPV and/or STIs, compared to Brazilians, who had the highest disease

prevalence at 81.1%. The highest proportions of combined HPV and/or STI positivity were observed among American Indian/Alaskan men (86%), followed by Black men (78.1%). When observing prevalence by marital status, the highest combined proportion of HPV and/or STIs were observed among men who were divorced, separated, or widowed (84.7%), whereas the lowest were seen among single men (65.2%), followed closely by married men (68.9%). The highest rates of HPV and/or STIs were observed among bisexual (85.1%) and homosexual (79.8%) men. Within our study sample, the proportions of HPV and STI diagnosis, as well as diagnosis with STIs only, increased with increasing number of lifetime sexual partners.

HPV and STI prevalence at baseline (Visit 1) by self-reported sexual behaviors is presented in Table 3.2. Within this sexually active sample, oral and paid sexual encounters in the past six months were associated with significantly higher rates of diagnosis with HPV and STIs (17.0% and 25.6%, respectively). Men who reported vaginal and oral sex in the past six months had higher frequencies of HPV only (46.6% and 47.7%, respectively), whereas men who reported paid sex in the past six months had higher frequencies of STIs only (8.5%). Men who reported never using condoms for vaginal sex had higher rates for HPV only (53.2%). The highest frequency of HPV and STIs (29.2%) was observed among men who reported three or more new sexual partners in the past six months.

Changes in self-reported sexual behaviors following STI testing and the receipt of test results are summarized in Table 3.3. In the overall study sample,

statistically significant decreases were only observed in vaginal sex throughout the study period (baseline/Visit 1 to Visit 2, p<.0001; Visit 2 to Visit 3, p=0.0257). For all other sexual behaviors, significant changes were only noted from baseline to the first /Visit 1 to Visit 2, prior to receipt of HPV and STI test results (p<.0001). Reduced levels of oral sex and paid sex were reported, along with fewer numbers of new sexual partners in the prior six-month period. Similar behavioral patterns were observed among men with positive diagnoses for HPV and/or other STIs. However, among men who were negative for both HPV and other STIs, reductions in vaginal sex did not persist beyond the receipt of their HPV and STI test results (i.e., from Visit 2 to Visit 3). Additionally, paid sexual encounters among these men decreased immediately after being tested for HPV and STIs (i.e., from baseline/Visit 1 to Visit 2); however, this behavior increased following the receipt of their negative test results. No significant changes were detected in numbers of new sexual partners among men without HPV/STI diagnoses.

Adjusted odds ratios and 95% confidence intervals for sexual behaviors among study participants are presented in Table 3.4. Significant changes were observed in reported vaginal, oral, and paid sexual encounters from baseline/Visit 1 to Visit 2, following testing for HPV and other STIs. Our findings indicate that, during the six months following testing, the odds of vaginal sex decreased by 66% (AOR=0.34, 95% CI=0.27-0.41), while those of oral sex decreased by 41% (AOR=0.59, 95% CI=0.48-0.72). Paid sexual encounters showed the largest likelihood of reduction following testing, with a decrease in

odds of 75% (AOR=0.25, 95% CI=0.20-0.32). Additionally, the likelihood of having no new sexual partners during the preceding six-month period decreased by 28% following testing (AOR=0.72, 95% CI=0.61-0.84). No changes in sexual behaviors were observed following notification of HPV/STI status (between Visits 2 and 3). While there were no changes in condom use based on testing, men whose results indicated they were positive for HPV (and not other STIs) had a 39% reduced likelihood of using condoms with vaginal sex (AOR=0.61, 95% CI=0.40-0.92) over the study period. Furthermore, men who tested positive for HPV and other STIs or HPV only were 49-50% less likely to report no new sexual partners in the most recent six-month period (Positive for HPV and other STIs: AOR=0.51, 95% CI=0.31-0.83; Positive for HPV only: AOR=0.50, 95% CI=0.34-0.72). No significant interactions between visit and HPV/STI diagnoses were observed for any of the outcome variables.

Discussion

Our study found a significant change in men's sexual behaviors in the six-month period following testing for HPV and other STIs, regardless of their diagnoses. Being informed of one's test results did not lead to further behavioral change. Significant reductions in vaginal and oral sex, as well as paid sexual encounters, were reported among men in the study sample following HPV and STI testing. While the impact of STI testing on sexual behaviors is relatively unstudied, similar research on HIV testing has found subsequent decreases in paid sex (Bentley et al., 1998) and vaginal sex (Hernando et al., 2009). It is

possible that the reduction in sexual behaviors revealed in our study might be the product of the "Hawthorne Effect," indicating that changes within the study sample are the result of the process of participating in a study and being observed (Gall, Gall & Borg, 2007; Neuman, 1997). Alternatively, the act of being tested for HPV and other STIs may be the motivator for behavioral change among study participants.

Interestingly, men who tested positive for HPV only (and not other STIs) had a significantly reduced likelihood of using condoms with vaginal sex. This increase in sexual risk behavior, despite HPV diagnosis, may be attributable to a lack of knowledge regarding HPV among men, as previous research has indicated that HPV knowledge among men is relatively low (Brewer, Ng, McRee & Reiter, 2010; Bynum, Brandt, Friedman, Annang & Tanner, 2011; Gerend & Barley, 2009; Nandwani, 2010; Tider, Parsons, & Bimbi, 2005). However, recent analyses with the US sub-population of this study have revealed that men are knowledgeable about HPV (Daley, 2009). Therefore, this supposition may only be applicable to Brazilian and Mexican men. Furthermore, in the present study, this conclusion is speculative, as we did not have information on the participants' HPV knowledge for analysis.

It is important to note that the testing scenario presented within this study may not reflect real-world circumstances for men. The ability to be tested for STIs is critically dependent on the availability and access to health services. Within this cross-national study, men were provided with testing services at no cost. However, structural barriers, such as lack of health care coverage or

transportation to the health care facility, may serve as a barrier to receiving such services (Parrish & Kent, 2008; Politzer et al., 2001; Weissman, Stern, Fielding & Epstein, 1991). As some STIs are asymptomatic for men, if men do not present with visible signs or symptoms, they may not elect to obtain STI testing. Furthermore, a simple, ubiquitous means for testing for the presence of HPV is not currently available for men (Centers for Disease Control and Prevention, 2012; McGinley, Hey, Sussman & Brown, 2011).

There are some potential limitations in this study. Since this study used data from an existing dataset, the variables considered were restricted to those readily available. The enrollment procedure in this cross-national study was not uniform across the three research sites (i.e., Brazil, Mexico, and the US), which may have influenced the external validity of our study. Furthermore, the variance in socio-cultural norms and beliefs regarding sexual behavior, STIs, and testing may have also affected the study outcomes. Although we did not have community level data regarding sex and sexuality, significant differences were observed by country (i.e., Brazil, Mexico, and the US), indicating that there may be cultural factors at play. Taking into consideration these various issues, the generalizability of our study is minimized.

The men included in this analysis were those who participated in all study visits (i.e., Visits 1, 2, and 3). Men who initially enrolled the study may be inherently different than those who did not, as previous research has indicated that volunteers for sexual behavior research may be more sexually informed and experienced to some extent (Catania, McDermott & Pollack, 1986; Gaither,

Sellbom & Meier, 2003; Strassberg & Lowe, 1995). Additionally, those lost to follow-up may have different perceptions of risk and beliefs about STIs from those who stayed in the study for its duration. The pattern of attrition in our study population suggests that the data are not missing at random (Tables D1, D2, and D3) and, consequently, could not be modeled in our analysis (Allison, 2002; Little & Rubin, 2002).

Due to the highly sensitive nature of the outcomes of interest in this study (i.e., sexual behaviors), there is a possibility of social desirability bias in participant responses, as behavioral variables were all self-reported. However, Computer-Assisted Self-Interviewing (CASI), which was used in this study for the risk factor questionnaire, has been demonstrated as an effective option in sexual behavior research for the presentation of questions in a less threatening manner, which reduces non-responses to items and the likelihood of biased information being reported, improving the overall validity of study findings (Fenton, Johnson, McManus & Erens, 2001; Ghanem, Hutton, Zenilman, Zimba & Erbelding, 2005; Kissinger et al., 1999; Kurth et al., 2004). Given the nature of these variables, estimation of their validity is not possible; however, reliability assessments serve as a measure of consistency and stability of the variables (Saltzman, Stoddard, McCusker, Moon & Mayer, 1987). A prior test-retest reliability assessment of the risk factor questionnaire utilized in this study yielded strong results (Nyitray et al., 2009) , which indicates that recall bias should be minimal. Furthermore, previous research has indicated that sexual behavior reported at time intervals of six

months or less can improve subject recall (Catania, Gibson, Marin, Coates & Greenblatt, 1990).

In spite of these limitations, this study provides some noteworthy insights and information regarding the potential implications of STI testing and sexual behavior among men that may prove beneficial for intervention development. Our study used a large cross-national sample of a general population of men, which enhances the strength of our results. Since few studies have explored factors associated with STI testing of men, our findings provide important information on an understudied group. While we cannot eliminate the possibility of residual confounding in our analysis attributable to unmeasured variables, we controlled for several potential confounders. Male involvement, male motivation, and services for men have been recommended as an innovative approach to STI prevention (World Health Organization, 2007). Therefore, this data should prove useful for the development and planning of programs to prevent the spread of STIs and provide more opportunities for treatment and education among men.

While our findings suggest that there are short-term effects on sexual behavior following STI testing, further research into individual level factors, such as knowledge and attitudes regarding STIs and sexual behavior, as well as psychosocial and sociocultural constructs (e.g., gender norms, stigma), is warranted. Prior research has indicated that testing positive for HPV, the most common STI, can result in adverse psychosocial outcomes, including anxiety and distress and concern about their sexual relationships (Daley et al., 2010; Kahn et al., 2005; McCaffery et al., 2004; McCaffery, Waller, Nazroo & Wardle, 2006;

Waller, McCaffery, Forrest & Wardle, 2004). Additionally, perceptions of risk and stigma regarding HPV testing have been assessed (Daley et al., 2010; Kahn et al., 2005; McCaffery et al., 2006; Waller et al., 2004). However, these studies have predominantly been conducted with women; the influence of these issues on HPV and STI testing within a general male population (i.e., not specifically men who have sex with men or injection drug users) is virtually unexplored. Future studies should also examine partner-level correlates, which were not included in this analysis and may have implications on sexual behavior and health outcomes. Disclosure of one's disease status is an important aspect of STI prevention, potentially reducing the likelihood of transmission through treatment and protective behaviors (e.g., condom use) (McKay & Mutchler, 2010; Mutchler et al., 2008; Wong et al., 2009).

Overall, our study highlights the potential for STI testing to reduce sexual risk taking among men. However, given the noted limitations within this study, the development and implementation of STI testing initiatives should be approached with caution. The short-term effects on behavioral changes in our study sample underscores the need for further investigation to maximize the effectiveness of STI testing programs for men. Furthermore, coupling testing strategies with education on STIs and risk reduction approaches may improve long-term health outcomes.

Table 3.1: Baseline demographic and behavioral characteristics among study participants by HPV and STI test results [a, b]

Characteristics	TOTAL N=2,351 n (%)	Positive for HPV & STIs n=395 (16.8%) n (%)	Positive for HPV only n=1,088 (46.3%) n (%)	Positive for STIs only n=143 (6.1%) n (%)	Negative for HPV & STIs n=725 (30.8%) n (%)	P-value [c]
Country of Residence						**<.0001**
Brazil	943 (40.1)	262 (27.8)	416 (44.1)	87 (9.2)	178 (18.9)	
Mexico	560 (23.8)	58 (10.4)	288 (51.4)	18 (3.2)	196 (35.0)	
United States	848 (36.1)	75 (8.8)	384 (45.3	38 (4.5)	351 (41.4)	
Age						**<.0001**
18-30 years	1,142 (48.6)	113 (9.9)	563 (49.3)	35 (3.1)	431 (37.7)	
31-44 years	880 (37.4)	211 (24.0)	392 (44.6)	65 (7.4)	212 (24.1)	
45-70 years	329 (14.0)	71 (21.6)	133 (40.4)	43 (13.1)	82 (24.9)	
Race						**<.0001**
White	1,218 (52.4)	216 (17.7)	555 (45.6)	77 (6.3)	370 (30.4)	
Black	392 (16.9)	92 (23.5)	175 (44.6)	39 (10.0)	86 (21.9)	
Asian/Pacific Islander	58 (2.5)	8 (13.8)	18 (31.0)	0 (0.0)	32 (55.2)	
American Indian/Alaskan	50 (2.2)	13 (26.0)	24 (48.0)	6 (12.0)	7 (14.0)	
Mixed	608 (26.1)	61 (10.0)	303 (49.8)	20 (3.3)	224 (36.8)	
Hispanic						**0.0002**
Yes	908 (38.8)	134 (14.8)	440 (48.5)	35 (3.9)	299 (32.9)	
No	1,430 (61.2)	259 (18.1)	643 (45.0)	107 (7.5)	421 (29.4)	
Marital Status						**<.0001**
Single	1,125 (47.9)	158 (14.0)	520 (46.2)	55 (4.9)	392 (34.8)	
Married	732 (31.2)	125 (17.1)	327 (44.7)	52 (7.1)	228 (31.2)	
Cohabitating	270 (11.5)	50 (18.5)	133 (49.3)	17 (6.3)	70 (25.9)	
Divorced/Separated/Widowed	223 (9.5)	62 (27.8)	108 (48.4)	19 (8.5)	34 (15.3)	
Educational Level						**<.0001**
<12 years	383 (16.3)	80 (20.9)	172 (44.9)	27 (7.1)	104 (27.2)	
12 years	627 (26.7)	129 (20.6)	277 (44.2)	45 (7.2)	176 (28.1)	
13-15 years	683 (29.1)	84 (12.3)	303 (44.4)	31 (4.5)	265 (38.8)	
16 years	491 (20.9)	79 (16.1)	246 (50.1)	30 (6.1)	136 (27.7)	
≥17 years	166 (7.1)	23 (13.9)	89 (53.6)	10 (6.0)	44 (26.5)	

Table 3.1 (Continued)

Sexual Orientation						**<.0001**
Heterosexual	2,068 (88.0)	306 (14.8)	974 (47.1)	111 (5.4)	677 (32.7)	
Homosexual	109 (4.6)	35 (32.1)	41 (37.6)	11 (10.1)	22 (20.2)	
Bisexual	174 (7.4)	54 (31.0)	73 (42.0)	21 (12.1)	26 (14.9)	
Circumcision Status						**<.0001**
Yes	925 (39.3)	105 (11.4)	438 (47.4)	43 (4.7)	339 (36.7)	
No	1,426 (60.7)	290 (20.3)	650 (45.6)	100 (7.0)	386 (27.1)	
Smoking Status						**0.0001**
Yes	483 (20.5)	87 (18.0)	259 (53.6)	27 (5.6)	110 (22.8)	
No	1,868 (79.5)	308 (16.5)	829 (44.4)	116 (6.2)	615 (32.9)	
Number of Lifetime Sexual Partners						**<.0001**
1	184 (8.0)	6 (3.3)	48 (26.1)	6 (3.3)	124 (67.4)	
2-9	971 (42.0)	105 (10.8)	413 (42.5)	47 (4.8)	406 (41.8)	
10-19	484 (21.0)	95 (19.6)	260 (53.7)	32 (6.6)	97 (20.4)	
20-49	472 (20.4)	105 (22.3)	269 (57.0)	30 (6.4)	68 (14.4)	
≥50	199 (8.6)	71 (35.7)	76 (38.2)	26 (13.1)	26 (13.1)	

Abbreviations: HPV=Human Papillomavirus; STI=Sexually Transmitted Infections

[a] *Percentages may not total to 100 due to rounding. Totals exclude unknown/refused values.*

[b] *STIs include chlamydia, gonorrhea, herpes, and syphilis.*

[c] *Significant values in bold font. P-values <0.05 considered significant.*

Table 3.2: Self-reported sexual behaviors among study participants at baseline by HPV and STI test results [a, b]

Behaviors	TOTAL N=2,351 n (%)	Positive for HPV & STIs n=395 (16.8%) n (%)	Positive for HPV only n=1,088 (46.3%) n (%)	Positive for STIs only n=143 (6.1%) n (%)	Negative for HPV & STIs n=725 (30.8%) n (%)	P-value [c]
Vaginal sex in past 6 months						**0.0440**
Yes	2,272 (96.6)	373 (16.4)	1,059 (46.6)	137 (6.0)	703 (30.9)	
No	79 (3.4)	22 (27.9)	29 (36.7)	6 (7.6)	22 (27.9)	
Oral sex in past 6 months						**<.0001**
Yes	2,068 (88.0)	352 (17.0)	986 (47.7)	116 (5.6)	614 (29.7)	
No	283 (12.0)	43 (15.2)	102 (36.0)	27 (9.5)	111 (39.2)	
Paid for sex in past 6 months						**<.0001**
Yes	414 (17.6)	106 (25.6)	189 (45.7)	35 (8.5)	84 (20.3)	
No	1,934 (82.4)	289 (14.9)	899 (46.5)	106 (5.5)	640 (33.1)	
Condom use for vaginal sex in recent past						**0.0015**
No vaginal sex	79 (3.8)	22 (27.9)	29 (36.7)	6 (7.6)	22 (27.9)	
Always	245 (11.6)	32 (13.1)	107 (43.7)	11 (4.5)	95 (38.8)	
Sometimes	1,628 (77.2)	266 (16.3)	780 (47.9)	97 (6.0)	485 (29.8)	
Never	156 (7.4)	34 (21.8)	83 (53.2)	6 (3.9)	33 (21.2)	
Number of new sexual partners in past 6 months						**<.0001**
0	1,437 (63.6)	221 (15.4)	630 (43.8)	101 (7.0)	485 (33.8)	
1	540 (23.9)	76 (14.1)	269 (49.8)	21 (3.9)	174 (32.2)	
2	137 (6.1)	25 (18.3)	80 (58.4)	3 (2.2)	29 (21.2)	
3+	144 (6.4)	42 (29.2)	72 (50.0)	7 (4.9)	23 (16.0)	

Abbreviations: HPV=Human Papillomavirus; STI=Sexually Transmitted Infections

[a] *Percentages may not total to 100 due to rounding. Totals exclude unknown/refused values.*

[b] *STIs include chlamydia, gonorrhea, herpes, and syphilis.*

[c] *Significant values in bold font. P-values <0.05 considered significant.*

Table 3.3: Change in self-reported sexual behaviors following HPV/STI testing and receipt of test results [a, b]

OVERALL STUDY POPULATION						
Behaviors	Response Categories	**STUDY VISITS** **Visit 1** n (%)	**Visit 2** n (%)	**Visit 3** n (%)	**Change from Visit 1 to Visit 2** [c] McNemar p-value	**Change from Visit 2 to Visit 3** [c] McNemar p-value
Vaginal sex in past 6 months	Yes	2,241 (96.6)	1,918 (82.7)	1,881 (81.1)	**<.0001**	**0.0257**
	No	79 (3.4)	402 (17.3)	439 (18.9)		
Oral sex in past 6 months	Yes	1,754 (88.9)	1,615 (81.8)	1,625 (82.3)	**<.0001**	0.5221
	No	220 (11.1)	359 (18.2)	349 (17.7)		
Paid for sex in past 6 months	Yes	359 (18.8)	96 (5.0)	98 (5.1)	**<.0001**	0.8312
	No	1,556 (81.3)	1,819 (95.0)	1,817 (94.9)		
Condom use for vaginal sex in recent past	No vaginal sex	65 (3.2)	249 (12.2)	277 (13.6)	**<.0001**	0.1196
	Always	233 (11.4)	202 (9.9)	166 (8.1)		
	Sometimes	1,592 (78.0)	1,445 (70.8)	1,465 (71.8)		
	Never	151 (7.4)	145 (7.1)	133 (6.5)		
Number of new sexual partners in past 6 months	0	1,097 (62.9)	1,005 (57.6)	1,006 (57.7)	**<.0001**	0.9930
	1	416 (23.8)	440 (25.2)	432 (24.8)		
	2	113 (6.5)	170 (9.7)	178 (10.2)		
	3+	119 (6.8)	130 (7.5)	129 (7.4)		
POSITIVE FOR HPV AND/OR OTHER STIs						
Behaviors	Response Categories	**STUDY VISITS** **Visit 1** n (%)	**Visit 2** n (%)	**Visit 3** n (%)	**Change from Visit 1 to Visit 2** [c] McNemar p-value	**Change from Visit 2 to Visit 3** [c] McNemar p-value
Vaginal sex in past 6 months	Yes	1,547 (96.5)	1,327 (82.7)	1,294 (80.7)	**<.0001**	**0.0187**
	No	57 (3.6)	277 (17.3)	310 (19.3)		
Oral sex in past 6 months	Yes	1,235 (90.2)	1,129 (82.4)	1,140 (83.2)	**<.0001**	0.3830
	No	135 (9.9)	241 (17.6)	230 (16.8)		
Paid for sex in past 6 months	Yes	288 (21.6)	82 (6.2)	74 (5.6)	**<.0001**	0.3458
	No	1,043 (78.4)	1,249 (93.8)	1,257 (94.4)		

Table 3.3 (Continued)

Condom use for vaginal sex in recent past	No vaginal sex Always Sometimes Never	47 (3.3) 144 (10.1) 1,119 (78.4) 118 (8.3)	173 (12.1) 144 (10.1) 1,003 (70.2) 108 (7.6)	201 (14.1) 114 (8.0) 1,012 (70.9) 101 (7.1)	**<.0001**	0.0573
Number of new sexual partners in past 6 months	0 1 2 3+	725 (60.9) 277 (23.3) 87 (7.3) 101 (8.5)	640 (53.8) 321 (27.0) 126 (10.6) 103 (8.7)	646 (54.3) 310 (26.1) 136 (11.4) 98 (8.2)	**<.0001**	0.9761
NEGATIVE FOR HPV AND OTHER STIs						
Behaviors	Response Categories	**STUDY VISITS** **Visit 1** n (%)	**Visit 2** n (%)	**Visit 3** n (%)	**Change from Visit 1 to Visit 2** [c] McNemar p-value	**Change from Visit 2 to Visit 3** [c] McNemar p-value
Vaginal sex in past 6 months	Yes No	694 (96.9) 22 (3.1)	591 (82.5) 125 (17.5)	587 (82.0) 129 (18.0)	**<.0001**	0.6506
Oral sex in past 6 months	Yes No	519 (85.9) 85 (14.1)	486 (80.5) 118 (19.5)	485 (80.3) 119 (19.7)	**0.0008**	0.9136
Paid for sex in past 6 months	Yes No	71 (12.2) 513 (87.8)	14 (2.4) 570 (97.6)	24 (4.1) 560 (95.9)	**<.0001**	**0.0124**
Condom use for vaginal sex in recent past	No vaginal sex Always Sometimes Never	18 (2.9) 89 (14.5) 473 (77.2) 33 (5.4)	76 (12.4) 58 (9.5) 442 (72.1) 37 (6.0)	76 (12.4) 52 (8.5) 453 (73.9) 32 (5.2)	**<.0001**	0.9284
Number of new sexual partners in past 6 months	0 1 2 3+	372 (67.0) 139 (25.1) 26 (4.7) 18 (3.2)	365 (65.8) 119 (21.4) 44 (7.9) 27 (4.9)	360 (64.9) 122 (22.0) 42 (7.6) 31 (6.6)	0.0848	0.7266

[a] *Percentages may not total to 100 due to rounding. Analysis excludes unknown/refused values.*
[b] *Other STIs include chlamydia, gonorrhea, herpes, and syphilis.*
[c] *Significant values in bold font. P-values < 0.05 considered significant.*

Table 3.4: Adjusted odds ratios and 95% confidence intervals for sexual behaviors following HPV/STI testing and receipt of test results [a, b]

	Vaginal sex in past 6 months [c]	**Oral sex in past 6 months**	**Paid sex in past 6 months**	**Condom use with vaginal sex in recent past** [d]	**# of new sexual partners in past 6 months** [e]
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
MODEL ESTIMATES BY STUDY PERIOD					
PRE-DIAGNOSIS PERIOD: Visit 2 compared to Visit 1/ Baseline	**0.34 (0.27-0.41)**	**0.59 (0.48-0.72)**	**0.25 (0.20-0.32)**	0.94 (0.71-1.24)	**0.72 (0.61-0.84)**
POST-DIAGNOSIS PERIOD: Visit 3 compared to Visit 2	0.87 (0.70-1.08)	0.96 (0.77-1.20)	1.05 (0.81-1.37)	1.05 (0.79-1.39)	1.01 (0.89-1.20)
MODEL ESTIMATES ACROSS ALL THREE VISITS					
HPV and STI Results [f]					
Positive for both HPV and other STIs	0.57 (0.29-1.12)	0.78 (0.41-1.47)	1.01 (0.60-1.70)	0.69 (0.39-1.24)	**0.51 (0.31-0.83)**
Positive for HPV only	1.15 (0.69-1.90)	1.40 (0.88-2.21)	0.66 (0.42-1.03)	**0.61 (0.40-0.92)**	**0.50 (0.34-0.72)**
Positive for other STIs	0.48 (0.19-1.21)	0.46 (0.20-1.08)	1.45 (0.71-2.94)	0.64 (0.28-1.43)	1.43 (0.70-2.96)
Negative for HPV and other STIs	Referent	Referent	Referent	Referent	Referent

Abbreviations: AOR=Adjusted Odds Ratio; CI=Confidence Interval; HPV=Human Papillomavirus; STI=Sexually Transmitted Infections

[a] Significant values in bold font.

[b] Model is adjusted for the following variables: country of residence, race, ethnicity/Hispanic, age, marital status, educational level, sexual orientation, circumcision status, smoking status, and number of lifetime sexual partners.

[c] Men categorized as homosexual men were excluded from analysis for vaginal sex due to plausibility of behavior.

[d] Modeling any condom use (sometimes and always) vs. never using condoms during last six months. Men reporting no vaginal sex during last six months were excluded from analysis.

[e] Modeling zero new sexual partners during last six months vs. 1, 2, or 3+ new sexual partners.

[f] Other STIs include chlamydia, gonorrhea, herpes, and syphilis.

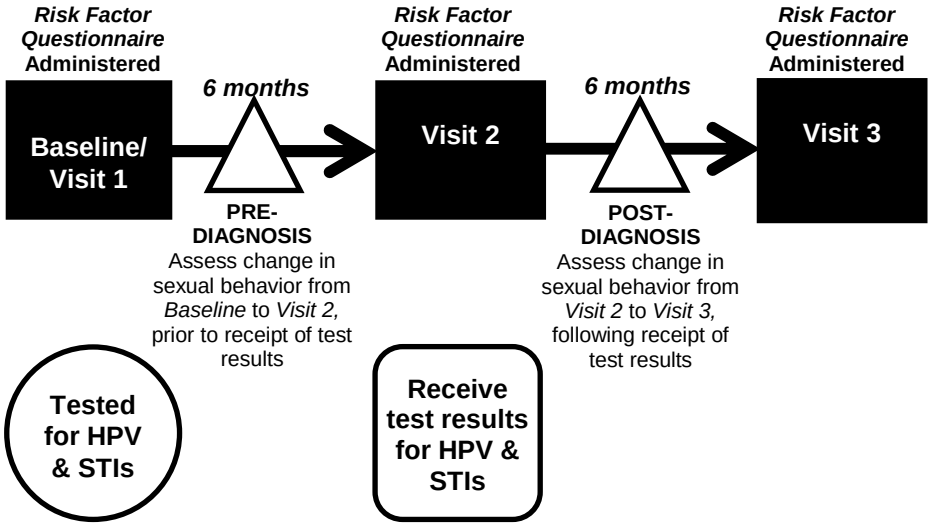

Figure 3.1: Study Design

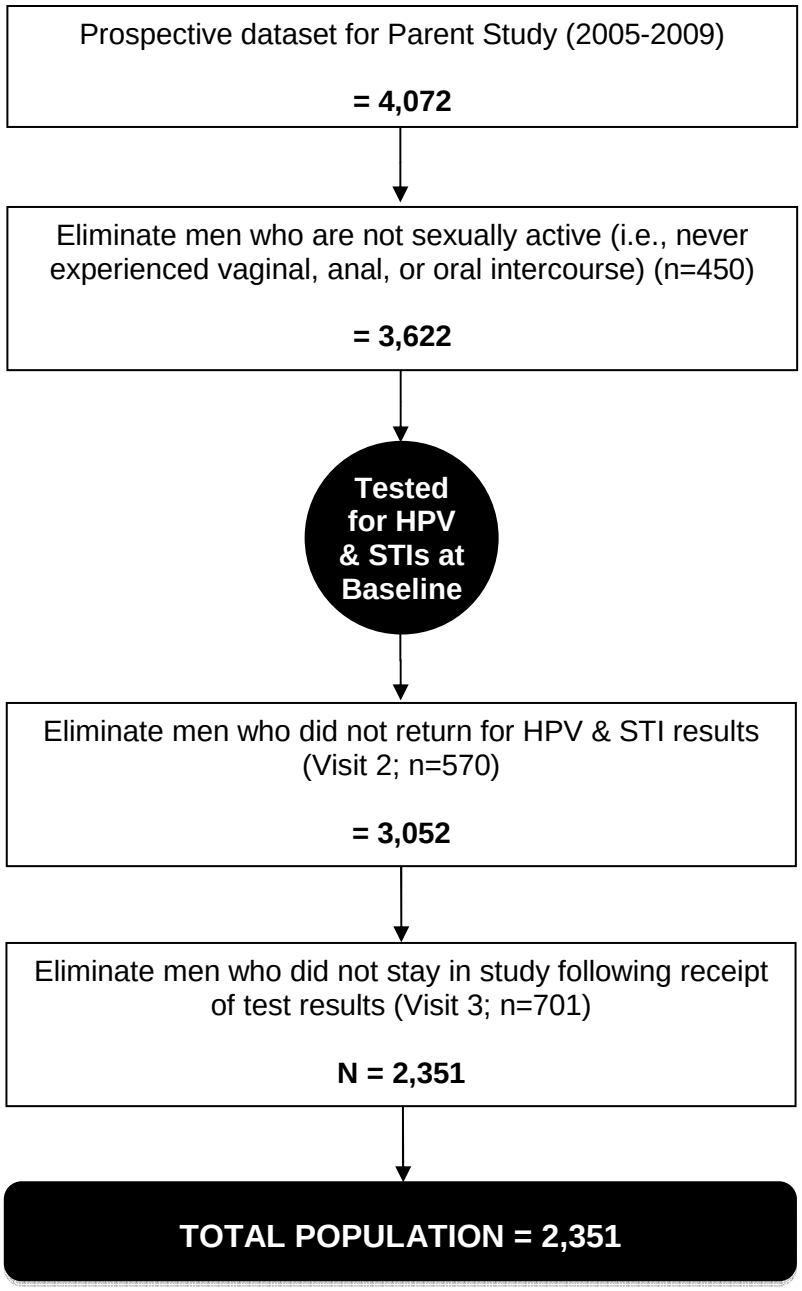

Figure 3.2: Flow chart of exclusion process for the study

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Section Four:

Discussion

This dissertation was prepared in a manuscript format, consisting of two complete manuscripts. While each of these manuscripts is drafted as independent documents, they are also part of a cohesive body of research focused on the sexual behaviors among men in a cross-national sample from Brazil, Mexico, and the United States (US). To organize and integrate the discussion of the results and research implications, each of the research questions is addressed and discussed in this final section. Furthermore, the strengths and limitations of the dissertation, as well as the public health implications and recommendations for future research are discussed in the context of the overall dissertation study and theoretical framework.

This final section is subdivided into the following four sections: 1) Overview of Significant Findings; 2) Public Health Implications; 3) Strengths and Limitations; and 4) Conclusions. The Overview of Significant Findings provides a summary of the findings for the two components of the study (i.e., two different manuscripts), synthesizes and discusses the synergism of the results, and outlines the limitations and strengths of the overall dissertation. The Public Health Implications discusses the potential impact of the research findings in research, policy, and practice, including the utility of the results in public health

interventions. The theoretical framework used in this study, the Social Ecological Model, guides the interpretation of study findings. The Strengths and Limitations subsection presents some considerations regarding the study design and findings. The Conclusion reiterates the key issues highlighted in this dissertation study and provides closing remarks.

Overview of Significant Findings

While there is an abundance of research on risk factors associated with sexual behaviors and adverse sexual health outcomes, most studies focus on sub-populations considered to be at high risk for STIs, such as men who have sex with men or men who use/abuse illicit drugs (Aidala et al., 2006; Dworkin, 2005; Exner, Gardos, Seal & Ehrhardt, 1999; Seal & Ehrhardt, 2004). Therefore, there is a paucity of research investigating sexual risk factors among general populations of men (Aidala et al., 2006; Campbell, 1995; Dworkin, Fullilove & Peacock, 2009; Exner et al., 1999; Flood, 2003b; Higgins, Hoffman & Dworkin, 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004). However, given the communicable nature of STI transmission and the pervasiveness of STIs among diverse populations worldwide (Gerbase, Rowley, Heymann, Berkley & Piot, 1998; World Health Organization/ Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007), research on sexual behaviors and factors among a broad range of men is warranted.

To address the dearth of information on sexual risk and behaviors among men, this dissertation used a cross-national dataset to address the following specific aims and corresponding research questions:

Specific Aim 1: To identify the most salient correlates of sexual behaviors among men residing in Brazil, Mexico, and the US.

Research Question 1.1: How does sexual risk differ among men residing in Brazil, Mexico, and the US by age cohort?

Specific Aim 2: To assess the impact of testing and knowledge of diagnosis with human papillomavirus (HPV) and/or other sexually transmitted infections (STIs) on sexual risk-taking behavior among men.

Research Question 2.1: Research Question 2.2: Do men's sexual behaviors change after being tested for HPV and other STIs?

Research Question 2.2: Do men's sexual behaviors change after being informed of diagnosis with HPV and other STIs?

Specific Aim 1: To identify the most salient correlates of sexual behaviors among men residing in Brazil, Mexico, and the US.

In the cross-sectional analysis of sexual risk among heterosexual men in this cross-national dataset, age, race, marital status, educational level, age at first vaginal sex, exchanging sex for money or drugs, lifetime number of partners, and country of residence emerged as important factors (Table 2.5). The data

showed that the probability of testing positive for an STI increases with increasing age. Additionally, black men had a 1.5 fold elevated likelihood for a positive STI test, compared to white men (AOR=1.5, 95% CI=1.15-1.96). Both lower educational attainment (<12 years) and prior marriage (i.e., being divorced, separated, or widowed) increased the probability of testing positive for an STI. Overall, Brazilian men were three times as likely to test positive for an STI, compared to US men.

Sexually risky behaviors were also found to increase the likelihood of having a positive STI test among heterosexual men. Younger age at sexual debut (≤14 years) heightened the odds of testing positive for an STI. Heterosexual men who reported having 20 or more lifetime sexual partners had an estimated 1.5 to 2.1-fold increased risk, and men who reported ever exchanging money or drugs for sex had an increased likelihood of having a positive STI test.

Although the longitudinal analysis was not restricted to heterosexual men, including men categorized as homosexual and bisexual, similar correlates of sexual behavior were identified: age, race, marital status, education, number of lifetime sexual partners, and country of residence (Table D5). Of these correlates, age demonstrated the greatest magnitude of association across the various sexual behaviors assessed. For vaginal sex and oral sex, young adult (aged 18-30) and middle aged (aged 31-44) men experienced exponential increases in risk compared to older men (aged 45-70). Young adult men had a more than 12-fold increased likelihood of reporting vaginal sex in past six months

(AOR=12.63, 95% CI=6.03-26.44) and a 20-fold increased likelihood of reporting oral sex in the past six months (AOR=20.06, 95% CI=10.27-39.19). For middle aged men, the risk decreased slightly but remained significantly elevated, with a 4.5-fold heightened odds of reporting vaginal sex (AOR=4.52, 95% CI=2.42-8.43) and a nearly 11-fold heightened odds of reporting oral sex (AOR=10.73, 95% CI=6.04-19.06). Conversely, young adult and middle aged men had a reduced likelihood of reporting no new sexual partners in the past six months (young: AOR=0.12, 95% CI=0.07-0.22; middle-aged: AOR=0.27, 95% CI=0.16-0.45).

Similar to the cross-sectional analysis, elevated odds were observed for Brazilian men compared to US men for vaginal sex, condom use with vaginal sex, and paid sexual encounter. However, Mexican men were significantly more likely report no new sexual partners in the past six months, compared to US men. Increasing numbers of lifetime partners (≥10) were associated with an increased likelihood of reporting vaginal sex, oral sex, and paid sexual encounters in the past six months.

Other correlates examined in the longitudinal analysis did not demonstrate consistency across sexual behaviors. Asian/Pacific Islander men had 75% decreased odds reporting vaginal sex in the past six months (AOR=0.25, 95% CI=0.07-0.86), while men of black or mixed race had a 49-53% reduced odds of reporting no new partners in the past six months (black: AOR=0.51, 95% CI=0.33-0.78; mixed: AOR=0.47, 95% CI=0.22-0.99). Lower educational level (<12 years) was associated with a reduced likelihood of reporting oral sex (AOR=0.11, 95% CI=0.05-0.27) and condom use with vaginal sex (AOR=0.45,

95% CI=0.21-0.98) in the past six months. Single and previously married (i.e., being divorced, separated, or widowed) men were associated with a 84-85% decreased odds of reporting vaginal sex in the past six months (single: AOR=0.16, 95% CI=0.08-0.29; divorced, separated, or widowed: AOR=0.15, 95% CI=0.07-0.32), while men with single status were more than twice as likely to report paid sexual experiences in the past six months (AOR=2.13, 95% CI=1.34-3.38).

Research Question 1.1: How does sexual risk differ among men residing in Brazil, Mexico, and the US by age cohort?

In this study, we examined sexual risk among heterosexual men in a cross-national sample through a composite measure of STI positivity by age cohort (young: 18 to 30 years; middle-aged: 31 to 44 years; older: 45 to 70 years). We found that the likelihood to test positive for an STI varied significantly by age group among heterosexual men by a number of covariates, including number of sexual partners, age at sexual debut, race, marital status, educational level, and prior experience of paid sexual encounters. Among younger men, higher educational levels were associated with lower odds of testing positive for an STI, while higher numbers of lifetime sexual partners were associated with higher odds. For middle-aged men, an elevated risk for a positive STI test was observed among those who were black and divorced, separated, or widowed. Older men who were of a younger age at their first vaginal sex encounter and had a history of paid sexual encounters had an increased likelihood of STI

positivity. Overall, the findings underscore that multiple factors associated with age and life stage may influence sexual risk and STI transmission among men.

As previous research among men's sexual behavior has predominantly focused on adolescents and young adults (Chopra et al., 2009; Harrison, Cleland, Gouws & Frohlich, 2005; Makenzius, Gadin, Tyden, Romild & Larsson, 2009; Mooney-Somers & Ussher, 2008; O'Donnell, O'Donnell & Stueve, 2001; Sandfort, Orr, Hirsch & Santelli, 2008), this study yields important information that may be of benefit in the examination of sexual risk across the lifespan. Given the escalating incidence of HIV/AIDS and STI cases among older adults (Casau, 2005; Coleman & Ball, 2007; Goodroad, 2003; Kohli et al., 2006; Savasta, 2004), as well as the increasing reports of sexual risk-taking in older cohorts (Bruhin, 2003; Kohli et al., 2006; Rogstad & Bignell, 1991; Stall & Catania, 1994), it is critical that public health interventions integrate age-appropriate strategies that move beyond the youth and young adult demographic.

Specific Aim 2: To assess the impact of testing and knowledge of diagnosis with human papillomavirus (HPV) and/or other sexually transmitted infections (STIs) on sexual risk-taking behavior among men.

- *Research Question 2.1:* Do men's sexual behaviors change after being tested for HPV and other STIs?

This analysis identified a significant reduction in sexual risk-taking behaviors among men in the six-month period following testing for HPV and other

STIs. In the study population, decreased levels of vaginal and oral sex, as well as paid sexual encounters, were observed, prior to participants being informed of the results of testing. The study findings illustrate the potential for behavior change with disease testing alone, as individuals may modify their behaviors to be more favorable while under observation (Gall, Gall & Borg, 2007; Neuman, 1997). These findings may have important public health implications, as they highlight the possibility for STI testing to be an effective preventive measure that reduces risky behavior, regardless of the testing outcome.

- *Research Question 2.2:* Do men's sexual behaviors change after being informed of diagnosis with HPV and other STIs?

Globally, the diagnosis and treatment of STIs has been prioritized as a central strategy for prevention (World Health Organization, 2007). This approach is driven by the widely accepted assumption that being aware of one's disease status would reduce risky sexual behaviors (Thornton, 2008; World Health Organization/ Joint United Nations Programme on HIV/AIDS/ UNICEF, 2009). However, the longitudinal analysis did not reveal any changes in sexual risk-taking behaviors among men after being informed of their diagnosis with HPV and/or other STIs.

The only significant finding was observed among men who tested positive for HPV only (and not other STIs); compared to others, these men had reduced odds of using condoms for vaginal sex. This finding is somewhat counterintuitive, as we would hypothesize that men who were informed that they

had HPV would adopt safer sexual practices. However, this finding may be attributable to the general lack of knowledge and awareness regarding HPV among men (Brewer, Ng, McRee & Reiter, 2010; Bynum, Brandt, Friedman, Annang & Tanner, 2011; Fernandez et al., 2009; Gerend & Barley, 2009; Nandwani, 2010; Tider, Parsons & Bimbi, 2005). Unfortunately, the dataset lacked cognitive measures; therefore, assessments of the level of HPV and STI-related knowledge within the study population were not possible.

Public Health Implications

The discussion of the public health implications of this dissertation research is framed within the context of the Social Ecological Model (SEM). The SEM is applicable to this research due to its utility in describing the complex interaction of multiple factors with sexual behavior. Since sexual behaviors that elevate the risk for STIs involve more than one person, the examination of such processes intrinsically moves beyond intrapersonal theories to those that incorporate ecological factors acting in the interpersonal, organizational, community and policy levels. Therefore, the occurrence of several types of sexual behavior may be attributed to factors within these various levels of influence. Due to limitations of the dataset, this research does not address multiple factors within the various SEM levels. Therefore, the research findings provide a narrow presentation of factors that influence sexual behaviors among men. However, SEM also aids in the identification and development of potential preventative interventions to reduce sexual risks, as well important research

measures that will aid in understanding and explaining sexual behavior. In this section, we use the SEM as a framework to assess limitations of the dissertation research while also providing recommendations for future investigations.

Intrapersonal Level. The intrapersonal level of the Social Ecological Model refers to individual characteristics that have been found to influence behaviors, including knowledge, attitudes, beliefs, and personality traits (Gregson et al., 2001; National Cancer Institute, 2005). Public health research and interventions frequently are grounded in the assumption that there is a correlation between knowledge, attitudes, and practice (Glanz, Lewis & Rimer, 1997). Therefore, by enhancing knowledge, attitudes, and risk perception regarding the disease(s) of interest (e.g., HPV and other STIs), desired behaviors (e.g., reduced sexual risk behavior) can be promoted (Leval et al., 2011).

While prior investigations of HPV knowledge and attitudes have focused almost entirely on women (Daley et al., 2008; Daley et al., 2010; Giles & Garland, 2006; Klug, Hukelmann & Blettner, 2008; Moreira et al., 2006; Pitts & Clarke, 2002; Pitts, Dyson, Rosenthal & Garland, 2007; Stark et al., 2008; Tiro, Meissner, Kobrin & Chollette, 2007; Vanslyke et al., 2008; Waller et al., 2003), some studies found that there is a low level of knowledge regarding HPV among men, which has resulted in misinformation regarding transmission and prevention (Brewer et al., 2010; Bynum et al., 2011; Daley et al., 2011; Fernandez et al., 2009; Gerend & Barley, 2009; Nandwani, 2010; Tider et al., 2005). For example, men may not understand that HPV is a precursor to various forms of cancer (Brewer et al., 2010; Fernandez et al., 2009; Gerend & Barley, 2009; Nandwani,

2010; Tider et al., 2005). Little is known regarding men's knowledge and awareness of other STIs, as research and interventions primarily target HIV/AIDS, with STIs being integrated due to its role as a moderator for HIV transmission (Low et al., 2006; Mayaud & McCormick, 2001; Wasserheit, 1992; World Health Organization/ Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). However, some studies have revealed that men's knowledge of STIs, particularly regarding signs and symptoms, is limited (Devonshire, Hillman, Capewell & Clark, 1999; Kellock, Piercy & Rogstad, 1999; Mason, 2005).

As previously stated, we found that being informed of one's HPV or STI status did not affect men's sexual behavior. The relatively low level of knowledge and awareness of factors related to HPV and other STIs among men, as indicated in other studies, may explain the lack of behavioral change based on one's diagnosis (Brewer et al., 2010; Bynum et al., 2011; Devonshire et al., 1999; Fernandez et al., 2009; Gerend & Barley, 2009; Kellock et al., 1999; Mason, 2005; Nandwani, 2010; Tider et al., 2005). Due to limited information, men may not understand the behavioral link between HPV and STI transmission and occurrence. Therefore, this finding may indicate that more individual-level education and awareness-raising interventions that target men may be needed.

Unfortunately, the dataset utilized in this dissertation research did not include cognitive level variables, so we are unable to ascertain the level of HPV and STI knowledge and awareness within the study population. However, general education levels among men in the study population were found to be

associated with STIs and sexual behavior. Men who had less than a high school or secondary level of education (<12 years) were at an increased likelihood of testing positive for an STI. Additionally, men with lower level of education were less likely to report oral sex and condom use with vaginal sex in the past six months. While lower educational attainment has previously been associated with an elevated risk for STIs and unprotected sex (Annang, Walsemann, Maitra & Kerr, 2010; Irwin et al., 1999; Noden, Gomes & Ferreira, 2010; Solomon, Smith & del Rio, 2008), the relationship between educational status and oral sex is not well understood, as investigations of sexual risk have predominately focused on vaginal and anal sex (Ompad et al., 2006). Further investigations of correlates associated with oral sex are needed to yield an enhanced understanding of sexual risk, particularly among men.

Interpersonal Level. Within the Social Ecological Model, interpersonal processes involve interactions between family, friends, and peers (Gregson et al., 2001; National Cancer Institute, 2005). Peer influence has been noted as a factor in the development of masculine identity, particularly regarding sexual attitudes, during adolescence (Flood, 2003a; Hyde, Drennan, Howlett & Brady, 2009). Previous research has revealed how interactions between young boys may enforce norms regarding sexuality (Hyde et al., 2009; Wight, 1994). Consequently, peer influence has been examined in investigations and interventions addressing adolescent sexual behavior (Biglan et al., 1990; Billy & Udry, 1985; DiClemente, 1991; Kinsman, Romer, Furstenberg & Schwarz, 1998; Maxwell, 2002; Prinstein, Meade & Cohen, 2003; Romer et al., 1994). Although

peer influence is relatively unexplored in adult populations, some researchers have recently conducted social network analysis to examine factors related to sexual behavior in special populations of men (e.g., men who have sex with men) (Amirkhanian et al., 2005; Choi, Ning, Gregorich & Pan, 2007; Morris, Zavisca & Dean, 1995). Unfortunately, the data do not offer information on the role of peers in male sexual decision-making. As no known studies examine the relationships of such social networks in sexual behaviors within a general adult population of men, this is a possible area for future investigation.

One's values and beliefs regarding sexuality and sexual behaviors are informed by their familial relationships (Biglan et al., 1990; Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997). During childhood and adolescence, family connectedness, support, and communication may impact risk and protective behaviors associated with STI transmission, such as early initiation of sexual activity and injection drug use (Ali & Ajilore, 2011; Miller, Kotchick, Dorsey, Forehand & Ham, 1998; O'Donnell et al., 2001; Wight, Williamson & Henderson, 2006). Furthermore, the religious and moral values demonstrated within the family may also influence sexual health knowledge, attitudes, and practices (Cotton & Berry, 2007; Edwards, Haglund, Fehring & Pruszynski, 2011; Ogland, Xu, Bartkowski & Ogland, 2011). As families have been found to be important determinants of adolescent sexual behavior, it is plausible that they may also influence subsequent behavior in adulthood. While this dissertation study does not examine familial factors, future

investigations that examine the long-term impact of such factors may prove beneficial in the development and enhancement of family focused interventions.

In sexual behavior, an intrinsic issue is the role and influence of one's sexual partner. There is epidemiological evidence of the link between partner level variables and one's risk of HPV (Abalos et al., 2012; Castellsagué, Bosch & Muñoz, 2003; Giuliano, Anic & Nyitray, 2010; Schiffman & Brinton, 1995; Schiffman & Castle, 2003). In recent years, numerous studies of heterosexual couples have revealed the heightened likelihood of HPV transmission and the onset of related cancers between sexual partners (Abalos et al., 2012; Baken et al., 1995; Bleeker et al., 2005; Brinton et al., 1989; Castellsagué et al., 2003; Franco, Duarte-Franco & Ferenczy, 2001; Hernandez et al., 2008; Parada et al., 2010; Widdice et al., 2010). However, for other STIs, much of the existing research explores factors among women and high-risk groups of men (e.g., injection drug users, men who have sex with men (Aidala et al., 2006; Dworkin & O'Sullivan, 2005; Exner et al., 1999; Seal & Ehrhardt, 2004; Seal, Exner & Ehrhardt, 2003). Minimal research has explored partnership in the transmission of other STIs (excluding HIV/AIDS); nevertheless, studies have indicated a relationship exists between sexual behaviors and risk factors among partners and STI transmission (Charnigo, Crosby & Troutman, 2010; Crosby, DiClemente, Yarber, Snow & Troutman, 2008; Doherty, Padian, Marlow & Aral, 2005; Drumright, Gorbach & Holmes, 2004; Evans, Bond & MacRae, 1997; Evans, Kell, Bond & MacRae, 1995; Finer, Darroch & Singh, 1999; Gullette, Rooker & Kennedy, 2009; Wellings et al., 2006).

In this dissertation research, the multivariate models in the quantitative analysis were adjusted for marital status. Both single and previously married (i.e., being divorced, separated, or widowed) men in the study population had a reduced likelihood of reporting vaginal sex in the past six months. Furthermore, single men had an elevated likelihood of reporting experiences of paid sex in the past six months, while those who previously had been married had increase odds of testing positive for an STI. As sexual risk has been shown to vary based on one's marital status, it is important to consider this role in the examination of sexual behaviors. Furthermore, an assessment of partner level variables (e.g., socio-demographic variables, sexual behaviors) is helpful in understanding the context of one's sexual risk and protective factors. However, the analysis of interpersonal factors influencing men's sexual relationships was not possible, as this information was not available in the dataset.

Due to the data limitations in the present study, further exploration of the research questions in the context of the type and nature of men's sexual relationships may prove beneficial in the development of comprehensive approaches to reduce the likelihood of STI transmission. Couple-level data should be collected when and where feasible to facilitate comprehensive assessments of sexual risk and behavior change to better target preventive efforts. Literature on couples-based interventions have demonstrated that partner expectations, reactions to information, and support may determine sexual practices and, therefore, are important in risk appraisal and reduction (Bruhin, 2003; El-Bassel et al., 2003; Perez-Jimenez, Seal & Serrano-Garcia, 2009;

Quina, Harlow, Morokoff, Burkholder & Deiter, 2000; Wingood & DiClemente, 1998).

Organizational Level. Activities and factors that facilitate or influence behavior change at the organizational level may include health care systems and professional organizations (Gregson et al., 2001; National Cancer Institute, 2005). Within sexual behavior, most interventions target individuals, promoting behaviors that promote risk reduction within relationships. However, structural factors have been noted to influence STI prevention, such as access to health care services and barriers within the health care system (Bond, Lauby & Batson, 2005; Dean & Fenton, 2010; Gupta, Parkhurst, Ogden, Aggleton & Mahal, 2008; Parker, Easton & Klein, 2000).

Research has suggested that gender differences exist in health care experiences, as men may be reluctant to obtain advice from a medical professional and delay seeking medical care (Galdas, Cheater & Marshall, 2005; Möller-Leimkühler, 2002; Robertson, Douglas, Ludbrook, Reid & van Teijlingen, 2008; Sandman, Simantov & An, 2000; Shoveller, Knight, Johnson, Oliffe & Goldenberg, 2010). More specifically, men may be slow to get tested for STIs (Flood, 2003a). It has been suggested that socio-cultural norms of traditional masculinity support these behaviors among men (Galdas et al., 2005; Mahalik, Burns & Syzdek, 2007; Möller-Leimkühler, 2002). Men may only access health care services for immediate cures or treatments for overt health problems or symptoms (Robertson et al., 2008; Shoveller et al., 2010). Consequently, the asymptomatic nature of some STIs is problematic among men who are

potentially at risk (Bozicevic et al., 2006; Flores et al., 2008; Lewis et al., 2008; Mason, 2005; Rieg et al., 2008). Furthermore, when men do access health services, physicians may fail to counsel them regarding health concerns, missing opportunities to inform their male patients of preventive measures to reduce risk of adverse health outcomes (Sandman et al., 2000).

Historically, physicians are considered gatekeepers to health information, resources, and services (Dixon-Woods et al., 2002; Hesse et al., 2005; U. S. Department of Health and Human Services, 2001). As such, they play a critical role in prevention efforts for a variety of diseases and negative health outcomes, including HPV and other STIs (Dixon-Woods et al., 2002). More specifically, physicians can reduce health risks to their patients through early education and prevention (Haslegrave & Olatunbosun, 2003). Physicians are generally deemed the most trustworthy and reliable sources of health information, as compared to any other source of health information (Hesse et al., 2005; Sandman et al., 2000; Winkler et al., 2008). Therefore, personalized health education and information regarding STI screening and prevention from a health care provider may be highly valued and may be critical to increasing the likelihood that men acquire such services. However, data to specifically assess the perceived role and efficacy of health care providers in STI risk reduction among men were absent from this analysis. Qualitative research may be fruitful in understanding the potential contributions of physicians to behavioral interventions for men.

Although health care providers are considered a primary resource for health information, their knowledge and attitudes regarding HPV may be

inadequate to meet the community needs (Cuzick, Mayrand, Ronco, Snijders & Wardle, 2006). Health care providers may lack understanding of the relationship between HPV and cancer (Cuzick et al., 2006; Sherris et al., 2006; Winkler et al., 2008). The attitudes of health care professionals may be perceived as a barrier for health care access and service delivery within culturally diverse communities, as patients may respond either negatively or positively to their provider's demeanor (Bradley et al., 2006; Flores, 2000). Discomfort during the screening procedure and fear of a bad diagnosis were associated with negative contact with the health care provider (Bradley et al., 2006).

Health care providers have requested more training opportunities on HPV and other STIs, including materials to facilitate patient education and counseling (Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997; Sherris et al., 2006). Providers may not be aware of the scope of STIs and may also lack the skills and knowledge to diagnose and treat STIs (Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases., 1997). This may be a more daunting task for providers in the developing world, who may not have access to costly, peer-reviewed journals (Sherris et al., 2006). However, due to the prominence of health care providers as purveyors of health information within the community, it is critical that they have the most accurate and current information on HPV and STIs. The lack of training among health care providers is compounded by the unavailability of equipment and resources for STI testing (Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997), as well as the

unavailability of a standardized test for HPV infection in men (Centers for Disease Control and Prevention, 2012; McGinley, Hey, Sussman & Brown, 2011; Schiffman & Castle, 2003).

Poverty is another factor that limits access to STI prevention information and services. People who live in poverty are more likely to be uninsured, which results in less access to preventive care services (Betancourt, Green, Carrillo & Ananeh-Firempong, 2003; Parrish & Kent, 2008; Politzer et al., 2001; Sandman et al., 2000; Weissman, Stern, Fielding & Epstein, 1991). Furthermore, men with a low income are more likely to lack a regular physician (Parrish & Kent, 2008; Sandman et al., 2000; Weissman et al., 1991). These factors may result in delayed care and later-stage diagnosis of infection (Betancourt et al., 2003; Sandman et al., 2000; Weissman et al., 1991). While it would have been beneficial to examine income within the study population, income categories are not easily comparable across study sites in this cross-national study. Therefore, income data were unavailable for consideration in analyses.

While this dissertation study does not examine infrastructure issues, a key implication of the research findings is that getting tested for STIs may be an important strategy for reduced sexual risk-taking among men. In the context of the literature on health services, providers may play a vital role in promoting STI screening, while also improving knowledge and awareness. As studies suggest that the health care system tends to focus STI services and testing on women or special populations of men (e.g., men who have sex with men), a renewed focus is required to attract men into the health care system for preventive services.

This may involve creating more male-friendly environments, including providers who are provided with training in culturally-appropriate, gender-relevant health care (Sonfield, 2004). On a broader level, economic growth and social development are important long-term approaches to support health care access and increase availability of resources.

Community Level. Socio-cultural norms that define the male role within intimate relationships may also affect sexual behaviors and STI transmission (Bertone & Ferrero Camoletto, 2009; Santana, Raj, Decker, La Marche & Silverman, 2006). Men may be expected to be the aggressor in relationships, actively initiating and pursuing sexual encounters (Bertone & Ferrero Camoletto, 2009; Greene & Faulkner, 2005; Seal & Ehrhardt, 2003, 2004). Additionally, casual, non-monogamous sex, multiple sexual partners, and sexual experimentation may be more acceptable for men, compared to women (Almonte et al., 2008; Carey, Senn, Seward & Vanable, 2010; Greene & Faulkner, 2005; Santana et al., 2006; Seal & Ehrhardt, 2003). As pleasure-seeking has been noted as a driving force in sexual relationships for men (Flood, 2003a, 2003b; Hyde et al., 2009) and a common belief among men is that condoms reduce sensation and feeling during sex (Campbell, Peplau & Debro, 1992; Flood, 2003b; Mizuno et al., 2007), STI risk reduction through condom use may be negatively impacted by these pervasive male ideologies. Furthermore, research has found that heterosexual men who ascribe to more traditional male gender roles may be more likely to engage in risky sexual practices, such as unprotected sexual intercourse (Santana et al., 2006). This suggests that sexual risk

reduction messages for heterosexual men may prove more effective if they build upon traditional and change gender norms that influence sexual interactions. For example, public health programs that exclusively promote monogamy may demonstrate minimal success among men, as they contradict male socio-cultural norms.

Culture within a community provides a means for how the world is seen and interpreted (Aquino & Zago, 2007; Granda-Cameron, 1999). Consequently, culture frames how health and diseases, such as cancer, are experienced and understood within the community (Aquino & Zago, 2007; Granda-Cameron, 1999). In Latin American countries, such as Mexico and Brazil, cultural expectations that closely associate multiple partners and early sexual debut with conceptualizations of virility and *machismo* may lead respondents to over-report the number of partners (Falicov, 2010; Parker, 1996; Perez-Jimenez et al., 2009; Villarruel & Rodriguez, 2003; Wallace, 2011). *Machismo* is a concept that establishes the male role in society as dominant and strong, serving as the protector and caregiver for the family, with permission to express more sexual freedom, including early sexual debut and multiple and concurrent partners (Falicov, 2010; Sobralske, 2006; Sternberg, 2000). In the study, the possibility of over-reporting associated with *machismo* was minimized through the use of Computer-Assisted Self-Interviewing (CASI), which has been shown to reduce reporting bias (Fenton, Johnson, McManus & Erens, 2001; Ghanem, Hutton, Zenilman, Zimba & Erbelding, 2005; Kissinger et al., 1999; Kurth et al., 2004).

However, we cannot eliminate the potential influence of socio-cultural variability on sexual behaviors within the study population.

In many Latin American communities, religion is a central guiding framework for behaviors associated with sexuality (Edwards et al., 2011; Ogland et al., 2011; Perez-Jimenez et al., 2009; Torres & Cernada, 2003). However, much of the examination of religious influence on sexual health has been conducted among females (Edwards et al., 2011; Torres & Cernada, 2003). Religious views reinforce traditional roles among women, which are embodied by the concept of *marianismo.* Rooted in characteristics of the Virgin Mary from Christian theology, women are expected to be self-sacrificing caregivers, who are obedient to men and virginal, delaying sexual activity and maintaining monogamous relationships (Cofresi, 2002; Edwards et al., 2011). Among couples, religious background may inhibit condom use and other forms of sexual risk reduction (Perez-Jimenez et al., 2009). It has been noted that involving faith-based groups in STI prevention activities for Latinos may strengthen their impact and outreach (Alvarez et al., 2009; Perez-Jimenez et al., 2009). Data were not available in this dissertation research to assess the role of religion with STI risk and sexual behavior among men. However, qualitative assessments are recommended as an appropriate means of investigating the influence and context of religion in sexual knowledge, beliefs, and behaviors among men, as well as the potential role of faith-based organizations and leaders in sexual risk-reduction within this group.

According to a report from the Institute of Medicine, stigma affects the emotions and feelings associated with sexually transmitted infections (Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997). Social stigma has been broadly documented for HPV and other STIs (Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997; McCaffery, Waller, Nazroo & Wardle, 2006; Mulholland & Van Wersch, 2007; Perrin et al., 2006; Waller, Marlow & Wardle, 2007). Previous research has indicated that stigma associated with other STIs may be due to prejudicial feelings about STIs, fear of isolation or judgment, and/or concerns about one's sexual relationship (Mulholland & Van Wersch, 2007). Because diagnosis with HPV or other STIs is associated with sexual intercourse, people may fear being judged (Hubbell, Chavez, Mishra & Valdez, 1996; Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997; McMullin, De Alba, Chávez & Hubbell, 2005). Stigma towards STIs inhibits public discussion and education to promote awareness and risk reduction strategies (Institute of Medicine/ Committee on Prevention Control of Sexually Transmitted Diseases, 1997).

The quantitative nature of this dissertation research does not allow for the in-depth investigation of community level factors regarding sexual practices among men. Therefore, socio-cultural norms, religious influences, and social stigma are not examined in this study. However, qualitative investigations are recommended as future avenues of research to specifically explore male traditional roles and community influences on sexual behavior.

Policy Level. A global strategy for the prevention of STIs is prompt diagnosis and treatment (World Health Organization, 2007). However, this strategy has primarily been promoted for the prevention of HIV/AIDS (Laxminarayan et al., 2006). Overall, STI prevention has been a secondary goal to HIV prevention, as STIs help facilitate HIV transmission (Low et al., 2006; Mayaud & McCormick, 2001; Wasserheit, 1992; World Health Organization/ Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization., 2007). However, STIs are a significant public health concern in their own right, as they can result in adverse, long-term health outcomes (De Schryver & Meheus, 1990; Genuis & Genuis, 2004; Gerbase et al., 1998; Mayaud & Mabey, 2004; Mayaud & McCormick, 2001; World Health Organization/ Joint United Nations Programme on HIV/AIDS, 1999; World Health Organization, 2007). Due to the lack of information and awareness regarding STI screening among men, public health campaigns have been suggested as a possible means to educate men about the testing experience (Shoveller et al., 2010). Moreoever, it has been recommended that men have pelvic exams, similar to women, and that STI testing and treatment be incorporated within the regular continuum of services (Alt, 2002; Kalmuss & Tatum, 2007; Shoveller et al., 2010).

Although STI testing has been noted as a critical step in public health prevention, the focus has primarily been on high-risk populations, such as men who have sex with men or injection drug users (Denison, O'Reilly, Schmid, Kennedy & Sweat, 2008; Marks, Crepaz, Senterfitt & Janssen, 2005; Wolitski, MacGowan, Higgins & Jorgensen, 1997), or women (Aidala et al., 2006;

Campbell, 1995; Dworkin et al., 2009; Exner et al., 1999; Flood, 2003a; Higgins et al., 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004; Seal et al., 2003). Heterosexual men are relatively absent in the literature regarding STI risk and prevention (Aidala et al., 2006; Campbell, 1995; Dworkin et al., 2009; Exner et al., 1999; Flood, 2003a; Higgins et al., 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004; Seal et al., 2003). Furthermore, research on sexual behavior and STI risk among men has been limited to younger cohorts (Chopra et al., 2009; Harrison et al., 2005; Makenzius et al., 2009; Mooney-Somers & Ussher, 2008; Sandfort et al., 2008). The study findings underscore the potential effectiveness of STI testing as a prevention strategy among general populations of men, beyond high-risk groups (i.e., injection drug users, men who have sex with men). Further investigation of the needs and perspectives of men is required to develop and implement gender-relevant and age-appropriate STI prevention approaches.

Strengths and Limitations

There are several important limitations to this dissertation research. Since this study used data from an existing cross-national dataset, the research questions and methodology were limited to the scope and breadth of the parent study. For example, there is some ambiguity in the wording of the variable for paid sex (i.e., “ever exchanged sex for money or drugs”), which makes it unclear as to whether the men responding affirmatively to this item were commercial sex workers or purchasers of services. This uncertainty affects the interpretation and

understanding of findings regarding paid sexual encounters. However, since this study utilized secondary data, the analysis was limited to the available data. Furthermore, there is the potential for instrument bias, as the Risk Factor Questionnaire that was administered at all three study sites (i.e., Brazil, Mexico, US) was originally developed by US-based researchers in English. Although the instrument was translated into the primary language of each of the study sites (i.e., Portuguese in Sao Paulo, Brazil; Spanish in Cuernavaca, Mexico) and back-translated to English to aid in the comprehension of the survey by participants at the non-English speaking sites, the appropriateness and relevance of some socially-constructed items on the survey instrument may be questionable. For example, the response categories for race/ethnicity were based on generally accepted groupings in the US, which may not be meaningful in other countries. Given these limitations, the findings should be interpreted with caution.

Although participant solicitation was conducted in the general population to broaden the representation at the community level, the process utilized by the parent study was not randomized. Therefore, the results of this secondary analysis cannot be generalizable to all men in the United States, Brazil, and Mexico. Furthermore, the socio-cultural heterogeneity of the study should be considered in the interpretation and understanding of the study findings. The data utilized in this study were collected at three different study sites with contrasting socio-cultural norms and expectations, which may differentially affect sexual behaviors within the study population. For example, virility and machismo are cultural concepts that are entrenched in Latin American countries, such as

Mexico and Brazil, and may potentially result in over-reporting of sexual partners, age of sexual debut, and frequency of sexual behaviors (Falicov, 2010; Parker, 1996; Perez-Jimenez, Seal & Serrano-Garcia, 2009; Villarruel & Rodriguez, 2003; Wallace, 2011). Consequently, the implications of the study findings may not be unilaterally applied to men within all of the study sites.

The recruitment and enrollment procedure in this cross-national study was not uniform across the three country-based research sites (i.e., Brazil, Mexico, US). Brazilian men were recruited through media advertising and a urogenital medical center, while beneficiaries of the public health system, factory employees, and officials of the army were recruited in Mexico. In the US, men were recruited through promotional flyers and media advertising at a local university and in the greater metropolitan area. The variance in these approaches may have affected the study findings, as the sub-populations may be inherently different. For example, there is an extensive amount of literature that investigates correlates of sexual risk, such as knowledge, attitudes, and perceptions, and underscores the elevated likelihood of STIs and risky sexual behaviors among male university students (Crosby, Sanders, Yarber, Graham & Dodge, 2002; Daley, Marhefka, Buhi, Vamos, Hernandez & Giuliano, 2010; Hightow et al., 2005; Johnson, Douglas & Nelson, 1992; Katz, Krieger & Roberto, 2011; LaBrie, Earleywine, Schiffman, Pedersen & Marriot, 2005; Partridge et al, 2007). Additionally, research with military personnel reveals that sexual behaviors that heighten the risk of STI transmission are an important public health concern (Bing, Russak, Ortiz & Galvan, 2005; Essien et al., 2010; Kingma

& Yeager, 2010; Szwarcwald, de Carvalho, Barbosa Júnior, Barreira, Speranza & de Castilho, 2005; Whitehead & Carpenter, 1999; World Health Organization/ Joint United Nations Programme on HIV/AIDS, 1998; Yeager, 2000). Reports have estimated that STI rates among military personnel are generally two to five times higher than that of civilian populations (World Health Organization/ Joint United Nations Programme on HIV/AIDS, 1998; Yeager, 2000). Therefore, the overall findings of this research must be considered with caution, as no information were available in the dataset to define and assess the influence in men's contextual life experiences and roles within society on sexual behaviors, as well as norms, beliefs, and expectations related to such behaviors. These issues limit the generalizability of the study results.

In the longitudinal analysis (i.e., Section 3 of this dissertation, Manuscript 2), the study population consisted of men who participated in all three study visits (i.e., baseline/Visit 1, Visit 2, and Visit 3). It is noteworthy that the men who initially enrolled in the study may be intrinsically different from those who did not. Previous research has determined that volunteers in sexual behavior research may be more informed regarding sexual health and may also be more sexually experienced (Catania, McDermott & Pollack, 1986; Gaither, Sellbom & Meier, 2003; Strassberg & Lowe, 1995). On the other hand, there may be a differential in beliefs and attitudes about STIs among men who were lost to follow-up, compared to those who remained in the study. Furthermore, it is possible that structural barriers (e.g., transportation) and logistical issues (e.g., scheduling with study staff and/or work). Due the pattern of attrition in the study population, the

study population across the three time points results in data that are not missing at random (i.e., NMAR) (Allison, 2002; Little & Rubin, 2002). Therefore, the missingness in the data could not be modeled without a broad-based understanding of the relationship between the variables. Given the exploratory nature of this analysis and the overarching research questions, this is not possible.

Due to attrition bias, there is a potential threat to internal and external validity in this dissertation research. Overall, the decrease in sample size due to attrition may reduce power in the analysis (Barry, 2005; Miller & Hollist, 2007). However, due to the large size of the dataset utilized in this study, attrition bias did not minimize this study's power. The longitudinal sample utilized in the analysis may differ significantly from the original sample, decreasing the generalizability of the findings to the original study population (Miller & Hollist, 2007). The systematic loss of men to follow-up (rather than random attrition) may alter the correlations between variables within the study (Miller & Hollist, 2007). Furthermore, the differential dropout rates among participants by exposure groups may affect the strength of the associations revealed within the study (Barry, 2005; Miller & Hollist, 2007).

Within the secondary dataset used in this study, several of the variables were derived from self-reported data, which may be affected by recall bias. However, the timeframe for behavioral variables was limited to the most recent six month period, which has been found to improve subject recall (Catania, Gibson, Marin, Coates & Greenblatt, 1990). Additionally, due to the highly

sensitive nature of the outcomes of interest in this research (i.e., sexual behaviors), social desirability bias is possible in participant responses. This may be attributed to socio-cultural norms regarding the role of men in sexual relationships. However, Computer-Assisted Self-Interviewing (CASI), which was used in the data collection process, has been shown to be an effective means of requesting information on intimate issues in a less threatening manner (Fenton et al., 2001; Ghanem et al., 2005; Kissinger et al., 1999; Kurth et al., 2004). The use of CASI in other studies has been demonstrated to reduce non-response rates and biases in participant responses while also enhancing data validity (Fenton et al., 2001; Ghanem et al., 2005; Kissinger et al., 1999; Kurth et al., 2004). Furthermore, an assessment of the risk questionnaire utilized found strong test-retest reliability, which also demonstrates that the data should yield minimal biases (Nyitray et al., 2009).

In spite of these limitations, this dissertation research has some noteworthy strengths that may prove beneficial in the identification of key factors that play an important role in sexual risk reduction in men. The study used a large cross-national sample of a general population of men, which offers substantial power for the detection of group variances in the analysis. Although the possibility of residual confounding attributable to unmeasured variables cannot be excluded, several potential confounders were controlled for in the statistical analysis.

Since few studies have explored sexual risk factors within general populations of men, the findings provide important information on an

understudied group. As male-centered approaches have been noted as an important aspect of STI prevention (World Health Organization, 2007), the study findings will prove useful in the development and planning of programs to prevent the spread of STIs and provide more opportunities for treatment and education among men. Furthermore, the sub-analysis by age cohort offers critical information on sexual behaviors across the lifespan, which will aid in addressing the health needs of men beyond the youth and/or young adult age group. More specifically, this dissertation research may aid in the design and implementation of sexual risk-reduction interventions for adult males (>30 years), addressing an important gap in preventive services and information.

Conclusions

In this dissertation research, we conducted analyses with a cross-national sample of adult, sexually active men in Brazil, Mexico, and the United States. We examined the prevalence and correlates of sexual behaviors by age cohort, as well as the impact of HPV and STI testing on sexual behaviors. The study findings highlight the need for added public health efforts to reduce STI risk and transmission among heterosexual men beyond the adolescent period. Furthermore, the study underscores the potential for STI testing to decrease sexual risk-taking among men.

Due to the dearth of studies on STI risk and sexual behavior among general populations of men, continued research is needed to yield a greater contextual understanding of male needs and perspectives regarding sexual risk

reduction. Knowledge of the factors associated with an increased likelihood of STI transmission, as well as those associated with sexual risk-taking, may be beneficial in prioritizing prevention strategies and target populations. More specifically, this information will aid in the development and implementation of appropriate and relevant sexual health interventions to ultimately reduce STI incidence and prevalence, increase knowledge and awareness, and improve quality of life.

This study underscores the potential utility of audience segmentation in the development of public health interventions to reduce sexual risk-taking among men by socio-demographic characteristics, particularly age, marital status, and educational level, as well as sexual behaviors, such as age of initiation of sexual activity and lifetime number of sexual partners. A plausible methodological approach to aid in the understanding of these factors, as well as the interaction between them, is chi-squared automatic interaction detection (CHAID). CHAID produces segments within a study population that result from an iterative process of analyzing relationships and interactions between predictor variables (Biggs, de Ville & Suen, 1991; Forthofer & Bryant, 2000; Kass, 1980). CHAID has previously been used to identify unique audience segments (i.e. mutually exclusive and exhaustive subgroups) and patterns and relationships between variables in sexual health research (Catania et al., 1995; Dilorio, Dudley& Soet, 1998; Huba et al., 2001).

Future studies should delve into ecological factors that may influence sexual risk among men, including partner-level correlates, community level

factors (e.g., stigma, culture, religion), and the influence of the health care system. Furthermore, policy and advocacy initiatives should incorporate more broad-based approaches that engage general populations of men, rather than those who have historically been considered to be at high risk. As there is a growing body of research that prioritizes and targets the specific sexual health needs of women, efforts are now needed to equip men with the knowledge, skills, and resources to access STI prevention, screening, and treatment services.

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Appendix A: Literature Review –

Human Papillomavirus among Heterosexual Males

Introduction

The Human Papillomavirus (HPV) is a sexually transmitted virus that is passed on through skin-to-skin and genital contact (Centers for Disease Control and Prevention, 2010). Approximately half of all people who have had sex will have an HPV infection at some point in their lifetime (Centers for Disease Control and Prevention, 2010; Vetter & Geller, 2007). As the most common sexually transmitted infection, an estimated 6.2 million persons are newly infected with HPV annually in the United States (Dunne, Nielson, Stone, Markowitz & Giuliano, 2006; Nielson et al., 2007). HPV infections are largely asymptomatic and transient among both men and women (Dunne et al., 2009; Giuliano, 2007; Nielson et al., 2007), resulting in people unknowingly transmitting the virus to their sexual partners (Giuliano, 2007).

Of the 100 known types of HPV (American Cancer Society, 2006; Bharadwaj, Hussain, Nasare & Das, 2009; Calloway, Jorgensen, Saraiya & Tsui, 2006; Centers for Disease Control and Prevention, 2007; Dunne et al., 2006; Schiffman & Castle, 2003), approximately 30 are associated with anogenital cancer (Bharadwaj et al., 2009), whereas 60 are known to infect the genital tract (Nielson et al., 2007). Roughly 15 strains may potentially cause cervical tumors

(Lowy, Solomon, Hildesheim, Schiller & Schiffman, 2008). Given the numerous strains that infect shared regions of the body, concurrent infection with multiple types of HPV is common (Nielson, Harris et al., 2009).

HPV is strongly associated with the development of invasive cervical, vulvar, oropharyngeal, and anal cancers in women and penile, oropharyngeal, and anal cancers in men (Castellsagué, Bosch & Muñoz, 2003; Chaturvedi, 2010; Colon-Lopez, Ortiz & Palefsky, 2010; Giuliano, Lazcano-Ponce et al., 2008; Giuliano & Salmon, 2008; Giuliano, Tortolero-Luna et al., 2008; Human papillomavirus infection in men residing in Brazil, Mexico, and the USA," 2008; Lowy et al., 2008; Lu et al., 2009; Nielson et al., 2007; Nyitray et al., 2008; Parkin & Bray, 2006). The majority of cancers worldwide (71.8%) are attributable to HPV type 16 and HPV type 18 (Chaturvedi, 2010; Colon-Lopez et al., 2010; Parkin & Bray, 2006). More specifically, HPV is universally recognized as the primary cause of cervical cancer (American Cancer Society, 2006; Barr & Tamms, 2007; Bosch, 2003; Centers for Disease Control and Prevention, 2008; Clifford, Smith, Plummer, Muñoz & Franceschi, 2003; Cox, 2006; Franco, Duarte-Franco & Ferenczy, 2001; Nielson, Harris et al., 2009; Pan American Health Organization, 2007; Sankaranarayanan, Budukh & Rajkumar, 2001; Vetter & Geller, 2007; Walboomers et al., 1999; World Health Organization Information Centre on HPV and Cervical Cancer, 2007a, 2007b; World Health Organization, 2006). Nearly all (99.7%) cervical cancer cases are due to infection with some strain of HPV (Pan American Health Organization, 2004; Walboomers et al., 1999). HPV type 16 and HPV type 18 are two oncogenic strains, which account

for more than two-thirds of cervical cancer cases worldwide (American Cancer Society, 2006; Calloway et al., 2006; Centers for Disease Control and Prevention, 2007; Cox, 2006; Lowy et al., 2008; Vetter & Geller, 2007; World Health Organization Information Centre on HPV and Cervical Cancer, 2007a, 2007b; World Health Organization, 2006).

The non-oncogenic types of HPV are associated with genital warts and are primarily attributable to HPV Types 6 and 11(Beutner, Reitano, Richwald, Wiley & A. M. A. Expert Panel on External Genital Warts., 1998; Colon-Lopez et al., 2010; Donovan, 2004; Giuliano, 2007; Giuliano, Tortolero-Luna et al., 2008; Lacey, Lowndes & Shah, 2006; Mortensen & Larsen, 2010). There are an estimated 500,000 to 1 million new cases of HPV-induced genital warts annually (Beutner et al., 1998). Approximately 20-50% of genital warts cases also involve co-infections with oncogenic HPV strains (Lacey et al., 2006). Although the clinical symptoms of genital warts (i.e., burning, bleeding, and pain) may be uncomfortable, the psychosocial consequences (i.e., embarrassment, depression, anger, shame, impact on sexual and social relationships) may have a greater impact on quality of life (Lacey et al., 2006; Mortensen & Larsen, 2010).

Overall, the impact of HPV on men's health, as well as factors associated with HPV infection among men, is not widely understood. Much of the research on HPV in men has examined their role in the epidemiological chain between HPV and cervical cancer (Agarwal, Sehgal, Sardana, Kumar & Luthra, 1993; Almonte et al., 2008; Bosch et al., 1996; Campion et al., 1988; Giuliano, 2007; Giuliano, Lazcano-Ponce et al., 2008; Giuliano & Salmon, 2008; Human

papillomavirus infection in men residing in Brazil, Mexico, and the USA," 2008; Kyo et al., 1994; Lu et al., 2009; Muñoz & Bosch, 1997; Schiffman & Brinton, 1995; Schiffman & Castle, 2003; Waller, McCaffery, Forrest & Wardle, 2004). Various studies have shown that a high proportion of the male sexual partners of HPV positive women were also HPV positive (Bleeker et al., 2002; Kyo et al., 1994; Nicolau et al., 2005). Male carriers of HPV may be vectors for high-risk HPV types, placing their female sexual partners at risk for cervical cancer (Agarwal et al., 1993; Bosch et al., 1996; Giuliano, Lazcano-Ponce et al., 2008; Hernandez et al., 2008; Muñoz & Bosch, 1997; Schiffman & Castle, 2003). A recent study has identified risk factors associated with anal HPV in heterosexual men, including reported number of lifetime female sex partners and frequency of sex during the previous month (Nyitray et al., 2008).

HPV & Sexual Behavior

Women's risk to HPV and cervical cancer is dependent on the sexual behaviors and practices of their male sexual partners (Agarwal et al., 1993; Almonte et al., 2008; Bosch et al., 1996; Castellsagué et al., 2003; de Sanjosé, Bosch, Muñoz & Shah, 1997; Giuliano, 2007; Giuliano, Lazcano-Ponce et al., 2008; Giuliano & Salmon, 2008; Human papillomavirus infection in men residing in Brazil, Mexico, and the USA," 2008; Lu et al., 2009; Nielson, Schiaffino, Dunne, Salemi & Giuliano, 2009). Previous research indicates that there is an elevated risk of cervical cancer among women whose husbands or male partners had significantly more sexual partners (Almonte et al., 2008; Castellsagué et al.,

2003; Schiffman & Brinton, 1995; Waller et al., 2004). Furthermore, husbands of patients with cervical cancer had a higher likelihood of reporting a history of sexually transmitted infections, as compared to husbands of control subjects who reported more frequent condom usage (Schiffman & Brinton, 1995).

Sexual behavior has been strongly associated with HPV infection and seropositivity in men across multiple studies (Dunne et al., 2006; Giuliano, Lazcano-Ponce et al., 2008). More specifically, lifetime number of sex partners, number of recent sex partners, age at first sexual intercourse, condom use, and sexual frequency are significantly associated with HPV infection in men (Dunne et al., 2006; Lu et al., 2009; Nielson et al., 2007). Other HPV risk factors include smoking status and the presence of genital warts (Lu et al., 2009; Nielson et al., 2007). Unlike other factors associated with heightened risk for HPV, the protective nature of male circumcision has been revealed in several studies (Almonte et al., 2008; Castellsagué et al., 2002; Castellsagué et al., 2003; Drain, Halperin, Hughes, Klausner & Bailey, 2006; Giuliano et al., 2009; Giuliano & Salmon, 2008; Lu et al., 2009; Mcintosh, Sturpe & Khanna, 2008; Murthy & Mathew, 2000; Nielson et al., 2007; Nielson, Schiaffino et al., 2009; Schiffman & Brinton, 1995; Schiffman & Castle, 2003; Waller et al., 2004).

Heterosexual Men's Sexual Behavior

While previous research has unearthed critical information on the importance of sexual behavior in the risk and transmission of HPV, few studies have provided an in-depth examination of men's sexual risk-taking behaviors.

Risky sexual behavior is generally defined as practices, such as high numbers of sexual partners and inconsistent and incorrect condom use, that puts one at higher risk for exposure and contraction of a sexually transmitted infection (STI) (Janssen, Goodrich, Petrocelli & Bancroft, 2009). Studies within the area of HIV/AIDS, as well as other STIs, have examined factors associated with male sub-populations considered to be at high-risk, such as men who have sex with men and substance users (Aidala et al., 2006; Dworkin, 2005; Exner, Gardos, Seal & Ehrhardt, 1999; Seal & Ehrhardt, 2004). Minimal research has investigated risk factors associated with heterosexual transmission of STIs among men, instead focusing largely on women (Aidala et al., 2006; Campbell, 1995; Dworkin, Fullilove & Peacock, 2009; Exner et al., 1999; Flood, 2003; Higgins, Hoffman & Dworkin, 2010; Neumann et al., 2002; Seal & Ehrhardt, 2004). This is shaped partially due to the nature of the epidemic, in which heterosexual transmission is predominantly an attribute of women's risk (Dworkin, 2005; Flood, 2003; Seal & Ehrhardt, 2004). Consequently, heterosexual men have been considered a "forgotten group" within sexual and reproductive health (Exner et al., 1999; Higgins et al., 2010; Seal & Ehrhardt, 2004). In general, men are less knowledgeable about sexual and reproductive health issues, as compared to women (Makenzius, Gadin, Tyden, Romild & Larsson, 2009).

Due to the limited focus of STI education and preventive efforts with heterosexual men, some may perceive that the heterosexual community, particularly males, may be not be at risk, or relatively safe, of contracting STIs

(Flood, 2003). This may be perpetuated by the concept that heterosexual men are powerful and invulnerable, compared to their female counterparts who are more biologically susceptible to STI transmission from their male partners (Dworkin, 2005; Higgins et al., 2010; Perez-Jimenez, Seal & Serrano-Garcia, 2009). Overall, there may be limited knowledge among men and women about the male's role in risk reduction for unintended pregnancy and STIs (Makenzius et al., 2009).

Besides abstinence, correct and consistent use of male condoms is the most effective means of preventing the heterosexual transmission of many STIs (Holmes, Levine & Weaver, 2004; Saul et al., 2000). For HPV, correct and consistent condom use is associated with higher rates of regression of HPV-associated cervical and penile lesions, as well as accelerated clearance of genital HPV infection (Holmes et al., 2004). Given the nature of the male condom, safer sex practices remain largely under the direct volitional control of the male partner (Exner et al., 1999; O'Sullivan, Hoffman, Harrison & Dolezal, 2006; Purcell et al., 2006; Seal & Ehrhardt, 2004). Furthermore, it is frequently expected within heterosexual couples for the male partner to have condoms available for sexual intercourse (Gullette, Rooker & Kennedy, 2009; Thorburn, Harvey & Ryan, 2005). However, few studies have examined the correlates of condom use among heterosexual men (Noar, Morokoff & Redding, 2001).

A major deterrent in consistent condom use among heterosexual men is the pervasiveness of negative attitudes and beliefs regarding condom use. Common beliefs that heighten the likelihood of sexual risk-taking behaviors

include the idea that condoms decrease sexual pleasure and penile sensitivity and that they are inconvenient, serving as a disruption to the sexual act (Flood, 2003; Gullette et al., 2009; Harawa, Williams, Ramamurthi & Bingham, 2006; LaBrie, Pedersen, Thompson & Earleywine, 2008; Perez-Jimenez et al., 2009; Seal & Ehrhardt, 2004; Semaan, Des Jarlais & Malow, 2006). Consequently, many heterosexual men report inconsistent condom use (Aidala et al., 2006; Exner et al., 1999; Flood, 2003; Seal & Ehrhardt, 2004). Additionally, condom use may be partially determined by the male partner's fear of a potential pregnancy and fatherhood, which may be more dominant than one's concern about contracting an STI (Flood, 2003; Seal & Ehrhardt, 2004).

Sexual behaviors among heterosexual men have been found to be fluid, with practices being dependent on the nature of the relationship (Aidala et al., 2006; Exner et al., 1999; Flood, 2003; Seal & Ehrhardt, 2004). Heterosexual men may practice serial monogamy, in which one accumulates multiple sexual partners over their lifetime with varying levels of condom use with each partner (Aidala et al., 2006; Exner et al., 1999; Flood, 2003; Seal & Ehrhardt, 2004). Within serial monogamy, the relationships often involve early commitment and early initiation of sexual activity, with the presumption of exclusivity by both partners (O'Sullivan et al., 2006). Before establishing a longer term, monogamous relationship, there may be transitional periods of increased risk behavior, as men cycle through a series of concurrent or brief sexual relationships (Aidala et al., 2006; Seal & Ehrhardt, 2004). During these transitional periods, greater condom use consistency has been reported, as men

report more risky sexual practices, including multiple concurrent partners and high frequencies of casual sex (Exner et al., 1999). Conversely, within their primary relationships, heterosexual men are less likely to use condoms (Corbett, Dickson-Gomez, Hilario & Weeks, 2009; Flood, 2003; O'Sullivan et al., 2006).

Lack of condom use within relationships has been found to signify trust, commitment, and intimacy among men, as well as their female partners (Corbett et al., 2009; Flood, 2003; LaBrie et al., 2008; O'Sullivan et al., 2006; Thorburn et al., 2005). Studies regarding condom use have yielded conflicting results. Some studies have found that men with non-regular partners (i.e., not in a monogamous relationship) used condoms more frequently (Evans, Bond & MacRae, 1997; Evans, Kell, Bond & MacRae, 1995). Interestingly, other studies have shown that men who have multiple casual sex partners are not more likely to practice safer sex than those in monogamous relationships (Exner et al., 1999; LaBrie et al., 2008). Furthermore, previous research has found that men reporting concurrent, multiple sexual partners are more likely to incorrectly use condoms (Crosby, DiClemente, Yarber, Snow & Troutman, 2008). It has also been found that changing sexual risk behaviors is more challenging with one's primary sexual partner, as compared to practices with casual sexual partners (Purcell et al., 2006).

Heterosexual men who participate in extramarital or extradyadic sexual activities play a critical role in the introduction of STIs into their marital relationships (Manhart, Aral, Holmes & Foxman, 2002; O'Sullivan et al., 2006; Schensul et al., 2006). These men may engage in such activities due to reported

sexual dissatisfaction and their need for sexual excitement, sexual curiosity, and sexual enjoyment (Glass & Wright, 1992; Mooney-Somers & Ussher, 2008; Schensul et al., 2006). Sexual activity outside of the confines of the presumed monogamous relationship has been found to be more common among men, as compared to women (Choi, Catania & Dolcini, 1994; Manhart et al., 2002; O'Sullivan et al., 2006; Wiederman, 1997). Among men, lifetime incidence of extramarital sex was found to increase with age, while a curvilinear relationship existed among women, with the greatest likelihood of extramarital sex being among those 30-50 years old (Wiederman, 1997). Condom use levels have been found to be consistently low (between 8 and 19%) among people reporting extramarital sex (Choi et al., 1994).

When examining sexual risk practices among men, the majority of research conducted has focused on younger populations, including adolescents and young adults (Mooney-Somers & Ussher, 2008). As HIV/AIDS and STI transmission is higher among younger age groups (LaBrie et al., 2008; Noar et al., 2001; Tan, Wong & Chan, 2006), research has been primarily focused on these groups. However, the increase in HIV/AIDS cases among older adults in recent years (Casau, 2005; Coleman & Ball, 2007; Goodroad, 2003; Kohli et al., 2006; Savasta, 2004), coupled with research documenting escalating sexual behavior risks within older age cohorts (Kohli et al., 2006; Rogstad & Bignell, 1991), highlight the need for further research on this sub-group. Multiple studies have found that younger heterosexual men are more likely to practice risky sexual behaviors, such as inconsistent condom use (Aidala et al., 2006; Finer,

Darroch & Singh, 1999; Noar et al., 2001). Conversely, other research has reported condom use to be common among young and middle-aged heterosexual couples but not among older couples (Bruhin, 2003; Kohli et al., 2006; Stall & Catania, 1994). Given this conflicting evidence, additional information is needed to understand how sexual behavior may change with age. Furthermore, it has been acknowledged that sexual risk behaviors, likelihood of infection with an STI, and sexual motivations of heterosexual men evolve over time; therefore, interventions and messaging should be tailored to address these developmental differences between young adult, middle-aged, and older men (Seal & Ehrhardt, 2004).

Although reducing sexual risk behaviors is critical in the prevention of STIs, such as HPV, there are inherent challenges due to the nature of sexual behavior. Within multiple societies and cultures, sex is considered private, which hinders open communication and discussion (Perez-Jimenez et al., 2009; Semaan et al., 2006). Communication about sexual behaviors and safer sex may also be hindered by conflicting perspectives due to the prescribed gender roles of men and women (Perez-Jimenez et al., 2009). Additionally, traditional gender roles within many heterosexual relationships may result in power inequities that influence decision-making regarding condom use and give men greater control over sexual practices (Campbell, 1995; Chopra et al., 2009; Dworkin, 2005; Elwy, Hart, Hawkes & Petticrew, 2002; Exner et al., 1999; Higgins et al., 2010; Saul et al., 2000; Seal & Ehrhardt, 2004). Furthermore, abstinence from all forms of sexual intercourse, which is the most effective

strategy for STI prevention, is not the preferred choice of most heterosexual men and is usually not considered an acceptable alternative to penetrative vaginal intercourse (Exner et al., 1999; Flood, 2003).

Impact of HPV Testing

In recent years, studies have been conducted to assess the impact of HPV testing. However, most of these studies have focused on psychosocial issues influenced by HPV testing, as well as cervical smear testing, among women (Gray et al., 2006; Maissi et al., 2004; Maissi et al., 2005; McCaffery et al., 2004; McCaffery, Waller, Nazroo & Wardle, 2006); no known studies have investigated behavioral risk associated with HPV testing. Previous research has indicated that women who were HPV-positive had heightened levels of anxiety, distress, and concern (Maissi et al., 2004; McCaffery et al., 2004). The raised anxiety and distress levels were diminished six months following initial testing; however, concern about the test results remained elevated (Maissi et al., 2005). Women also had reduced anxiety with increasing age (Gray et al., 2006; Maissi et al., 2004). Due to the sexually transmitted nature of HPV, women who tested positive for HPV reported feeling stigmatized, stressed, and concerned about their sexual relationships (McCaffery et al., 2006). Furthermore, women were worried and anxious about disclosing their HPV status to their sexual partner, family members, and friends (McCaffery et al., 2006). They also felt worse about their past and future sexual relationships (McCaffery et al., 2004). No known studies have examined the impact of HPV testing among men.

Conclusion

Although some studies have emerged that qualitatively explore the role of heterosexual men in safer sex practices and STI transmission, this issue remains relatively unexplored. Overall, public health interventions and programs may be enhanced with a greater understanding of sexual risk behaviors and associated factors of heterosexual men, improving health outcomes among both men and their sexual partners.

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Appendix B

RISK FACTOR QUESTIONNAIRE

The HIM Study: BASELINE VISIT

Moffitt Cancer Center is conducting a research study in order to learn more about Human Papillomavirus (HPV) in men. HPV is a virus that is passed on when people have sex. It is very common in men and women. With your assistance, the information gained from this study will be used to better serve you and the community.

We appreciate your willingness to participate in this project.

All of the information you provide for us is strictly confidential, and your name will not be associated with this questionnaire and will never be used in reports.

Please read each question and provide the answer that best fits your situation. Remember, you have the option of refusing to answer any question that you do not wish to answer.

If you have any questions feel free to ask the project interviewer.

1. Do you consider yourself Spanish/Hispanic/Latino?
   _____ Yes
   _____ No
   _____ Refuse

2. Which one of the following would you say best represents your race?
   _____ White
   _____ Black or African American
   _____ Asian
   _____ Native Hawaiian or Other Pacific Islander
   _____ American Indian, Alaska Native
   _____ Other
   _____ Refuse

3. In which country were you born?
_____ U.S.
_____ Mexico
_____ Brazil
_____ Other
_____ Refuse

4. How many years have you lived in the U.S.?
_____ Years
_____ Refuse

5. In which country have you lived most of your life?
_____ U.S.
_____ Mexico
_____ Brazil
_____ Other
_____ Refuse

6. Date of birth
Month: _____ Day: _____ Year: _____

7. What is your current marital status?
_____ Single, never married
_____ Married
_____ Cohabiting, Living together
_____ Divorced/Separated
_____ Widowed
_____ Refuse

8. How many years of school did you complete?
_____ Did not complete 6th grade
_____ 6th-8th grade
_____ 9th-11th grade
_____ Completed high school/GED
_____ Vocational school
_____ Some college
_____ Graduated college
_____ Postgraduate or professional school
_____ Refuse

9. Have you had at least one drink of any alcoholic beverage in the past month?
_____ Yes
_____ No (Skip to question 12.)
_____ Refuse

10. A drink of alcohol is 1 can or bottle of beer, 1 glass of wine, 1 can or bottle of wine cooler, 1 cocktail, or 1 shot of liquor. During the past 1 month, how many days did you have at least one drink of any alcoholic beverage?
_____ Days
_____ Refuse

11. On the days when you drank, about how much did you drink on average? (Choose all that apply)
_____ Bottles of beer
_____ Glasses of wine
_____ Bottles of wine cooler
_____ Number of cocktails
_____ Shots of liquor
_____ Other types of alcohol
_____ Refuse

12. Have you ever used any form of tobacco (cigarettes, pipes, cigars, chew, snuff)?
_____ Yes
_____ No (Skip to question 20.)
_____ Refuse

13. During your entire life, have you smoked at least 100 cigarettes, which is about 5 packs of cigarettes?
_____ Yes
_____ No (Skip to question 19.)
_____ Refuse

14. How old were you when you started smoking cigarettes?
_____ Years
_____ Refuse

15. About how many years have you smoked cigarettes?
_____ Years
_____ Refuse

16. How many cigarettes on average do/did you smoke per day?
_____ Cigarettes
_____ Refuse

17. Do you smoke cigarettes now?
_____ Yes
_____ No
_____ Refuse

18. During the past 12 months have you stopped smoking for 1 day or longer because you were trying to quit?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

19. Do you currently use chewing tobacco or snuff?
_____ Every Day
_____ Some Days
_____ Not at all
_____ Refuse

20. During the past month, approximately how many hours were you exposed to other people's cigarette smoke in an enclosed location (i.e., home, vehicle, work, bar, restaurant)? If never, enter a 0 and select "Hours per day".
_____ Hours _____ Per Day
_____ Per Week
_____ Per Month
_____ Refuse

21. If you spent an hour in the mid-day sun for the first time without sunscreen, which of these reactions best describes what would happen to your skin: (*Check only one)*
_____ A blistering sunburn
_____ A sunburn without blisters
_____ A mild sunburn that becomes a tan
_____ A tan with no sunburn
_____ No change in skin color

22. A sunburn is any reddening or discomfort of your skin that lasts longer than 2 hours after exposure to the sun or other UV (ultraviolet) sources, such as tanning beds or sunlamps. How many times in your life have you been sunburned severely enough to cause blistering?
_____None (never had a blistering sunburn)
_____ 1 blistering sunburn
_____ 2 blistering sunburns
_____ More than 2 blistering sunburns

The next questions we are going to ask you are sensitive. It is useful to have this information because HPV infection may differ depending on your sexual history.

23. Have you ever been diagnosed with a sexually transmitted disease or infection by a doctor or health care provider?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

24. Has a doctor or health care provider ever diagnosed you with any of the following?

	Yes	No	Don't know
Genital warts	_____	_____	_____
Genital herpes	_____	_____	_____
Chlamydia	_____	_____	_____
Gonorrhea	_____	_____	_____
Syphilis	_____	_____	_____
NGU (non-gonococcal urethritis)	_____	_____	_____
Hepatitis B	_____	_____	_____
Hepatitis C	_____	_____	_____
HIV	_____	_____	_____

25. Have you ever had a sex partner who has had a sexually transmitted disease?
_____ Yes
_____ No
_____ Don't know

_____ Refuse

26. Have you ever had a sex partner who has had genital warts?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

27. Have you ever had a sex partner who has had an abnormal Pap smear?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

28. Have you ever had a female sex partner who has received an HPV vaccine?
_____ Yes
_____ No (skip to question 31)
_____ Don't know (skip to question 31)
_____ Refuse (skip to question 31)

29. How many of your female partners have had an HPV vaccine?
_____ partner(s)
_____ Refuse

30. Has your current partner had an HPV vaccine?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

31. Have you been circumcised?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

We are going to ask you questions about sexual relations. For the questions on sexual intercourse, we define sexual intercourse as your penis in someone else's

vagina or anus.

32. Have you ever performed vaginal, anal, or oral sex (your penis in partner's vagina, anus, or mouth or your partner's penis in your anus or mouth)?
_____ Yes
_____ No (Skip to Medical History Questionnaire)
_____ Refuse

33. Have you ever performed vaginal sex (your penis in partner's vagina)?
_____ Yes
_____ No (Skip to question 42)
_____ Refuse

34. How old were you when you first had vaginal sex?
_____ Years
_____ Refuse

35. In your life, what is the number of women with whom you have had vaginal sex?
_____ Women
_____ Refuse

36. In the past 6 months, how many different women have you had vaginal sex with?
_____ Women
_____ Refuse

37. In the past 6 months, how many women have you had vaginal sex with for the first time?
_____ Women
_____ Refuse

38. In the past 6 months, how many times did you have vaginal sex?
_____ Times
_____ Refuse

39. In the past 6 months, when you had vaginal sex, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ No vaginal sex in past 6 months
_____ Refuse

40. How long has it been since you had vaginal sex?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

41. Did you use a condom the last time you had vaginal sex?
_____ Yes
_____ No
_____ Don't remember
_____ Never used a condom with vaginal sex
_____ Refuse

42. Have you ever performed oral sex (your penis in your partner's mouth or your partner's vagina in your mouth or your partner's penis in your mouth)?
_____ Yes
_____ No (Skip to question 50)
_____ Refuse

43. Did you perform oral sex on your partner in the past 6 months?
_____ Yes
_____No (Skip to question 45)
_____Refuse

44. In the past 6 months, how many times did you perform oral sex on your partner?
_____ Times
_____ Refuse

45. How long has it been since you performed oral sex on your partner?
_____Hours
_____Days
_____Weeks
_____Months
_____Years
_____Refuse

46. Has a partner ever performed oral sex on you? (Your penis in your partner's mouth)
_____ Yes
_____ No (Skip to question 50)
_____ Refuse

47. Did your partner perform oral sex on you in the past 6 months?
_____Yes
_____No (Skip to question 49)
_____Refuse

48. In the past 6 months, how many times did your partner perform oral sex on you?
_____ Times
_____ Refuse

49. How long has it been since your partner performed oral sex on you?
_____Hours
_____Days
_____Weeks
_____Months
_____Years
_____Refuse

50. Have you ever performed insertive anal sex (your penis in partner's anus)?
_____ Yes
_____ No (Skip to question 56)
_____ Refuse

51. Have you performed insertive anal sex in the past 6 months?
_____ Yes
_____ No (Skip to question 54)
_____ Refuse

52. In the past 6 months, how many times did you perform insertive anal sex?
_____ Times
_____ Refuse

53. In the past 6 months, when you had insertive anal sex, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

54. How long has it been since you performed insertive anal sex?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

55. Did you use a condom the last time you performed insertive anal sex?
_____ Yes
_____ No
_____ Don't remember
_____ Refuse

56. Have you ever performed receptive anal sex (your partner's penis in your anus)?
_____ Yes
_____ No (Skip to introduction to question 62)
_____ Refuse

57. Have you had receptive anal sex in the past 6 months?
_____ Yes

_____ No (Skip to question 60)
_____ Refuse

58. In the past 6 months, how many times did you have receptive anal sex?
_____ Times
_____ Refuse

59. In the past 6 months, when you had receptive anal sex, how often did your partner use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

60. How long has it been since you had receptive anal sex?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

61. Did your partner use a condom the last time you had receptive anal sex?
_____ Yes
_____ No
_____ Don't remember
_____ Refuse

For the next few questions, we are going to ask you about your steady partner you see regularly.

62. Do you have a steady female sex partner?
_____ Yes
_____ No (Skip to introduction to question 70)
_____ Refuse

63. The last time you had sex, was the partner a steady partner?
_____ Yes
_____ No
_____ Refuse

64. How long have you been having sexual intercourse with your steady partner?
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

65. In the past 3 months, when you had sexual intercourse with your steady partner, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Have not had sex with steady partner in past 3 months
_____ Refuse

66. The first time you had sex with your steady partner, did one of you use a condom?
_____ Yes
_____ No
_____ Don't remember
_____ Refuse

67. In the past 3 months, did you have sex with someone other than your steady partner?
_____ Yes
_____ No (Skip to introduction to question 70)
_____ Refuse

68. How many people other than your steady partner have you had sex with in the past 3 months?
_____ People
_____ Refuse

69. In the past 3 months, when you had sexual intercourse with your other partner(s), how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

The next questions we are going to ask are sensitive, and have to do with some private sex practices. Your answers are private and used only for research purposes.

70. Have you ever exchanged sex for money or drugs?
_____ Yes
_____ No (Skip to introduction to question 77)
_____ Refuse

71. Have you ever paid a woman to have sex (vaginal or anal or oral) with you?
_____ Yes
_____ No (Skip to introduction to question 77)
_____ Refuse

72. In the past 3 months, have you paid a woman to have sex with you?
_____ Yes
_____ No (Skip to introduction to question 77)
_____ Refuse

73. In the past 3 months, how many times have you paid a woman to have sex with you?
_____ Times
_____ Refuse

74. In the past 3 months, when you paid for sex, was it: (Choose all that apply)
_____ In the U.S.
_____ Outside the U.S.
_____ Refuse

75. In the past 3 months, what kind of sex did you pay for? (Choose all that apply)
_____ Vaginal sex (your penis in partner's vagina)
_____ Oral sex (your penis in partner's mouth or partner's vagina in your mouth)
_____ Anal sex, insertive (your penis in partner's anus)
_____ Other
_____ Refuse

76. In the past 3 months, when you paid for vaginal, oral, or anal sex, how often did you use condoms?
____ Always
____ More than half the time
____ Half the time
____ Less than half the time
____ Never
____ Refuse

We are now going to ask you additional sensitive questions. It is useful to have this information because HPV infection may differ depending on the type of sex. Your answers are strictly confidential and used only for research purposes.

77. Have you ever had sex with a man (your penis in partner's anus or mouth, or our partner's penis in your anus or mouth)?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse (Thank you for your participation – please end the questionnaire)

78. Have you ever performed oral sex with a man (your penis in partner's mouth or your partner's penis in your mouth)?
_____ Yes
_____ No
_____ Refuse

79. Have you ever performed anal sex with a man (your penis in partner's anus or your partner's penis in your anus)?
_____ Yes

_____ No (Skip to question 83)
_____ Refuse (Skip to question 83)

80. In your life, what is the number of men with whom you have had anal sex (your penis in partner's anus or partner's penis in your anus)?
_____ Men
_____ Refuse

81. In the past 3 months, how many men have you had anal sex with?
____ Men
_____ Refuse

82. In the past 3 months, how many men have you had anal sex with for the first time?
_____ Men
_____ Refuse

83. Have you ever paid a man to have sex (anal or oral) with you?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse

84. In the past 3 months, have you paid a man to have sex with you?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse (Thank you for your participation – please end the questionnaire)

85. In the past 3 months, how many times have you paid a man to have sex with you?
_____ Times
_____ Refuse

86. In the past 3 months, when you paid for sex with a man, was it: (Choose all that apply)
_____ In the U.S.
_____ Outside the U.S.

_____ Refuse

87. In the past 3 months, what kind of sex (with a man) did you pay for? (Choose all that apply)
_____ Oral sex (your penis in partner's mouth)
_____ Anal sex, insertive (your penis in partner's anus)
_____ Other
_____ Refuse

88. In the past 3 months, when you paid for anal or oral sex with a man, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

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Appendix C

RISK FACTOR QUESTIONNAIRE

The HIM Study: FOLLOW-UP VISITS

Moffitt Cancer Center is conducting a research study in order to learn more about Human Papillomavirus (HPV) in men. HPV is a virus that is passed on when people have sex. It is very common in men and women. With your assistance, the information gained from this study will be used to better serve you and the community.

We appreciate your willingness to participate in this project.

All of the information you provide for us is strictly confidential, and your name will not be associated with this questionnaire and will never be used in reports.

Please read each question and provide the answer that best fits your situation. Remember, you have the option of refusing to answer any question that you do not wish to answer.

If you have any questions feel free to ask the project interviewer.

1. Do you consider yourself Spanish/Hispanic/Latino?
   _____ Yes
   _____ No
   _____ Refuse

2. Which one of the following would you say best represents your race?
   _____ White
   _____ Black or African American
   _____ Asian
   _____ Native Hawaiian or Other Pacific Islander
   _____ American Indian, Alaska Native
   _____ Other
   _____ Refuse

3. What is your current marital status?

_____ Single, never married
_____ Married
_____ Cohabiting, Living together
_____ Divorced/Separated
_____ Widowed
_____ Refuse

4. How many years of school did you complete?
_____ Did not complete 6th grade
_____ 6th-8th grade
_____ 9th-11th grade
_____ Completed high school/GED
_____ Vocational school
_____ Some college
_____ Graduated college
_____ Postgraduate or professional school
_____ Refuse

5. Have you had at least one drink of any alcoholic beverage in the past month?
_____ Yes
_____ No (Skip to question 8)
_____ Refuse

6. A drink of alcohol is 1 can or bottle of beer, 1 glass of wine, 1 can or bottle of wine cooler, 1 cocktail, or 1 shot of liquor. During the past 1 month, how many days did you have at least one drink of any alcoholic beverage?
_____ Days
_____ Refuse

7. On the days when you drank, about how much did you drink on average? (Choose all that apply)
_____ Bottles of beer
_____ Glasses of wine
_____ Bottles of wine cooler
_____ Number of cocktails
_____ Shots of liquor
_____ Other types of alcohol
_____ Refuse

8. During the past 6 months, or since your last visit, have you used any form of tobacco (cigarettes, pipes, cigars, chew, snuff)?
_____ Yes
_____ No (Skip to question 11)
_____ Refuse

9. During the past 6 months or since your last visit, how many cigarettes on average did you smoke per day?
_____ Cigarettes/day
_____ Refuse

10. Do you smoke cigarettes now?
_____ Yes
_____ No
_____ Refuse

11. During the past 6 months or since your last visit, have you used any forms of nicotine replacement (patches, nicotine gum, etc.)?
_____ Yes
_____ No
_____ Refuse

12. Do you currently use chewing tobacco or snuff?
_____ Every day
_____ Some days
_____ Not at all
_____ Refuse

13. If you spent an hour in the mid-day sun for the first time without sunscreen, which of these reactions best describes what would happen to your skin: (*Check only one)*
_____ A blistering sunburn
_____ A sunburn without blisters
_____ A mild sunburn that becomes a tan
_____ A tan with no sunburn
_____ No change in skin color

14. A sunburn is any reddening or discomfort of your skin that lasts longer than 2 hours after exposure to the sun or other UV (ultraviolet) sources,

such as tanning beds or sunlamps. How many times in your life have you been sunburned severely enough to cause blistering?
_____ None (never had a blistering sunburn)
_____ 1 blistering sunburn
_____ 2 blistering sunburns
_____ More than 2 blistering sunburns

The following section will ask you questions about kissing and oral hygiene.

15. How many different people have you kissed in the past 6 months? (Kissing is defined as open mouth kissing, or putting your tongue in a person's mouth)
_____ People
_____ Refuse

16. How many different people have you ever kissed (Kissing is defined as open mouth kissing, or putting your tongue in a person's mouth)?
_____0
_____1-9 people
_____10-24 people
_____25-49 people
_____50 or more people
_____ Refuse

17. Have you been diagnosed with gingivitis as an adult (Gingivitis is a mild form of gum (periodontal) disease)?
_____ Yes
_____ No
_____ Refuse

18. How many teeth have you had extracted due to gum disease, gingivitis, or decay?
_____ Teeth
_____ Refuse

19. How often on average do you brush your teeth? (Choose only one answer)
_____ Times/day
_____ Times/week
_____ Times/month

_____ Refuse

20. Do your gums consistently bleed when you brush your teeth or are your gums swollen?
_____ Yes
_____ No
_____ Refuse

21. Have you ever had warts in your mouth or throat?
_____Yes
_____No (Skip to introduction to question 24)
_____Refuse (Skip to introduction to question 24)

22. How many warts have you had in your mouth?
____Warts
____ Refuse

23. When did you have warts in your mouth?
____ Currently have warts in my mouth
____ 1 month ago
____ 6 months ago
____ More than 6 months ago
____ Refuse

The next questions we are going to ask you are sensitive. It is useful to have this information because HPV infection may differ depending on your sexual history.

24. During the past 6 months or since your last visit, have you been diagnosed with a sexually transmitted disease or infection, other than HPV, by a doctor or health care provider?
____Yes
____No
____Don't know
____Refuse

25. During the past 6 months or since your last visit, has a doctor or health care provider diagnosed you with any of the following?

Genital warts ___Yes ___No ___ Don't know ___Refuse

Genital herpes	___Yes	___No	___ Don't know	___Refuse
Chlamydia	___Yes	___No	___ Don't know	___Refuse
Gonorrhea	___Yes	___No	___ Don't know	___Refuse
Syphilis	___Yes	___No	___ Don't know	___Refuse
NGU (Non-gonococcal urethritis)	___Yes	___No	___ Don't know	___Refuse
Hepatitis B	___Yes	___No	___ Don't know	___Refuse
Hepatitis C	___Yes	___No	___ Don't know	___Refuse
HIV	___Yes	___No	___ Don't know	___Refuse

26. During the past 6 months or since your last visit, have you had a sex partner who has had a sexually transmitted disease or infection?
____ Yes
____ No
____ Don't know
____ Refuse

27. During the past 6 months or since your last visit, have you had a sex partner who has had genital warts?
____ Yes
____ No
____ Don't know
____ Refuse

28. During the past 6 months or since your last visit, have you had a sex partner who has had an abnormal Pap smear?
____ Yes
____ No
____ Don't know
____ Refuse

29. Have you ever had a female sex partner who has received an HPV vaccine?
____ Yes
____ No (Skip to question 32)
____ Don't know (Skip to question 32)
____ Refuse (Skip to question 32)

30. How many of your female partners have had an HPV vaccine?
____ Partner(s)
____ Refuse

31. Has your current partner had an HPV vaccine?
_____ Yes
_____ No
_____ Don't know
_____ Refuse

32. Have you ever received an HPV vaccine?
_____ Yes
_____ No (Skip to introduction to question 36)

33. When did you receive your first dose of the HPV vaccine?
Month:_____ Day:_____ Year:_____

34. When did you receive your second dose of the HPV vaccine? (If you have not had your second dose yet, please add zero for month, day, and year.)
Month:_____ Day:_____ Year:_____

35. When did you receive your third dose of the HPV vaccine? (If you have not had your third dose yet, please add zero for month, day, and year.)
Month:_____ Day:_____ Year:_____

The following section will ask you questions about sexual relations.

36. During the past 6 months or since your last visit, have you performed vaginal, anal, or oral sex (your penis in partner's vagina, anus, or mouth or your partner's penis in your anus or mouth)?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse

37. During the past 6 months or since your last visit, have you performed vaginal sex (your penis in partner's vagina)?
_____ Yes
_____ No
_____ Never had vaginal sex (Skip to question 47)
_____ Refuse

38. How old were you when you first had vaginal sex?
_____ Years
_____ Refuse

39. In your life, what is the number of women with whom you have had vaginal sex?
_____ Women
_____ Refuse

40. During the past 6 months or since your last visit, how many new female sexual partners have you had?
_____ Women
_____ Refuse

41. In the past 6 months, how many women have you had vaginal sex with?
_____ Women
_____ Refuse

42. In the past 6 months, how many women have you had vaginal sex with for the first time?
_____ Women
_____ Refuse

43. In the past 6 months, how many times did you have vaginal sex?
_____ Times
_____ Refuse

44. In the past 6 months, when you had vaginal sex, how often did you use a condom?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ No vaginal sex in past 6 months
_____ Refuse

45. How long has it been since you had vaginal sex?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

46. Did you use a condom the last time you had vaginal sex?
_____ Yes
_____ No
_____ Don't remember
_____ Never used a condom with vaginal sex
_____ Refuse

47. Have you ever had oral sex (your penis in your partner's mouth or your partner's vagina in your mouth or your partner's penis in your mouth)?
_____ Yes
_____ No (Skip to question 55)
_____ Refuse

48. Did you perform oral sex on your partner in the past 6 months?
_____ Yes
_____ No (Skip to question 50)
_____ Refuse

49. In the past 6 months, how many times did you perform oral sex on your partner?
_____ Times
_____ Refuse

50. How long has it been since you performed oral sex on your partner?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

51. Has a partner ever performed oral sex on you? (Your penis in your partner's mouth)
_____ Yes
_____ No (Skip to question 55)
_____ Refuse

52. Did your partner perform oral sex on you in the past 6 months?
_____ Yes
_____ No (Skip to question 54)
_____ Refuse

53. In the past 6 months, how many times did your partner perform oral sex on you?
_____ Times
_____ Refuse

54. How long has it been since your partner performed oral sex on you?
_____Hours
_____Days
_____Weeks
_____Months
_____Years
_____Refuse

55. Have you ever performed insertive anal sex (your penis in partner's anus)?
_____ Yes
_____ No (Skip to question 61)
_____ Refuse

56. Have you performed insertive anal sex in the past 6 months?
_____Yes
_____ No (Skip to question 59)
_____Refuse

57. In the past 6 months, how many times did you perform insertive anal sex?
_____Times
_____Refuse

58. In the past 6 months, when you had insertive anal sex, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

59. How long has it been since you performed insertive anal sex?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

60. Did you use a condom the last time you performed insertive anal sex?
_____ Yes
_____ No
_____ Don't remember
_____ Refuse

61. Have you ever had receptive anal sex (your partner's penis in your anus)?
_____ Yes
_____ No (Skip to introduction to question 67)
_____ Refuse

62. Have you had receptive anal sex in the past 6 months?
_____Yes
_____ No (Skip to question 65)
_____Refuse

63. In the past 6 months, how many times did you have receptive anal sex?
_____Times
_____Refuse

64. In the past 6 months, when you had receptive anal sex, how often did your partner use condoms?
_____ Always

_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

65. How long has it been since you had receptive anal sex?
_____ Hours
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

66. Did your partner use a condom the last time you had receptive anal sex?
_____ Yes
_____ No
_____ Don't remember
_____ Refuse

For the next few questions, we are going to ask you about steady partner(s), or partner(s) you see regularly.

67. Do you have a steady female sex partner?
_____ Yes
_____ No (Skip to introduction to question 75)
_____ Refuse

68. The last time you had sex, was the partner a steady partner?
_____ Yes
_____ No
_____ Refuse

69. How long have you been having sexual intercourse with your steady partner?
_____ Days
_____ Weeks
_____ Months
_____ Years
_____ Refuse

70. In the past 3 months, when you had sexual intercourse with your steady partner, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Have not had sex with steady partner in past 3 months
_____ Refuse

71. The first time you had sex with your steady partner, did one of you use a condom?
_____ Yes
_____ No
_____ Don't remember
_____ Refuse

72. In the past 3 months, did you have sex with someone other than your steady partner?
_____ Yes
_____ No (Skip to introduction to question 75)
_____ Refuse

73. How many people other than your steady partner have you had sex with in the past 3 months?
_____ People
_____ Refuse

74. In the past 3 months, when you had sexual intercourse with your other partner(s), how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

The next questions we are going to ask are sensitive, and have to do with some private sex practices. Your answers are private and used only for research purposes.

75. In the past 6 months or since your last visit, have you exchanged sex for money or drugs?
_____ Yes
_____ No (Skip to introduction to question 83)
_____ Refuse

76. In the past 6 months or since your last visit, have you paid a woman to have sex (vaginal or anal or oral) with you?
_____ Yes
_____ No (Skip to introduction to question 83)
_____ Refuse

77. In the past 6 months or since your last visit, what kind of sex did you pay for? (Mark all that apply.)
_____ Vaginal sex (your penis in partner's vagina)
_____ Oral sex (your penis in partner's mouth or partner's vagina in your mouth)
_____ Anal sex, insertive (your penis in partner's anus)
_____ Other
_____ Refuse

78. In the past 3 months, have you paid a woman to have sex with you?
_____ Yes
_____ No (Skip to introduction to question 83)
_____ Refuse

79. In the past 3 months, how many times have you paid a woman to have sex with you?
_____ Times
_____Refuse

80. In the past 3 months, when you paid for sex, was it: (Choose all that apply)
_____ In the U.S.
_____ Outside the U.S.
_____ Refuse

81. In the past 3 months, what kind of sex did you pay for? (Choose all that apply)
_____ Vaginal sex (your penis in partner's vagina)
_____ Oral sex (your penis in partner's mouth or partner's vagina in your mouth)
_____ Anal sex, insertive (your penis in partner's anus)
_____ Other
_____ Refuse

82. In the past 3 months, when you paid for vaginal, oral, or anal sex, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

We are now going to ask you additional sensitive questions. It is useful to have this information because HPV infection may differ depending on the type of sex. Your answers are strictly confidential and used only for research purposes.

83. In the past 6 months or since your last visit, have you had sex with a man (your penis in partner's anus or mouth, or your partner's penis in your anus or mouth)?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse

84. In the past 6 months or since your last visit, have you performed oral sex with a man (your penis in partner's mouth or your partner's penis in your mouth)?
_____ Yes
_____ No
_____ Refuse

85. In the past 6 months or since your last visit, have you performed anal sex with a man (your penis in partner's anus or your partner's penis in your anus)?
_____ Yes
_____ No (Skip to question 90)
_____ Refuse (Skip to question 90)

86. During the past 6 months or since your last visit, have you had a new male sex partner?
_____ Yes
_____ No
_____ Refuse

87. In your life, what is the number of men with whom you have had anal sex (your penis in partner's anus or partner's penis in your anus)?
_____ Men
_____ Refuse

88. In the past 3 months, how many men have you had anal sex with?
_____ Men
_____ Refuse

89. In the past 3 months, how many men have you had anal sex with for the first time?
_____ Men
_____ Refuse

90. During the past 6 months or since your last visit, have you paid a man to have sex (anal or oral) with you?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse

91. In the past 3 months, have you paid a man to have sex with you?
_____ Yes
_____ No (Thank you for your participation – please end the questionnaire)
_____ Refuse (Thank you for your participation – please end the questionnaire)

92. In the past 3 months, how many times have you paid a man to have sex with you?
_____ Times
_____ Refuse

93. In the past 3 months, when you paid for sex with a man, was it: (Choose all that apply)
_____ In the U.S.
_____ Outside the U.S.
_____ Refuse

94. In the past 3 months, what kind of sex (with a man) did you pay for? (Choose all that apply)
_____ Oral sex (your penis in partner's mouth)
_____ Anal sex, insertive (your penis in partner's anus)
_____ Other
_____ Refuse

95. In the past 3 months, when you paid for anal or oral sex with a man, how often did you use condoms?
_____ Always
_____ More than half the time
_____ Half the time
_____ Less than half the time
_____ Never
_____ Refuse

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Appendix D

Supplemental Tables for Manuscript 2

Table D1: Test results for HPV and other STIs in study population by level of participation (i.e., attrition) [a]

HPV and STI Test Results [b]	**TOTAL** N=3,052 n (%)	**Pre-Diagnosis Only** [c] n=701 (23.0%) n (%)	**Pre-Diagnosis & Post-Diagnosis** [c] n=2,351 (77.0%) n (%)	P-value [d]
Positive for both HPV and other STIs	512 (16.8)	117 (22.9)	395 (77.2)	**0.0030**
Positive for HPV only	1,376 (45.1)	288 (20.9)	1,088 (79.1)	
Positive for other STIs only	211 (6.9)	68 (32.2)	143 (67.8)	
Negative for both HPV and other STIs	953 (31.2)	228 (23.9)	725 (76.1)	

Abbreviations: HPV=Human Papillomavirus; STI=Sexually Transmitted Infections
[a] *Percentages may not total to 100 due to rounding. Totals exclude unknown/refused values.*
[b] *Other STIs include chlamydia, gonorrhea, herpes, and syphilis.*
[c] *Pre-Diagnosis Only group includes men who received HPV & STI results (Baseline/Visit 1 to Visit 2) but subsequently dropped out of the study. Pre-Diagnosis & Post-Diagnosis group includes men who received HPV & STI results and subsequently returned to participate in the study (Baseline/Visit 1 to Visit 3).*
[d] *Significant values in bold font. P-values <0.05 considered significant.*

Table D2: Baseline demographic and behavioral characteristics in study population by level of participation (i.e., attrition) [a]

Characteristics	TOTAL N=3,052 n (%)	Pre-Diagnosis Only [b] n=701 (23.0%) n (%)	Pre-Diagnosis & Post-Diagnosis [b] n=2,351 (77.0%) n (%)	P-value [c]
Country of Residence				**<.0001**
Brazil	1,187 (38.9)	244 (20.6)	943 (79.4)	
Mexico	870 (28.5)	310 (35.6)	560 (64.4)	
United States	995 (32.6)	147 (14.8)	848 (85.2)	
Age				0.0693
18-30 years	1,451 (47.5)	309 (21.3)	1,142 (78.7)	
31-44 years	1,175 (38.5)	295 (25.1)	880 (74.9)	
45-70 years	426 (14.0)	97 (22.8)	329 (77.2)	
Race				**<.0001**
White	1,482 (49.1)	264 (17.8)	1,218 (82.2)	
Black	481 (15.9)	89 (18.5)	392 (81.5)	
Asian/ Pacific Islander	75 (2.5)	17 (22.7)	58 (77.3)	
American Indian/ Alaskan	62 (2.1)	12 (19.4)	50 (80.7)	
Mixed	919 (30.4)	311 (33.8)	608 (66.2)	
Hispanic				**<.0001**
Yes	1,289 (42.5)	381 (29.6)	908 (70.4)	
No	1,743 (57.5)	313 (18.0)	1,430 (82.0)	
Marital Status				**<.0001**
Single	1,377 (45.1)	252 (18.3)	1,125 (81.7)	
Married	1,038 (34.0)	306 (29.5)	732 (70.5)	
Cohabitating	360 (11.8)	90 (25.0)	270 (75.0)	
Divorced/ Separated/ Widowed	276 (9.1)	53 (19.2)	223 (80.8)	
Educational Level				**<.0001**
<12 years	574 (18.8)	191 (33.3)	383 (66.7)	
12 years	802 (26.3)	175 (21.8)	627 (78.9)	
13-15 years	840 (27.5)	157 (18.7)	683 (81.3)	
16 years	622 (20.4)	131 (21.1)	491 (78.9)	
≥17 years	212 (7.0)	46 (21.7)	166 (78.3)	

Table D2 (Continued)

Sexual Orientation				0.6482
Heterosexual	2,692 (88.2)	624 (23.2)	2,068 (76.8)	
Homosexual	136 (4.5)	27 (19.9)	109 (80.2)	
Bisexual	224 (7.3)	50 (22.3)	174 (77.7)	
Circumcision Status				**<.0001**
Yes	1,127 (36.9)	202 (17.9)	925 (82.1)	
No	1,925 (63.1)	499 (25.9)	1,426 (74.1)	
Smoking Status				**<.0001**
Yes	676 (22.2)	193 (28.6)	483 (71.5)	
No	2,376 (77.9)	508 (21.4)	1,868 (78.6)	
Number of Lifetime Sexual Partners				0.5975
1	239 (8.0)	55 (23.0)	184 (77.0)	
2-9	1,282 (42.7)	311 (24.3)	971 (75.7)	
10-19	630 (21.0)	146 (23.2)	484 (76.8)	
20-49	602 (20.1)	130 (21.6)	472 (78.4)	
≥50	250 (8.3)	51 (20.4)	199 (79.6)	

[a] *Percentages may not total to 100 due to rounding. Totals exclude unknown/refused values.*
[b] *Pre-Diagnosis Only group includes men who received HPV & STI results (Baseline/Visit 1 to Visit 2) but subsequently dropped out of the study. Pre-Diagnosis & Post-Diagnosis group includes men who received HPV & STI results and subsequently returned to participate in the study (Baseline/Visit 1 to Visit 3).*
[c] *Significant values in bold font. P-values <0.05 considered significant.*

Table D3: Self-reported sexual behaviors among study participants at baseline by level of participation (i.e., attrition) [a]

Behaviors	TOTAL N=3,052 n (%)	Pre-Diagnosis Only [b] n=701 (23.0%) n (%)	Pre-Diagnosis & Post-Diagnosis [b] n=2,351 (77.0%) n (%)	P-value [c]
Vaginal sex in past 6 months				0.6342
Yes	2,952 (96.7)	680 (23.0)	2,272 (77.0)	
No	100 (3.3)	21 (21.0)	79 (79.0)	
Oral sex in past 6 months				**0.0002**
Yes	2,646 (86.7)	578 (21.8)	2,068 (78.2)	
No	406 (13.3)	123 (30.3)	283 (69.7)	
Paid for sex in past 6 months				**0.0041**
Yes	571 (16.7)	157 (27.5)	414 (72.5)	
No	2,476 (81.3)	542 (21.9)	1,934 (78.1)	
Condom use for vaginal sex in recent past				**0.0333**
No vaginal sex	100 (3.6)	21 (21.0)	79 (79.0)	
Always	300 (10.9)	55 (18.3)	245 (81.7)	
Sometimes	2,136 (77.5)	508 (23.8)	1,628 (76.2)	
Never	220 (8.0)	64 (29.1)	156 (70.9)	
Number of new sexual partners in past 6 months				0.7892
0	1,868 (63.8)	431 (23.1)	1,437 (76.9)	
1	697 (23.8)	157 (22.5)	540 (77.5)	
2	182 (6.2)	45 (24.7)	137 (75.3)	
3+	181 (8.2)	37 (20.4)	144 (79.6)	

[a] *Percentages may not total to 100 due to rounding. Totals exclude unknown/refused values.*
[b] *Pre-Diagnosis Only group includes men who received HPV & STI results (Baseline/Visit 1 to Visit 2) but subsequently dropped out of the study. Pre-Diagnosis & Post-Diagnosis group includes men who received HPV & STI results and subsequently returned to participate in the study (Baseline/Visit 1 to Visit 3).*
[c] *Significant values in bold font. P-values <0.05 considered significant.*

Table D4. Change in self-reported sexual behaviors following HPV/STI testing and receipt of test results by HPV and/or STI diagnosis [a, b]

POSITIVE FOR BOTH HPV AND OTHER STIs						
Behaviors	Response Categories	**STUDY VISITS** **Visit 1** n (%)	**Visit 2** n (%)	**Visit 3** n (%)	**Change from Visit 1 to Visit 2** [c] McNemar p-value	**Change from Visit 2 to Visit 3** [c] McNemar p-value
Vaginal sex in past 6 months	Yes	371 (94.4)	301 (76.6)	292 (74.3)	**<.0001**	0.2076
	No	22 (5.6)	92 (23.4)	101 (25.7)		
Oral sex in past 6 months	Yes	297 (89.2)	275 (82.6)	270 (81.1)	**0.0005**	0.4111
	No	36 (10.8)	58 (17.4)	63 (18.9)		
Paid for sex in past 6 months	Yes	97 (30.0)	33 (10.2)	30 (9.3)	**<.0001**	0.5316
	No	226 (70.0)	290 (89.8)	293 (90.7)		
Condom use for vaginal sex in recent past	No vaginal sex	17 (5.0)	56 (16.3)	66 (19.2)	**<.0001**	0.6069
	Always	32 (9.3)	33 (9.6)	30 (8.8)		
	Sometimes	263 (76.7)	234 (68.2)	227 (66.2)		
	Never	31 (9.0)	20 (5.8)	20 (5.8)		
Number of new sexual partners in past 6 months	0	171 (61.7)	138 (49.8)	143 (51.6)	**0.0282**	0.3587
	1	53 (19.1)	76 (27.4)	67 (24.2)		
	2	17 (6.1)	29 (10.5)	41 (14.8)		
	3+	36 (13.0)	34 (12.3)	26 (9.4)		
POSITIVE FOR HPV ONLY						
Behaviors	Response Categories	**STUDY VISITS** **Visit 1** n (%)	**Visit 2** n (%)	**Visit 3** n (%)	**Change from Visit 1 to Visit 2** [c] McNemar p-value	**Change from Visit 2 to Visit 3** [c] McNemar p-value
Vaginal sex in past 6 months	Yes	1,042 (97.3)	923 (86.2)	902 (84.2)	**<.0001**	0.0583
	No	29 (2.7)	148 (13.8)	169 (15.8)		
Oral sex in past 6 months	Yes	848 (91.5)	768 (82.9)	789 (85.1)	**<.0001**	**0.0443**
	No	79 (8.5)	159 (17.2)	138 (14.9)		
Paid for sex in past 6 months	Yes	163 (18.0)	39 (4.3)	33 (3.7)	**<.0001**	0.3657
	No	742 (82.0)	866 (95.7)	872 (96.4)		

Table D4 (Continued)

Condom use for vaginal sex in recent past	No vaginal sex Always Sometimes Never	25 (2.6) 101 (10.4) 761 (78.6) 81 (8.4)	97 (10.0) 98 (10.1) 694 (71.7) 79 (8.2)	111 (11.5) 76 (7.9) 708 (73.1) 73 (7.5)	**<.0001**	0.2596
Number of new sexual partners in past 6 months	0 1 2 3+	485 (59.1) 209 (25.5) 68 (8.3) 59 (7.2)	446 (54.3) 219 (26.7) 91 (11.1) 65 (7.9)	445 (54.2) 222 (27.0) 85 (10.4) 69 (8.4)	**0.0403**	0.9861
POSITIVE FOR STIs ONLY						
Behaviors	Response Categories	**STUDY VISITS** **Visit 1** n (%)	**Visit 2** n (%)	**Visit 3** n (%)	**Change from Visit 1 to Visit 2** [c] McNemar p-value	**Change from Visit 2 to Visit 3** [c] McNemar p-value
Vaginal sex in past 6 months	Yes No	134 (95.7) 6 (4.3)	103 (73.6) 37 (26.4)	100 (71.4) 40 (28.6)	**<.0001**	0.5316
Oral sex in past 6 months	Yes No	90 (81.8) 20 (18.2)	86 (78.2) 24 (21.8)	81 (73.6) 29 (26.4)	0.3173	0.1655
Paid for sex in past 6 months	Yes No	28 (27.2) 75 (72.8)	10 (9.7) 93 (90.3)	11 (10.7) 92 (89.3)	**<.0001**	0.6547
Condom use for vaginal sex in recent past	No vaginal sex Always Sometimes Never	5 (4.3) 11 (9.4) 95 (81.2) 6 (5.1)	20 (17.1) 13 (11.) 75 (84.1) 9 (7.7)	24 (20.5) 8 (6.8) 77 (65.8) 8 (6.8)	**0.0055**	0.7915
Number of new sexual partners in past 6 months	0 1 2 3+	69 (75.) 15 (16.3) 2 (2.2) 6 (6.5)	56 (60.9) 26 (28.3) 6 (6.5) 4 (4.4)	58 (63.0) 21 (22.8) 10 (10.9) 3 (3.3)	0.1051	0.5814

Abbreviations: STI=Sexually Transmitted Infections
[a] *Percentages may not total to 100 due to rounding. Analysis excludes unknown/refused values.*
[b] *Other STIs include chlamydia, gonorrhea, herpes, and syphilis.*
[c] *Significant values in bold font. P-values < 0.05 considered significant.*

Table D5. Adjusted estimates for sexual behaviors among study participants (full model) [a]

Covariates	Vaginal sex in past 6 months [b]	Oral sex in past 6 months	Paid sex in past 6 months	Condom use with vaginal sex in recent past [c]	# of new sexual partners in past 6 months [d]
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
MODEL ESTIMATES BY STUDY PERIOD					
PRE-DIAGNOSIS PERIOD: Visit 2 compared to Visit 1/ Baseline	**0.34 (0.27-0.41)**	**0.59 (0.48-0.72)**	**0.25 (0.20-0.32)**	0.94 (0.71-1.24)	**0.72 (0.61-0.84)**
POST-DIAGNOSIS PERIOD: Visit 3 compared to Visit 2	0.87 (0.70-1.08)	0.96 (0.77-1.20)	1.05 (0.81-1.37)	1.05 (0.79-1.39)	1.01 (0.89-1.20)
MODEL ESTIMATES ACROSS ALL THREE VISITS					
HPV and STI Results [e]					
Positive for both HPV and other STIs	0.57 (0.29-1.12)	0.78 (0.41-1.47)	1.01 (0.60-1.70)	0.69 (0.39-1.24)	**0.51 (0.31-0.83)**
Positive for HPV only	1.15 (0.69-1.90)	1.40 (0.88-2.21)	0.66 (0.42-1.03)	**0.61 (0.40-0.92)**	**0.50 (0.34-0.72)**
Positive for other STIs	0.48 (0.19-1.21)	0.46 (0.20-1.08)	1.45 (0.71-2.94)	0.64 (0.28-1.43)	1.43 (0.70-2.96)
Negative for HPV and other STIs	Referent	Referent	Referent	Referent	Referent
Country of Residence					
Brazil	**5.28 (2.62-10.67)**	1.82 (0.94-3.54)	**6.25 (3.56-10.96)**	**2.91 (1.60-5.29)**	0.60 (0.36-1.00)
Mexico	2.35 (0.74-7.45)	0.70 (0.23-2.13)	2.21 (0.76-6.42)	0.67 (0.25-1.78)	**2.68 (1.15-6.28)**
United States	Referent	Referent	Referent	Referent	Referent
Race					
White	Referent	Referent	Referent	Referent	Referent
Black	0.57 (0.31-1.05)	0.62 (0.35-1.09)	1.32 (0.86-2.02)	1.16 (0.70-1.93)	**0.51 (0.33-0.78)**
Asian/ Pacific Islander	**0.25 (0.07-0.86)**	0.59 (0.17-2.09)	1.12 (0.33-3.83)	16.05 (0.94-274.13)	0.55 (0.21-1.44)
American Indian/ Alaskan	1.09 (0.21-5.75)	0.82 (0.21-3.14)	1.49 (0.57-3.88)	0.57 (0.19-1.76)	0.67 (0.24-1.93)
Mixed	0.67 (0.24-1.87)	0.84 (0.31-2.28)	1.51 (0.58-3.92)	1.79 (0.75-4.30)	**0.47 (0.22-0.99)**
Hispanic					
Yes	0.98 (0.51-1.86)	1.49 (0.80-2.76)	0.65 (0.41-1.04)	1.07 (0.62-1.84)	0.95 (0.61-1.49)
No	Referent	Referent	Referent	Referent	Referent
Age					
18-30 years	**12.63 (6.03-26.44)**	**20.06 (10.27-39.19)**	0.61 (0.34-1.08)	1.43 (0.78-2.61)	**0.12 (0.07-0.22)**
31-44 years	**4.52 (2.42-8.43)**	**10.73 (6.04-19.06)**	0.86 (0.52-1.43)	1.19 (0.70-2.00)	**0.27 (0.16-0.45)**
45-70 years	Referent	Referent	Referent	Referent	Referent

Table D5 (Continued)

Marital Status					
Single	**0.16 (0.08-0.29)**	1.70 (0.97-2.96)	**2.13 (1.34-3.38)**	1.19 (0.72-1.96)	**0.10 (0.06-0.16)**
Married	Referent	Referent	Referent	Referent	Referent
Cohabitating	1.11 (0.48-2.58)	1.46 (0.76-2.82)	0.75 (0.42-1.32)	0.61 (0.35-1.05)	**0.39 (0.23-0.67)**
Divorced/ Separated/ Widowed	**0.15 (0.07-0.32)**	1.68 (0.82-3.45)	0.94 (0.51-1.74)	0.80 (0.43-1.50)	**0.18 (0.10-0.33)**
Educational Level					
<12 years	0.98 (0.38-2.50)	**0.11 (0.05-0.27)**	0.61 (0.29-1.25)	**0.45 (0.21-0.98)**	0.55 (0.27-1.13)
12 years	1.19 (0.50-2.83)	0.59 (0.25-1.39)	0.60 (0.31-1.18)	0.78 (0.37-1.65)	0.71 (0.36-1.38)
13-15 years	2.04 (0.87-4.79)	1.05 (0.45-2.47)	0.67 (0.34-1.33)	1.13 (0.53-2.38)	**0.49 (0.25-0.96)**
16 years	1.85 (0.77-4.46)	1.18 (0.50-2.80)	0.69 (0.35-1.35)	1.40 (0.65-3.01)	0.94 (0.48-1.86)
≥17 years	Referent	Referent	Referent	Referent	Referent
Sexual Orientation					
Heterosexual	Referent	Referent	Referent	Referent	Referent
Homosexual	[b]	**46.08 (6.76-314.12)**	1.87 (0.93-3.75)	[b]	**0.22 (0.11-0.44)**
Bisexual	**0.04 (0.02-0.09)**	**9.87 (3.65-26.68)**	**2.68 (1.60-4.51)**	1.21 (0.55-2.62)	**0.23 (0.13-0.40)**
Circumcision Status					
Yes	1.19 (0.67-2.11)	1.30 (0.76-2.22)	0.76 (0.48-1.21)	1.11 (0.68-1.79)	**1.60 (1.05-2.44)**
No	Referent	Referent	Referent	Referent	Referent
Smoking Status					
Yes	0.78 (0.47-1.32)	1.27 (0.77-2.10)	1.18 (0.79-1.78)	1.04 (0.67-1.59)	0.89 (0.61-1.30)
No	Referent	Referent	Referent	Referent	Referent
# of Lifetime Partners					
1	Referent	Referent	Referent	Referent	Referent
2-9	1.90 (0.94-3.87)	1.42 (0.73-2.78)	1.60 (0.75-3.39)	1.67 (0.89-3.12)	1.07 (0.60-1.88)
10-19	**3.14 (1.39-7.11)**	**2.93 (1.34-6.41)**	**3.50 (1.61-7.59)**	1.31 (0.66-2.62)	**0.38 (0.20-0.71)**
20-49	**5.82 (2.48-13.68)**	**5.79 (2.52-13.30)**	**4.70 (2.17-10.19)**	0.99 (0.50-2.00)	**0.19 (0.10-0.37)**
≥50	**5.21 (1.85-14.65)**	**6.90 (2.44-19.50)**	**8.67 (3.74-20.09)**	0.90 (0.38-2.12)	**0.09 (0.04-0.19)**

Abbreviations: AOR=Adjusted Odds Ratio; CI=Confidence Interval; HPV=Human Papillomavirus; STI=Sexually Transmitted Infections

[a] *Significant values in bold font.*

[b] *Men categorized as homosexual men were excluded from analysis for vaginal sex due to plausibility of behavior.*

[c] *Modeling any condom use (sometimes and always) vs. never using condoms during last six months. Men reporting no vaginal sex during last six months were excluded from analysis.*

[d] *Modeling zero new sexual partners during last six months vs. 1, 2, or 3+ new sexual partners.*

[e] *Other STIs include chlamydia, gonorrhea, herpes, and syphilis.*

Table D6: Visit x HPV/STI diagnosis interaction for sexual behaviors among study participants [a, b]

Interaction	Vaginal sex in past 6 months [c]			Oral sex in past 6 months			Paid sex in past 6 months			Condom use with vaginal sex in recent past [d]			# of new sexual partners in past 6 months [e]		
	(F=0.23, p=0.9658)			(F=1.19, p=0.3101)			(F=0.89, p=0.4995)			(F=0.49, p=0.8142)			(F=0.53, p=0.7891)		
	Estimate	t-Value	P-value	Estimate	t-Value	P-value	Estimate	t-Value	P-value	Estimate	t-Value	P-value	Estimate	t-Value	P-value
Visit 1															
Positive for HPV & STIs	-0.5909	-1.54	0.1242	-0.05597	-0.16	0.8745	-0.0301	-0.11	0.9142	-0.6404	-1.86	0.0629	-0.6280	-2.28	**0.0225**
Positive for HPV only	0.0582	0.18	0.8556	0.5336	2.05	**0.0409**	-0.2563	-1.10	0.2708	-0.5925	-2.30	**0.0217**	-0.6925	-3.36	**0.0008**
Positive for other STIs	-0.6705	-1.29	0.1961	-0.7124	-1.48	0.1388	0.2326	0.61	0.5439	-0.3343	-0.66	0.5078	0.5990	1.48	0.1379
Negative for HPV & STIs	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*
Visit 2															
Positive for HPV & STIs	-0.4659	-1.23	0.2188	-0.2871	-0.81	0.4163	0.2276	0.66	0.5104	-0.1804	-0.51	0.6085	-0.7730	-2.80	**0.0050**
Positive for HPV only	0.2315	0.82	0.4128	0.1358	0.53	0.5971	-0.2695	-0.88	0.3767	-0.4339	-1.70	0.0883	-0.7263	-3.51	**0.0005**
Positive for other STIs	-0.7201	-1.40	0.1605	-0.6325	-1.30	0.1937	0.5547	1.19	0.2347	-0.4304	-0.87	0.3830	0.1752	0.44	0.6614
Negative for HPV & STIs	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*
Visit 3															
Positive for HPV & STIs	-0.6502	-1.73	0.0840	-0.3998	-1.12	0.2607	-0.1823	-0.53	0.5948	-0.2771	-0.77	0.4405	-0.6502	-2.37	**0.0179**
Positive for HPV only	0.1215	0.43	0.6659	0.3312	1.27	0.2039	-0.7191	-2.39	**0.0170**	-0.4777	-1.84	0.0664	-0.6759	-3.28	**0.0010**
Positive for other STIs	-0.8218	-1.61	0.1084	-0.9867	-2.02	**0.0438**	0.3253	0.70	0.4829	-0.5927	-1.18	0.2387	0.3056	0.77	0.4438
Negative for HPV & STIs	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*	*Referent*

Abbreviations: HPV=Human Papillomavirus; STI=Sexually Transmitted Infections

[a] *Significant values in bold font. P-values <0.05 considered significant.*

[b] *Model is adjusted for the following variables: country of residence, race, ethnicity/Hispanic, age, marital status, educational level, sexual orientation, circumcision status, smoking status, and number of lifetime sexual partners.*

[c] *Men categorized as homosexual men were excluded from analysis for vaginal sex due to plausibility of behavior.*

[d] *Modeling any condom use (sometimes/always) vs. never using condoms during last 6 months. Men reporting no vaginal sex during last 6 months were excluded.*

[e] *Modeling zero new sexual partners during last six months vs. 1, 2, or 3+ new sexual partners.*

[f] *Other STIs include chlamydia, gonorrhea, herpes, and syphilis.*

About the Author

Euna M. August has over 15 years of experience in public health, with expertise in sexual and reproductive health, health disparities, and global health. Euna earned her Master of Public Health degree in Health Education and Communication from the Tulane University School of Public Health and Tropical Medicine and her Bachelor of Science degree in Biochemistry from Louisiana State University. Euna also has graduate certifications in Social Marketing and Women's Health from the University of South Florida (USF).

Prior to returning to academia to pursue her Doctor of Philosophy in Public Health at USF, Euna was the Executive Director of the Institute of Women & Ethnic Studies, a nonprofit organization based in New Orleans, Louisiana. Most recently, Euna has worked as a Research Coordinator with the Lawton & Rhea Chiles Center for Healthy Mothers & Babies at USF and the H. Lee Moffitt Cancer Center and Research Institute. She has also worked on research projects at the Florida Prevention Research Center and the Harrell Center for the Study of Family Violence at USF and has taught various undergraduate level public health courses at the university.

Euna has conducted numerous workshops and presentations at national and international conferences and presently has over 30 publications in various well-known public health, medical, and social science journals. In addition, Euna serves as a reviewer for multiple peer-reviewed journals.