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Examining Prevalence of HIV Infection and Risk Factors among Female Sex Workers (FSW) and Men Who Have Sex with Men (MSM) in Swaziland

EXAMINING PREVALENCE OF HIV INFECTION AND RISK FACTORS AMONG FEMALE SEX WORKERS (FSW) AND MEN WHO HAVE SEX WITH MEN (MSM) IN SWAZILAND

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Introduction

Swaziland is burdened by one of the world's worst generalized HIV epidemics, with an estimated 26.1% of reproductive age adults currently infected (Central Statistical Office & Macro International, 2008). Research indicates that key populations (KP) such as men who have sex with men (MSM) and female sex workers (FSW) are vital groups to target in HIV prevention efforts, even in generalized epidemics (Baral et al., 2009; Smith et al., 2009). Unique biological, behavioral, and structural risk factors put these groups at heightened risk for HIV infection and of HIV transmission to members of their sexual networks and the population at large (Baral et al., 2009; Smith et al., 2009). However, HIV surveillance in countries with generalized epidemics continue to use population-based models with limited attention to the epidemiology of HIV among specific subgroups, and prevention efforts largely ignore these important populations (Baral & Phaswana-Mafuya, 2012; Smith et. al, 2009; Potts et al., 2008).

To date, there remains limited data on MSM and FSW in Swaziland, making it difficult to accurately gauge the role of these populations in larger transmission dynamics, as well as the biological, behavioral, and structural risk factors that contribute to their heightened vulnerability. This study sought to estimate HIV prevalence among KP in Swaziland, describe behavioral risk factors associated with HIV infection, and examine the influences of social and structural factors on HIV-related behaviors and risk for infection among these populations.

Methods

MSM and FSW in Swaziland were recruited via respondent-driven sampling (RDS), a peer-referral sampling methodology designed for data collection among hard-to-reach populations (Heckathorn, 1997). Potential participants were required to be at least 18 years of age, able to provide informed consent in either English or siSwati, and willing to undergo HIV and syphilis testing. They also were required to present a valid recruitment coupon. Additionally, FSW participants had to report exchanging or selling sex for money, favors, or goods in the past 12 months. MSM had to report having anal sex with another man in the past 12 months.

All participants completed face-to-face behavioral surveys and received HIV and syphilis tests on-site. Surveys were administered by trained members of the research staff and lasted approximately one hour. Questions on socio-demographics (e.g., age, marital status, education), behavioral HIV-related risk factors (e.g., HIV-related knowledge, attitudes, risk behaviors), and structural factors (e.g., stigma, discrimination, social cohesion) were included. HIV and syphilis testing were conducted by trained phlebotomists or nurses, according to official Swazi guidelines. Test results, counseling, and any necessary treatment (for syphilis) and/or referrals (for HIV) were provided on-site.

The study received human subjects research approval from both the National Ethics Committee of Swaziland and the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health.

Key Findings

HIV and STI prevalence

There was a high HIV prevalence among KP in our sample. This was particularly true among FSW, with over 60% living with HIV, compared to 31.2% among women in the general population (Mngadi et al., 2009). The prevalence of HIV among MSM was 12.6%, which is comparable to the high prevalence in the general population in Swaziland. Despite literature linking sexually transmitted infection (STI) and HIV risk (Cohen, 1998), participants who tested positive for HIV were no more likely to test positive for syphilis than HIV-negative participants in both populations.

While FSW demonstrated higher levels of HIV infection than MSM, they also appeared to be actively engaged in HIV testing and treatment. A higher percentage of FSW who tested positive for HIV in our study (61.0%) had been tested for HIV within the past year than MSM who tested positive for HIV in our study (51.0%), and a greater percentage of FSW living with HIV (41.5%) also reported receiving HIV treatment than did MSM living with HIV (33.3%) in our sample. Given the high prevalence of HIV in FSW and the encouraging proportion of participants being tested and treated for HIV, it is possible that a biologically based prophylactic approach may be beneficial for this population. It is also imperative that the needs of HIV-positive FSW in treatment are being met.

Biological and behavioral risk factors

In general, MSM and FSW reported multiple sexual partners. One-third of all FSW (33.5%) reported an average of six or more clients per week, and one-quarter of all MSM reported having both male and female partners in the past year (25.5%), providing evidence that the heightened risk ascribed to MSM may have a direct link to the general population (Beyrer, Baral, et al., 2012). Encouragingly, condom use with all types of partners was high for both MSM and FSW, generally comparable to or higher than the general population (Mngadi et al., 2009); this suggests that population-level condom promotion has been somewhat effective in Swaziland.

There was a lack of HIV-related knowledge among both populations, as only 18.3% of MSM and 10% of FSW in our study knew of the heightened risk of contracting HIV from receptive anal sex. Over 96% of FSW in our study answered that you could get HIV from using a needle to inject illegal drugs (though the question did not specify whether this was a needle that had previously been used by someone else). Just over 21% of FSW responded that water-based lubricants were the safest to use during vaginal and anal sex. Less than 40% of MSM reported using condom-compatible lubricants, and over 80% of FSW did not use lubricants at all. Importantly, questions did not define “safe” as specifically relating to the prevention of HIV, and did not specify that this meant with latex condoms. However, since a large proportion of FSW reported using condoms, it is notable that low percentages reported that condom-compatible lubricants were the safest. It is possible that HIV education campaigns for the general population may overlook the myriad behavioral risks that are more relevant for KP. For example, while 78.9% of MSM had received HIV prevention information concerning sex between men and women, only 21.4% had received information concerning sex between men.

Structural risk factors

Behavioral and structural risk factors appeared to be intricately related within these populations. More than half of all FSW reported that it was somewhat or very difficult to insist on condom use if a client offered more money not to use one (61.8%), and 57.8% of MSM reported the same for male sexual partners who provide regular economic support. There were also high levels of human rights violations reported among our sample, with around one-third of both MSM and FSW reporting legal discrimination. FSW reported strained interactions with law enforcement, including being refused police protection (37.1%). Over one-third (36.3%) of MSM reported having been tortured due to their sexual orientation. (Notably, "torture" can be difficult to translate, and while the study defined torture as sustained physical or sexual violence, it is possible that participants interpreted the term differently.) Stigma and discrimination also carried over into healthcare settings: Over 40% of FSW and 60% of MSM felt afraid to seek healthcare due to their sexual orientation or practices.

In general, MSM indicated that they had strong social networks. Approximately three-quarters (73.6%) reported that they could trust the majority of MSM in their community, and the majority of participants gave positive answers to questions on trust within various situations. Social cohesion among FSW was less clear. For example, while 60% of FSW could count on fellow FSW to talk to about their problems, only 38% reported that they could trust the majority of their sex worker colleagues.

Associations with HIV infection

Student's t-tests revealed few significant differences between participants who tested positive and those who tested negative for HIV within both populations. Participants who tested positive for HIV were more likely to be older than participants who tested negative in both populations. This could be due to the fact that older persons have been exposed to HIV for longer than younger persons. FSW with HIV were also more likely to have one or more children than FSW who tested negative for HIV. Over three-quarters of our overall sample reported having children (74.1%), indicating that interventions may do well to capitalize on the existing reproductive health infrastructure in Swaziland.

It is important to note that the limited number of significant differences between groups does not necessarily indicate that the selected variables do not contribute to HIV risk in MSM and FSW. This may instead suggest that it is not individual risk factors but rather *combinations* of factors that characterize the heightened risk of KP in Swaziland.

Conclusions

MSM and FSW demonstrate a heightened risk for HIV infection in Swaziland, particularly FSW. The data presented here highlight the need for a multifaceted, targeted HIV prevention strategy that integrates behavioral, biomedical and structural components. Country-wide HIV surveillance should include specific KP measures. Additionally, as both MSM and FSW face unique social and structural hurdles such as high levels of stigma and discrimination, programs and policies must take into account the social and political context of HIV infection in these populations.

Recommendations

Our study provides evidence to support the following recommendations:

Programmatic

1. ***Develop and implement comprehensive, evidence-based, multi-level interventions for KP***: This study identified key gaps in HIV-related knowledge, behaviors, and access to services for KP. However, it also identified overarching structural constraints to accessing services and engaging in effective HIV prevention. Interventions for KP should be developed and implemented that consider how to address important factors at all levels. Recently, the World Health Organization (WHO) has developed guidelines for the prevention and treatment of HIV and STIs among both MSM (WHO, 2011) and FSW (WHO, 2012). These guidelines recommend a combination of evidence-based interventions for MSM and FSW at multiple levels, framed within a strong empowerment and rights-based approach. This approach has been found to be cost-effective in a recent mathematical modeling exercise (Kerrigan, Wirtz, et al., 2013).

2. ***Tailor intervention efforts to the needs of KP in Swaziland, recognizing differences between groups:*** While both MSM and FSW demonstrated high levels of risk for HIV infection, there were key differences between these populations. For example, though HIV prevalence was considerably higher among FSW than among MSM, a lower percentage of MSM reported being tested for HIV in the past 12 months than did FSW. Social cohesion appeared to be stronger among MSM than FSW. And while a majority of the FSW in our sample had one or more child, only 10% of MSM reported having children. The differences in populations underscore the notion that no uniform intervention effectively addresses all problems facing different KPs. Program administrators must consider the specific vulnerabilities of each group when designing and implementing interventions in the following areas:

    a. **HIV and STI prevalence**: The high prevalence of HIV in KP, especially among FSW, indicates that there is a large number of KP with ongoing care and treatment needs. Interventions should consider the needs of KP living with HIV using the Positive Health, Dignity, and Prevention Framework (PHDP). These multi-modal interventions focus on mitigating individuals' own physical and psychological suffering from HIV/AIDS as well as curbing HIV transmission by protecting their sexual partners and promoting greater involvement and advocacy among people living with HIV. Strengthening linkages to care within and beyond PHDP can also open possible opportunities for biologically based prophylactic interventions.

    b. **Biological and behavioral risk factors**: Interventions must specifically work to address the biological and behavioral risk factors noted in this study. The high prevalence of HIV in FSW coupled with the promising proportion of FSW who had been tested and treated for HIV may signify that a biologically based prophylactic approach to HIV could be effective for FSW in Swaziland. Such an approach could combine HIV pre-exposure prophylaxis (PrEP) for HIV-negative sex workers with increased availability of HIV treatment for sex workers living with HIV. Biological interventions must be coupled with behavioral approaches to address HIV-related knowledge gaps specific to individual KP (such as low lubricant use among FSW or lack of prevention information concerning anal

sex among MSM). As the practice of protective sexual behaviors is shown to be influenced by the economic and social context of partners, programs should be sure to include elements that target sexual partners or clients.

c. **Structural risk factors**: The high numbers of KP reporting legal discrimination and fear of seeking healthcare reveal a need to address stigma and discrimination in these settings. Policymakers must work with KP to establish protection for KP seeking services in HIV prevention, testing, and treatment. It is also essential to equip health and legal personnel with sensitive training on how to address the quality of care and human rights abuses that contribute to structural violence or limit access to services or protection for KP. For FSW and lower-income MSM, programs should promote economic empowerment to alleviate the cycles of poverty and risk behavior that make them particularly vulnerable to HIV infection.

3. ***Include MSM and FSW in national HIV surveillance***: HIV surveillance in Swaziland utilizes population-based mathematical models that do not adequately capture the nuances of the country's epidemic. While this study provides the first unbiased estimate of HIV-prevalence in these KP, Swaziland must develop and adopt surveillance systems that continue to collect this type of data in order to monitor the epidemic among KP and better understand the role KP play in larger transmission dynamics.

Research

1. ***Conduct Population Size Estimations of MSM and FSW***: To date, there has not been a systematic assessment of the size of MSM or FSW populations in Swaziland. A rigorous estimate of the size of these populations would allow for a better understanding of their overall contribution to the HIV epidemic in Swaziland, assist with national planning for service delivery, and inform future surveillance efforts.

2. ***Explore the feasibility of biological interventions***: The results provide great support for the need for structural and behavioral programming, though biological risk factors are an important component of the HIV pandemic. Future research could determine the feasibility of biologically based prophylactic approaches, such as those mentioned in item 2b above, including assessing levels of adherence to such regimens.

3. ***Examine other KP such as people who use drugs:*** A complete investigation of KP in Swaziland will also need to include an assessment of people who use drugs (PWUD) as another possible KP. Robust estimates of injection drug use prevalence and associations with HIV have not yet been conducted in Swaziland. Though we identified low levels of drug use among MSM and FSW, PWUD may be a separate KP in this setting that has yet to be explored.

INTRODUCTION

Sub-Saharan Africa (SSA) is home to the majority of the world's generalized HIV epidemics, with an estimated 22.9 million people currently living with HIV/AIDS (UNAIDS, 2010). In contrast to concentrated epidemics, in which the burden of HIV-infection is primarily carried by key populations (KP) such as men who have sex with men (MSM) or female sex workers (FSW), generalized epidemics are characterized by a population-wide HIV-prevalence of greater than 1% (UNAIDS & WHO, 2000). Research and prevention efforts in these countries tend to operate on the assumption that KP are less relevant in widespread epidemics, focusing instead on addressing heterosexual sexual transmission and mother-to-child transmission (Smith et. al, 2009; Potts et al., 2008, Baral & Phaswana-Mafuya, 2012). However, an increasing body of research points to the importance of KP in generalized epidemics due to their own high risk of acquisition and the risk of HIV transmission to members of their sexual networks (Baral et al., 2009; Smith et al., 2009). As the categorization of an epidemic as "generalized" is based on surveillance methods that fail to account for variations within subpopulations, any influence KP may have on transmission dynamics is effectively masked (Baral & Phaswana-Mafuya, 2012). There is therefore a dire need for countries with generalized epidemics to better examine these important groups.

Swaziland is burdened by one of the worst generalized HIV epidemics, with an estimated 26.1% of the country's reproductive age adults currently infected (Central Statistical Office & Macro International, 2008). Due to a lack of data, policies and strategies that deal with HIV prevention often overlook the significance of KP in Swaziland. Neither MSM nor FSW populations were cited as major influences on the generalized epidemic in the country's 2009 report on modes of HIV transmission (Mngadi et al., 2009). Likewise, the Swaziland Partnership Framework on HIV and AIDS 2009-2013 does not specifically address KP in the epidemic, and there is no mention of MSM in the 2008 USG Country Operating Plan for Swaziland (amfAR & JHSPH, 2011). However, the 2006-2008 Swaziland National Strategic Plan noted the need to strengthen condom promotion among FSW and MSM (NERCHA, 2008), a first indication of a national need to better understand the HIV prevalence and risk factors among KP in Swaziland.

HIV prevalence in key populations

Despite the lack of data from Swaziland, results from other SSA countries with generalized epidemics suggest that that FSW and MSM are at heightened risk for HIV infection (Baral et al., 2009; Baral, Beyrer et al., 2012). For MSM, cross-sectional HIV prevalence studies among MSM have now been completed in numerous countries of Southern and Eastern Africa (Baral et al., 2009). In South Africa, for example, the HIV prevalence among MSM was estimated to be 3.6 times higher than that among men who did not report they had sex with a man (Jewkes et al., 2006). Likewise, in Malawi, HIV prevalence was 21.4% among MSM, compared to 11.5% of men in the general population (Baral et al., 2009). Among FSW in SSA, HIV prevalence ranged from 24% in Rwanda (Braunstein et al., 2011), and 37% in Uganda (Vandepitte et al., 2011), to over 70% in Malawi, approximately 14 times higher than what is typically found in the general population (National AIDS Commission, 2007; Baral et al., 2012)

Biological and behavior risk factors for key populations

Both FSW and MSM exhibit specific biological and behavioral characteristics that are thought to underlay their heightened risk for HIV. The increased risk of MSM is considered to be biologically driven by the risk of contracting HIV through anal intercourse (Beyrer, Baral, et al., 2012). Certain sexual risk behaviors have also been shown to make MSM more vulnerable to infection. For example, a study on MSM in Kenya found that a significant portion of MSM may have also participated in transactional sex, and that men who sold sex were more likely to report unprotected sex (Sanders et al., 2007). Low levels of HIV testing and knowledge have been shown to be a problem among MSM in some countries experiencing generalized epidemics. In a study conducted in Malawi, 95.3% of MSM participants were unaware of their HIV status (Baral et al., 2009). MSM were also more likely to have received information about preventing HIV transmission in sex between men and women than in sex between men, and few were aware that HIV was more easily transmitted through anal intercourse than through vaginal intercourse. Further, sexual networks of MSM are not closed to this KP, and female partners of MSM represent pathways for the heightened risk associated with MSM to affect the general population (Beyrer, Baral, et al., 2012).

The heightened risk for HIV acquisition and transmission among FSW operates through a variety of behavioral and biological (or biomedical) risks (Kilmarx, 2009; Watts et al., 2010). Behavioral risk factors act at the level of the individual, with FSW demonstrating greater risk for HIV acquisition through high numbers of sexual partners and frequent concurrency of these partners (Baral, Beyer et al., 2012). Biologically, simply being female makes FSW eight times more likely to contract HIV in a single sexual act with an infected male partner than men are with an infected female partner (Wingood & DiClemente, 2000). The high prevalence of bacterial sexually transmitted infections (STIs) among FSW (Cwikel et al., 2008) and synergistic relationship between HIV and STIs (Cohen, 1998) compound their risk of infection and raise complications around reproductive health and child-bearing (Chacham et al., 2007; Decker et al., 2011; Swain et al., 2011). HIV transmission among FSW may also be exacerbated by the intersection of injection drug use and sex work, as studies have demonstrated high prevalences of injecting drug use among FSW in various settings (Medhi et al., 2011; Strathdee et al., 2008; Tuan et al., 2007). FSW who use drugs may face additional risk factors such as parenteral exposures from shared injection equipment, sex with greater numbers of partners living with HIV, lower likelihood of condom use, and increased risk of other STIs such as syphilis and hepatitis C (Strathdee et al., 2008).

Structural and social factors

An increasing body of evidence highlights the importance of structural and social factors above and around the individual in relation to HIV-related vulnerability. In a seminal systematic review detailing the global context of sexual practices, Wellings and colleagues (2006) identified laws and policies that marginalize or stigmatize certain populations as key risk factors for heightened HIV epidemics in both KP and general national populations. By criminalizing targeted HIV interventions or disrupting funding mechanisms supporting HIV prevention and treatment for KP, these policies can hinder a community's ability to provide preventive or harm-reduction services to its constituents. For example, as sex work is criminalized in Swaziland, researchers and program administers can have difficulty finding and enrolling FSW in HIV prevention studies or treatment (Mandla, 2007). These policies may therefore have negative

ramifications for HIV transmission within the general population, as KP, though marginalized, are intricately linked to the population at large.

Among FSW, structural factors are thought to indirectly heighten risk for HIV infection through a complex and self-replicating relationship between social structures and power (Parker & Aggleton, 2003). The illegal nature of sex work can intensify inequalities and power dynamics already at play within a society, limiting a woman's ability to negotiate safer sex (Ghimire et al., 2011). Systemic violence against FSW has been documented as being inflicted by both law enforcement officials and clients (Arnott & Crago, 2009; Simic & Rhodes, 2009), and experiences with police have been linked to outcomes such as physical abuse from clients, inconsistent condom use, and unprotected sex with police officers in return for favors (Erausquin, Reed & Blankenship, 2011). Socioeconomic hierarchies can also make condom negotiation more difficult for FSW, as it has been shown to do for FSW who have a greater number of clients (Grayman et al, 2005) or work in venues thought to serve those of lower social standing (Yang, Latkin, Luan, & Nelson, 2010). Importantly, the stigma ascribed to transactional sex may keep FSW from seeking HIV/STI treatment and prevention services. In a 2009 qualitative study of FSW living with HIV in India, FSW cited perceived discriminatory practices at healthcare centers as a key reason to not seek antiretroviral treatment (Chakrapani et al., 2009).

Clients of FSW are also at increased risk of HIV and act as a bridge for infection from the FSW to the general population. A study of five African countries that compared HIV prevalence among men who have ever paid for sex to men reporting not having paid for sex found that having had transactional sex significantly increased the odds of having a positive HIV status (Leclerc & Garenne, 2008). Additionally, a cross-sectional survey of 1,405 male workers conducted in rural Zimbabwe—in which 48% of men reported ever having had sexual contact with an FSW—concluded that contact with FSW played a significant role in the spread of HIV (Cowan et al., 2005).

Certain social factors, however, have been shown to be beneficial to FSW. Studies from both Asia and Latin America have demonstrated that social cohesion and social inclusion among FSW are significantly positively associated with consistent condom use (Kerrigan et al., 2006; Lippman et al., 2010). Intervention models developed in India, the Dominican Republic, and Brazil have sought to mobilize FSW by establishing safe centers that aim to improve social cohesion, facilitate access to resources, and better ensure the protection of their human rights (Lippman, et al., 2010). In all three settings, these efforts were found to decrease HIV-related risk behavior.

Though less research exists, emerging studies suggest that MSM experience frequent human rights abuses, including data from Malawi, Botswana, Lesotho, and South Africa (Baral et al., 2009; Baral, Adams et al., 2011; Baral, Burrell et al., 2011). Therefore, in light of the similar social and structural risk factors confronting the FSW and MSM communities, it is conceivable that comparable social cohesion elements may also be protective for MSM.

Existing data on KP of Swaziland

Data on the biological, behavioral, and structural risks faced by KP in the HIV epidemic in Swaziland is limited, particularly among MSM, and there currently exists no population-level estimate of HIV

prevalence among these groups. One study of 1,050 women in Swaziland and Botswana found that 5% had engaged in transactional sex, a behavior that was significantly associated with food insecurity and economic hardship (Weiser et al., 2007). Two rapid assessments of sex work in Swaziland were conducted in 2002 and 2007 by FHI and UNFPA, respectively, but these utilized small convenience samples which could not provide accurate measures of HIV prevalence (Mandla, 2007). These reports suggested that 98% of FSW used condoms with their last client in Swaziland, and 94% had been tested for HIV and were aware of their status, but that knowledge related to HIV was low (Mandla, 2007). The Swaziland 2007/08 Demographic and Health Survey suggested that payment for sex is considerably less common in Swaziland compared to other countries in the sub-region. Nationally, only about 0.1% of men reported paying for sex in Swaziland compared to 10.6% in Zambia, 7.0% in Zimbabwe and 8.3% in Malawi (Central Statistical Office & Macro International, 2008).

Objectives

The Swaziland Ministry of Health recently expressed willingness to address needs of KP, claiming that the core mandate of "equitable non-discriminatory health services" should be applicable for all (Phakathi, 2009). In response to this statement and in light of the lack of definitive research on HIV among KP in Swaziland, the current study was designed to provide probability estimates of HIV prevalence among KP in Swaziland, describe behavioral factors associated with HIV infection, and examine the influences of social and structural factors on HIV-related behaviors and risk for infection among these populations. The specific aims of this study are

1. To calculate an unbiased estimate of HIV and Syphilis prevalence among FSW and MSM in Swaziland;
2. To describe behavioral factors associated with HIV infection, including individual sexual and drug-related practices, condom use and negotiation, and knowledge of HIV transmission risk factors; and
3. To examine the role of social and structural factors on HIV-related behaviors and risk for HIV infection among FSW and MSM, including human rights violations as a result of stigma/discrimination and degree of social cohesion.

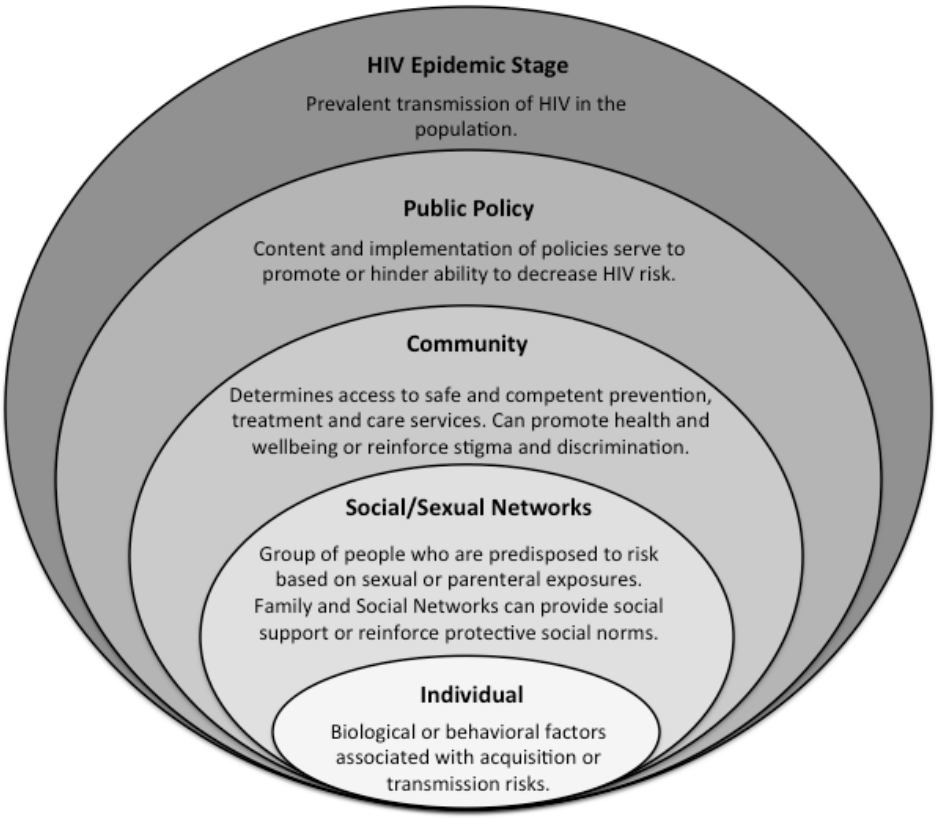
METHODS

Study design and sampling

Theoretical framework

The study utilized the Modified Social Ecological Model (MSEM) as a guiding theoretical framework, presented in Figure 1, below (Baral et al., 2013). The MSEM posits five layers of risk for HIV infection: individual, network, community, policy, and stage/level of the HIV epidemic. It modifies the traditional Social Ecological Model (Krieger, 2001) by tailoring the levels of risk to HIV-relevant domains. For example, the "interpersonal" level present in the original model has been changed to "social and sexual networks," and an additional level specifying HIV/epidemic stage has been added. The MSEM is based on the premise that while individual-level risks are necessary for the spread of disease, they are not sufficient; higher order social and structural levels of risk (network, community, policy, level/stage of epidemic) represent risk factors outside of the control of any individual person (Wellings et al., 2006). This model therefore recognizes the important role social and structural factors can have in HIV transmission dynamics in KP, which has been demonstrated by research in African settings (Fay et al., 2010).

Figure 1: Modified Social Ecological Model (MSEM) for HIV risk in Vulnerable Populations*



*Adapted from Krieger, 2001

Respondent-Driven Sampling (RDS)

Respondent-driven sampling (RDS) was used to recruit both MSM and FSW in Swaziland. RDS is a peer-referral sampling methodology specifically designed to address the challenges in collecting rigorous, representative data within hard-to-reach populations (Heckathorn, 1997). In RDS, a small convenience sample of the population is first identified and recruited. These initial participants, known as "seeds," are then asked to recruit other individuals from the target population, beginning a series of chain-referral sampling. RDS analysis allows for estimation of unbiased prevalence estimates from a non-probability sample by limiting the number of people accrued by any one individual through the use of a coupon system—whereby a participant is given a set number of recruitment coupons to present to prospective participants in their network—and adjusting for the convenience sampling of early waves. Theoretically, with each additional wave, the recruitment becomes more diverse and representative, and thus a closer approximation of a random sample. As KP in Swaziland are considered hard-to-reach populations and present limited opportunities for venue-based time-location sampling, RDS offers an ideal means for recruiting an adequate sample.

Seed Selection

At the onset of the study, three seeds were chosen to begin the recruitment chain for each population. Seeds were chosen according to their social status and connection to the MSM and FSW communities, ability to explain the purpose of the study and requirements of participation to others, enthusiasm about the study aims, and willingness to promote the project. The research team also aimed to select seeds representing diverse demographics (age, education, socioeconomic status), risk status, sexual practices, and sub-group membership. Each seed had to meet the same study eligibility criteria required of other participants (described below). Seeds were given referral coupons with an expiration date four weeks from the date of dispersal. Each seed was allowed to recruit no more than three participants. This practice continued for all participants enrolled in the study. For FSW, six additional seeds were added to the study to sustain accrual, and for MSM eight additional seeds were added to the study when referrals began to slow.

Sample Size Calculation

The reproductive-age HIV prevalence in Swaziland was estimated to be 26% in 2007 (Central Statistical Office & Macro International, 2008). As there are no rigorous estimates of HIV prevalence for KP in Swaziland, the national prevalence was used as the base for sample size calculations in the current study. With this base rate in mind, we estimated that we needed 324 participants in each population group (MSM and FSW) in order to detect significant differences (odds ratio [OR] of 2.0) in HIV prevalence between participants with higher HIV-related protective behaviors (such as consistent condom use) and those with lower HIV-related protective behaviors with 95% confidence, 80% power, and a design effect of 1.5. This sample size allowed us to determine whether or not there were significant differences between these two groups per level of key social factors, such as experiences with stigma and discrimination.

Inclusion criteria and ethical considerations

In order to be eligible for participation, potential participants were required to be at least 18 years of age (legally considered an adult and able to provide personal consent by Swazi law) and able to provide informed consent in either English or siSwati. They also had to present a valid recruitment coupon.

Further, FSW were considered eligible if they reported having exchanged or sold sex for money, favors, or goods in the past 12 months. MSM were considered eligible if they reported having had anal sex with another man in the past 12 months. In order to participate, potential participants also had to agree to be tested for HIV and syphilis.

Participants gave verbal informed consent at the study site. Following survey administration, each participant was reimbursed for travel, ranging from the equivalent of US $7.00-$23.00. Those who recruited participants into the study also received the equivalent of US $2.50 per participant successfully enrolled in the study. No names or identifying information were collected of any participants. HIV and syphilis tests also remained anonymous, and participants elected whether or not they wished to receive results.

Data collection

Following informed consent, FSW and MSM participants completed face-to-face behavioral surveys in a private office setting. The survey was administered verbally by a trained local member of the research staff and had a typical duration of one hour. Items included in the survey were designed to explore the multiple dimensions of the MSEM theoretical framework described above. Participants were first asked questions about their socio-demographics, followed by questions related to behavioral HIV-related risk factors, including questions on HIV-related knowledge, attitudes, and risk behaviors, as well as condom negotiation difficulty. Collateral effects of structural factors (stigma and discrimination) were ascertained by questions on human rights violations. Social cohesion for both MSM and FSW was measured according to a scale previously developed and used among sex worker populations in Brazil (Kerrigan et al., 2008; Lippman et al., 2010). Population-specific questions were included for both MSM and FSW, such as questions regarding sexual orientation for MSM and legal discrimination due to the criminalization of sex work for FSW.

Laboratory procedures

HIV and syphilis counseling and testing were then conducted according to official Swazi guidelines. Swaziland country-wide voluntary counseling and testing methodology for HIV was used, which includes screening and confirmatory tests with rapid kit tests. Serum samples were collected by a trained nurse or phlebotomist. Syphilis was tested using the Determine Syphilis Treponema Pallidum rapid kit. Participant codes were used to anonymously link results of surveys to test results as well as facilitate the provision of test results and appropriate clinical management.

Results were available on-site shortly after testing for participants who chose to receive them. If found to be positive for HIV, syphilis, or both, participants were administered optional post-test counseling, referral to appropriate healthcare services, and offered syphilis treatment on-site.

Risk Management

Numerous procedures were put in place to protect subjects against the risk of disclosure, including the formation of two community advisory committees (CAC) that provided input into site and protocol issues. The first CAC represented the MSM community and included members from the only lesbian, gay, bisexual, and transgender (LGBT) organization in Swaziland, House of our Pride (HOOP). The second CAC included representation by FSW, though there is no dedicated organization officially registered in Swaziland to represent FSW. Both the CAC dedicated to sex work and the CAC dedicated to MSM felt there was minimal risk in presenting to a research site in terms of disclosure.

Surveys were conducted in a private setting at a dedicated site at the New Start Center which has significant experience in providing confidential HIV testing and counseling services. The site also provided private rooms for medical treatment and counseling associated with the study. To minimize physical risks, collection of biologic samples and HIV/STI tests were performed by trained nurses who were contracted by PSI. All nurses had completed training with the Swaziland Ministry of Health. Psychological risks were minimized by providing sensitivity training for all staff on the specific needs of MSM and FSW.

Confidentiality was maintained by using a unique study identifier rather than real names on surveys, protecting all electronic data with passwords, storing hard copies of data in locked cabinets, and keeping results and data off-site.

Analysis

Population weights were computed separately for each variable (Schonlau & Liebau, 2012), with each variable's proportion based on the number of participants for whom data was available. These weights were then used to calculate RDS-adjusted proportion estimates (Heckathorn, 1997). Adjusted RDS estimates attempt to account for two potential biases of the RDS methodology: The tendency for participants to recruit others like themselves (homophily), and the variation in network sizes of different individuals. A bootstrap method with 1,000 repetitions was used to estimate standard errors for these estimates.

Student's t-tests were conducted to examine the differences between proportions of participants testing positive for HIV and those testing negative for HIV within MSM and FSW populations. Those that yielded significant results are noted by asterisks (Appendix A).

Ethical review

The study received human subjects research approval from both the National Ethics Committee of Swaziland and the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health.

RESULTS

Results from the surveys and laboratory tests are summarized below and in the corresponding tables (Appendix A). Data from the sample of MSM are reported first, followed by those from the FSW sample. Each section contains the following subheadings, consistent with study aims: Sociodemographic profile, HIV/STI-related outcomes, sexual behavior and drug use, knowledge of HIV-risk behaviors, condom negotiation, social discrimination/human rights violations, and social cohesion. All percentages reported in the text for overall populations are RDS-adjusted unless otherwise noted; only percentages for participants who tested positive for HIV are not RDS-adjusted due to smaller sample sizes.

MSM Results

Sociodemographic profile

A total of 324 men were successfully recruited and consented to participate in the study (Table 1). A majority of the participants were 21 years of age or older (65.1%) and unmarried (98.3%). Just over half (56.0%) had completed secondary school or more, and 69.2% were currently employed or a student. Only a small proportion (10.4%) reported having one or more children. Most participants reported their nationality at birth as Swazi (97.8%), with the remainder hailing from Mozambique (1.5%), South Africa (0.5%), or other countries (0.2%). Over half (61.2%) had grown up in an urban area.

Approximately one-third (39.9%) reported their sexual orientation as bisexual, and 57.0% reported it as gay or homosexual. While almost half (44.9%) reported having disclosed their sexual behavior to a family member, only one-third reported disclosing their sexual behavior to a healthcare worker (data not shown).

Participants who tested positive for HIV were significantly more likely to be over 21 when compared to participants who tested negative for HIV (p=<.001). No other significant differences in demographics were found between the MSM participants who tested positive for HIV and those who tested negative.

HIV/STI-related outcomes

HIV- and STI-related outcomes among MSM are summarized in Table 2. The prevalence of HIV in this sample was 12.6%, while active syphilis was present in 1.2%. The percentage of participants who reported they were diagnosed with an STI in the past 12 months was 7.2% (data not shown).

Approximately half (51.0%) of all participants reported having been tested for HIV in the last 12 months. Among participants who tested positive for HIV, 30.0% reported that they had been previously diagnosed with HIV, and one-third (33.3%) of participants living with HIV were receiving treatment for HIV.

Sexual behavior and drug use

Table 3 summarizes responses to questions regarding sexual practices and drug use. In general, MSM participants reported some concurrent sexual partnerships in the past 12 months, including sex with two or more male partners (23.8%), two or more female partners (1.9%), and both male and female partners (25.5%). Condom use at last sex varied somewhat by partner type, with 69.6% reporting

condom use with a main male partner, 82.9% with a casual male partner, 63.7% with a main female partner, and 62.7% with a casual female partner.

Lubricant use for anal sex was also prevalent, with petroleum jelly most commonly used among the entire sample (60.7%), followed by water-based lubricant (26.8%). Over half the participants reported either no access or difficulty in gaining access to water-based lubricants (data not shown).

Drug use was low among this population, as more than 95% of MSM reported no injection drug use within the last 12 months. Almost all of those participants reporting drug use also reported that they did not share needles (95.7%; non-RDS-adjusted due to small number of MSM who have shared needles). Further, 33.7% of participants admitted to using a non-injectable drug that was not prescribed to them. There were no significant differences between proportions of participants who tested positive for HIV and those who tested negative for these sexual and drug use behaviors.

Knowledge of HIV-risk behaviors

Proportions of correct responses to questions on knowledge of HIV risk behaviors appear in Table 4. Almost all participants responded that someone can get HIV from sharing needles (99.0%), although the question did not specify whether these were needles someone else had used previously. However, only 18.3% knew that anal sex was the "most risky type of sex," and only 31.9% responded that receptive anal sex was riskier for acquiring HIV than insertive anal sex.

Three-quarters (78.9%) of all participants reported having received HIV prevention information on sex between men and women in the last year. However, less than one-quarter (21.4%) had received prevention information relating to sex between men in the same time period.

Condom negotiation

Table 5 summarizes responses to questions about condom negotiation. In general, approximately half of all MSM reported that it was somewhat or very difficult to get their partner to agree to use condoms in most situations. This includes when the partner does not want to use a condom (46.0%), when the partner gets angry when a condom is suggested (47.7%), and when the partner has been drinking or using drugs (49.4%). It also includes situations when the participant has been drinking or using drugs (44.8%), when the participant has not always used condoms with this partner in the past (53.3%), and when the participant cares about the partner (45.4%). The item with the lowest percentage of participants reporting difficulty was when the partner may think the participant has an STI (34.9%). The items with the highest numbers reporting difficulty were when the partner provides the participant with economic support (57.8%) and during oral sex (60.9%).

Social discrimination/human rights violations

Table 6 summarizes participants' responses to questions about instances of human rights abuse as a result of their sexual orientation or practices. In regard to sexual and physical violence, 6.4% reported having ever been raped, 8.3% reported having ever been beaten up, and one-third of participants (36.2%) reported having ever been tortured. However, the term "torture" can be difficult to translate, and while the study defined torture as sustained physical or sexual violence, it is possible that participants interpreted the term differently.

Approximately one-third (30.2%) felt they had experienced legal discrimination, and 3.7% reported having lost employment due to their sexual orientation or practices.

More than half (61.8%) reported that they have been afraid to seek healthcare because of their sexual orientation or practices, 14.9% reported difficulty accessing healthcare, and 1.7% reported that they had been tested for HIV without their consent. About one in five (19.0%) felt that they had received lower quality medical care due to their sexual orientation or practices, but only 3.0% reported having been denied healthcare.

In the entire sample, 6.8% reported ever having heard healthcare workers gossiping about the participant. This percentage was 18.5% among participants who tested positive for HIV only, significantly higher than for participants who tested negative for HIV ($p<.05$).

Social cohesion

Responses to questions regarding social cohesion within the MSM community are summarized in Table 7. The MSM in this study appear to have a strong network of others to confide in or go to for support, with the majority of participants (73.6%) agreeing with the statement, "You can trust the majority of MSM you know."

Participants were asked if they could count on other MSM in their group of friends in six unique situations. Positive answers were high for all situations, which included counting on MSM colleagues to assist in violent or difficult situations (88.4%), offer a place to stay (87.2%), loan money to the participant (83.6%), accompany the participant to the hospital (77.6%), help the participant find other MSM (90.4%), and support the use of condoms (84.0%).

FSW Results

Sociodemographic profile

Table 8 summarizes selected demographic characteristics of FSW participants. A total of 327 FSW participated in the study. Of these, 68.2% of study participants were 21 years of age or older. A large majority of the participants were born in Swaziland (94.9%; non-RDS-adjusted), with the remainder from Mozambique (2.2%), South Africa (2.7%) and other African countries (1.3%). Education levels were low; only 13.9% of study participants completed secondary and/or post-secondary schooling. Participants were overwhelmingly single—90.6% of FSW studied reported never having been married. The remaining 9.4% of FSW were married, cohabiting, or widowed. Most had one or more living children (74.1%).

Over two-thirds of FSW (73.2%) reported sex work as their sole income. Approximately one-quarter (24.3%) had disclosed the fact that they engaged in sex work to a family member, and only 13.4% had disclosed it to a healthcare worker.

As with the MSM population, FSW participants who tested positive for HIV were significantly more likely to be over 21 when compared to HIV-negative participants ($p=<.001$). Participants who tested positive for HIV were also more likely to have children ($p<.05$) and to disclose their occupation to a healthcare worker ($p<.05$) as compared to the sample testing negative.

HIV/STI-related outcomes

Table 9 summarizes HIV and STI-related outcomes among the FSW sample. Prevalence of HIV was highly elevated among this sample of FSW: 60.5%. The prevalence of active syphilis among participants was 6.6%.

Almost two-thirds (61.7%) of all participants reported having been tested for HIV in the last 12 months and 41.5% of participants living with HIV were receiving treatment for HIV. Among participants who tested positive for HIV in our study, 73.8% had been previously diagnosed with HIV.

Sexual behavior and drug use

Responses to questions regarding sexual practices and drug use are summarized in Table 10. The majority of FSW in this sample reported having 1-5 clients per week (66.5%), with 18.8% reporting 6-10 clients and 14.7% reporting over 11 clients. Condom use at last sex was with regular clients 82.9%, with new clients 84.8% and with non-paying partners 51.1%. Some participants (13%) reported having somewhat difficult, difficult, or no access to condoms when they needed them. Most FSW (81.5%) reported going without any type of lubricant. Petroleum jelly was reported by 11% of participants, and only 4% reported using water-based lubricant.

Drug use was low, with 96.3% of all FSW reporting no injection drug use in the last 12 months. Just over one-fifth (21.5%) admitted to using a non-injectable drug that was not prescribed to them.

Knowledge of HIV-risk behaviors

Table 11 presents proportions of responses to knowledge questions of HIV risk behaviors. As measured by this survey, HIV-related knowledge was low among this population. Only 10% of participants correctly identified anal sex as the most risky type of sex for HIV infection. However, when comparing groups, the proportion of participants who identified anal sex as the most risky form of sex was significantly larger for participants who tested positive for HIV than for those who tested negative ($p<.05$). Over 96% of FSW in our study answered that you could get HIV from using a needle to inject illegal drugs (though the question did not specify whether this was a needle that had previously been used by someone else). Just over 21% of FSW responded that water-based lubricants were the safest to use during vaginal and anal sex. These questions did not define “safe” specifically for the prevention of HIV, and did not specify that this meant with latex condoms. However, since a large proportion of FSW reported using condoms, it is interesting to note that low percentages reported that condom-compatible lubricants were the safest.

Just about half of all participants (49.9%) had participated in talks or meetings related to HIV in the past year, and the majority had received some HIV prevention information in this time (84.9%).

Condom negotiation

Table 12 summarizes responses to selected questions about condom negotiation. Over half of all FSW indicated that condom negotiation is somewhat or very difficult when the client provides regular economic support (56.8%), when the client offers more money not to use one (61.8%), and during oral sex (63.2%) The situation reported difficult by the most respondents was when there is a precedent of no condom use with the client (67.5%); the situations reported difficult by the least respondents were

when the client is under the influence of drugs or alcohol (46.6%) and when the FSW is under the influence of drugs or alcohol (38.6%).

Social discrimination/human rights violations

Table 13 summarizes selected human rights abuses among FSW. Sexual and physical violence were strikingly common against FSW, with one-third of the population (33.5%) reported having ever been raped since age 18. Over half (59.8%) have ever experienced verbal or physical harassment, with 49.2% having ever been tortured and (32.3%) having ever been beaten up. Almost half (49.3%) reported ever being scared to walk in public.

Legal difficulties were also frequently reported. Over one-third (34.6%) experienced legal discrimination as a result of selling sex. This includes discrimination by law enforcement officials: 37.1% reported having ever been denied police protection and 10.1% having ever been arrested on false charges. Reported experience of blackmail was common, at 29.9%. Additionally, over ten percent (10.2%) felt that they had been denied educational opportunities, and 9.5% reported losing employment due to their involvement in sex work.

In regard to healthcare, 38.1% of participants felt afraid to seek services because they sell sex. Among all participants, 8.9% felt that they received lower quality healthcare as a result of selling sex, 3.9% reported being denied healthcare for this reason, and 3.1% reported being tested for HIV without their consent. There were no significant differences between the participants who tested positive for HIV and those who tested negative.

Social cohesion

As shown in Table 14, participants held conflicting opinions about other FSW in their community. When FSW were asked if they could count on other FSW in five unique situations, they tended to respond positively to items regarding client issues and material assistance. This includes counting on other FSW to assist with difficult/violent clients (82.2%), offer a place to stay (70%), loan money (68%), accompany the participant to the hospital (65%), and support the use of condoms (73.3%). However, while 60% of all FSW reported that they could talk to their colleagues about their problems, only 38.0% felt that they could trust the majority of other FSW (38%).

DISCUSSION

Overview

KP are often overlooked in research and surveillance efforts in countries with generalized epidemics. To our knowledge, this study is the first of its kind to attempt to calculate an unbiased prevalence of HIV among MSM and FSW in Swaziland, as well as explore the behavioral and structural risk factors that may contribute to HIV infection in these populations. The results echo previous studies of KP in similar settings, revealing their heightened risk for HIV. Both MSM and FSW in Swaziland reported a variety of risk factors such as low levels of HIV-related knowledge and high numbers of sexual partners. Social and structural risk factors were also common, including high levels of perceived discrimination, legal persecution, and physical and sexual violence.

Our discussion section begins with interpretations of the measures reported above, as organized under the following subheadings: HIV and STI prevalence, biological and behavioral risk factors, and structural risk factors. This is followed by a reflection on the significant associations between biological, behavioral and structural risk factors and risk for HIV infection within both populations, as well as an overview of study limitations.

HIV and STI prevalence

Results from our study suggest that there is high HIV prevalence among KP in Swaziland. This was particularly true among FSW, with over 60% of FSW in our sample living with HIV, compared to 13.1% prevalence in the general adult female population(Mngadi et al., 2009). Despite literature linking STI infection and HIV risk (Cohen, 1998), participants who tested positive for HIV were no more likely to test positive for syphilis than participants who tested negative for HIV in both populations. It should be noted that because the study only tested for active syphilis infections, these results are not comparable to the demographic and health survey.

In comparing the two populations, higher percentages of FSW who tested positive for HIV in our study reported being tested for HIV within the past year than MSM living with HIV. A greater percentage of FSW living with HIV also reported receiving HIV treatment than did MSM living with HIV in our sample. Therefore, while FSW demonstrate higher levels of HIV infection than MSM, they also appear to be actively engaged in HIV testing and treatment. This may be related to the fact that these services coincide with prenatal visits, and around three-quarters of FSW in the sample had children. It is commonly believed that HIV-status-dependent interventions are the most effective in preventing HIV transmission (i.e., those that provide early antiretroviral treatment for people living with HIV/AIDS and chemoprophylaxis for people at risk for acquisition) (Abdool Karim et al., 2010; Baeten et al., 2012; J. Cohen, 2010; M. S. Cohen & Baden, 2012; M. S. Cohen et al., 2011). Given the high prevalence of HIV in FSW and the encouraging proportion of participants being tested and treated for HIV, it is possible that a biologically based prophylactic approach to HIV may be beneficial for this population of FSW. Antiretroviral chemoprophylaxis may be a more effective means of protecting those FSW who are most at risk if they are able to adhere to such a medication regimen.

While HIV prevalence is lower in MSM than FSW, it is comparable to the high prevalence in the general population in Swaziland. Poor levels of HIV-testing among MSM have been noted in other generalized epidemics (Baral et al., 2009) and appear to be a problem in Swaziland. Programs encouraging regular testing may therefore be important components of prevention efforts targeting MSM. While health education coupled with access to condoms could provide immediate preventive impact (Beyrer, Sullivan, et al., 2012), comprehensive HIV prevention for MSM will also likely need to integrate biomedical interventions (such as early antiretroviral therapy) as they become available (Baral et al., 2012; Sullivan et al., 2012).

Biological and behavioral risk factors

Our data support the existence of some biological and behavioral risk factors for KP in Swaziland, though not all. In general, MSM and FSW reported multiple sexual partners. Approximately one-quarter of our MSM sample reported having both male and female partners in the past year, providing evidence that the heightened risk ascribed to MSM may have a direct link to the general population (Beyrer, Baral, et al., 2012). Encouragingly, condom use with all types of partners was mostly comparable to the general population for MSM and FSW, suggesting, perhaps, that population-level condom promotion has been effective. In contrast to studies indicating a high prevalence of injection drug use among KP such as FSW (Medhi, et al., 2011; Strathdee, et al., 2008; Tuan, et al., 2007), levels of drug use among both MSM and FSW in Swaziland were strikingly low, indicating that prevention efforts in Swaziland should focus their attention on other, more prevalent risk factors.

The lack of HIV-related knowledge appears to be a particularly salient problem among KP in Swaziland, as only 18.3% of MSM and 10% of FSM in our study knew of the heightened risk of contracting HIV from anal sex. Less than 40% of MSM reported using condom-compatible lubricants, and over 80% of FSW did not use lubricants at all. It is possible that HIV education campaigns for the general population may overlook the myriad behavioral risks that are more relevant for KP. For example, while 78.9% of MSM had received HIV prevention information concerning sex between men and women, only 21.4% had received information concerning sex between men. Unique campaigns tailored to these populations might highlight more specific risk factors that are shown to be problematic in KP, such as lubricant use and concurrent partnerships.

Structural risk factors

Our study provides support for the argument that behavioral and structural risk factors are intricately related for these populations. More than half of all FSW reported that it was somewhat or very difficult to insist on condom use if a client offered more money for unprotected sex, and a similar proportion said this of clients who provide them with regular economic support. Economic dependence has been linked to inconsistent condom use in FSW (Blankenship et al., 2008), and researchers are beginning to recognize the value of structural interventions such as economic programs in addressing these problems (Parker, Easton, and Klein, 2000; Blankenship et al., 2006, 2008). These interventions, which include conditional cash transfers, microloans, and job or technical trainings, aim to promote social “bargaining power” and independence by providing an alternate means of income (Mahmud, 2003). While these interventions are not necessarily intended to prevent sex work, they may allow FSW to rely less on

monetary support from clients, giving them more power to negotiate condom use and practice safer sex. As the majority of FSW in our study reported that they could borrow money from sex worker colleagues if needed (83.6%), it is possible that this existing framework might be leveraged to create a formal, community-based savings and credit association. Interventions for sex workers should be developed within a community empowerment and rights-based approach, as these have proven successful elsewhere (Kerrigan et al., in press) and have been recommended by the World Health Organization (WHO) (2011).

The high levels of human rights violations reported among MSM and FSW are alarming. Legal issues were prevalent, with approximately one-third of both MSM (30.2%) and FSW (34.6%) reporting legal discrimination. For FSW, the illegality of sex work in Swaziland likely complicates the interactions between FSW and law enforcement officials. Similar to results from previous studies (Arnott & Crago, 2009; Simic & Rhodes, 2009), FSW reported strained interactions with law enforcement, including being refused police protection (37.1%). Systemic legal issues must be addressed through structural interventions, such as those that provide ways for FSW to report crimes anonymously or without fear of being arrested themselves.

For MSM, anti-homophobia campaigns might help to reduce reported violations such as torture. Given the strength of social networks reported by MSM, it may be feasible to organize the MSM community to advocate for decriminalization and conduct anti-homophobia campaigns. This might also extend to the medical community, as results suggest that discrimination has a direct effect on protective healthcare-seeking behaviors. Over 40% of FSW and 60% of MSM felt afraid to seek healthcare due to their sexual orientation or practices. As discrimination within the medical community may subvert any efforts to increase HIV testing and treatment, it is essential that this barrier be addressed. Sensitization training for healthcare workers must address issues such as gossiping about clients, refusing clinical care, and providing lower quality care to MSM and FSW.

In contrast to the clear social cohesion present among MSM, responses to questions regarding social cohesion among FSW were mixed. More research is needed to better understand these social networks. It is possible that social cohesion is strong among small groups, but a central “community” of FSW could be lacking. Nevertheless, the positive responses to certain items—such as their ability to count on other FSW to accompany them to the hospital or borrow money if needed—suggest that initiatives rooted in female empowerment paradigms might be well-received. Similar to the economic programs described above, these programs seek to empower women by engaging them in education and advocacy efforts. This approach has grown in popularity since its successful implementation among sex workers in India (Jana et al., 2004). Groups of FSW could be trained as peer educators and patient advocates that educate fellow FSW about HIV and promote safe sexual practices, breaching the challenges in outreach targeting this “hidden” population.

Associations with HIV infection

Student’s t-tests revealed few significant differences between participants testing positive for HIV and those testing negative within both populations. In some instances, associations between independent variables and HIV-risk could be explained by the variable itself. For example, both MSM with HIV and

FSW with HIV were more likely to have been previously diagnosed with HIV than their counterparts who tested negative for HIV in our study. This is to be expected, as it is unlikely that many HIV-negative individuals would have received this diagnosis. Likewise, HIV-positive MSM were more likely to report hearing healthcare workers gossiping about them because of their sexual orientation/practices than HIV-negative MSM. A positive HIV status may lead healthcare workers to make assumptions about sexual behavior, and may also make an individual more sensitive to perceived discrimination. This behavior may therefore occur *because of* a positive HIV status, rather than serve as a predictor.

Our findings showed that HIV-positive participants were more likely to be older than HIV-negative participants in both populations. This may be reflective of the fact that older persons have been exposed to HIV for longer than younger persons.

We believe it is particularly meaningful that FSW living with HIV were more likely to have one or more children than FSW who tested negative for HIV. As over three-quarters of our overall sample reported having children (74.1%), interventions may do well to capitalize on the existing reproductive health infrastructure in Swaziland. Medical visits associated with reproductive health services are widely regarded as an ideal means of identifying individuals living with HIV and linking them to care, as well as providing prevention services to at-risk women (Blankenship et al., 2006). The high percentage of women with one or more children in our study coupled with the associated risk of HIV infection indicate that strengthening the package of services provided by reproductive health clinics may be critical for HIV prevention among FSW.

The limited number of significant differences between groups does not necessarily indicate that the selected variables do not contribute to HIV risk in MSM and FSW. It is possible that this instead signifies that it is not individual behaviors but rather *combinations* of behaviors that characterize the heightened risk of KP in Swaziland. Future analyses should examine more complex models of combination behaviors to determine whether multiple risk factors taken in tandem might better explain group differences.

Study limitations

A number of limitations must be noted. First, this study dealt with a number of socially stigmatized topics, such as HIV serostatus, sexual behaviors, and drug use. While we took every step to ensure confidentiality and create a safe space for the MSM and FSW who participated in our research, it is possible that some participants were not fully forthcoming during face-to-face surveys. This may have resulted in data that are somewhat skewed towards favorable answers (for example, an over-reporting of condom use and under-reporting of number of sexual partners). This phenomenon, referred to as "social desirability bias," is a limitation faced by all researchers seeking to examine sensitive topics, including HIV (Maccoby & Maccoby, 1954).

Second, RDS is built on a number of assumptions about the organization of social networks. It is possible that the relative uniformity of the sociodemographics of the sample may be due to unique social structures within these KP that violate the basic assumptions of RDS. Should this be the case, our sample may not be as representative of KP in Swaziland as we had hoped. Nevertheless, RDS is generally accepted to be the best sampling method for hard-to-reach populations.

Finally, as with any cross-sectional study conducted at a single site, associations should not be interpreted as causal, and data are not generalizable to other populations. The study was meant to provide a snapshot of KP in Swaziland in order to inform future initiatives concerning KP within this specific country. While our results provide a useful framework for countries with similar generalized epidemics, it is important that the distinctive characteristics of KP within these settings be examined independently.

Conclusions

It is clear that urgent action and consistent monitoring of HIV in KP are needed to turn the tide of the epidemics facing these KP, as well as populations connected through sexual networks. The significance of KP in Swaziland's generalized epidemic should be addressed through surveillance that includes specific KP measures. Additionally, as both MSM and FSW face unique social and structural hurdles such as high levels of stigma and discrimination, prevention programs and policies must take into account the social and political context of HIV infection in these populations.

The results presented here reveal some barriers to HIV prevention efforts targeting MSM and FSW in Swaziland, but also potential opportunities for effective programming. The data highlight the need for a targeted HIV prevention strategy that integrates behavioral, biomedical, and structural components. Future research and programming efforts must work towards developing and implementing multi-layered interventions for KP in Swaziland that recognize the complex relationship between levels of risk and the need for sensitive, population-specific programming.

RECOMMENDATIONS

Results from our study represent the first data on HIV prevalence and risk factors among KP in Swaziland. As such, they not only provide useful information for HIV prevention programming and surveillance efforts, but also raise a number of questions for future research. After examining these data, we offer the following recommendations:

Programmatic

1. ***Develop and implement comprehensive, evidence-based, multi-level interventions for KP***: This study identified key gaps in HIV-related knowledge, behaviors, and access to services for KP. However, it also identified overarching structural constraints to accessing services and engaging in effective HIV prevention. Interventions for KP should be developed and implemented that consider how to address important factors at all levels, including structural factors such as discrimination from health care settings and law enforcement, and the availability of condoms, lubricant, and other services. Recently, WHO has developed guidelines for the prevention and treatment of HIV and STIs among both MSM (WHO, 2011) and FSW (WHO, 2012). These guidelines recommend a combination of evidence-based interventions for MSM and FSW at multiple levels, framed within a strong empowerment and rights-based approach. This approach has been found to be cost-effective in recent mathematical modeling exercise (Kerrigan, Wirtz, et al., 2013).

2. ***Tailor intervention efforts to the needs of KP in Swaziland, recognizing differences between groups:*** While both MSM and FSW demonstrated high levels of risk for HIV infection, there were key differences between these populations. For example, though HIV prevalence was considerably higher among FSW than among MSM, a lower percentage of MSM reported being tested for HIV in the past 12 months than did FSW. Social cohesion appeared to be stronger among MSM than FSW. And while a majority of the FSW in our sample had one or more child, only 10% of MSM reported having children. The differences in populations underscore the notion that no uniform intervention effectively addresses all problems facing different KPs. Program administrators must consider the specific vulnerabilities of each group when designing and implementing interventions in the following areas:

    a. **HIV and STI prevalence**: The high prevalence of HIV in KP, especially among FSW, indicates that there is a large number of KP with ongoing care and treatment needs. A corresponding qualitative study conducted under R2P focused on needs of KP living with HIV using the Positive Health, Dignity, and Prevention Framework (PHDP) (Kennedy et al., 2013). Recommendations from this study should be implemented among KP in Swaziland. These multi-modal interventions focus on mitigating individuals' own physical and psychological suffering from HIV/AIDS as well as curbing HIV transmission by protecting their sexual partners and promoting greater involvement and advocacy among people living with HIV. Strengthening linkages to care within and beyond PHDP

can also open possible opportunities for biologically based prophylactic interventions (see below).

b. **Biological and behavioral risk factors**: Interventions must specifically work to address the biological and behavioral risk factors noted in this study. The high prevalence of HIV in FSW coupled with the promising proportion of FSW who had been tested and treated for HIV may signify that a biologically based prophylactic approach to HIV could be effective for FSW in Swaziland. Such interventions could HIV pre-exposure prophylaxis (PrEP) for HIV-negative sex workers with increased availability of HIV treatment for sex workers living with HIV. Biological interventions must be coupled with behavioral approaches to address HIV-related knowledge gaps specific to individual KP (such as low lubricant use among FSW or lack of prevention information concerning anal sex among MSM). As the practice of protective sexual behaviors is shown to be influenced by the economic and social context of partners, programs should be sure to include elements that target sexual partners or clients.

c. **Structural risk factors**: The high numbers of KP reporting legal discrimination and fear of seeking healthcare point to a need to address stigma and discrimination in these settings. Policymakers must work with KP to establish protection for KP seeking services in HIV prevention, testing, and treatment. It is also essential to equip health and legal personnel with sensitive training on how to address the quality of care and human rights abuses that contribute to structural violence or limit access to services or protection for KP. For FSW and lower-income MSM, programs should promote economic empowerment to alleviate the cycles of poverty and risk behavior that make them particularly vulnerable to HIV infection.

3. ***Include MSM and FSW in national HIV surveillance***: HIV surveillance in Swaziland utilizes population-based mathematical models that do not adequately capture the nuances of the country's epidemic. While this study provides the first unbiased estimate of HIV-prevalence in these KP, Swaziland must develop and adopt surveillance systems that continue to collect this type of data in order to monitor the epidemic among KP and better understand the role KP play in larger transmission dynamics.

Research

1. ***Conduct Population Size Estimations of MSM and FSW***: To date, there has not been a systematic assessment of the size of MSM or FSW populations in Swaziland. A rigorous estimate of the size of these populations would allow for a better understanding of their overall contribution to the HIV epidemic in Swaziland, assist with national planning for service delivery and inform future surveillance efforts.

2. ***Explore the feasibility of biological interventions***: The results provide great support for the need for structural and behavioral programming, though biological risk factors are an important

component of the HIV pandemic. Future research could determine the feasibility of biologically based prophylactic approaches, such as those mentioned in item 2b above, including assessing levels of adherence to such regimens.

3. ***Examine other KP such as people who use drugs:*** A complete investigation of KP in Swaziland will also need to include an assessment of people who use drugs (PWUD) as another possible KP. Robust estimates of injection drug use prevalence and associations with HIV have not yet been conducted in Swaziland. Though we identified low levels of drug use among MSM and FSW, PWUD may be a separate KP in this setting that has yet to be explored.

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APPENDIX

Table 1: Sociodemographic characteristics of MSM

		Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
General Demographics					
Age***	< 21 years old	1.9%	29.8% (95/319)	**36.0%**	[29.6%, 40.6%]
	21-25 years old	38.9%	45.5% (145/319)	**45.6%**	[30.7%, 41.8%]
	26-30 years old	38.9%	17.9% (57/319)	**11.9%**	[40.1%, 51.1%]
	> 30 years old	20.4%	6.9% (22/319)	**6.5%**	[4.3%, 9.7%]
Nationality at birth	Swazi	100%	95.7% (308/322)	**97.8%**	[96.0%, 98.7%]
	Mozambique	0%	2.5% (8/322)	**1.5%**	[0.7%, 3.2]
	South African	0%	1.2% (4/322)	**0.5%**	[0.1%, 1.4%]
	Other	0%	0.6% (2/322)	**0.2%**	[0.1%, 1.0%]
Highest education	Some secondary, high school or lower	30.9%	34.3% (110/321)	**44.0%**	[38.4%, 49.8%]
	Completed secondary or high school	45.5%	42.7% (137/321)	**41.1%**	[35.7%, 46.7%]
	Post HS vocational training or higher	23.7%	23.4% (75/324)	**14.9%**	[11.9%, 18.5%]
Employment status	Currently employed/student	75%	68.2% (212/311)	**69.2%**	[63.8%, 74.1%]
	Unemployed	25%	31.8% (99/311)	**30.8%**	[25.9%, 36.2%]
Marital status	Married, cohabitating, or widowed	7.3%	3.7% (12/322)	**1.7%**	[1.0%, 3.0%]
	Single/never married	92.7%	95.7% (308/322)	**98.3%**	[97.0, 99.0%]
Have one or more children		28.3%	12.4% (40/322)	**10.4%**	[7.6%, 14.1%]
Grew up in urban area		56.4%	61.6% (199/323)	**61.2%**	[55.7%, 66.4%]
Items specific to MSM					
Sexual orientation	Gay or homosexual	69.8%	64.2% (204/318)	**57.0%**	[51.3%, 62.6%]
	Bisexual	30.2%	35.8% (114/318)	**39.9%**	[34.4, 45.5%]
Disclosed sexual behavior to a family member		61.8%	53.1% (172/324)	**44.9%**	[39.5%, 50.4%]

*** = p<.001

Table 2: HIV and STI-related outcomes of MSM

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Laboratory tests				
HIV-positive	100%	17.1% (55/321)	**12.6%**	[9.7%, 16.2%]
Active syphilis	7.6%	1.9% (6/321)	**1.2%**	[0.5%, 2.7%]
Self report				
Tested for HIV in the last 12 months	47.3%	54.3% (176/324)	**51.0%**	[42.2%-60.8%]
Previously diagnosed with HIV***	30.0%	6.1% (19/311)	**4.2%**	[2.6%, 6.6%]
Receiving treatment for HIV	33.3%	25% (5/20)	**47.1%**	[22.5%-73.3%]

*** = p<.001

Table 3: Sexual behaviors and drug use among MSM in Swaziland

		Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Sexual behaviors					
Sexual partners in the past 12 months	Both male and female regular partners	21.8%	20.8% (67/322)	**25.5%**	[20.7%, 31.0%]
	Two or more male partners	27.3%	31.4% (101/322)	**23.8%**	[19.7%, 28.4%]
	Two or more female partners	1.8%	2.2% (7/322)	**1.9%**	[0.8%, 4.1%]
Condom use at last sex with:	Main male partner	72.2%	71.9% (218/303)	**69.5%**	[63.9%, 74.7%]
	Casual male partner	82.9%	74.1% (157/212)	**46.0%**	[40.6%, 51.6%]
	Main female partner	64.7%	67.3% (70/104)	**63.7%**	[53.4%, 72.8%]
	Casual female partner	69.2%	70.7% (53/75)	**62.7%**	[50.0%, 73.9%]
Always condom use with	Main male partner	51.9%	52.0% (156/300)	**48.2%**	[42.5%, 54.0%]
	Casual male partner	57.1%	56.8% (121/213)	**57.1%**	[50.2%, 63.8%]
	Main female partner	47.1%	51.5% (52/101)	N/A[1]	N/A
	Casual female partner	46.2%	52.8% (38/72)	N/A	N/A
General Lubricant use	Petroleum jelly	35.8%	46.5% (144/310)	**60.7%**	[55.1%, 66.0%]
	Water based lubricant	45.3%	37.1% (115/310)	**26.8%**	[22.4%, 31.7%]
	Body creams	9.4%	6.1% (19/310)	**4.0%**	[2.6%, 6.3%]
	None	7.5%	9.0% (28/310)	**8.6%**	[5.9%, 12.2%]
Drug use					
No injection drug use in the past 12 months		96.4%	97.2% (315/324)	**97.7%**	[98.8%, 95.7%]
No sharing of needles		100%	95.7% (22/23)	N/A[2]	N/A
Use of any non-injectable drug that was not prescribed		30.9%	35.6% (115/323)	**33.7%**	[28.7%, 39.1%]

[1] Since these questions did not apply to many participants, it was not possible to calculate the RDS-adjusted proportions in the same way as the male partner questions.
[2] Due to the small number of MSM who have shared needles, we could not estimate the RDS-adjusted proportion for this variable.

Table 4: Knowledge of HIV risk behaviors and exposure to prevention efforts among MSM

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
HIV-related knowledge				
Knowledge of anal sex as the most risky type of sex	24.1%	24.3% (78/321)	**18.3%**	[14.8%, 22.5%]
Knowledge that receptive anal sex is riskier than insertive	30.9%	30.0% (95/317)	**31.9%**	[26.9%, 37.3%]
Exposure to HIV prevention efforts				
Have received HIV prevention information between man and woman in the last year	77.8%	80.9% (259/320)	**78.9%**	[73.9%, 83.2%]
Have received HIV prevention information between men in the last year	27.3%	26.9% (87/323)	**21.4%**	[17.5%, 25.8%]

Table 5: Condom negotiation among MSM

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion reporting somewhat or very difficult (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Somewhat or very difficult to insist on condom use with a male sexual partner				
If he might think you have an STI	35.2%	34.9% (112/321)	**34.9%**	[27.5%, 43.9%]
If he does not want to use one	45.1%	42.4%(133/314)	**46.0%**	[37.3%, 56.1%]
If he gets angry if you suggest it	49.1%	45.4%(142/313)	**47.7%**	[39.1%, 57.6%]
If he has been drinking or using drugs	43.2%	44.1%(137/311)	**49.4%**	[40.3%, 59.9%]
If you have been drinking or using drugs	38.8%	40.2%(119/296)	**44.8%**	[36.1%, 55.0%]
If you haven't always used condoms with him in the past	63.0%	53.9%(171/317)	**53.3%**	[44.5%, 63.2%]
If he provides you with regular economic support	58.2%	55.8%(177/317)	**57.8%**	[49.1%, 67.5%]
If you care about him	43.6%	43.7%(141/323)	**45.4%**	[36.7%, 55.5%]
During oral sex	65.4%	59.2%(184/311)	**60.9%**	[52.5%, 70.4%]

Table 6: Prevalence of human rights abuses among MSM

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Sexual violence				
Ever been raped	7.4%	6.1% (19/324)	**6.4%**	[4.1%, 9.8%]
Occurring as a result of sexual orientation				
Lost employment	3.6%	2.8% (9/323)	**3.7%**	[1.9%, 6.9%]
Afraid to seek healthcare	50.9%	55.5% (178/321)	**61.8%**	[56.4%, 66.9%]
Denied healthcare	3.6%	3.7% (12/323)	**3.0%**	[1.7%, 5.3%]
Felt they received lower quality care	18.2%	16.4% (53/324)	**19.0%**	[14.9%, 24.0%]
Heard healthcare workers gossiping*	18.5%	10.2% (33/323)	**6.8%**	[4.9%, 9.5%]
Felt legal discrimination	37.7%	31.5% (101/321)	**30.2%**	[25.4%, 35.4%]
Beaten up	15.1%	9.0% (29/323)	**8.3%**	[5.8%, 11.9%]
Tortured	43.6%	39.5% (128/324)	**36.2%**	[31.2%, 41.5%]
Tested for HIV without consent	5.5%	2.8% (9/323)	**1.7%**	[0.9%, 3.3%]

* = $p<.05$

Table 7: Social networks and social cohesion among MSM

		Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion reporting strongly agree or agree (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Social cohesion					
You can count on other MSM in your group of friends…	If you need to borrow money	79.6%	84.6% (264/312)	**83.6%**	[72.9%, 94.8%]
	To accompany you to the doctor or hospital	81.8%	80.0% (255/319)	**77.6%**	[67.1%, 88.7%]
	If you need somewhere to stay	87.0%	89.5% (280/313)	**87.2%**	[76.3%, 98.5%]
	To help deal with a violent or difficult situation	85.2%	86.7% (273/315)	**88.4%**	[77.3%, 99.7%]
	To help you find other MSM	92.6%	91.1% (286/314)	**90.4%**	[79.7%, 101.3%]
	To support the use of condoms	78.2%	85.0% (272/320)	**84.0%**	[73.5%, 94.9%]
You can trust the majority of MSM you know		63.6%	69.8% (225/322)	**73.6%**	[63.3%, 84.8%]

Table 8: Sociodemographic characteristics of FSW

Characteristic		Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
General Demographics					
Age***	< 21 years old	12.6%	19.6% (62/317)	**33.0%**	[27.1%, 39.4%]
	21-25 years old	31.4%	31.5% (100/317)	**30.4%**	[25.5%, 35.8%]
	26-30 years old	29.6%	26.5% (84/317)	**22.8%**	[18.6%, 27.6%]
	> 30 years old	26.5%	22.4% (71/317)	**13.9%**	[11.0%, 17.4%]
Nationality at birth	Swazi	93.7%	94.9% (300/316)	N/A[3]	N/A
	Mozambique	2.2%	1.9% (6/316)	N/A	N/A
	South African	2.7%	1.9% (6/316)	N/A	N/A
	Other African	1.3%	1.3% (4/316)	N/A	N/A
Highest Education	Some secondary high school or lower	88.3%	86.8% (275/317)	**86.2%**	[71.5%, 103.6%]
	Completed secondary	10.3%	12.0% (38/317)	**11.2%**	[8.2%, 15.0%]
	Post-secondary	1.3%	1.3% (4/317)	**2.7%**	[1.0%, 7.0%]
Marital Status	Married, cohabiting, or widowed	13.2%	11.2% (35/313)	**9.4%**	[6.8%, 12.9%]
	Single/ never married	86.8%	88.8% (278/313)	**90.6**	[87.1%, 93.2%]
Have one or more children		80.2%	75.6% (239/316)	**74.1%**	[61.4%, 88.7%]
Items specific to FSW					
Disclosed occupation to family		31.5%	30.4% (96/316)	**24.3%**	[20.1%, 29.0%]
Disclosed occupation to healthcare worker*		29.7%	25.9% (82/316)	**13.4%**	[10.7%, 16.6%]
Sex work is sole income		64.6%	66.9% (212/317)	**73.2%**	[68.3%, 77.5%]

* = p<.05

** = p<.001

[3] Due to the small number of FSW born outside Swaziland, we could not estimate RDS-adjusted proportions for this variable.

Table 9: HIV and STI-related outcomes of FSW

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Laboratory tests				
HIV-positive	100%	69.7% (223/320)	**60.5%**	[52.1%, 69.0%]
Active Syphilis	8.6%	7.5% (24/319)	**6.6%**	[3.2%, 10.1%]
Self-report				
Tested for HIV in the last 12 months	78.0%	74.1% (234/316)	**61.7%**	[55.6%, 67.5%]
Previously diagnosed with HIV***	73.8%	55.3% (173/313)	**45.0%**	[39.5%, 50.6%]
Receiving treatment for HIV	41.5%	40.8% (71/174)	**36.9%**	[30.1%, 44.2%]

***= p<.001

Table 10: Sexual behaviors and drug use among FSW

		Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Sexual behaviors					
Average number of clients per week	1-5	57.6%	59.0% (183/310)	**66.5%**	[61.3%, 71.4%]
	6-10	25.8%	24.5% (76/310)	**18.8%**	[15.1%, 23.0%]
	11+	16.6%	16.5% (51/310)	**14.7%**	[11.3%, 19.0%]
Condom at last vaginal or anal sex with	Regular client	82.5%	82.2% (250/304)	**82.9%**	[78.3%, 86.7%]
	New client	86.3%	87.4% (257/294)	**84.8%**	[79.8%, 88.8%]
	Non-paying partner in last 30 days	50.3%	48.9% (132/270)	**51.1%**	[45.1%, 57.1%]
Have had sex without a condom in the past 6 months		68.2%	68.0% (215/316)	**68.7%**	[63.4%, 73.6%]
No, difficult, or somewhat difficult access to condoms when needed		20.5%	17.2 %(54/313)	**13.0%**	[8.9%, 18.6%]
Lubricant use during vaginal or anal sex with men	Petroleum jelly or Vaseline	41.5%	11.3% (35/310)	**11.0%**	[5.7%, 16.2%]
	Body creams/fatty creams	6.2%	1.9% (6/316)	N/A[4]	N/A
	Water-based	26.2%	6.4% (20/313)	**4.0%**	[1.2%, 6.9%]
	Saliva	9.2%	1.2% (4/333)	N/A	N/A
	None	16.9%	79.0% (245/310)	**81.5%**	[75.4%, 87.6%]
Drug use					
No injection drug use in the last 12 months		94.1%	94.3% (297/315)	**96.3%**	[94.2%, 97.7%]
No sharing of needles		96.2%	95.9% (71/74)	N/A	N/A
Use of any non-injectable drug that was not prescribed		33.0%	32.1% (100/312)	**21.5%**	[17.8%, 25.8%]

[4] Due to the small number of participants who used particular types of lubricants, we could not estimate RDS-adjusted proportions for some of these responses.

Table 11: Knowledge of HIVrisk behaviors and exposure to prevention efforts among FSW

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
HIV-related knowledge				
Knowledge of anal sex as most risky for HIV infection*	10.0%	10.9% (34/312)	**10.0%**	[7.2%, 13.8%]
Which is the safest lubricant to use during vaginal sex?				
Water-based lubricant	23.4%	21.2% (38/179)	**17.9%**	[13.1%, 23.9%]
Which is the safest lubricant to use during anal sex?				
Water-based lubricant	23.9%	21.6% (21/97)	**1.9%**	[1.2%, 3.1%]
Can you get HIV from using a needle to inject illegal drugs?				
No	3.6%	3.8% (12/314)	**4.4%**	[2.5%, 7.6%]
Yes	96.4%	96.2% (302/314)	**95.6%**	[92.4%, 97.5%]
Exposure to prevention efforts				
Have received HIV prevention information in the past year	88.2%	86.0% (271/315)	**84.9%**	[80.3%, 88.6%]
Have participated in talks or meetings related to HIV in the past year	61.5%	60.5% (190/314)	**49.9%**	[44.2%, 55.6%]

* = p<.05

Table 12: Condom negotiation among FSW

Characteristic	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n)	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Somewhat or very difficult to insist on condom use with a client				
While under the influence of drugs or alcohol	34.1%	34.7% (96/276)	**38.6%**	[30.8%, 48.2%]
While client is under the influence of drugs or alcohol	42.5%	44.6% (138/309)	**46.6%**	[38.0%, 56.5%]
If client offers more money not to use one	58.9%	57.0% (179/314)	**61.8%**	[52.2%, 72.6%]
If client provides regular economic support	50.7%	49.9% (158/317)	**56.8%**	[47.3%, 67.5%]
If client hasn't always used condom in the past	54.7%	57.7% (176/305)	**67.5%**	[57.2%, 78.8%]
During oral sex	52.2%	54.2% (143/264)	**63.2%**	[53.9%, 73.7%]

Table 13: Prevalence of human rights abuses among FSW

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Sexual violence				
Ever been raped	43.6%	40.5% (122/301)	**33.5%**	[28.5%, 38.8%]
Events occurring as a result of selling sex				
Felt afraid to seek healthcare	43.0%	44.8% (142/317)	**38.1%**	[33.0%, 43.4%]
Received lower quality healthcare	10.8%	10.7% (34/317)	**8.9%**	[6.4%, 12.3%]
Been denied healthcare	6.3%	5.4% (17/317)	**3.9%**	[2.4%, 6.2%]
Tested for HIV without consent	4.0%	3.8% (12/317)	**3.1%**	[1.7%, 5.3%]
Lost employment	15.7%	13.6% (43/317)	**9.5%**	[7.1%, 12.7%]
Experienced legal discrimination	50.0%	47.5% (150/316)	**34.6%**	[29.7%, 39.8%]
Been refused police protection	52.3%	49.4% (156/316)	**37.1%**	[32.0%, 42.4%]
Been blackmailed	36.3%	35.0% (111/317)	**29.9%**	[25.2%, 34.9%]
Experienced verbal or physical harassment	64.1%	61.5% (195/317)	**59.0%**	[53.5%, 64.4%]
Been tortured	52.5%	53.9% (171/317)	**49.2%**	[43.7%, 54.8%]
Been beaten up	39.5%	38.9% (122/314)	**32.2%**	[27.4%, 37.4%]
Heard healthcare workers gossiping about them	11.3%	11.7% (37/315)	**12.3%**	[9.0%, 16.5%]

Table 14: Social networks and social cohesion among FSW

	Non-RDS-adjusted proportion of HIV+ participants	Non-RDS-adjusted Proportion (n) agree or strongly agree	RDS-adjusted Proportion	RDS-adjusted 95% Confidence Interval
Social cohesion				
Can borrow money from sex worker colleagues if needed	66.1%	66.9% (210/314)	**68.0%**	[57.7%, 79.0%]
Can count on sex worker colleagues for accompaniment to the doctor or hospital	71.5%	68.9% (215/312)	**65.0%**	[55.2%, 75.7%]
Can count on sex worker colleagues for somewhere to stay	72.8%	74.9% (235/314)	**70.0%**	[59.6%, 81.0%]
Can count on sex worker colleagues for help dealing with violent or difficult clients	83.1%	83.0% (259/312)	**82.2%**	[71.7%, 93.1%]
Can count on sex worker colleagues to support the use of condoms	80.5%	81.3% (256/315)	**73.0%**	[72.3%, 94.1%]
Can count on sex worker colleagues if you need to talk about your problems	58.2%	59.7% (187/313)	**60.0%**	[50.2%, 70.7%]
Can trust the majority of sex worker colleagues	35.3%	36.9% (116/314)	**38.0%**	[29.9%, 47.6%]