

HIV-related conspiracy beliefs and its relationships with HIV testing and unprotected sex among men who have sex with men in Tshwane (Pretoria), South Africa

Waimar Tun^{a*}, Scott Kellerman^b, Senkhu Maimane^c, Zukiswa Fipaza^d, Meredith Sheehy^e, Lung Vu^a and Dawie Nel^c

^aPopulation Council, HIV and AIDS, Washington, DC, USA; ^bManagement Sciences for Health, Arlington, VA, USA; ^cOUT LGBT WELL-BEING, Pretoria, South Africa; ^dPopulation Council, Johannesburg, South Africa; ^ePopulation Council, HIV and AIDS, New York, NY, USA

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The objective of this study was to determine extent of HIV conspiracy belief endorsement among men who have sex with men (MSM) in Pretoria, and assess whether endorsement of HIV conspiracy beliefs are associated with inconsistent condom use and never testing for HIV. A cross-sectional survey using respondent-driven sampling was conducted between February and August 2009. A high proportion of respondents endorsed HIV conspiracy beliefs. MSM commonly endorsed beliefs related to AIDS information being held back from the general public (51.0%), HIV being a man-made virus (25.5%), and people being used as guinea pigs in HIV research and with HIV treatments (approximately 20%). Bisexually- or heterosexually-identified MSM were significantly more likely to endorse conspiracy beliefs compared to homosexually-identified MSM (38.5% vs. 14.7%). Endorsing conspiracy beliefs was not associated with unprotected anal intercourse; however, it was significantly associated with not having been HIV tested (AOR: 2.4; 95% CI: 1.1–5.7). Endorsing beliefs in HIV conspiracies reflects a mistrust in government institutions and systems which could be an impediment to seeking HIV-related services, including HIV counseling and testing.

Keywords: HIV conspiracy beliefs; unprotected sex; HIV testing; men who have sex with men; South Africa

Introduction

South Africans have always been the recipients of misinformation and mixed messages about the origins, treatment, and prevention of HIV. With messages from high-profile public figures contradicting evidence-based information from HIV researchers and the medical community, it is hard for the average South African to glean accurate HIV prevention information. Former South African President Mbeki and his health minister, during Mbeki's tenure as president, advised by the famous AIDS denialist Peter Duesberg, publicly supported the theory that AIDS is not caused by HIV, and accused the US Central Intelligence Agency of conspiring with pharmaceutical companies to promote antiretroviral treatments in poor countries to increase profits (Niehaus & Jonsson, 2005; Paton & Rickard, 2000). The health minister claimed that HIV was introduced to South Africa as part of a global conspiracy to reduce the African population and that an HIV vaccine may contain the AIDS virus (MacGregor, 2000). These ideas stalled the rollout of HIV prevention and treatment programs needed to curb the epidemic. Experts have pointed to the devastating impact Mbeki's HIV denialistic policies have had on the HIV epidemic and the lives of

people in South Africa, including the huge numbers of deaths and new HIV infections that could have been averted due to the delayed rollout of antiretrovirals (Chigwedere & Essex, 2010; Chigwedere, Seage, Gruskin, & Lee, 2008; Nattrass, 2007; Nattrass, 2010).

Although these denialist positions have been retracted, the messages have already spread and continue to spread. After hearing denialist messages for so long, one wonders if such messages have taken hold and if it has changed perceptions among the most-at-risk for HIV in South Africa. A 2005 study conducted in Lowveld, South Africa, found that men believed that HIV was a result of soldiers, Americans, and governments (Niehaus & Jonsson, 2005), and others such as the former health minister touted cures for HIV, from root vegetables and garlic to vitamins.

While there is much written about the prevalence of conspiracy beliefs around HIV in South Africa, there is a need to understand the extent to which South Africans are affected by HIV-related conspiracy beliefs and whether the beliefs may affect risky sexual practices and HIV preventive health-seeking behaviors. Only one study to date has reported on the negative role of HIV conspiracy beliefs on HIV testing behaviors in South Africa (Bogart, Kalichman, & Simbayi, 2008); the study was conducted among male

*Corresponding author. Email: waimartun@yahoo.com

and female clients of sexually transmitted infection units in clinics in three cities in South Africa.

South African men who have sex with men (MSM) are at high risk for HIV infection with an estimated prevalence of 10–13%, with gay-identified men having the highest prevalence (33%) (Burrell, Mark, Grant, Wood, & Bekker, 2010; Lane et al., 2009). While the South African constitution protects sexual minorities, MSM in South Africa largely remain a hidden group and with only minimal HIV prevention activities focused on them. They face high levels of stigma and discrimination and even homophobic violence, which may impede access to HIV information, prevention, and care and treatment services (Lane, McIntyre, & Morin, 2006). As a result, they may be particularly more vulnerable to misinformation about HIV and mistrust in authorities, including health care providers. Therefore, we examined if this population has been affected by the inaccurate messages of HIV denialism of the past and whether they have an impact on HIV prevention behaviors. Specifically, this paper examines the role of HIV conspiracy belief on unprotected anal intercourse (UAI) and never having been tested for HIV.

Methodology

Study design and study participants

We estimated the prevalence of HIV-related conspiracy beliefs, misinformation and mistrust in medical providers and institutions, and HIV-related sexual risk behaviors in the MSM population in greater Pretoria, Republic of South Africa. A cross-sectional survey was conducted using respondent-driven sampling (RDS) to recruit MSM. RDS is an adaptation of chain-referral sampling where members of the target population refer other members in their network to participate in the study (Heckathorn, 1997; Heckathorn, Semaan, Broadhead, & Hughes, 2002). In contrast to snowball sampling, RDS survey participants have a quota on the number of peers they can recruit to minimize the oversampling of certain subgroups. In addition, information on the linkages between participants and size of participants' social networks is collected to adjust for in statistical analysis to provide population-based estimates (Heckathorn, 1997; Heckathorn, 2002).

Eligible participants were men aged 18 years and older who engaged in oral or anal sex with another male partner in the past 6 months, and live in and around Pretoria. The study sites were located in both Pretoria City as well as in Atteridgeville township approximately 10–20 km outside Pretoria to allow for recruitment of a diverse MSM population with regard

to demographic, socioeconomic, and other HIV-related characteristics. Formative research was conducted prior to the study to select appropriate initial participants ("seeds") to start off the peer recruitment. Each seed received three uniquely coded referral coupons to be used to recruit other MSM. Eligible MSM who presented with a coupon were consented, enrolled, and in turn given three recruitment coupons until the sample size was reached. A total of 324 MSM (12 seeds and 307 nonseeds; 5 were missing recruitment linkage information and thus treated as seeds in the analysis) were recruited from February to August 2009.

Measures

HIV-related conspiracy beliefs were assessed by 12 statements (Cronbach's $\alpha = 0.73$) asking about levels of mistrust regarding HIV research, prevention and treatment. The scale has been used in previous research (Bogart & Bird, 2003; Bogart & Thorburn, 2005; Bogart, Wagner, Galvan, & Banks, 2010; Hutchinson et al., 2007; Ross, Essien, & Torres, 2006). Items include: "People who take HIV medication are human guinea pigs" or "HIV/AIDS is being used to kill black people". Participants responded to these false statements using a five-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). First, we explored the scale using factor analysis, which yielded two different dimensions. Second, we conducted confirmatory factor analysis; it confirmed that the model comprising of all of these 12 items as a one-factor model fit better than the two-factor model. Therefore, endorsement of HIV-related conspiracy beliefs was categorized as "Endorses" if participant endorsed at least 25% (or 3/12) of the statements and "Did not endorse" if participant endorsed less than three of the 12 statements (Bogart & Bird, 2003). We used this dichotomous variable to assess the relationship between HIV-related conspiracy beliefs and risk behaviors.

Attitudes toward condoms were measured using 13 statements regarding individual's experience and attitudes about using condoms (DeHart & Birkimer, 1997). Respondents reported their agreement or disagreement to statements such as "It is a hassle to use condoms" or "Condoms are irritating". Participants responded on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scale had high internal validity ($\alpha = 0.84$) and constituted a single component via factor analysis. Some items were reversed so that higher values indicate more positive condom attitudes. A composite index was computed by summing up these items. Because the continuous

index was not normally distributed, it was dichotomized at the median (low vs. high) for analysis.

Condom use knowledge was based on agreement with the item "Using condoms when you have anal sex with a man can reduce the chance of getting HIV," which was measured on a Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Strong agreement was categorized as having correct knowledge about condoms for anal sex.

Human Immune Virus (HIV) risk behavior was defined as having unprotected anal sex (receptive or insertive) with male sex partners in the past 12 months. Those who reported not having anal sex in the past 12 months were not included in the analysis assessing factors associated with risky sexual behavior ($n = 53$ (16%)) leaving a sample of 271 for this analysis. HIV testing was a dichotomous variable indicating whether someone has ever been tested for HIV. Other covariates include socioeconomic characteristics, sexual orientation, multiple sexual partnerships, attitudes toward condoms, perceived HIV risk, and engagement in sex work.

Statistical analysis

Descriptive and bivariate analyses were conducted using RDSAT software to adjust for recruitment patterns and the relative sizes of participants' networks (www.respondentdrivensampling.org). Population-based estimates from RDSAT are presented to describe the study population and bivariate relationship with endorsement of HIV-related conspiracy beliefs (Table 1). Population-based estimates from RDSAT are also presented for endorsement of specific conspiracy beliefs (Table 2). Bivariate relationships were also assessed in RDSAT for select characteristics and the two outcome variables (UAI and HIV testing; Tables 3 and 4). We assessed the level of significance in RDSAT bivariate analysis by comparing point estimates of two variables and their corresponding confidence intervals. If the confidence intervals of the two point estimates were nonoverlapping, we report there was a strong association between the two variables (www.respondentdrivensampling.org). If the confidence intervals overlapped but at least one point estimate falls outside the confidence interval of the other point estimate, we considered this to be suggestive of an association between the two variables (Raymond et al., 2009).

The individualized weights based on the outcome variable (UAI and HIV testing) were generated in RDSAT and were exported to STATA Software (Version 11.0; STATA Corp., College Station, TX) for logistic regression analysis (www.respondentdrivensampling.org). Unadjusted and adjusted odds

ratios (RDSAT individualized weights were included in all analyses) and p -values were reported. Selection of independent variables into the multivariate logistic regression models was determined through literature, theoretical concepts, and levels of significance in bivariate analysis ($p < 0.15$ as criteria for each variable to enter the multivariate analysis model). Missing data on the 12 items of the conspiracy belief scale ranged from 0% to 3% and were imputed by mean of the nonmissing items. There were two missing cases on HIV testing and data on UAI had no missing values.

Results

The crude and adjusted estimates of characteristics of MSM in Pretoria are presented in Table 1. Based on adjusted analyses, approximately three quarters were 18–25 years of age (71.7%), had less than 12 years of education (73.6%), and lived in townships (71.9%). The majority of MSM were black (93.7%) and single/not living with a partner (87.4%). One-half (58.0%) self-identified as homosexual, 17.5% reported engaging in sex work in the last 6 months, 20.4% reported engaging in unprotected anal sex in the last 2 months, 38.8% reported 2 or more sex partners in the last 2 months, and 28.9% had never been tested for HIV.

Endorsement of HIV conspiracy beliefs

Agreement to the 12 HIV conspiracy belief items is presented in Table 2. Overall, 22.9% of men met the definition of endorsement of HIV-related conspiracy beliefs. The item most commonly endorsed by MSM was related to information about AIDS being held back from the general public (51.0%) and that HIV is a man-made virus (25.5%). Conspiracy beliefs related to people being used as guinea pigs (experimental subjects) were also commonly endorsed with 21.0% believing that people being experimented on with new HIV treatments in South Africa without their knowledge, 20.0% believing that people who take new medicines for HIV are human guinea pigs, and 17.6% believing that researchers use black people as guinea pigs in HIV research studies. Conspiracy beliefs about HIV being put into condoms and beliefs related to malicious intent (i.e., HIV being used to kill people) were not commonly endorsed by MSM.

Sexual identity was significantly associated with conspiracy belief endorsement. Those who identified themselves as bisexual or heterosexual were significantly more likely to endorse conspiracy beliefs compared to those who identified themselves as

Table 1. Characteristics of the study population ($N = 307$).

	Population-based estimates % (95% CI)			Crude estimates % (<i>n</i>)
	Endorse conspiracy beliefs	Does not endorse conspiracy beliefs	Total sample	Total sample
Age (median = 24)				
18–25 years	23.8 (14.7–31.8)	76.2 (68.2–85.3)	71.7 (62.1–79.6)	66.1 (203)
26–42 years	20.1 (6.4–27.0)	79.9 (73.0–93.6)	28.3 (21.0–37.9)	33.9 (104)
Education				
≤ 12 years	26.8 (18.1–36.0)	73.2 (64.0–81.9)	73.6 (63.6–79.2)	69.4 (213)
Some college	14.5 (4.0–24.0)	85.5 (75.8–96.0)	26.4 (20.8–36.4)	30.6 (94)
Residence				
Non-Township	28.0 (14.5–43.5)	72.0 (56.5–85.5)	28.1 (17.7–40.2)	30.3 (93)
Township	20.8 (12.8–29.2)	79.2 (70.8–87.2)	71.9 (59.8–82.3)	69.7 (214)
Race				
Black	23.2 (16.0–30.9)	76.8 (69.1–84.0)	93.7 (90.4–97.2)	91.5 (281)
White + other colors	11.4 (2.0–31.0)	88.6 (69.0–98.1)	6.3 (2.8–9.6)	8.5 (26)
Marriage				
Single, not living with partner	22.4 (14.9–30.3)	77.6 (69.7–85.1)	87.4 (82.2–92.9)	85.3 (262)
Living with partner or in union	25.7 (9.9–47.5)	74.3 (52.5–90.1)	12.6 (7.1–17.8)	14.7 (45)
Job situation				
No earning job	20.1 (12.1–32.6)	79.9 (67.4–87.9)	54.5 (45.7–62.5)	48.9 (150)
Earning job	28.2 (16.8–37.6)	71.8 (62.4–83.2)	45.5 (37.5–54.3)	51.1 (157)
Self-reported sexual identity				
Homosexual	14.7 (8.2–22.2)	85.3 (77.8–91.8)	58.0 (47.7–67.7)	72.6 (223)
Bi/heterosexual	38.5 (25.6–53.4)	61.5 (46.6–74.4)	42.0 (32.3–52.3)	27.4 (84)
Engaged in sex work in last 6 months				
Yes	35.5 (16.7–47.3)	64.5 (52.7–83.3)	17.5 (11.4–26.0)	14.3 (44)
No	21.0 (14.4–29.7)	79.0 (70.3–85.6)	82.5 (74.0–88.6)	85.7 (263)
Condom use knowledge				
Incorrect knowledge	29.9 (13.5–45.7)	70.1 (54.3–86.5)	18.7 (12.2–24.6)	18.2 (56)
Correct knowledge	19.7 (12.6–27.7)	80.3 (72.3–87.4)	81.3 (75.4–87.8)	81.8 (251)
Had unprotected anal sex last 2 months				
Yes	25.4 (11.0–37.5)	74.6 (62.5–89.0)	20.4 (13.6–86.4)	26.6 (69)
No	19.4 (11.3–31.2)	80.6 (68.8–88.7)	79.6 (71.6–86.4)	73.4 (190)
Number of sex partners past 2 months				
1	19.8 (11.5–30.1)	80.2 (69.9–88.5)	61.2 (53.9–69.6)	55.7 (171)
≥2	28.0 (16.9–39.0)	72.0 (61.0–83.1)	38.8 (30.4–46.1)	44.3 (136)
Ever had HIV test				
Yes	20.1 (13.2–26.3)	79.9 (73.7–86.8)	71.1 (63.7–79.9)	78.2 (240)
No	38.5 (22.8–60.7)	61.5 (39.3–72.2)	28.9 (20.1–36.3)	21.8 (67)

Note: Population-based estimates were generated from RDSAT. Crude estimates reflect sample proportions produced from STATA.

homosexual (38.5% vs. 14.7%; Table 1). Although not strongly associated with conspiracy beliefs, MSM who were less educated, black, engaged in sex work and had never tested for HIV were slightly more likely to endorse conspiracy beliefs.

Unprotected anal intercourse

Endorsing conspiracy beliefs was not associated with UAI (Table 3). However, in bivariate analyses, unprotected anal intercourse with male partners was associated with having unfavorable attitudes

Table 2. Endorsement of specific conspiracy beliefs among MSM in Pretoria (population-based estimates).

Scale items	% (95% CI)
A lot of information about AIDS is being held back from the general public	51.0 (42.5–59.3)
HIV was invented in a laboratory (in other words, it is a man-made virus)	25.5 (17.6–32.9)
People are being experimented on with new HIV treatments in South Africa, but are not being told	21.0 (14.3–29.7)
People who take the new medicines for HIV are human guinea pigs (experimental subjects)	20.0 (12.8–27.2)
Researchers use black people as guinea pigs in HIV research studies	17.6 (11.2–24.2)
It is likely that you have been tested for HIV without your permission	11.3 (6.1–15.8)
HIV was created and spread by the US government	8.6 (4.4–13.0)
AIDS comes from the West	7.7 (4.1–11.6)
HIV/AIDS is being used to kill off black people	5.6 (2.5–12.6)
Doctors put HIV into condoms	3.9 (1.1–7.0)
HIV/AIDS is being used to kill off poor people.	3.3 (0.6–6.6)
The South African government puts HIV into condoms	2.0 (0.4–3.9)

Note: Analysis of 307 nonseed participants using RDSAT.

toward condom use and greater number of sex partners. After controlling for age and education, unfavorable attitudes toward condom use (adjusted odds ratio [AOR]: 2.9; 95% confidence interval [CI]: 1.04–8.23) and greater number of sex partners (AOR: 2.5; 95% CI: 1.2–5.4) remained statistically significant.

HIV testing

Never having been tested for HIV was significantly associated with endorsement of HIV-related conspiracy beliefs (Table 4). While 20.1% of those who had ever tested for HIV endorsed conspiracy beliefs, 38.5% of those had never tested for HIV endorsed conspiracy (Table 1). In multivariate analysis, after controlling for age and education, endorsement of conspiracy beliefs was significantly associated with not having been tested for HIV (AOR: 2.4; 95% CI: 1.1–5.7).

Of the 71.1% who had been tested for HIV, one-half (53.0%) reported not having revealed to the HIV counselor or provider that they had sex with men (Data not shown).

Trust for information on HIV and AIDS

When asked about who they trusted for information on HIV and AIDS, doctors in private practice, hospitals or clinics (90.2%; 95% CI: 83.7–94.8), doctors in government hospitals and clinics (83.5%; 95% CI: 76.5–88.4), and gay/lesbian organizations (83.9%; 95% CI: 79.9–89.7) were the most trusted sources of HIV and AIDS information (Data not shown). Other trusted sources were the internet (60.5%; 95% CI: 52.4–68.8), teachers (65.1%; 95% CI: 56.3–73.1), and radio/television public service announcements (71.4%; 95% CI: 63.5–79.6). The least trusted sources of information on HIV were traditional African healers (11.6%; 95% CI: 5.7–17.9).

Discussion

We found that a fairly high proportion of MSM in Pretoria endorse conspiracy beliefs, particularly those related to HIV information being withheld from the public and to people being experimental subjects with HIV treatments and in HIV research. This finding is similar to findings among other populations that have faced a great deal of discrimination and been disenfranchised such as African-Americans in the USA (Bogart & Thorburn, 2005; Klonoff & Landrine, 1999; Zekeri, Habtemariam, Tameru, Ngawa, & Robnett, 2009). It is often the most socially marginalized populations who suffer the most from misinformation due to their lack of exposure to credible sources of health information. This ultimately often results in negative health consequences. In South Africa, MSM are not privy to nor do they seek health services available to the mainstream population, including HIV prevention, treatment, and care services. A 2004 study among gay men and lesbians in Gauteng Province (which includes Pretoria) found that a high proportion of black MSM did not seek any kind of health services in the past one to two years and over one-half indicated being too scared to test for HIV (Wells & Polders, 2004). Given their lack of exposure to health services, they are less likely to get HIV information from credible sources, thus presenting a significant barrier to HIV prevention efforts and increasing their vulnerability to HIV. Our finding that MSM in Pretoria hold HIV conspiracy beliefs is not surprising particularly in light of the history of apartheid in that socially marginalized groups, particularly black MSM, have little trust in authority (government, providers, or institutions). This finding has important implications for HIV prevention programs; HIV conspiracy beliefs should

Table 3. Factors associated with unprotected anal intercourse with male partners among sexually active MSM in Pretoria ($N = 271$).

	Unprotected anal intercourse		
	Population-based estimates % (95% CI)	Odds ratio with weights (95% CI)	Adjusted odds ratio with weights (95% CI)
Conspiracy beliefs			
Does not endorse	20.4 (13.2–30.5)	1.0	1.0
Endorses	26.6 (11.4–43.0)	1.8 (0.8–4.3)	1.3 (0.6–3.1)
Age			
18–25	23.0 (14.1–34.0)	1.0	1.0
26–42	16.5 (6.5–27.4)	0.8 (0.4–1.8)	1.0 (0.4–2.3)
Residence			
Non-Township	21.9 (5.4–41.4)	1.0	n/a
Township	19.1 (12.5–28.1)	0.8 (0.4–1.9)	
Job situation			
No earning job	18.2 (9.5–28.1)	1.0	n/a
Earning job	22.7 (14.1–35.0)	1.5 (0.7–3.2)	
Education			
≤ 12 years	21.8 (13.5–31.6)	1.0	1.0
Some college	18.7 (9.9–33.9)	0.8 (0.4–1.8)	1.4 (0.5–3.7)
Self-identified sexual identity			
Bi or heterosexual	13.3 (5.4–22.2)	1.0	1.0
Homosexual	26.1 (17.7–38.6)	2.2 (0.9–5.0)	3.1 (0.9–10.1)
Attitude towards condom use			
Favorable	13.7 (8.2–21.9)	1.0	1.0
Not favorable	29.6 (15.9–43.0)	2.6 (1.2–5.5)**	2.9 (1.04–8.23)*
Condom use knowledge			
Incorrect knowledge	26.9 (9.8–43.8)	1.0	1.0
Correct knowledge	18.5 (12.2–26.8)	0.5 (0.2–1.3)	0.7 (0.3–1.6)
Type of sex partner (last sex)			
Steady	20.5 (11.6–30.2)	1.0	1.0
Casual	22.0 (12.1–35.2)	1.2 (0.6–2.7)	1.6 (0.7–3.7)
Number sex partners in the last 2 months			
One	10.5 (4.2–19.0)	1.0	1.0
2 or more	30.6 (19.4–45.4)	2.9 (1.3–6.1)**	2.5 (1.2–5.4)*
Engaged in sex work			
No	18.5 (11.2–24.6)	1.0	1.0
Yes	40.0 (19.9–75.0)	2.0 (0.7–5.4)	1.8 (0.7–4.7)

* $p < 0.05$; ** $p < 0.001$

not only be addressed but also tailored for the MSM population.

We also found that risky sexual behaviors persist at high levels with 20% having unprotected anal sex in the past 2 months and 39% having multiple sex partners. Further, approximately 30% of these men have never been tested for HIV. Sexual identity was associated with HIV conspiracy beliefs in that those who self-identified as bisexual or heterosexual (compared to homosexual) were significantly more likely to

endorse HIV conspiracy beliefs. It is likely that gay-identified persons are more exposed to HIV prevention messages and programs as there are a number of HIV prevention programs for gay and other MSM in South Africa. Given our findings that bisexually and heterosexually self-identified persons are more likely to hold HIV conspiracy beliefs, HIV educational programs need to better reach these men who are not gay-identified. They are likely more difficult to reach as they would not access programs for gay men.

Table 4. Factors associated with never having tested for HIV ($N=324$).

	Never tested for HIV		
	Population-based estimates % (95% CI)	Odds ratio with weights (95% CI)	Adjusted odds ratio with weights (95% CI)
Conspiracy beliefs			
Does not endorse	26.9 (16.0–32.5)	1.0	1.0
Endorses	38.5 (23.4–61.5)	2.2 (0.9–5.0)	2.4 (1.1–5.7)*
Age			
26–42	11.2 (3.7–17.9)	1.0	1.0
18–25	37.1 (26.5–46.6)	4.6 (1.9–10.9)**	4.7 (1.9–11.3)**
Residence			
Non-Township	34.7 (17.1–48.7)	1.0	n/a
Township	26.7 (17.6–34.8)	0.7 (0.3–1.7)	
Job situation			
No earning job	33.2 (21.3–43.4)	1.0	n/a
Earning job	23.5 (11.7–33.8)	0.6 (0.3–1.4)	
Education			
≤ 12 years	33.2 (22.5–42.3)	1.0	1.0
Some college	19.5 (6.0–35.3)	0.4 (0.2–1.4)	0.5 (0.2–1.5)
Sexual orientation			
Bi/heterosexual	28.9 (16.1–40.6)	1.0	1.0
Homosexual	31.0 (20.0–39.8)	1.2 (0.6–2.7)	1.2 (0.5–2.8)
Attitude towards condom use			
Favorable	31.0 (18.0–43.2)	1.0	n/a
Not favourable	28.7 (17.9–36.9)	0.9 (0.4–2.0)	
Type of sex partner (last sex)			
Casual	32.5 (19.1–43.8)	1.0	n/a
Steady	29.9 (17.3–38.3)	0.9 (0.4–2.0)	
Perceived HIV risk			
Low	30.7 (21.2–39.7)	1.0	n/a
High	20.1 (8.6–31.1)	0.6 (0.2–1.5)	
Engaged in sex work			
No	30.5 (19.8–36.9)	1.0	1.0
Yes	25.7 (3.2–39.3)	0.6 (0.2–2.1)	0.4 (0.1–1.3)

* $p < 0.05$; ** $p < 0.001$

One of the key findings of this analysis was that endorsement of conspiracy beliefs was significantly associated with not testing for HIV. Holding beliefs in HIV-related conspiracies reflects a mistrust in government institutions and systems which could be an impediment to seeking HIV prevention and treatment services, including HIV counseling and testing. The association between conspiracy belief endorsement and not testing for HIV has also been found in a previous study conducted among a higher risk sample of men and women in several provinces in South Africa (Bogart et al., 2008). In our study, MSM who believe in conspiracy beliefs were 2.4 times less likely to have been tested. It has also previously

been reported that South African men's fear of stigmatization as gay may be a barrier to seeking HIV counseling and testing (Lane et al., 2006). This stigma (whether perceived or actual) likely further intensifies HIV-related conspiracy beliefs as there is no opportunity to rectify these misconceptions and provide culturally appropriate HIV prevention information as they are not coming into contact with the health care system.

Despite advances in HIV testing technology and treatment, many who are at-risk for HIV still do not seek HIV testing. In our study population of MSM in Pretoria, over one-quarter had never tested for HIV. In order to promote HIV testing among MSM, HIV

educational messages must address HIV conspiracy beliefs and be delivered through trusted channels. A great deal of resources are spent on mass media such as public service announcements; however, to target the MSM population, HIV prevention education efforts should be delivered through sources highly trusted by MSM such as doctors and gay/lesbian organizations as found in our study. While gay/lesbian organizations typically attract gay-identified men, these organizations in South Africa do also recognize that a large proportion of their target population is hidden and not gay-identified, and they conduct outreach to reach these more hidden groups. Any HIV program for MSM must have tailored approaches for both gay-identified and non-gay-identified men.

While conspiracy belief endorsement was independently associated with not testing for HIV, it was not independently associated with UAI. However, we found that having unfavorable attitudes towards condom use was a more important predictor of UAI. Even after controlling for knowledge about condoms, unfavorable attitudes toward condom use was significant. This suggests that it is more important to address unfavorable condom attitudes than simply increasing knowledge about condoms.

In our study, an estimated 38.8% (30.4–46.1) had multiple sex partners in the past 2 months, and we found that those with greater number of partners were more likely to have unprotected anal intercourse. Having unprotected sex with multiple sex partners likely exacerbates the spread of HIV transmission (Mah & Halperin, 2010). Recent studies suggest that sexual concurrency plays a key role in increased HIV infections among gay and bisexual men in America and emerging HIV epidemics among MSM in Asia (Bohl, Raymond, Arnold, & McFarland, 2009; Choi, Hudes, & Steward, 2008). HIV prevention programs must target this high risk sub-group of MSM in reducing number of sex partners in a more complex manner that reflects the diversity of MSM's sexual behaviors and the different social and political contexts affecting them. There have been a number of controlled trials of targeted interventions for MSM that have demonstrated significant reductions in numbers of sex partners that could be adapted (Choi et al., 1996; Kalichman & Grebler, 2010; Kalichman et al., 2008).

There are a number of limitations to this study. First, despite using RDS, which is meant to yield a diverse sample of MSM, study participants were primarily young and black, thus limiting the generalizability of this study to nonblack MSM in South Africa or even in Pretoria. Second, there may be

reporting bias since data were recorded through face-to-face interviews. Third, some analyses may be under-powered resulting in large variances of the estimates, thus limiting our ability to examine the association between certain salient variables such as residency in townships and self-reported sexual identity with HIV testing and UAI. In summary, HIV-related conspiracy beliefs are endorsed by a sub-population of MSM, particularly among those who are not gay-identified. Given that endorsement of HIV-related conspiracy beliefs was found to be significantly associated with never having been tested for HIV, it will be important to address these beliefs through channels trusted by MSM and to continue targeted intervention efforts to reduce risky sexual behaviors among MSM.

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