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# HIV and sexually transmitted infection knowledge among women who have sex with women in four Southern African countries

Margaret M. Paschen-Wolff[a], Vasu Reddy[b], Zethu Matebeni[c], Ian Southey-Swartz[d] and Theodorus Sandfort[a,e]

[a]Department of Psychiatry, Division of Gender, Sexuality, and Health, HIV Center for Clinical and Behavioral Studies at the NY State Psychiatric Institute and Columbia University, New York, NY, USA; [b]Faculty of Humanities, University of Pretoria, Hatfield, South Africa; [c]Department of Anthropology and Sociology, University of the Western Cape, Bellville, South Africa; [d]Open Society Initiative for Southern Africa, Johannesburg, South Africa; [e]Department of Psychology, University of Pretoria, Hatfield, South Africa

**ABSTRACT**

Women who have sex with women in Southern Africa, where HIV prevalence is high, are often presumed to have minimal risk for sexually transmitted infections (STI) and HIV despite research documenting female-to-female transmission. This study examined the demographic and social factors contributing to female-to-female STI/HIV transmission knowledge among Southern African women who have sex with women using an integrated model of health literacy. In collaboration with community-based organisations in Botswana, Namibia, South Africa and Zimbabwe, data were collected through anonymous surveys (N = 591). Multivariable stepwise forward logistic regression assessed independent associations between participant characteristics and high vs. low knowledge using five items. Overall, 64.4% ($n = 362$) of women had high knowledge; 35.6% ($n = 200$) had low knowledge. Higher education (adjusted odds ratio [aOR]: 2.24, 95% confidence interval [CI]: 1.48, 3.40), regular income (aOR: 2.14, 95% CI: 1.43, 3.21), residence in Botswana (aOR: 3.12, 95% CI: 1.15, 8.48) and having ever received tailored STI/HIV information (aOR: 2.17, 95% CI: 1.41, 3.32) predicted significantly higher odds of high knowledge in the final multivariable model. Results suggest opportunities for peer-led sexual health programming and expanded HIV prevention campaigns addressing women who have sex with women.

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## Introduction

Women who have sex with women who are cisgender (i.e. whose assigned sex at birth aligns with their current gender identity) are often inaccurately perceived to be at minimal to no risk for sexually transmitted infections (STIs) and HIV (Doull et al. 2018;

CONTACT Margaret M. Paschen-Wolff margaret.paschen-wolff@nyspi.columbia.edu
Please note new affiliation for MMPW: NY State Psychiatric Institute, Columbia University Irving Medical Center, Department of Psychiatry, Division on Substance Use Disorders, New York, NY, USA

Gorgos and Marrazzo 2011; Matebeni 2009; Muzny et al. 2013), despite research documenting equal or higher risk compared to women with exclusively male partners (Gorgos and Marrazzo 2011; McCune, Imborek and Stockdale 2017; Kerr, Ding and Thompson 2013). Studies have documented risk factors for and transmission of trichomoniasis, syphilis, hepatitis A and human papillomavirus between female sexual partners (Gorgos and Marrazzo 2011; Kerr, Ding and Thompson 2013). Higher rates of Chlamydia trachomatis have also been observed among women who have sex with women compared to women who have only had male partners (Singh, Fine and Marrazzo 2011). Although limited, research has also reported on evidence of female-to-female transmission of HIV, as well as risk factors for HIV (Matebeni et al. 2013; Sandfort et al. 2013).

In the context of Southern Africa, a region with some of the world's highest HIV prevalence (World Health Organization 2017; Joint United Nations Programme on HIV/AIDS 2017), it is particularly important to assess knowledge of STI and HIV transmission dynamics among women who have sex with women. Southern African women in general face extensive gender-based violence and disproportionally high rates of HIV compared to Southern African men (World Health Organization 2017). Southern African women who have sex with women, by virtue of being women as well as sexual minorities, have the added burden of encountering discrimination, homophobia and sexuality-based violence despite some legal advances in gender and sexual minority rights (Sandfort et al. 2015; Sandfort et al. 2013; Smith 2015). Gender- and sexuality-based violence and homophobia, particularly in the context of a patriarchal society, amplify STI and HIV risk (Tallis 2012). Risk factors for Southern African women who have sex with women include sexual assault at the hands of both men and women, often resulting from homophobia, as well as transactional sex and barrier-free sex with HIV-positive female partners (Matebeni et al. 2013; Sandfort et al. 2013; Lock Swarr 2012; Sandfort et al. 2015).

Despite documented female-to-female STI transmission as well as high HIV risk and prevalence among women in Southern African countries, both STI and HIV risk perception remains low among Southern African women who have sex with women. For example, in a study of 23 young lesbians in South Africa, 9 reported that they had never used safer sex methods with a female partner because they discounted potential STI and HIV risk. Lack of access to safer sex resources such as dental dams further compounded low STI and HIV risk perception (Matebeni 2009).

Low perceived HIV risk among Southern African women who have sex with women may be attributed to a belief that HIV only impacts women with exclusively male partners (Matebeni et al. 2013; Muranda, Mugo and Antonites 2014; Sandfort et al. 2013). For example, 57% of South African lesbians in one study believed they could not have been exposed to HIV, and 53% were not apprehensive about the possibility of testing HIV-positive (Wells, Kruger and Judge 2006). In the aforementioned study of 23 young lesbians in South Africa, some stated they were not concerned about HIV 'because it's for heteros' (Matebeni 2009). South African lesbian women living with HIV reported being surprised when they tested positive, having assumed that sex with other women would not have put them at risk (Matebeni et al. 2013). Other research using the same dataset as the current study has found that 39% of the sample elected not

to undergo an HIV test because they did not perceive themselves to be at risk; yet, among those who had tested, 9.6% reported an HIV-positive serostatus (Sandfort et al. 2013). The route of transmission could not be determined for about 33% of the HIV-positive sample. An important limitation of that study, however, was that HIV status was collected via self-report. Although the women with an undetermined HIV transmission route could have contracted it at birth, through used needles or by some other means, female-to-female transmission remained a possibility (Sandfort et al. 2013).

## Female-to-female STI/HIV transmission knowledge

Southern African women who have sex with women, and their healthcare providers (Matebeni 2009; Muller and Hughes 2016; Matebeni et al. 2013), frequently lack sufficient knowledge about the sexual health of women who have sex with women. Such knowledge may be examined using Sørensen and colleagues' integrated model of health literacy (Sørensen et al. 2012), which accounts for both individual (e.g. sexual orientation) and socio-political (e.g. access to culturally sensitive care) factors that impact health-related knowledge. While health literacy models often focus only on concrete health knowledge (e.g. how STIs are transmitted), the integrated model also includes preceding determinants and the application of such knowledge to seeking health care. The core components of the model involve one's ability to: (1) *access*, (2) *understand*, (3) *appraise* and (4) *apply* health information. Access denotes the capacity for pursuing, locating and acquiring health information; understand, the capacity for grasping the information that is obtained; appraise, the capacity for evaluating the information; and apply, the capacity for employing the health information to support healthy decisions (Sørensen et al. 2012).

For Southern African women who have sex with women, access to appropriate sexual health information is limited, thus restricting opportunities to develop an understanding of their STI and HIV risk factors in order to apply that understanding to obtain sexual health services. In one study of African women who have sex with women from countries including Namibia, South Africa and Zimbabwe, nearly half (46%) of the sample was uncertain about where to obtain relevant sexual health information (Muranda, Mugo and Antonites 2014). Although lesbian, gay, bisexual and transgender (LGBT) community organisations in Southern African countries provide free safer sex resources for women who have sex with women, such as dental dams, many would need to travel long distances to access those services (Matebeni et al. 2013).

Southern African healthcare providers' lack of knowledge (Matebeni 2009; Muller and Hughes 2016) further perpetuates low perceived STI and HIV risk among women who have sex with women and limited access to relevant sexual health information. In two separate studies based in South Africa, women who have sex with women reported that healthcare providers questioned their desire to test for STIs and HIV (Matebeni et al. 2013; Smith 2015), believing that female-to-female transmission was impossible (Smith 2015). As reviewed in Tat et al. (2015), women who have sex with women in low- and middle-income countries like those in Southern Africa would

welcome relevant sexual health information but are often reluctant to disclose their sexual behaviours and identities to healthcare providers for fear of encountering discrimination (Tat, Marrazzo and Graham 2015). Homophobia on the part of medical providers (Smith 2015) also means that women who have sex with women in Southern Africa are hesitant to access health services in general (Muller and Hughes 2016).

Further restricting opportunities for women who have sex with women to develop their sexual health knowledge are public health campaigns and health policy initiatives that overlook their needs. Many of the existing sexual health campaigns (Matebeni 2009; Muranda, Mugo and Antonites 2014) and HIV policy priorities (Daly, Spicer and Willan 2016; Morison and Lynch 2016) in Southern Africa reflect heteronormative notions of sexuality and heterosexual or male-to-male HIV transmission dynamics, thus excluding women who have sex with women from the safer sex dialogue. As a result, many lack adequate information about their STI and HIV risk (Matebeni 2009). A social environment that continues to marginalise, reject and stigmatise homosexuality further restricts sexual health knowledge development (Sandfort et al. 2013).

Although several studies have reported on barriers to sexual health knowledge among women who have sex with women in Southern Africa (Daly, Spicer and Willan 2016; Matebeni 2009; Matebeni et al. 2013; Morison and Lynch 2016; Muller and Hughes 2016; Muranda, Mugo and Antonites 2014; Smith 2015), research has focused less on the factors that support knowledge advancement. Some research suggests that Southern African women who have sex with women do recognise their risks for STIs and HIV, take steps to obtain information about their sexual health and share that knowledge with friends and romantic partners (Matebeni 2009). In a region of the world with high HIV prevalence (World Health Organization 2017; Joint United Nations Programme on HIV/AIDS 2017), threats of sexual violence against women who have sex with women (Sandfort et al. 2013; Sandfort et al. 2015) and homophobic discrimination in healthcare settings (Matebeni 2009; Matebeni et al. 2013; Smith 2015), it is important to examine the components that facilitate the enhancement of sexual health knowledge. An informed understanding of resiliency as it relates to sexual health knowledge would support other Southern African women who have sex with women in obtaining information necessary to protect themselves from STIs and HIV. Against this background, the purpose of this study was to examine the demographic and social factors that contribute to high vs. low female-to-female STI/HIV transmission knowledge among Southern African women who have sex with women.

## Methods

The current study draws on data from a collaboration between academic researchers (Matebeni, Reddy and Sandfort), the Open Society Initiative for Southern Africa (Southey-Swartz) and LGBT community-based organisations (CBOs) across four countries: Gays and Lesbians of Zimbabwe (GALZ); Lesbians, Gays and Bisexuals of Botswana (LeGaBiBo); OutRight Namibia; and, in South Africa, the Triangle Project, Durban Lesbian and Gay Community & Health Centre, Forum for the Empowerment of Women, OUT LGBT Well-Being and Behind the Mask. The team held two one-week-

long meetings in 2010 and 2012 and regular conference calls to collaboratively develop research questions, the study design and assessment tools. CBO staff members received comprehensive training from the research team in participant recruitment, data collection and research ethics before collecting study data. Regular telephone communication occurred throughout the study. Study results, dissemination strategies and their relevance to policies were discussed in a three-day meeting after completion of data collection.

The study received approval from the South African Research Ethics Committee of the Human Sciences Research Council and the Internal Review Board of the New York State Psychiatric Institute. We were unable to obtain approval from partner organisations in Botswana, Namibia and Zimbabwe due to a lack of infrastructure in these countries and the stigma attached to sexual minority populations. Additionally, some of our partner organisations were operating under the threat of criminalisation and possible closure and thus advised us to avoid seeking ethical approval from government bodies. Our partner organisation in Botswana, however, relied on their own network of non-governmental organisations to discuss ethical considerations.

CBO staff members explained and reviewed the study procedures with participants and gave each participant a study information sheet containing contact information for the principal investigator and the South African Research Ethics Committee of the Human Sciences Research Council. The anonymous study received a waiver of written consent for participation. After CBO staff explained the study, they obtained verbal consent from participants, documented through CBO staff members' signing the form without stating the name of the study participant to protect confidentiality. Some CBOs provided participant compensation, while others did not.

### *Procedure*

Eligibility criteria included the following: (1) assigned female sex at birth; (2) at least 18 years old; (3) sex with a woman during the past year; and (4) residence in Botswana, Namibia, South Africa or Zimbabwe. Members of seven CBOs – four based in South Africa and one in Botswana, Namibia and Zimbabwe, respectively (Behind the Mask did not participate in participant recruitment) – recruited study participants via announcements at meetings, LGBT-friendly religious services and other LGBT spaces. Additional recruitment efforts leveraged CBO databases to identify potential participants who were contacted by text message, mobile phone call, direct email and/or Facebook. Participants were also recruited through word-of-mouth referrals.

Data collection occurred from September to December 2010. In spaces that participants determined to be 'safe' for lesbian and bisexual women, fieldworkers met with participants to explain the study purpose, obtain consent and subsequently enable participants to complete self-administered questionnaires. Spaces included CBO offices, participants' or their friends' homes, universities, cars or public locations such as parks and restaurants. Fieldworkers provided participants with assistance in completing the questionnaire 15.1% of the time. Some participants opted to complete the questionnaire in the company of other participants, while fieldworkers safeguarded participant

confidentiality. Anonymous surveys were administered in English; sparse resources prohibited the ability to translate surveys into local languages.

### Measures

Basic demographic characteristics included age in years, race (Black/African [reference category], coloured [an apartheid-era classification for mixed race], white or Asian/Indian, with white and Asian/Indian ultimately collapsed into a single category), education (primary, secondary, university or other post high school institution, dichotomised as low [primary; reference] vs. higher [secondary or higher] education), employment status (full time [reference], part time, student, unemployed or something else), whether participants had a regular income from employment (yes vs. no [reference]), whether participants had medical insurance (yes vs. no [reference]), their country of residence (South Africa [reference], Namibia, Zimbabwe or Botswana), ever married (yes vs. no [reference]) and whether participants had children (yes vs. no [reference]). HIV (yes vs. no [reference]) status was measured by asking participants if they had ever tested for HIV (yes vs. no) and, if so, if they had ever tested HIV-positive (yes vs. no [reference]). Responses were combined to create a three-category HIV status variable: never tested (reference), negative or positive.

Sexual orientation (including attraction and identity) and gender identity were assessed based on existing measurement guidelines (Saewyc et al. 2004; Sell and Becker 2001). To assess sexual attraction, women were asked: 'Do you feel more sexually attracted to women or to men?' Response options included 'only to women', 'more to women than to men', 'to women and men equally', 'more to men than to women' and 'only to men'. Responses were collapsed into 'women only' (reference [reference]) and 'women and men'. Sexual identity was assessed by asking women: 'In terms of your sexual orientation, what do you consider yourself?' Response options included 'lesbian', 'bisexual', 'gay', 'heterosexual' and 'other'. Responses were collapsed into two categories: 'lesbian/gay' (reference) and 'other' (bisexual, heterosexual or other).

In Southern African countries, sexual minority identity (e.g. lesbian, gay or bisexual) is frequently aligned with gender presentation (Matebeni 2009; Lock Swarr 2012); therefore, we also measured participants' self-perceptions of their masculinity and femininity using two three-question scales with five response options (from 'not at all' to 'extremely') (Storms 1979). Questions related to how feminine participants felt they were; how feminine they acted, appeared and came across to others; and how feminine their personality was. The same questions were used to measure perceptions of masculinity. Femininity and masculinity were defined for participants as alignment with societal expectations of and norms for women and men, respectively, in terms of appearance and behaviour. Cronbach's alphas were .94 for the femininity and .91 for the masculinity scale. Cronbach's alpha, ranging from 0 to 1, indicates a scale's reliability of measuring what it purports to measure. Alphas between .70 and .95 are considered reliable (Tavakol and Dennick 2011).

Sense of belonging to the general community and to an LGBT community were assessed using two scales adapted from Hagerty and Patusky (1995) and McLaren

(2009). To measure a general sense of belonging, participants were requested to specify their level of agreement on a 4-point scale ('disagree strongly' to 'agree strongly') with four statements: 'Where I live, people accept me', 'I feel misunderstood where I live', 'I am part of the community where I live' and 'I feel like an outsider where I live'. The scale had a Cronbach's alpha of .77. Sense of belonging to the LGBT community was assessed using similar statements, replacing 'where I live' with 'LGBT people' or 'the LGBT community'. The Cronbach's alpha for this scale was also .77.

Internalised homophobia was assessed using a six-item scale adapted from the Lesbian, Gay and Bisexual Identity scale (LGBIS) (Mohr and Fassinger 2000). Participants were asked to indicate their level of agreement with each of the following statements on a 4-point scale ('disagree strongly' to 'agree strongly'): 'Sometimes I dislike myself for being a person who has (or wants) sex with people of the same sex', 'I wish I were only sexually attracted to the opposite sex', 'I am not proud of myself for being sexually attracted to people of the same sex', 'I feel that being attracted to people of the same sex is a personal weakness of mine', 'If someone offered me the chance to be completely heterosexual, I would accept the offer' and 'Whenever I think about having sex with someone of the same sex, I feel bad about myself'. The Cronbach's alpha was .88.

To assess women's access to sexual health information pertaining to same-sex sexuality, participants were asked: 'Have you ever received STI/HIV information specifically for women who have sex with women?' (yes vs. no [reference]). If women had received such information, they were then requested to specify the source of such information, with responses including television, radio, newspapers, books and magazines, pamphlets/flyers, the Internet, health workers, friends, relatives, partners, LGBT or AIDS service organisations or other sources.

Finally, the primary outcome was the level of female-to-female STI/HIV transmission knowledge, assessed using five items. HIV knowledge was assessed through two statements – with 'true', 'false' or 'don't know' response options – that focused on HIV transmission between female partners: 'Women who have sex with each other are not at risk for HIV transmission' ('false' = correct; 'true' or 'don't know' = incorrect) and 'Women who have sex with each other can transmit HIV if they use sex toys (for example, vibrators) that are not cleaned' ('true' = correct; 'false' or 'don't know' = incorrect). STI knowledge was measured using three questions about STI transmission risk between female partners with 'yes' or 'no' responses: 'Women who have sex with each other can get a sexually transmitted disease through: (1) skin-to-skin contact; (2) contact with vaginal fluids; and (3) contact with menstrual blood'. A 'yes' response to each question was the correct answer.

### *Data analysis*

We first characterised the sample using descriptive statistics, including demographics, sexual and gender orientation, general and LGBT sense of belonging, internalised homophobia (with appropriate reverse coding) and receipt of tailored STI/HIV information (Table 1). For the primary outcome, we calculated the mean number of correct responses to the five statements regarding female-to-female STI/HIV transmission

knowledge. Level of knowledge was then dichotomised as high (3–5 correct responses) vs. low (0–2 correct responses; reference). We then compared the proportion with high (vs. low) knowledge by each of the aforementioned characteristics using unadjusted binary logistic regression (Table 1). We also reported on the proportion of participants who responded to each of the five knowledge statements correctly and incorrectly (Table 2). Next, we used multivariable logistic regression to assess the independent associations between participant characteristics and knowledge (0 = low knowledge; 1 = high knowledge). Variables for which we observed significant differences in level of knowledge were entered into a stepwise forward regression model, given the exploratory nature of the study (Table 3). Level of significance was set to $p < .05$ to indicate a less than 5% chance that findings were due to random sampling error (Biau, Jolles and Porcher 2010). All analyses were conducted in SPSS version 24.

## Results

### *Participants*

There were 591 women who participated in the study. As described in Table 1, participants were 26 years old (standard error [SE] = 0.27) on average. The majority identified as Black ($n = 464$, 78.8%), 12.4% ($n = 73$) as coloured and 8.8% ($n = 52$) as another race. Over half ($n = 319$, 54.3%) had received an education beyond secondary school. About one-third were employed full time ($n = 192$, 32.4%), and about a third were unemployed ($n = 199$, 33.7%), with the remainder being employed part time ($n = 73$, 12.4%), students ($n = 96$, 16.2%) or in another employment situation ($n = 31$, 5.2%). Less than half of the sample ($n = 280$, 48.1%) had a regular source of income, and over two-thirds ($n = 374$, 63.9%) lacked health insurance coverage. Most participants lived in South Africa ($n = 364$, 61.6%), with the rest residing in Namibia ($n = 112$, 19.0%), Zimbabwe ($n = 64$, 10.8%) and Botswana ($n = 51$, 8.6%). Few women had ever been married ($n = 48$, 8.1%). About one-quarter of the sample had children ($n = 140$, 23.7%).

The majority ($n = 416$, 70.5%) expressed being exclusively sexually attracted to women; only 29.5% ($n = 174$) reported being attracted to both men and women. In terms of sexual identity, nearly all women identified as lesbian or gay ($n = 452$, 76.9%; 0.7% of whom identified as gay), with the remaining 23.1% ($n = 136$) identifying as another sexual orientation such as bisexual or heterosexual. Mean scores were 2.93 (SE = 0.05, range 1–4, as no one selected a response of '5') for femininity and 2.57 (SE = 0.05, range 1–4; again, no responses of '5') for masculinity gender orientation scales, demonstrating that, on average, participants did not strongly identify as either feminine or masculine. For internalised homophobia, the mean score was relatively low at 1.59 (SE = 0.66, range 1–4; Table 1).

Most participants had never received STI or HIV information specifically for women who have sex with women ($n = 352$, 60.7%; Table 1). Among the 228 who had (39.3%), 70.6% received the information from LGBT or AIDS service organisations ($n = 161$), 50.9% from pamphlets or flyers ($n = 116$), 39.9% from friends ($n = 91$), 31.6% from partner(s) ($n = 72$) and 31.6% from the Internet ($n = 72$), respectively, and a smaller proportion from health workers ($n = 65$, 28.5%), books and magazines ($n = 60$, 26.3%), television ($n = 55$, 24.1%), radio ($n = 39$, 17.1%), newspapers ($n = 34$, 14.9%),

**Table 1.** Characteristics of Southern African women who have sex with women and female-to-female STI/HIV transmission knowledge (N = 591).

| | | STI/HIV Knowledge[a,b] (M correct responses = 2.84, SD = 1.04, Range = 0–5) | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Sample N = 591 *n* (% of N) | Low[c] *n* = 200 (35.6%) *n* (Row %) | High[d] *n* = 362 (64.4%) *n* (Row %) | B | SE | OR (95% CI) | |
| Age, mean (SE) | 26.0 (0.27) | 25.44 (6.92) | 26.09 (6.32) | 0.02 | 0.01 | 1.02 (0.99, 1.04) | |
| Race | | | | | | | |
| Black (ref) | 464 (78.8) | 160 (36.4) | 279 (63.6) | | | 1.00 | |
| Coloured | 73 (12.4) | 28 (40.0) | 42 (60.0) | −0.15 | 0.26 | 0.86 (0.51, 1.44) | |
| White or Asian/Indian | 52 (8.8) | 11 (21.6) | 40 (78.4) | 0.74 | 0.36 | 2.09 (1.04, 4.18) | * |
| Education | | | | | | | |
| Low (ref) | 269 (45.7) | 125 (49.8) | 126 (50.2) | | | 1.00 | |
| High | 319 (54.3) | 73 (23.7) | 235 (76.3) | 1.16 | 0.18 | 3.19 (2.23, 4.58) | *** |
| Employment | | | | | | | |
| Full time (ref) | 192 (32.4) | 41 (23.0) | 137 (77.0) | | | 1.00 | |
| Part time | 73 (12.4) | 23 (35.4) | 42 (64.6) | −0.60 | 0.34 | 0.55 (0.30, 1.01) | |
| Student | 96 (16.2) | 32 (34.4) | 61 (65.6) | −0.56 | 0.28 | 0.57 (0.33, 0.99) | * |
| Unemployed | 199 (33.7) | 93 (47.4) | 103 (52.6) | −1.10 | 0.23 | 0.33 (0.21, 0.52) | *** |
| Other | 31 (5.2) | 11 (36.7) | 19 (63.3) | −0.66 | 0.42 | 0.52 (0.23, 1.17) | |
| Regular Income | | | | | | | |
| No (ref) | 302 (51.9) | 133 (45.7) | 158 (54.3) | | | 1.00 | |
| Yes | 280 (48.1) | 65 (24.6) | 199 (75.4) | 0.95 | 0.19 | 2.58 (1.79, 3.70) | *** |
| Health Insurance | | | | | | | |
| No (ref) | 374 (63.9) | 144 (40.4) | 212 (59.6) | | | 1.00 | |
| Yes | 211 (36.1) | 52 (25.9) | 149 (74.1) | 0.67 | 0.19 | 1.95 (1.33, 2.85) | ** |
| Country of Residence | | | | | | | |
| South Africa (ref) | 364 (61.6) | 117 (33.3) | 234 (66.7) | | | 1.00 | |
| Botswana | 51 (8.6) | 6 (12.2) | 43 (87.8) | 1.28 | 0.45 | 3.58 (1.48, 8.67) | ** |
| Namibia | 112 (19.0) | 51 (51.5) | 48 (48.5) | −0.75 | 0.23 | 0.47 (0.30, 0.74) | ** |
| Zimbabwe | 64 (10.8) | 26 (41.3) | 37 (58.7) | −0.34 | 0.28 | 0.71 (0.41, 1.23) | |
| (Ever) Married | | | | | | | |
| No (ref) | 543 (91.9) | 182 (34.9) | 339 (65.1) | | | 1.00 | |
| Yes | 48 (8.1) | 18 (43.9) | 23 (56.1) | −0.38 | 0.33 | 0.69 (0.36, 1.30) | |
| Has children | | | | | | | |
| No (ref) | 451 (76.3) | 144 (33.4) | 287 (66.6) | | | 1.00 | |
| Yes | 140 (23.7) | 56 (42.7) | 75 (57.3) | −0.40 | 0.20 | 0.67 (0.45, 1.00) | |
| HIV Status | | | | | | | |
| Never tested (ref) | 128 (22.2) | 49 (39.5) | 75 (60.5) | | | 1.00 | |
| Negative | 388 (67.2) | 120 (32.5) | 249 (67.5) | −0.53 | 0.37 | 0.59 (0.28, 1.22) | |
| Positive | 41 (7.4) | 20 (52.6) | 18 (47.4) | 0.30 | 0.22 | 1.36 (0.89, 2.07) | |
| Sexual Attraction | | | | | | | |
| Women only (ref) | 416 (70.5) | 140 (35.2) | 258 (64.8) | | | 1.00 | |
| Women/men | 174 (29.5) | 60 (36.6) | 104 (63.4) | −0.06 | 0.19 | 0.94 (0.64, 1.37) | |
| Sexual Identity | | | | | | | |
| Lesbian/gay (ref) | 452 (76.9) | 146 (34.0) | 283 (66.0) | | | 1.00 | |
| Other | 136 (23.1) | 53 (40.5) | 78 (59.5) | −0.28 | 0.21 | 0.76 (0.51, 1.14) | |
| Gender Orientation | | | | | | | |
| Masculinity, mean (SE) | 2.57 (0.05) | 2.65 (1.28) | 2.54 (1.20) | −0.07 | 0.07 | 0.93 (0.80, 1.07) | |
| Femininity, mean (SE) | 2.93 (0.05) | 2.79 (1.31) | 3.03 (1.25) | 0.15 | 0.07 | 1.17 (1.02, 1.34) | * |
| General Sense of Belonging | | | | | | | |
| Mean (SE) | 2.86 (0.03) | 2.77 (0.67) | 2.89 (0.63) | 0.28 | 0.14 | 1.32 (1.01, 1.74) | * |
| LGBT Sense of Belonging | | | | | | | |
| Mean (SE) | 3.25 (0.03) | 3.15 (0.62) | 3.32 (0.57) | 0.49 | 0.15 | 1.63 (1.21, 2.21) | ** |
| Internalised Homophobia | | | | | | | |
| Mean (SE) | 1.59 (0.66) | 1.66 (0.65) | 1.54 (0.66) | −0.28 | 0.14 | 0.76 (0.58, 0.99) | * |
| Ever received STI/HIV information specifically | | | | | | | |

(*continued*)

**Table 1.** Continued.

| | | STI/HIV Knowledge[a,b] (M correct responses = 2.84, SD = 1.04, Range = 0–5) | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Sample N = 591 *n* (% of N) | Low[c] *n* = 200 (35.6%) *n* (Row %) | High[d] *n* = 362 (64.4%) *n* (Row %) | B | SE | OR (95% CI) | |
| for women who have sex with women | | | | | | | |
| No (ref) | 352 (60.7) | 143 (42.4) | 194 (57.6) | | | 1.00 | |
| Yes | 228 (39.3) | 51 (23.5) | 166 (76.5) | 0.88 | 0.19 | 2.40 (1.64, 3.51) | *** |

*Notes*. SD: standard deviation; B: beta; SE: standard error; OR: odds ratio; CI: confidence interval.
[a]29 missing responses.
[b]Higher score = more correct.
[c]Low Knowledge = 0–2 correct responses.
[d]High Knowledge = 3–5 correct responses.
*$p < .05$; **$p < .01$; ***$p < .001$.

**Table 2.** STI and HIV Knowledge Items (N = 591).

| HIV Knowledge | True n (%) | False n (%) | Don't Know n (%) |
|---|---|---|---|
| Women who have sex with each other are not at risk for HIV transmission. (*Correct answer: 'False'*) | 71 (12.4) | 451 (79.0) | 49 (8.6) |
| Women who have sex with each other can transmit HIV if they use sex toys (for example, vibrators) that are not cleaned. (*Correct answer: 'True'*) | 378 (66.2) | 72 (12.6) | 121 (21.2) |
| *STI Knowledge* | Yes *n* (%) | No *n* (%) | |
| *Women who have sex with each other can get a sexually transmitted disease through:* | | | |
| Skin-to-skin contact (*Correct answer: 'Yes'*) | 100 (16.9) | 491 (83.1) | |
| Contact with vaginal fluids (*Correct answer: 'Yes'*) | 444 (75.1) | 147 (24.9) | |
| Contact with menstrual blood (*Correct answer: 'Yes'*) | 269 (45.5) | 322 (54.5) | |

relatives ($n = 27$, 11.8%) or another source ($n = 13$, 5.7%) (data not shown within tables).

### *Female-to-female STI and HIV transmission knowledge*

In terms of HIV knowledge, 79.0% ($n = 451$) correctly identified the statement 'Women who have sex with each other are not at risk for HIV transmission' as 'false', and 66.2% ($n = 378$) correctly identified the statement 'Women who have sex with each other can transmit HIV if they use sex toys' as 'true'. STI knowledge was more variable: only 16.9% ($n = 100$) knew that women could transmit STIs through skin-to-skin contact with other women, while 75.1% ($n = 444$) knew that STIs could be transmitted through contact with vaginal fluid and 45.5% ($n = 269$) through contact with menstrual blood (Table 2).

The average number of correct responses to the five items was 2.84 (standard deviation [SD] = 1.04). Overall, 64.4% ($n = 362$) of women had high and 35.6% ($n = 200$) had low knowledge (Table 1). There were significant differences in the proportion of

**Table 3.** Multivariable forward stepwise logistic regression: female-to-female STI/HIV transmission knowledge (0 = Low, 1 = High) (n = 480).

| Variables | B | SE | aOR (95% CI) | |
|---|---|---|---|---|
| Education (High vs. Low - *ref*) | 0.80 | 0.21 | 2.24 (1.48, 3.40) | *** |
| Regular income (Yes vs. No - *ref*) | 0.76 | 0.20 | 2.14 (1.43, 3.21) | *** |
| Country of residence (vs. South Africa – *ref*) | | | | |
| Botswana | 1.13 | 0.51 | 3.12 (1.15, 8.48) | * |
| Namibia | −0.49 | 0.27 | 0.62 (0.36, 1.04) | |
| Zimbabwe | −0.24 | 0.32 | 0.79 (0.43, 1.47) | |
| Ever received STI/HIV information specifically for women who have sex with women (Yes vs. No - *ref*) | 0.77 | 0.22 | 2.17 (1.41, 3.32) | *** |

*Notes.* B: beta; SE: standard error; CI: confidence interval; aOR: adjusted odds ratio.
Model Statistics -2LL = 574.747; $\chi^2 = 74.24$, $df = 6$, $p < .001$; $R^2 = .189$ (Nagelkerke); .136 (Cox & Snell).
Hosmer & Lemeshow Test: $p = .448$; Classification accuracy: 69.7%.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

respondents with high (vs. low) knowledge in terms of race, education level, employment status, income, health insurance, country of residence, gender orientation, level of sense of belonging to the general and LGBT communities, level of internalised homophobia and having ever received tailored STI/HIV information. Women in the following groups had significantly greater odds of having high knowledge: white and Asian/Indian (vs. Black) women (odds ratio [OR]: 2.09, 95% confidence interval [CI]: 1.04, 4.18, $p < .05$), women with a high (vs. low) level of education (OR: 3.19, 95% CI: 2.23, 4.58, $p < .001$), a regular (vs. no regular) income (OR: 2.58, 95% CI: 1.79, 2.85, $p < .001$), health insurance (vs. no health insurance) (OR: 1.95, 95% CI: 1.33, 2.85, $p < .01$), women residing in Botswana (vs. South Africa) (OR: 3.58, 95% CI: 1.48, 8.67, $p < .01$), with a more feminine gender orientation (OR: 1.17, 95% CI: 1.02, 1.34, $p < .05$), a greater sense of belonging to both the general (OR: 1.32, 95% CI: 1.01, 1.74, $p < .05$) and LGBT communities (OR: 1.63, 95% CI: 1.21, 2.21, $p < .01$) and who had ever (vs. never) received tailored STI/HIV information (OR: 2.40, 95% CI: 1.64, 3.51, $p < .001$). Women who were students (vs. employed full time) (OR: 0.57, 95% CI: 0.33, 0.99, $p < .05$), unemployed (vs. employed full time) (OR: 0.33, 95% CI: 0.21, 0.52, $p < .001$), who resided in Namibia (vs. in South Africa) (OR: 0.47, 95% CI: 0.30, 0.74, $p < .01$) and who had less internalised homophobia (OR: 0.76, 95% CI: 0.58, 0.99, $p < .05$) had significantly *lower* odds of having high knowledge (Table 1).

Before entering the variables significantly associated with having high knowledge into a multivariable forward stepwise logistic regression model, we checked for multicollinearity and found a variance inflation (VIF) of 1.05 to 1.81 across the variables. The final model predicted a small relationship between participant characteristics and level of knowledge (Hosmer & Lemeshow test: $p = .448$; Nagelkerke $R^2 = .189$). The variables retained in the final model were education, regular income, country of residence and receipt of tailored STI/HIV information. High vs. low education predicted 2.24 times the odds (95% CI: 1.48, 3.40, $p < .001$); regular vs. no regular income, 2.14 times the odds (95% CI: 1.43, 3.21, $p < .001$); living in Botswana vs. South Africa, 3.12 times the odds (95% CI: 1.15, 8.48, $p < .05$); and having ever vs. never received tailored STI/HIV information, 2.17 times the odds (95% CI: 1.41, 3.32, $p < .001$) of having high (vs. low) knowledge. See Table 3 above for full details.

## Discussion

Over 60% of the women in the current study had high knowledge of female-to-female STI/HIV transmission, while approximately 36% had low knowledge. The results of this study add support to Sørensen and colleagues' integrated model of health literacy, showing that both individual and structural factors impact level of health-related knowledge. Individual factors associated with high knowledge included characteristics indicative of a higher socio-economic status, such as higher education and having a regular income. Structural-level predictors included having ever received tailored STI/HIV information (i.e. access) and residence in Botswana.

Although the sample for the current study was primarily recruited through LGBT organisations, less than half had ever received tailored STI/HIV information. Thus, having a connection to an LGBT organisation does not always ensure access to sexual health information relevant for women who have sex with women. When women in the current study did receive such information, the majority had obtained it from LGBT or AIDS service organisations. Therefore, LGBT organisations have the potential to play a critical and enabling role in enhancing sexual health knowledge among women who have sex with women. LGBT organisations could help close the knowledge gaps for women whose socio-economic status limits their opportunities for learning (e.g. lower income and less education) and for women whose needs are not being addressed in mainstream healthcare settings where their sexual health is not appreciated nor well understood (Matebeni 2009; Muller and Hughes 2016; Smith 2015).

Previous research has found that community-led and community-based programming for men who have sex with men in South Africa successfully connected participants to tailored HIV prevention information and resources like lubricants and condoms, while also enhancing participants' social support and self-efficacy (Batist et al. 2013). Such research thus suggests that LGBT CBOs could similarly enhance STI/HIV prevention knowledge and access to resources among women who have sex with women. Both researchers and practitioners should support Southern African LGBT CBOs and peer groups to be able to offer health information and tools tailored for women who have sex with women. Support could be both monetary and time-based, with established researchers potentially providing grant funding to existing Southern African LGBT organisations, and peer leaders running safer sex education groups for women who have sex with women. Peer-led interventions related to sexual risk behaviour have generally been found to be efficacious, including in developing nations and in settings with limited resources and professional staffing (Simoni et al. 2011).

Where the political and social climate allows, public health campaigns in Southern African countries should be expanded to include women who have sex with women. As discussed, when current public health messaging in a Southern African context does address same-sex sexual relationships, it typically focuses on sexual risk behaviours among male partners, effectively overlooking the needs of women who have sex with women. Women who do not see themselves or their relationships reflected in such messaging may in turn overlook their STI and HIV risk and may not retain knowledge that could otherwise be achieved through sexual health social marketing campaigns (Matebeni 2009).

Finally, we found that participants residing in Botswana ($n = 51$) had significantly greater odds of having high knowledge than those in South Africa, which could be attributed to the small sample in Botswana compared to other nations (e.g. $n = 364$ in South Africa). It is possible that nearly all 51 women living in Botswana were recruited from LGBT organisations where they may have had greater community connections and, in turn, more access to tailored STI/HIV information. At the time of writing, same-sex relationships continue to be criminalised in Botswana according to the Penal Code (Columbia University Global Freedom of Expression 2018; Library of Congress 2015). The Botswana constitution, however, does not forbid homosexuality; LeGaBiBo won a Court of Appeal case in 2012 permitting the group to register and advocate for the decriminalisation of same-sex partnerships (Columbia University Global Freedom of Expression 2018). Despite this small victory, it is unlikely that women in Botswana would have had more access to tailored STI/HIV information than those in South Africa, where anti-LGBT discrimination is incorporated into the constitution (Beresford, Schneider and Sember 2010). Still, constitutional laws prohibiting discrimination do not inherently translate into increased availability of tailored STI/HIV information (Sandfort et al. 2015; Sandfort et al. 2013; Smith 2015; Currier and Migraine-George 2017). Persistent homophobia, particularly on the part of medical providers, continues to impede access to relevant sexual health information among women who have sex with women (Muller and Hughes 2016; Tat, Marrazzo and Graham 2015).

### *Limitations*

Although providing information that may help support sexual health literacy among women who have sex with women in Southern Africa, this study is not without limitations. First, the study consisted of a non-probability sample, which may have introduced selection bias (Henry 1990) and implies that findings cannot be generalised. Given the conditions under which some partner CBOs were operating (e.g. threat of criminalisation and/or closure), however, word-of-mouth referrals allowed for recruitment of participants who might otherwise have been hidden, such as those not connected to social media or to LGBT organisations. Second, having had the questionnaire available only in English may have resulted in selective participation. Third, a more extensive operationalisation of female-to-female STI/HIV transmission knowledge and other aspects of health information is needed to better understand how sexual health knowledge and information can be promoted among women who have sex with women. Fourth, although we used two measures of sexuality (identity and attraction) and indicators of masculine and feminine gender identity, we recognise that we may not have accounted for the interaction of sexuality and gender, nor for sexual orientation as a multidimensional construct (Wolff et al. 2017). The current measures were also limited to masculine/feminine binaries. Moreover, eligibility criteria included assigned female sex at birth, thus potentially overlooking transgender women who have sex with women. While outside the scope of the current study, future research should consider multiple components of sexual orientation, the relationship between sexuality and gender identity and non-binary identities within study measures. Finally, future research should extend the current study by not only

examining the preceding factors that influence sexual health knowledge among women who have sex with women, but also the outcomes (e.g. accessing STI testing) that follow information obtainment.

## Conclusion

The results of this study suggest that, for women who have sex with women in Southern African countries, having access to tailored health information fosters improved sexual health knowledge, yet individual factors like income and education also influence such knowledge. Given a political and social climate that is not particularly welcoming to sexual minorities, peer-led and community-based sexual health programming could support and strengthen sexual health knowledge when improved LGBT health care in mainstream settings is not feasible or safe. In a part of the world where HIV prevalence is high, particularly among women, and where sexual minorities often face the threat of homophobic violence, it is crucial that all women receive adequate and appropriate STI/HIV prevention information. Finally, promoting better sexual health among women who have sex with women would profit from a more comprehensive understanding of their ability to appraise and apply relevant health information and the structural and personal factors affecting these decisions.

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## Declaration of interest

No potential conflict of interest was reported by the authors.

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## ORCID

Margaret M. Paschen-Wolff http://orcid.org/0000-0003-1176-5183
Vasu Reddy http://orcid.org/0000-0002-6004-2320

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