# STIs Among Women Who Have Sex with Women

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## Introduction

Recent data indicate that same-sex behavior among women in the United States is not uncommon. The National Survey of Family Growth 2002, a nationally representative sample of households in the United States, reported that 4.4% of women aged 15–44 years old had a female sex partner in the past 12 months, and 1.3% reported having exclusively female sex partners in the past 12 months. These investigators used measures of self-reported sexual identity and sexual behavior to estimate that 1.3–1.9% of US women self-identify as lesbians, and that 3.1–4.8% are bisexual [1]. In large population-based surveys, lifetime same-sex behavior is commonly reported by women, including 12% of women in the 2006–2008 National Survey of Family Growth (NSFG), 9.7% of women in the 1999–2001 British National Survey of Sexual Attitudes and Lifestyles [3], and 7.1% of women in National Health and Nutrition Examination Surveys (NHANES) 2001–2006 [2–4]. Despite these substantial numbers, the evidence based on sexual risk, epidemiology and natural history of sexually transmitted infections (STI) and related health care delivery among WSW is very limited. We review here the available evidence for key STI in WSW, and emphasize important preventive measures that all healthcare providers should be aware of for this understudied group of women.

## Basic Science Concepts

The use of molecular testing methods, such as nucleic acid amplification assays, for detection of STIs, including chlamydia, gonorrhea, and HPV, has expanded the ability to detect infection and further define the epidemiology of STI among women in general. New data utilizing molecular testing methods more fully describe STI among populations of WSW at a local, regional, and national level [5–8].

Bacterial vaginosis (BV) is a common vaginal infection that tends to be more common among women with female sex partners [9]. With the advent of 16S ribosomal RNA gene polymerase chain reaction and pyrosequencing to define the bacterial communities involved in BV, there has been a greater appreciation of the microbial diversity and complex nature of this condition [10–14]. These methods can identify previously uncultivable or difficult to culture microorganisms, and this has

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allowed a more detailed understanding of specific vaginal flora associated with prevalent BV infection [15], incident BV infection [16], persistent BV following treatment [17], potential extra-genital reservoirs of vaginal bacteria that may contribute to new BV infection [18], and vaginal bacteria shared between female partners [19]. Many of these studies have included WSW in part or exclusively. Moreover, efforts using molecular methods to fingerprint specific strains of *Lactobacillus* bacteria in female sex partners strongly suggest that such partners share these specific strains, and the likelihood of their doing so is directly related to the duration of their sexual partnership [19]. While the etiology and pathogenesis of BV is not completely understood, these data have contributed to an expanded understanding of BV and the ongoing investigation of whether BV can be sexually transmitted between same-sex and opposite-sex partnerships in women.

## Case Illustration

A 22-year-old college student presented to her university health service complaining of vaginal discharge and odor for 2 weeks that had not responded to over-the-counter vaginal clotrimazole cream. She reported having a female sex partner for the past 6 months. She was prescribed metronidazole 500 mg orally twice daily for 7 days for presumptive treatment of bacterial vaginosis, and a pelvic exam was not performed at the initial visit. She noted some improvement with metronidazole but at 2 weeks post-treatment continued to experience vaginal discharge with new onset of inter-menstrual bleeding and abdominal pain. On reevaluation a urine pregnancy test was negative. Pelvic exam disclosed mucopurulent discharge from the cervix and cervical motion tenderness. A vaginal wet mount showed no evidence of vaginal candidiasis, trichomoniasis, or BV. She was started on treatment for pelvic inflammatory disease (PID). A cervical swab sent for nucleic acid amplification testing returned positive for *Chlamydia trachomatis* and negative for *Neisseria gonorrhoeae*. She responded rapidly to treatment for PID. On further interview she reported a history of two prior male sex partners and one prior female sex partner in her lifetime. Her current partner was asymptomatic and had not been recently tested for chlamydia.

## Epidemiology

A major challenge in interpreting the studies examining sexual risk behaviors and STI among WSW results from the fact that different studies often use different methods to categorize and define sexual contact between women. Some studies have identified these women based on self-identified sexual orientation ("homosexual," "lesbian," "bisexual," "heterosexual"), while others use reported sexual behaviors and same-sex partner selection over time (history of a female partner during the lifetime, or during a more recent period, such as the past year; history of male partners) alone or in combination with measures of sexual orientation. This limits the methodological comparability across studies, and should be considered in interpreting the available evidence. For data discussed below, the definition of WSW used in the particular study will be included for reference.

Women who have sex with women are a diverse group with variations in sexual identity, sexual behaviors, sexual practices, and risk behaviors. Sexual identity is not necessarily in concordance with sexual behaviors and gender of sexual partners [3, 4, 20–22]. Past and current studies affirm that the majority of women (up to 87%) who report same-sex behavior have had male partners in the past and may continue to do so in the present (6–23%) [23–25]. It cannot be presumed that women who identify as "lesbian" do not or have not had male partners. Surveys among adolescent and young women also highlight the potential discordance between sexual identity and gender of partner(s). Among women aged 15–44 self-identifying as heterosexual in the 2006–2010 National Survey of Family Growth (NSFG), a national population-based household survey, 11.2% reported ever having a same-sex partner, and 1.8% reported a female sex partner in the past year [20]. Girls in 8th to

12th grade participating in the Youth Risk Behavior Survey (YRBS) for 2005 and 2007 who self-identified as lesbian reported having male only partners (25%), female only partners (34%), and both male and female partners (40%). For girls who reported both male and female partners, 28% self-identified as heterosexual, 7% as lesbian, and 58% as bisexual [26].

Some women who have both female and male partners (WSWM) may also evidence increased risk-taking behaviors compared to their peers with exclusively opposite-sex (WSM) or exclusively same-sex partners. Prior surveys included women attending STD clinics, primary care settings, or living in specific regions. Women who reported a past or current history of both male and female partners were more likely to report high-risk behaviors including: exchanging sex for money or drugs [27], having partners who were injection drug users [24, 27, 28], sex with MSM or bisexual men [24, 27, 28], an HIV positive partner [27], and both past and current drug use [28]. While reporting having "riskier" male partners, the lesbian and bisexual women were more likely to engage in protective behaviors such as condom use and to recognize their risk of STI and HIV with subsequent care seeking for testing [24].

Population-based surveys of women living in the US, UK, and France reported potential for increased sexual risk among WSWM compared to women with exclusively same-sex or opposite-sex partners including: a higher number of male partners [3, 7, 20, 22]; high alcohol intake or binge drinking [3, 20, 22]; drug use [3, 20, 22]; and partner concurrency [7, 20, 22]. Similar patterns were seen among adolescents and young women participating in YRBS and NSFG surveys, Those who identified as "other than heterosexual" or who reported same sex partners reported: more recent and lifetime partners [26, 29, 30]; illegal drug use [26, 29]; being coerced into sexual contact [29, 30]; and a younger age of heterosexual sexual debut [30]. In summary, many early studies of risk behaviors among WSW were based on convenience samples or on women attending STD clinics and are not necessarily generalizable to all women who have sex with women. However, it does appear that some WSW, particularly adolescents and young women as well as some women with both male and female partners may be at increased risk for STI and HIV based on reported risk behaviors.

Few data are available on the risk of STI conferred by sex between women, but transmission risk probably varies by the specific STI and sexual practice (e.g., oral–genital sex; vaginal or anal sex using hands, fingers, or penetrative sex items; oral–anal sex; and genital–genital contact). Practices involving digital-vaginal or digital-anal contact, particularly with shared penetrative sex items, present a possible means for transmission of infected cervicovaginal secretions. Transmission of human papillomavirus (HPV) can occur with skin-to-skin or skin-to-mucosa contact, which can occur during sex between women. A recent small study also documented the presence of HPV on vaginally inserted sex toys both before and after cleaning which could provide a mechanism for transmission of HPV between partners using shared sex toys [31].

Until recently, few published data on the risk of bacterial STI in WSW were available, and infections with major pathogens of concern, including *C. trachomatis* and *N. gonorrhoeae*, were considered to be uncommon. Earlier studies that included women from STD clinics and sexual health centers reported a prevalence of chlamydial infection among WSW ranging from 0.6 to 3.0% and of gonorrhea from 0.3 to 2.8% [32–35]. However, no data on chlamydia or gonorrhea infections in WSW from community or population-based venues were available. In 2008, Singh et al. examined chlamydia positivity among WSW aged 15–24 years old tested at family planning clinics participating in the Infertility Prevention Project in the Northwestern U.S. from 1997 to 2005 [6]. Women reporting sex with women (WSW) and women reporting sex with both men and women (WSMW) in the 12 months prior to testing were included. Chlamydia positivity was 7.1% among both WSW and WSMW and remained stable over the period of observation in the study. Chlamydia positivity for women reporting only

male partners in the 12 months prior to testing was 5.3%. Risks for chlamydia among WSW and WSMW were age <20 years, non-White race/ethnicity, new sex partner, symptomatic sex partner, symptoms, exposure to chlamydia, and cervicitis, and did not differ from those traditionally identified among women who report sex only with men.

Recent studies have examined STI prevalence and risk behaviors among diverse populations of WSW, including international settings and African American WSW. Convenience samples of WSW living in China demonstrated a relatively high prevalence of bacterial STI compared to prior surveys (gonorrhea 16%, chlamydia 4%) [36]. Testing among African American WSW attending an urban STD clinic included women with exclusively female partners in the past year and women with both male and female partners in the past year. STI at the time of visit were common overall in these women: *Trichomonas vaginalis* (TV) in 18.3%, *C. trachomatis* (CT) in 11%, *Mycoplasma genitalium* (MG) in 7.6%, *N. gonorrhoeae* (NG) in 3.7%. WSWM were more likely to be diagnosed with a current STI versus WSW: TV (25.0% vs. 13.5%); CT (22.5% vs. 2.7%); NG (7.5% vs. 0.9%); any STI (47.5% vs. 18.3%) [5].

Other sexually transmitted infections can be passed between female partners, including trichomoniasis [37, 38], syphilis [39], and hepatitis A [40]. Although it is presumably rare, sexual transmission of HIV may also occur in this manner [41]. Prior data suggesting potential HIV transmission between female partners is based on case reports where presumed female–female transmission was based on a lack of other identified risk factors [42–46]. Two case reports identified women who had no other reported behavioral risk for HIV acquisition other than sexual contact with a single HIV-infected female partner. Female–female sexual transmission was supported by recent infection with a similar HIV genotype to the known HIV-infected female partner in one case [41]. In the other case, transmission occurred in the context of an HIV discordant monogamous same-sex partnership where no risk factors for transmission were identified other than sexual contact. The virus infecting the two women had $\geq$98% sequence identity in three genes by phylogenetic linkage analysis [47]. More common is the potential for WSW to acquire HIV through other modes, including injection drug use and sexual contact with high-risk male partners [27, 48, 49].

Data are most extensive for the incidence and risk of some viral STI among WSW, particularly herpes simplex type 1 and 2 (HSV-1 and HSV-2) and human papillomavirus (HPV). The 2002 National Survey of Family Growth provided information on self-reported viral STI among women aged 15–44 years old. A history of "genital herpes" or "genital warts" was reported more frequently by bisexual women (15.0–17.2%) than by lesbians (2.3–6.7%) and their heterosexual counterparts (8.7–10.0%) [25].

A seroprevalence study of HSV in 392 WSW found that 46% had antibodies to HSV-1 and 8% had antibodies to HSV-2. Increasing age was predictive of higher seroprevalence of both HSV-1 and 2, and HSV-2 seropositivity was associated with having a male partner with genital herpes. Of the 78 women in the study reporting never having had a male partner, 3% were HSV-2 seropositive. HSV-1 seroprevalence increased with increasing numbers of female partners [50]. In a separate study of HSV-1 prevalence and acquisition among young women, receptive oral sex was associated with HSV-1 acquisition [51]. More recent data from NHANES conducted in years 2001–2006 among women aged 18–59 demonstrated an HSV-2 seroprevalence of 30.3% among women reporting same sex partners in the past year, 36.2% among women reporting same sex partners in their lifetime, and 23.8% among women reporting no lifetime same sex behavior [2]. HSV-2 seroprevalence among women self-identifying as "homosexual or lesbian" was 8.2%, similar to a prior clinic-based study of WSW.

While genital human papillomavirus infection is common, with certain HPV types associated with cervical cancer, WSW were once presumed to be at "low risk" for HPV acquisition and cervical cancer. Data now strongly support that HPV infections are common among WSW and that sexual transmission of HPV almost certainly

occurs between women [52–54]. Prior case reports highlighted the presence of cervical neoplasia and HPV among women who had no history of sex with men [55, 56]. HPV in WSW has been studied using both HPV serology and DNA detection methods. In a 1995 study, among WSW who reported never having had a male sexual partner, 26% had antibodies to HPV-16 and 42% had antibodies to HPV-6. No difference in the prevalence of HPV-16 and HPV-6 antibodies was found between those women with and without a history of male partners. HPV DNA was detected in genital tract specimens in 30% of the women enrolled, and the prevalence of squamous intraepithelial lesions (SIL) on Pap smear was 4%, similar to that found in heterosexual women [52]. A subsequent larger study again showed the high prevalence of HPV in WSW, with 13% having HPV DNA in genital tract specimens (74% of which were oncogenic types) and 4.4% having either low or high grade SIL [53]. A large cohort of HIV seropositive and HIV seronegative women in the US have been followed longitudinally as part of the Women's Interagency HIV Study with Pap and HPV DNA PCR tests obtained every 6 months. Women reporting no male and at least one female sex partner in the past 5 years (WSW) were matched to women reporting sex only with men (WSM). Pap abnormalities and HPV were common at study entry, even among the HIV seronegative WSW with a remote history of last male partner (>5 years): abnormal Pap (9% vs. 11%), any HPV DNA detected (27% vs. 20%), carcinogenic HPV (4.6% vs. 8.5%) [8].

Despite these persuasive data, WSW from diverse settings, particularly those with a history of having only female partners, are less likely to report having had Pap smear screening and too frequently believed they had less need for cervical cancer screening [52–54, 57–61]. Women identifying as lesbian or bisexual have also reported lower coverage for HPV vaccination [62, 63]. HPV vaccine uptake among girls aged 13–17 years in the National Immunization Survey-Teen (NIS-Teen) 2012 estimated that 53% of girls received at least one dose (vaccine initiation) and only 33% completed the three dose vaccine series as of 2012 [64]. Estimated vaccine coverage is even lower among young adults with estimates of HPV vaccine initiation among women aged 18–26 ranging from 23 to 45% [65, 66]. Utilizing NSFG 2006–2010 data for 15- to 25-year-old women asked about HPV vaccination, vaccine awareness was similar among heterosexual, bisexual, and lesbian participants. However, only 8.5% ($p = 0.007$) of lesbians and 33.2% ($p = 0.33$) of bisexual women who had heard of the vaccine had initiated vaccination compared with 28.4% of their heterosexual peers [63]. The weight of evidence strongly supports that WSW are at risk from acquiring HPV from both their female partners and from current or prior male partners, and thus are at risk for cervical cancer. Both the Centers for Disease Control and Prevention and the American College of Obstetrician Gynecologists recommend routine Pap smear screening among WSW in the same manner as is performed for heterosexual women.

Based on recent convenience surveys of WSW, use of barrier protection between female partners appears to be very low despite the risk for STI transmission, particularly HSV and HPV, between female partners. In these surveys, 80% or more of women reported having never used barrier protection (gloves, dental dams) for digital sex or oral sex, and 60% or more of women never used barriers with sex toys or shared sex toy use [67–70]. Little is known about the knowledge, attitudes, and choices of protective and risk-reduction behaviors across different populations of WSW. Table 13.1 summarizes potential modes of transmission for the major bacterial, protozoal, and viral STI between female partners and risk-reduction strategies that WSW may use to reduce their risk of STI acquisition.

## Pertinent Clinical Issues Unique to Population

Many studies report lower utilization of health services and cervical cancer screening among adult and adolescent WSW, especially those who

**Table 13.1** Summary of potential modes of transmission for the major bacterial, protozoal, and viral STI between female partners and risk reduction strategies that WSW may use to reduce their risk of STI acquisition

| Infection | Potential modes of transmission | Activities that may result in transmission between female partners | Risk reduction strategies |
|---|---|---|---|
| Chlamydia, gonorrhea | Shared cervicovaginal or anorectal fluids | Digital-vaginal sex<br>Digital-anal sex<br>Shared vaginal or anal sex toys | Use of barriers (gloves, condoms) on sex toys or during digital—genital contact<br>Avoid sharing sex toys<br>Clean toys between partners<br>Use a new barrier on toys when changing activities or partners |
| Trichomonas | Shared cervicovaginal fluids | Digital-vaginal sex<br>Shared vaginal sex toys | Use of barriers (gloves, condoms) on sex toys or during digital—genital contact<br>Avoid sharing sex toys<br>Clean toys between partners<br>Use a new barrier on toys when changing activities or partners |
| Herpes simplex virus (HSV) type 1 and 2 | Skin-to-mucosa contact<br>Skin-to-skin contact | Oral–vulvo/vaginal sex<br>Digital-vulvo/vaginal sex<br>Digital-anal sex<br>Genital–genital contact | Use of barriers (gloves, condoms) during digital—genital contact<br>Use of barriers ("dental dams") during oral–genital contact |
| Human papillomavirus (HPV) | Skin-to-skin contact | Oral–vulvo/vaginal sex<br>Digital-vulvo/vaginal sex<br>Digital-anal sex<br>Genital–genital contact?<br>Shared vaginal or anal sex toys | Use of barriers (gloves, condoms) on sex toys or during digital—genital contact<br>Avoid sharing sex toys<br>Clean sex toys between partners<br>Use a new barrier on toys when changing activities or partners<br>Use of barriers ("dental dams") during oral–genital contact |

identify as lesbian or have had exclusively female partners [7, 57, 60, 61, 71]. Sexual minority women (self-identified as lesbian or bisexual) participating in NHANES 2001–2010 reported being less likely to have a source of care, more likely to be uninsured, and to have worse self-reported health than heterosexual participants [72]. Data from the Behavioral Risk Factor Surveillance Survey 2000–2007 compared individuals in same-sex relationships to individuals in opposite-sex relationships. Women in same-sex relationships were significantly less likely to have health insurance coverage, were less likely to have had a checkup within the past year, were more likely to report unmet medical needs, and were less likely to have had a recent mammogram or Pap test [61].

Many reports have highlighted health disparities and the multiple barriers to care for sexual and gender minority persons. Barriers may include structural factors that impair access to health care (financial, lack of access to health insurance individually or with same sex partners); stigma, discrimination, and lack of nondiscrimination policies; reluctance to disclose sexual or gender identity; and a paucity of culturally competent providers and culturally appropriate prevention services [73–76]. In a recent survey of academic faculty practices accredited by the Liaison Committee on Medical Education, very few had existing policies (4%) or procedures (9%) to identify LGBT competent physicians in their institution. Only 16% reported having a comprehensive LGBT competency training and 52% reported having no LGBT training available at all [77]. Comprehensive research on the health of women with female sex partners across all dimensions of sexual identity

remains sparse. Based on a review from Coulter et al., from 1989 to 2011 the National Institutes of Health funded 628 studies concerning LGBT health. Once excluding projects about HIV/AIDS and sexual health, only 0.1% of all NIH-funded studies concerned LGBT health, and of the LGBT studies only 13.5% studied sexual minority women [78].

Assessing any woman for her risk of STI must incorporate an open discussion of all aspects of sexuality, including a lifetime history of sexual partners and practices, and not just those limited to preconceptions or stereotypes on the part of providers. Sexual and reproductive health services that are sensitive to gender minority women across a wide range of ages and populations are needed, including adolescents and college-aged women.

Bacterial vaginosis (BV) is a common, clinically pertinent condition among WSW, and there has been an expanding debate on whether BV can be transmitted between female sex partners and thus be considered an STI among WSW. The basic science and clinical aspects of BV among WSW will be reviewed in detail below.

Prior studies have suggested a higher prevalence of BV among WSW, although these studies had previously been limited to specific populations such as STD clinics or sexual health centers. Prevalence of BV among WSW in these studies ranged from 8 to 52% [32–34, 79–82]. In the largest sample to date, NHANES 2001–2004, a nationally representative sample of the U.S. civilian population, women who reported a lifetime history of a female sex partner had a prevalence of BV of 45.2% (35.5–57.5%) versus 28.8% (26.8–31.0%) in those not reporting a female sex partner [9].

Many studies have shown a high level of concordance of BV between a woman and her female sex partner (both partners with BV or both partners without BV) [79, 82–84]. A systematic review and meta-analysis examining the association between BV and female sexual partners found that having a history of female sex partner(s) conferred a twofold increased risk of BV (RR = 2.0, 1.7–2.3) [85]. Exchange of vaginal fluid among female partners or other shared behaviors may contribute to the initiation of BV. Among WSW, prior studies have found an association of BV with a higher lifetime number of female sexual partners, a history of receptive oral–anal sex, not always cleaning an insertive sex toy between uses, and smoking [82, 83, 86]. A recent observational study of community-based WSW aged 16–35 found those with BV were more likely to report a partner with BV (RR = 2.55, $p < 0.001$), sharing vaginal insertive sex toys (RR = 1.53, $p = 0.011$), >1 female sex partner in past 3 months (RR = 1.58, $p = 0.15$), and vaginal lubricant use (RR = 1.51, $p = 0.08$). No association was seen with age, race, smoking, hormone use, douching, vaginal intercourse, receptive oral or anal sex, and number of partners [87].

In a recent study that measured BV acquisition in a prospective cohort study of 199 WSW over one year, risks for incident BV were presentation $\leq 14$ days since onset of menses, report of new sex partner with BV history, change in vaginal discharge, and detection of any of several BV-associated bacteria (BVAB) in vaginal fluid at enrollment [16]. Detection of *Lactobacillus crispatus* at enrollment conferred reduced risk for subsequent BV. Detailed analysis of behavioral data suggested a direct dose–response relationship with increasing number of episodes of receptive oral–vulvovaginal sex [16]. The Women on Women's (WOW) Health Study enrolled 289 WSW, including 122 women who were co-enrolled with their female sex partner, with vaginal swabs collected every 3 months over a period of 2 years. Prevalent BV was 27% at study entry with an incident case rate of 9.75 per 100 woman-years. Incident BV infection was associated with a new sex partner, having a partner with BV symptoms, receptive oral sex, and the onset of BV symptoms. Of particular note, women who were co-enrolled with a BV negative partner were much less likely to have incident BV (AHR 0.26, 95% CI 0.11–0.61) and had a high concordance of Nugent score category (normal flora, intermediate flora, BV) between co-enrolled partners, which was predominantly normal flora [88]. In a separate analysis of WOW Study participants who collected once weekly

vaginal swabs for three weeks, co-enrolled WSW were less likely to have BV, and concordance of Nugent score category was associated with a relationship of >6 months and sexual contact more than once per month [84].

Molecular methods have allowed a more detailed analysis of specific vaginal flora and flora shared between partners. Using both culture methods and strain typing with repetitive element sequence-based PCR (rep-PCR) fingerprinting, Marrazzo et al. [19] examined *Lactobacillus* colonization at vaginal and rectal sites and whether unique *Lactobacillus* strains are shared by female sex partners. Among 392 women, 25.3% had BV and most (58%) reported only one female partner during the prior six months. *L. crispatus* was the most commonly isolated lactobacilli, followed by *Lactobacillus gasseri* and *Lactobacillus jensenii*. Relative to *L. crispatus*, the rectum was more commonly the sole site of *L. gasseri* colonization. Detection of *L. gasseri* was associated with recent receptive digital-vaginal sex and increased BV risk (OR = 4.3, 1.4–13.4). Within this study, both members of monogamous partnerships were enrolled. Of 31 couples monogamous for $\geq 3$ months, strains of genital lactobacilli by rep-PCR fingerprinting were identical in both members in 23 (74%). No similarities in lactobacilli strains were seen between "control" partners matched for age and date of enrollment to the study. Couples with identical *Lactobacillus* strains reported fewer female partners in the prior year. There was a trend towards an association of reporting use of shared vaginal sex toys and sharing identical lactobacillus strains. The likelihood of sharing identical lactobacilli was not related to mean age of the couple; number of lifetime male sex partners; or to practice, frequency, or timing of other types of sexual behaviors, including oral or anal sexual practices.

Several studies have examined the impact of specific sexual practices on the vaginal microflora among WSW and non-WSW. Among a cohort of community-based WSW, baseline vaginal colonization (by culture based method) with *Gardneralla vaginalis* was associated with >20 digital-vaginal sex acts in past 3 months or >10 toy–vaginal acts in past 3 months. There was no association of *G. vaginalis* colonization with oral–vaginal or anal–vaginal sex practices. Vaginal use of insertive sex toys and sharing of sex toys was associated with decreased quantities of $H_2O_2$ producing-*Lactobacilli* and a higher risk of colonization with *G. vaginalis* [89]. In an observational cohort of WSW, women treated for BV were reexamined 3–8 weeks post treatment. A full 40% still had BV (treatment failure) and only 27% were colonized with *L. crispatus* or *L. jensenii* post-treatment by PCR analysis. Reported interval sex practices were common (48% oral-vaginal 59% digital-vaginal; 18% penile-vaginal; 20% toy-vaginal), but there was no association between interim sex practices and the presence or absence of *L. crispatus* or *L. jensenii* at followup. Among women colonized with *Lactobaciili* at followup, report of receptive oral sex and digital-vaginal sex was associated with lower concentrations of vaginal *L. crispatus* [90].

An observational cohort of sexually experienced and sexually inexperienced women (including both WSW and non-WSW) examined associations between prevalent BV, BV-associated bacteria, and sexual behaviors. Six of eight candidate BV bacteria were absent or rare in vaginal samples from women with no reported history of sexual exposure (coital or non-coital) and showed increasing odds of detection with increasing levels of sexual activity and/or number of lifetime partners. Presence of *Megasphaera-1* in vaginal samples was independently associated with reporting a female sex partner in the past year and with having >10 lifetime sex partners [15].

Extra-vaginal reservoirs of vaginal bacteria may also be a risk factor for incident BV. In a case control study examining BV acquisition in a cohort of community-based WSW, detection of *G. vaginalis* in oral cavity or anal samples and *Leptotrichia/Sneathia* species in anal samples at enrollment was more common among women who subsequently developed BV during followup. *L. crispatus* was detected more frequently in anal samples among women who did not develop BV (controls) [18].

Despite an initial treatment response, BV commonly recurs or persists in both the short term [91–94] and long term [95, 96]. One study found that a past history of BV, a regular sex partner throughout the study, and female sex partners were significantly associated with recurrence of BV and abnormal vaginal flora [95]. A study of young WSW with BV treated with vaginal metronidazole gel examined behavioral and microbiologic correlates of persistent BV and abnormal vaginal flora at one month post-therapy. After adjustment for treatment adherence, detection of either BVAB3 or *Peptoniphilius lacrimalis* at baseline remained associated with the likelihood of BV persistence. Persistence was not related to any specific sexual activity, including male or female partners, use of sex toys, condom use, receptive oral or anal sex, or a sex partner with BV [17]. Among women (21% with a history of a female partner in past year) participating in a BV treatment trial, recurrence of BV was associated with having the same pre/post-treatment sexual partner, inconsistent condom use, and was reduced with use of estrogen-containing contraceptive [94].

Several prior clinic-based studies have examined the role of treatment of partners of females with BV in reducing persistent or recurrent BV. These trials enrolled women with male sex partners and involved treating women and their male partners with clindamycin [97], metronidazole [98, 99], or tinidazole [100] with followup ranging from 3 to 12 weeks. None of these trials have shown any benefit in reducing persistent or recurrent BV by treating male sex partners. The only proven interventions that have demonstrated an effect in preventing the development or recurrence of BV are chronic suppressive metronidazole therapy [96] and circumcision of male partners [101]. To date there have been no reported trials examining the potential benefits of treating female partners of women with BV, and thus no data on which to base a recommendation for partner therapy in WSW.

There has been one published trial utilizing a behavioral intervention to reduce persistent BV among WSW. Enrolled women were randomized to an intervention designed to reduce sharing of vaginal fluid on hands or sex toys following treatment for BV. Shared vaginal use of sex toys was infrequent among both groups. Despite the fact that women randomized to the intervention were 50% less likely to report receptive digital-vaginal contact without gloves than controls, there was no reduction in persistent BV at one month post-treatment or incident episodes of recurrent BV among women randomized to the intervention arm versus controls [102].

In summary, BV is common among women in general and even more so among women with female partners. Current data shows that women can share strain specific genital bacteria with their female partners and that specific bacterial species are associated with new infection and with treatment failure in BV. Recent data highlight the potential impact of sexual practices and sexual partnership characteristics on the vaginal microbial environment and that even extra-vaginal reservoirs of BV-associated bacteria may play a role in the development of BV or transfer of BV-associated flora between partners. Sexual behaviors that facilitate the transfer of vaginal fluid and/or bacteria between partners may be involved in the pathogenesis of BV, but more research needs to be done to understand the relationships between the transmission of BV-associated bacteria, BV pathogenesis, outcomes, and potential behavioral and medical interventions to reduce the occurrence, persistence, and recurrence of BV among WSW.

## Screening and Diagnostic Recommendations

WSW are at risk of acquiring bacterial, viral, and protozoal STI from both female and male partners. Women who have sex with women should not be presumed to be at low or no risk for STI based on stated sexual orientation. Effective screening requires a comprehensive and open discussion of sexual and behavioral risks, beyond sexual identity, between care providers and their female clients.

Report of same sex behavior in women should not deter providers from considering and

performing screening for STI, including *C. trachomatis*, in their clients according to current guidelines. Sexual transmission of HSV-1 and HSV-2 can occur between female sex partners, and this information should be included in the counseling and evaluation of women's sexual health. Routine cervical cancer screening should be offered to all women, regardless or sexual orientation or partner choice, and women and girls should be offered HPV vaccine as per current guidelines. Although BV is common among WSW, routine screening for BV is not currently recommended. The evaluation of WSW who present with symptoms concerning for STI is no different than that for women with male only partners and may include testing for common vaginal infections (BV, vaginal candidiasis) and STI (chlamydia, gonorrhea, trichomoniasis) in this population.

An improved understanding of the dynamics of the healthcare interaction between WSW patients and providers would be extremely useful. Little is known about the knowledge, attitudes, and behaviors that contribute to STI screening and health care access among WSW, either from the perspective of women themselves or from the providers who serve them. Valuable research could provide information on women's perceptions of STI risk, reproductive health needs, and patterns of seeking preventive sexual health care. These data are essential to inform both women and their health care providers about STI risks and prevention and to foster a dialogue that could support sexual health in general.

## Unique Treatment Considerations

STI and vaginal infections such as BV in WSW are treated in the same manner as in women with male sex partners. Diagnostic testing for and treatment of STIs and common vaginal infections remain the same for same sex and opposite-sex partnerships. Partner management for WSW with a known or suspected STI is part of comprehensive management, similar to that in opposite-sex partnerships. All partners should be offered testing and appropriate treatment guided by the source partner's diagnosis. Data continues to emerge regarding the potential for BV-associated bacteria to be shared between female partners and regarding the impact of common sexual practices among WSW on vaginal microbial flora which may impact acquisition or recurrence of BV. Encouraging awareness of signs and symptoms of BV in women and encouraging healthy sexual practices (barrier use, limiting or cleaning shared sex toys) may be helpful to women and their partners.

## Conclusion

As emphasized above, the database on sexual health and STI among WSW, while growing, remains small when compared to other populations. More accurate information from future research on population health and STI among women could be obtained by routinely examining measures of sexual orientation including sexual behaviors, sexual attraction, and sexual identity, particularly as they relate to participation in sexual networks [75]. Larger population-based studies are needed to more clearly define the epidemiology and transmission risks for STI among the diverse group of women who have sex with women, including adolescents and young women. Specifically, further research is needed to identify risks that may predispose to the acquisition and transmission of *C. trachomatis* in this group and to better quantify the epidemiology of chlamydia infection among WSW in the United States. Women who have sex with women have a higher prevalence of BV, and more research needs to be done to understand the relationships between the transmission of BV-associated bacteria, the pathogenesis of BV, and treatment outcomes. In addition, future research is needed to identify behavioral and medical interventions which can reduce the occurrence, persistence, and recurrence of BV among WSW.

An improved understanding of the knowledge, attitudes, and behaviors that contribute to STI screening and health care access among WSW, either from the perspective of women

themselves or from the providers who serve them, would be highly desirable. Valuable research could provide information on women's perceptions of STI risk, reproductive health needs, and patterns of seeking preventive sexual health care. These data should help to inform WSW and their healthcare providers about STI risks and prevention, and to meaningfully contribute to a dialogue aimed at enhancing sexual health in this understudied population.

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