

# Bacterial vaginosis after menopause: factors associated and women's experiences: a cross-sectional study of Australian postmenopausal women

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## Handling Editor:

Megan Lim

Received: 10 May 2023

Accepted: 21 March 2024

Published: 16 April 2024

Cite this: Stewart LL *et al.* (2024)

Bacterial vaginosis after menopause: factors associated and women's experiences: a cross-sectional study of Australian postmenopausal women. *Sexual Health* **21**, SH23094. doi:10.1071/SH23094

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## ABSTRACT

**Background.** Bacterial vaginosis (BV) is the most common cause of vaginal discharge in reproductive age women; however, little is known about it after menopause. We aimed to learn more about BV in Australian postmenopausal women. **Methods.** We conducted an online survey (July–September 2021). Participants were recruited via social media and professional networks and asked about demographic characteristics, sexual history and BV experiences. Outcomes of interest were the proportion who had heard of BV, had BV ever, or had BV after menopause. Factors associated with these outcomes were assessed using logistic regression. **Results.** Of 906 participants, 83% were included in the analysis. Overall, 37.9% had heard of BV, 11.0% reported having a BV diagnosis ever, 6.3% reported having a BV diagnosis after menopause and 4.4% reported having a BV diagnosis only after menopause. Multivariable analysis found that among all women the odds of having a BV diagnosis after menopause were increased for those who had BV before menopause, had douched in the past 12 months, or had a previous STI diagnosis. Among those in a sexual relationship, a BV diagnosis after menopause was associated with a BV diagnosis before menopause, or being in a sexual relationship of 5 years or less in duration. About half who reported BV after menopause described recurrences, distress, and a detrimental effect on sexual relationships. **Conclusions.** BV in postmenopausal women is associated with sexual activity, and impacts negatively on their lives. Research into BV should not be limited to reproductive age women.

**Keywords:** Australian postmenopausal women, bacterial vaginosis, BV, factors associated, menopause, postmenopausal, postmenopausal women, vaginosis, women.

## Introduction

Bacterial vaginosis (BV), the most common cause of abnormal vaginal discharge in women of reproductive age, is associated with significant morbidity including pregnancy complications (e.g. spontaneous abortion and premature labour), pelvic inflammatory disease, and a greater risk of acquiring a sexually transmissible infection (STI) including HIV.<sup>1–4</sup> It has been estimated that between 23% and 29% of women will have BV at any point in time,<sup>5</sup> with prevalence higher in women who have sex with women,<sup>6–9</sup> women of African ethnicity,<sup>10–15</sup> and women who engage in intravaginal practices.<sup>1,16</sup> Although the aetiology is unclear, BV is characterised by a change in the composition of the vaginal microbiota. The predominant *Lactobacillus* species is replaced by a more diverse group of organisms including *Gardnerella vaginalis*, *Fannyhessea vaginae* (previously *Atopobium vaginae*), and genital mycoplasmas.<sup>17–22</sup> Symptoms are common and can include a thin vaginal discharge and a fishy odour.<sup>1</sup> Recurrence following first-line antimicrobial therapy is common and can be very distressing and have a significant impact on a woman's self-esteem and intimate relations, affecting their quality of life.<sup>23,24</sup>

While BV is well recognised and readily diagnosed in women of reproductive age, little is known about it in postmenopausal women, perhaps because of the considerable obstetric and gynaecological complications associated with BV in younger women. Further, while

much is known about the negative impact of BV on reproductive age women's quality of life, there is little information about its impact in postmenopausal women. A recent systematic review found that few studies have reported on BV in postmenopausal women, with prevalence estimates ranging from 2% in women undergoing elective surgery to 57% in women presenting to a gynaecology clinic with vaginal symptoms.<sup>25</sup>

Given the paucity of data about BV in postmenopausal women, we conducted an online survey of Australian postmenopausal women that aimed to understand more about their experiences of BV and the factors associated with the condition after menopause.

## Materials and methods

This was a cross-sectional study of Australian postmenopausal women conducted between 8 July and 8 September 2021. Participants were asked to complete an anonymous online survey.

### Participants

Participants were recruited in a variety of ways: Facebook advertisements; promotion via Twitter; and emailing the recruitment flyer to professional networks, groups, and colleagues. No financial or other incentives were provided for participation in this survey. Interested women could click on a link that took them to an online Qualtrics survey. Participants were eligible to participate if they were female, over the age of 50 years and postmenopausal, and living in Australia.

### Data collection

The online questionnaire sought information on demographic characteristics, sexual practices, sexual health, and experiences of BV. Sex was defined as intimate physical contact with another person for sexual pleasure, including activities such as intercourse, oral sex, or the use of sex toys. Participants were asked about any BV diagnoses either before or after menopause and were asked about any experiences of the condition. We had three key outcomes of interest: (1) the proportion who had heard of BV; (2) the proportion who self-reported having been diagnosed with BV by a doctor ever; and (3) the proportion who self-reported having been diagnosed with BV by a doctor after menopause (the latter group consisted of those diagnosed with BV both before and after menopause and those diagnosed with BV only after menopause).

### Data analysis

As this was a convenience survey, we did not undertake any formal sample size calculations. However, we aimed to obtain responses from at least 800 postmenopausal women as this

would allow us to detect 95% confidence intervals (CI) from 46% to 54% around a proportion of 50%.

Proportions were calculated for each outcome with binomial 95% confidence intervals. Among those women who reported a BV diagnosis after menopause, we also asked about any symptoms they had experienced and the impact of BV on their lives. Descriptive statistics were used to describe the sociodemographic and behavioural characteristics of participants. Categorical data are presented as percentages with frequency, and continuous data are presented as median and range. The demographic profile of our sample was compared with data from the Australian Bureau of Statistics to assess the representativeness of our sample. Among those women who reported a BV diagnosis after menopause, we also examined the frequency of self-reported episodes and the impact of BV on their lives using descriptive statistics. Univariable and multivariable logistic regression were used to investigate factors associated with our three outcomes of interest. For each outcome, our regression model was conducted for all participants. In addition, for the outcomes having been diagnosed with BV by a doctor ever, and having been diagnosed with BV by a doctor after menopause, we conducted an additional regression model limiting it to those participants who were currently in a sexual relationship to investigate the association of sexual practice data with the outcomes. As not everyone completed all questions, denominators are provided to put any missing data into context. Variables were included in multivariable models if the *P*-value was  $<0.1$  on univariable analysis, however, age was included in each model as we believed there was a correlation with sexual activity. Odds ratios were reported with 95% confidence intervals and *P*-values; associations were considered significant at  $P < 0.05$ . All statistical analyses were performed using Stata ver. 17 (StataCorp, College Station, TX, USA).

### Ethics approval

This study was approved by the University of Melbourne Human Research Ethics Committee (ID: 14600).

## Results

### Participant characteristics

A total of 906 women commenced the survey, of whom 754 (83%) completed the first outcome question about having heard of BV and were included in the analysis (see Supplementary Fig. S1). Overall, 55.3% were aged under 60 years (median age = 59 years; range 51–90 years), 57.6% were born in Australia, 50.7% reported that they were tertiary educated and 91.5% indicated that they were heterosexual. Participants from every Australian state and territory were represented in the survey, with most respondents from New South Wales/Australian

Capital Territory (35.2%) and Victoria (30.7%). In comparison with the 2021 Australian census data for women, those aged 51–59 years and tertiary educated women were over-represented (Table 1).

## Proportions

A total of 286 women had heard of BV (37.9%; 95% CI: 34.5, 41.5) and 82 women self-reported having been diagnosed with BV by a doctor ever (11.0%; 95% CI: 9.0, 13.4). Overall, 47 women self-reported having been diagnosed with BV by a doctor after menopause (6.3%; 95% CI: 4.8, 8.3), and of these, 33 women self-reported having been diagnosed with BV by a doctor only after menopause (4.4%; 95% CI: 3.2, 6.2).

## Factors associated with having heard of BV

Among all women, regardless of whether or not they were in a sexual relationship, multivariable analysis found that the odds of having heard of BV were significantly increased for those currently using hormone replacement therapy (HRT) (AOR = 1.8, 95% CI: 1.2, 2.7;  $P = 0.007$ ) compared to those not currently using hormone replacement therapy (HRT) or had a previous STI diagnosis (AOR = 1.8, 95% CI: 1.3, 2.5;  $P = 0.001$ ) compared to those who did not have a previous STI diagnosis. The odds of having heard of BV were significantly decreased for those who were aged 60+ years (AOR = 0.6, 95% CI: 0.5, 0.9;  $P = 0.007$ ) compared to those who were aged 51–59 years (Table 2).

## Factors associated with having BV ever

Among all women, regardless of whether or not they were in a sexual relationship, multivariable analysis found that the odds of having a BV diagnosis ever were significantly increased for those currently using HRT (AOR = 2.2, 95% CI: 1.2, 3.8;  $P = 0.007$ ) compared to those not currently using HRT, those who reported that they had douched in the past 12 months (AOR = 4.5, 95% CI: 1.6, 12.7;  $P = 0.005$ ) compared to those who had not douched in the past 12 months or those who had a previous STI diagnosis (AOR = 2.0, 95% CI: 1.2, 3.2;  $P = 0.006$ ) compared to those who did not have a previous STI diagnosis. Among only those women currently in a sexual relationship, the odds of having a BV diagnosis ever were increased for those currently using HRT (AOR = 2.4, 95% CI: 1.2, 5.0;  $P = 0.016$ ) compared to those not currently using HRT (Table 3).

## Factors associated with having BV after menopause

Among all women, regardless of whether or not they were in a sexual relationship, multivariable analyses found that the odds of having a BV diagnosis after menopause were significantly increased for those who had had a BV diagnosis before menopause (AOR = 7.0, 95% CI: 3.4, 14.7;  $P < 0.001$ ),

**Table 1.** Sociodemographic and behavioural characteristics.

| All women (N = 754) <sup>A</sup>                                                                |         |      |                                            |
|-------------------------------------------------------------------------------------------------|---------|------|--------------------------------------------|
| Variable                                                                                        | n/N     | %    | ABS 2021 census data for same population % |
| Age (years)                                                                                     |         |      |                                            |
| Median: 59                                                                                      |         |      |                                            |
| Range: 51–90                                                                                    |         |      |                                            |
| 51–59                                                                                           | 417/754 | 55.3 | 31.6                                       |
| 60–69                                                                                           | 250/754 | 33.2 | 31.6                                       |
| 70+                                                                                             | 87/754  | 11.5 | 36.8                                       |
| State/territory                                                                                 |         |      |                                            |
| New South Wales/Australian Capital Territory                                                    | 263/748 | 35.2 |                                            |
| Northern Territory                                                                              | 1/748   | 0.1  |                                            |
| Queensland                                                                                      | 121/748 | 16.2 |                                            |
| South Australia                                                                                 | 51/748  | 6.8  |                                            |
| Tasmania                                                                                        | 32/748  | 4.3  |                                            |
| Victoria                                                                                        | 230/748 | 30.7 |                                            |
| Western Australia                                                                               | 50/748  | 6.7  |                                            |
| Country of birth                                                                                |         |      |                                            |
| Australia                                                                                       | 434/754 | 57.6 | 63.5                                       |
| NZ/US/UK/Europe                                                                                 | 111/754 | 14.7 |                                            |
| Other (Asia, Sub-Saharan Africa, South America, Papua New Guinea, International Solar Alliance) | 24/754  | 3.2  |                                            |
| Not stated                                                                                      | 185/754 | 24.5 |                                            |
| Aboriginal and Torres Strait Islander identity                                                  |         |      |                                            |
| Identifies as Aboriginal or Torres Strait Islander peoples                                      | 21/749  | 2.8  |                                            |
| Highest level of education                                                                      |         |      |                                            |
| Secondary school                                                                                | 137/750 | 18.3 | 54.3                                       |
| TAFE certificate                                                                                | 233/750 | 31.1 | 24.1                                       |
| University degree (undergraduate or postgraduate)                                               | 380/750 | 50.7 | 19.6                                       |
| Smoker                                                                                          |         |      |                                            |
| Non                                                                                             | 662/752 | 88.0 |                                            |
| Light <20 cigarettes per day                                                                    | 74/752  | 9.8  |                                            |
| Heavy ≥20 cigarettes per day                                                                    | 16/752  | 2.1  |                                            |
| Hormone replace therapy (HRT) use ever                                                          |         |      |                                            |
| Never                                                                                           | 630/751 | 83.9 |                                            |
| Currently using HRT                                                                             | 106/751 | 14.1 |                                            |
| Only used HRT in the past                                                                       | 15/751  | 2.0  |                                            |
| Douching in past 12 months                                                                      |         |      |                                            |
| No                                                                                              | 734/752 | 97.6 |                                            |
| Yes                                                                                             | 18/752  | 2.4  |                                            |
| STI diagnosis ever                                                                              |         |      |                                            |
| No/not sure                                                                                     | 552/751 | 73.5 |                                            |

(Continued on next page)

**Table 1.** (Continued).

| All women (N = 754) <sup>A</sup>                                                                          |         |      |                                            |
|-----------------------------------------------------------------------------------------------------------|---------|------|--------------------------------------------|
| Variable                                                                                                  | n/N     | %    | ABS 2021 census data for same population % |
| Yes                                                                                                       | 199/751 | 26.5 |                                            |
| Sexual identity                                                                                           |         |      |                                            |
| Heterosexual/straight                                                                                     | 688/752 | 91.5 |                                            |
| Other (includes women who have sex with women/have female partners and women who are bisexual or asexual) | 64/752  | 8.5  |                                            |
| Used sex toys alone in past 12 months                                                                     |         |      |                                            |
| No                                                                                                        | 474/747 | 63.5 |                                            |
| Less than once a month                                                                                    | 130/747 | 17.4 |                                            |
| At least once a month                                                                                     | 143/747 | 19.1 |                                            |
| Current sexual relationship                                                                               |         |      |                                            |
| No                                                                                                        | 308/747 | 40.9 |                                            |
| Yes                                                                                                       | 446/747 | 59.2 |                                            |
| Women currently in a sexual relationship (N = 446) <sup>B</sup>                                           |         |      |                                            |
| Variable                                                                                                  | n/N     | %    |                                            |
| Number of current sexual partners                                                                         |         |      |                                            |
| 1                                                                                                         | 433/443 | 97.7 |                                            |
| ≥2                                                                                                        | 10/443  | 2.25 |                                            |
| Length of time with current or primary partner                                                            |         |      |                                            |
| >5 years                                                                                                  | 351/444 | 79.1 |                                            |
| 2–5 years                                                                                                 | 40/444  | 9.0  |                                            |
| Less than 2 years                                                                                         | 53/444  | 11.9 |                                            |
| Vaginal or anal intercourse in past 12 months                                                             |         |      |                                            |
| No                                                                                                        | 56/440  | 12.7 |                                            |
| Less than once a month                                                                                    | 112/440 | 25.5 |                                            |
| At least once a month                                                                                     | 272/440 | 61.8 |                                            |
| Condom use during intercourse in past 12 months                                                           |         |      |                                            |
| No intercourse in past 12 months                                                                          | 56/442  | 12.7 |                                            |
| Intercourse without a condom                                                                              | 364/442 | 82.4 |                                            |
| Intercourse with a condom                                                                                 | 22/442  | 5.0  |                                            |
| Used lubricant during intercourse in past 12 months                                                       |         |      |                                            |
| No intercourse in past 12 months                                                                          | 56/441  | 12.7 |                                            |
| Intercourse without lubricant                                                                             | 151/441 | 34.2 |                                            |
| Intercourse with lubricant                                                                                | 234/441 | 53.1 |                                            |
| Receptive oral sex in past 12 months                                                                      |         |      |                                            |
| Not at all                                                                                                | 200/441 | 45.4 |                                            |
| Less than once a month                                                                                    | 108/441 | 24.5 |                                            |
| At least once a month                                                                                     | 133/441 | 30.2 |                                            |
| Used sex toys with a partner in past 12 months                                                            |         |      |                                            |
| No                                                                                                        | 291/440 | 66.1 |                                            |

(Continued on next column)

**Table 1.** (Continued).

| Women currently in a sexual relationship (N = 446) <sup>B</sup> |        |      |
|-----------------------------------------------------------------|--------|------|
| Variable                                                        | n/N    | %    |
| Less than once a month                                          | 79/440 | 18.0 |
| At least once a month                                           | 70/440 | 15.9 |

n, number who selected the response.  
<sup>A</sup>Number of participants who answered the question: 'Had you heard of BV prior to this study?' N = 754. Denominators may vary due to missing data.  
<sup>B</sup>Number of participants who answered the question: 'Had you heard of BV prior to this study?' and were currently in a sexual relationship N = 446. Denominators may vary due to missing data.

compared to those who had not had a BV diagnosis before menopause, had douched in the past 12 months (AOR = 4.2, 95% CI: 1.2, 14.5; *P* = 0.026) compared to those who had not douched in the past 12 months or had a previous STI diagnosis (AOR = 2.1, 95% CI: 1.1, 3.9; *P* = 0.025) compared to those who did not have a previous STI diagnosis. Among only those women currently in a sexual relationship, the odds of having a BV diagnosis after menopause were significantly increased for those who had had BV before menopause (AOR = 10.6, 95% CI: 3.7, 30.2; *P* < 0.001) compared to those who had not had BV before menopause) and those currently in a sexual relationship of 5 years or less in duration (AOR = 2.9, 95% CI: 1.2, 7.2; *P* = 0.019) compared to those not currently in a sexual relationship of 5 years or less in duration (Table 4).

**Impact of BV after menopause**

Of 47 women who reported having a BV diagnosis after menopause, 26 (55%) said that their most recent episode was within the past 2 years and 12 (26%) within the past 12 months. Overall, 42 (89%) reported an abnormal vaginal odour and/or vaginal discharge that caused them distress, 22 (47%) women reported that BV made them feel self-conscious, 24 (51%) were worried that others may notice the fishy odour and 20 (43%) were worried that it would return. In addition, 23 (49%) said that it had affected a sexual relationship, with 8 (35%) saying that they try to avoid sex altogether and 12 (52%) saying they were unable to relax and enjoy sex. Furthermore, 21 (45%) had experienced recurrences and of those, 15 (71%) experienced a recurrence within 12 months and 19 (91%) experienced a recurrence within 2 years.

**Discussion**

To our knowledge, this is the first study to investigate knowledge and experiences of BV in postmenopausal women in Australia, finding that over a third had heard of BV and about 6% reported having a BV diagnosis after menopause.

**Table 2.** Factors associated with having heard of BV among Australian postmenopausal women.

| Variable                                                                                                  | All participants         |                                 |                               |
|-----------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------|-------------------------------|
|                                                                                                           | Have heard of BV n/N (%) | Unadjusted OR (95% CI; P-value) | Adjusted OR (95% CI; P-value) |
| Age                                                                                                       |                          |                                 |                               |
| <60 years                                                                                                 | 179/417 (42.9)           |                                 |                               |
| 60+ years                                                                                                 | 107/337 (31.8)           | 0.6 (0.5, 0.8; P = 0.002)       | 0.6 (0.5, 0.9; P = 0.007)     |
| Country of birth                                                                                          |                          |                                 |                               |
| Australia                                                                                                 | 156/434 (35.9)           |                                 |                               |
| Elsewhere                                                                                                 | 65/147 (44.2)            | 1.4 (1.0, 2.1; P = 0.075)       | 1.5 (1.0, 2.2; P = 0.059)     |
| Not stated                                                                                                | 65/173 (37.6)            | 1.1 (0.7, 1.5; P = 0.707)       | 1.1 (0.7, 1.5; P = 0.795)     |
| Highest level of education                                                                                |                          |                                 |                               |
| Secondary school                                                                                          | 46/137 (33.6)            |                                 |                               |
| TAFE certificate                                                                                          | 88/233 (37.8)            | 1.2 (0.8, 1.9; P = 0.418)       |                               |
| University degree (undergraduate or postgraduate)                                                         | 151/380 (39.7)           | 1.3 (0.9, 2.0; P = 0.204)       |                               |
| Currently a smoker                                                                                        |                          |                                 |                               |
| No                                                                                                        | 247/662 (37.3)           |                                 |                               |
| Yes                                                                                                       | 38/90 (42.2)             | 1.2 (0.8, 1.9; P = 0.368)       |                               |
| Current hormone replacement therapy (HRT) use                                                             |                          |                                 |                               |
| No                                                                                                        | 231/645 (36.0)           |                                 |                               |
| Yes                                                                                                       | 55/108 (50.9)            | 1.9 (1.2, 2.8; P = 0.003)       | 1.8 (1.2, 2.7; P = 0.007)     |
| Douching in past 12 months                                                                                |                          |                                 |                               |
| No                                                                                                        | 276/733 (37.6)           |                                 |                               |
| Yes                                                                                                       | 10/18 (55.6)             | 2.1 (0.8, 5.3; P = 0.130)       |                               |
| STI ever                                                                                                  |                          |                                 |                               |
| No/not sure                                                                                               | 188/552 (34.1)           |                                 |                               |
| Yes                                                                                                       | 98/199 (49.3)            | 1.9 (1.4, 2.6; P < 0.001)       | 1.8 (1.3, 2.5; P = 0.001)     |
| Sexual identity                                                                                           |                          |                                 |                               |
| Other (includes women who have sex with women/have female partners and women who are bisexual or asexual) | 258/688 (37.5)           |                                 |                               |
|                                                                                                           | 28/64 (43.8)             | 1.3 (0.8, 2.2; P = 0.326)       |                               |
| Sex toy use alone in past 12 months                                                                       |                          |                                 |                               |
| No                                                                                                        | 169/474 (35.7)           |                                 |                               |
| Yes                                                                                                       | 114/273 (41.8)           | 1.3 (1.0, 1.8; P = 0.098)       | 1.1 (0.8, 1.5; P = 0.459)     |
| Current sexual relationship                                                                               |                          |                                 |                               |
| No                                                                                                        | 109/308 (35.4)           |                                 |                               |
| Yes                                                                                                       | 176/439 (40.1)           | 1.2 (0.9, 1.7; P = 0.193)       |                               |

n, number who have had BV after menopause; N, total. Denominators vary due to missing data; TAFE, technical and further education.

While a BV diagnosis before menopause was the strongest predictor of BV after menopause, it was also associated with having ever been diagnosed with an STI suggesting an association with sexual activity. Women diagnosed with BV after menopause reported being distressed with about half reporting that it had affected a sexual relationship.

We found that knowledge of BV among postmenopausal women was poor with only about one-third reporting that they had heard of BV. However, BV knowledge was associated with age, with younger women being much more likely to

have heard of BV. This is not surprising given that the term 'bacterial vaginosis' only began to appear in the literature in the 1980s. The condition had previously been known as *Haemophilus vaginalis* vaginitis or non-specific vaginitis.<sup>26,27</sup> Most published BV research is conducted in women of reproductive age with few BV prevalence estimates available for postmenopausal women, and while our study is not a prevalence survey, it does suggest that a considerable number of women continue to experience BV after menopause.

**Table 3.** Factors associated with having a BV diagnosis ever among Australian postmenopausal women.

| Variable                                                                                                  | Had BV ever<br>n/N (%) | Unadjusted OR<br>(95% CI; P-value) | Adjusted OR<br>(95% CI; P-value)  |
|-----------------------------------------------------------------------------------------------------------|------------------------|------------------------------------|-----------------------------------|
| A. All participants                                                                                       |                        |                                    |                                   |
| Age                                                                                                       |                        |                                    |                                   |
| <60 years                                                                                                 | 53/413 (12.8)          |                                    |                                   |
| 60+ years                                                                                                 | 29/333 (8.7)           | 0.6 (0.4, 1.0; <i>P</i> = 0.075)   | 0.7 (0.5, 1.2; <i>P</i> = 0.245)  |
| Country of birth                                                                                          |                        |                                    |                                   |
| Australia                                                                                                 | 51/431 (11.8)          |                                    |                                   |
| Elsewhere                                                                                                 | 12/145 (8.3)           | 0.7 (0.3, 1.3; <i>P</i> = 0.238)   |                                   |
| Not stated                                                                                                | 19/170 (11.8)          | 0.9 (0.5, 1.6; <i>P</i> = 0.821)   |                                   |
| Highest level of education                                                                                |                        |                                    |                                   |
| Secondary school                                                                                          | 18/136 (13.2)          |                                    |                                   |
| TAFE certificate                                                                                          | 27/230 (11.7)          | 0.9 (0.5, 1.7; <i>P</i> = 0.674)   |                                   |
| University degree (undergraduate or postgraduate)                                                         | 36/376 (9.6)           | 0.7 (0.4, 1.3; <i>P</i> = 0.236)   |                                   |
| Currently a smoker                                                                                        |                        |                                    |                                   |
| No                                                                                                        | 69/654 (10.6)          |                                    |                                   |
| Yes                                                                                                       | 12/90 (13.3)           | 1.3 (0.7, 2.5; <i>P</i> = 0.428)   |                                   |
| Current hormone replacement therapy (HRT) use                                                             |                        |                                    |                                   |
| No                                                                                                        | 62/638 (9.7)           |                                    |                                   |
| Yes                                                                                                       | 20/107 (18.7)          | 2.1 (1.2, 3.7; <i>P</i> = 0.007)   | 2.2 (1.2, 3.8; <i>P</i> = 0.007)  |
| Douching in past 12 months                                                                                |                        |                                    |                                   |
| No                                                                                                        | 76/726 (10.5)          |                                    |                                   |
| Yes                                                                                                       | 6/18 (33.3)            | 4.3 (1.6, 11.7; <i>P</i> = 0.005)  | 4.5 (1.6, 12.7; <i>P</i> = 0.005) |
| STI ever                                                                                                  |                        |                                    |                                   |
| No/not sure                                                                                               | 49/545 (9.0)           |                                    |                                   |
| Yes                                                                                                       | 33/198 (16.7)          | 2.0 (1.3, 3.3; <i>P</i> = 0.004)   | 2.0 (1.2, 3.2; <i>P</i> = 0.006)  |
| Sexual identity                                                                                           |                        |                                    |                                   |
| Other (includes women who have sex with women/have female partners and women who are bisexual or asexual) | 74/680 (10.9)          |                                    |                                   |
|                                                                                                           | 8/64 (12.5)            | 1.2 (0.5, 2.5; <i>P</i> = 0.693)   |                                   |
| Sex toy use alone in past 12 months                                                                       |                        |                                    |                                   |
| No                                                                                                        | 53/469 (11.3)          |                                    |                                   |
| Yes                                                                                                       | 29/270 (10.7)          | 0.9 (0.6, 1.5; <i>P</i> = 0.816)   |                                   |
| Current sexual relationship                                                                               |                        |                                    |                                   |
| No                                                                                                        | 34/306 (11.1)          |                                    |                                   |
| Yes                                                                                                       | 48/433 (11.1)          | 3.0 (0.6, 1.6; <i>P</i> = 0.991)   |                                   |
| B. Participants currently in a sexual relationship                                                        |                        |                                    |                                   |
| Age                                                                                                       |                        |                                    |                                   |
| <60 years                                                                                                 | 30/263 (11.4)          |                                    |                                   |
| 60+ years                                                                                                 | 18/170 (10.6)          | 0.9 (0.5, 1.7; <i>P</i> = 0.791)   | 1.1 (0.6, 2.1; <i>P</i> = 0.780)  |
| Country of birth                                                                                          |                        |                                    |                                   |
| Australia                                                                                                 | 29/251 (11.6)          |                                    |                                   |
| Elsewhere                                                                                                 | 7/76 (9.2)             | 0.8 (0.3, 1.9; <i>P</i> = 0.568)   |                                   |
| Not stated                                                                                                | 19/170 (11.2)          | 1.0 (0.5, 1.8; <i>P</i> = 0.905)   |                                   |
| Highest level of education                                                                                |                        |                                    |                                   |
| Secondary school                                                                                          | 9/74 (12.2)            |                                    |                                   |

(Continued on next page)

Table 3. (Continued).

| Variable                                                                                                  | Had BV ever<br>n/N (%) | Unadjusted OR<br>(95% CI; P-value) | Adjusted OR<br>(95% CI; P-value) |
|-----------------------------------------------------------------------------------------------------------|------------------------|------------------------------------|----------------------------------|
| TAFE certificate                                                                                          | 18/129 (14.0)          | 1.2 (0.5, 2.8; $P = 0.718$ )       |                                  |
| University degree (undergraduate or postgraduate)                                                         | 21/228 (9.2)           | 0.7 (0.3, 1.7; $P = 0.462$ )       |                                  |
| Currently a smoker                                                                                        |                        |                                    |                                  |
| No                                                                                                        | 43/391 (11.0)          |                                    |                                  |
| Yes                                                                                                       | 5/41 (12.2)            | 1.1 (0.4, 3.0; $P = 0.817$ )       |                                  |
| Current HRT use                                                                                           |                        |                                    |                                  |
| No                                                                                                        | 35/367 (9.5)           |                                    |                                  |
| Yes                                                                                                       | 13/66 (19.7)           | 2.3 (1.2, 4.7; $P = 0.018$ )       | 2.4 (1.2, 5.0; $P = 0.016$ )     |
| Douching in past 12 months                                                                                |                        |                                    |                                  |
| No                                                                                                        | 44/421 (10.5)          |                                    |                                  |
| Yes                                                                                                       | 4/12 (33.3)            | 4.3 (1.2, 14.8; $P = 0.021$ )      | 2.7 (0.7, 11.0; $P = 0.148$ )    |
| STI ever                                                                                                  |                        |                                    |                                  |
| No/not sure                                                                                               | 30/315 (9.5)           |                                    |                                  |
| Yes                                                                                                       | 18/118 (15.3)          | 1.7 (0.9, 3.2; $P = 0.094$ )       | 1.6 (0.8, 3.1; $P = 0.159$ )     |
| Sexual identity                                                                                           |                        |                                    |                                  |
| Other (includes women who have sex with women/have female partners and women who are bisexual or asexual) | 45/404 (11.14)         |                                    |                                  |
|                                                                                                           | 3/29 (10.3)            | 0.9 (0.3, 3.2; $P = 0.895$ )       |                                  |
| Sex toy use alone in past 12 months                                                                       |                        |                                    |                                  |
| No                                                                                                        | 33/271 (12.2)          |                                    |                                  |
| Yes                                                                                                       | 15/159 (9.4)           | 0.75 (0.4, 1.4; $P = 0.384$ )      |                                  |
| Number of current sexual partners                                                                         |                        |                                    |                                  |
| 1                                                                                                         | 45/423 (10.6)          |                                    |                                  |
| ≥2                                                                                                        | 3/10 (30.0)            | 3.6 (0.9, 14.4; $P = 0.070$ )      | 2.1 (0.5, 9.4; $P = 0.344$ )     |
| Length of time with current/primary partner                                                               |                        |                                    |                                  |
| >5 years                                                                                                  | 31/340 (9.1)           |                                    |                                  |
| 5 years or less                                                                                           | 17/93 (18.3)           | 2.2 (1.2, 4.2; $P = 0.014$ )       | 1.5 (0.8, 3.2; $P = 0.233$ )     |
| Vaginal/anal intercourse in past 12 months                                                                |                        |                                    |                                  |
| No/less than once a month                                                                                 | 11/165 (6.7)           |                                    |                                  |
| At least once a month                                                                                     | 37/264 (14.0)          | 2.3 (1.1, 4.6; $P = 0.022$ )       | 2.1 (1.0, 4.3; $P = 0.051$ )     |
| Condom use during intercourse in past 12 months                                                           |                        |                                    |                                  |
| No intercourse/intercourse with a condom                                                                  | 7/77 (9.1)             |                                    |                                  |
| No                                                                                                        | 41/354 (11.6)          | 1.3 (0.6, 3.0; $P = 0.530$ )       |                                  |
| Lubricant use during intercourse in past 12 months                                                        |                        |                                    |                                  |
| No intercourse/intercourse without lubricant                                                              | 18/202 (8.9)           |                                    |                                  |
| Yes                                                                                                       | 30/228 (13.2)          | 1.5 (0.8, 2.9; $P = 0.165$ )       |                                  |
| Receptive oral sex in past 12 months                                                                      |                        |                                    |                                  |
| No/less than once a month                                                                                 | 30/299 (10.0)          |                                    |                                  |
| At least once a month                                                                                     | 18/131 (13.7)          | 1.4 (0.8, 2.7; $P = 0.263$ )       |                                  |
| Sex toy use with a partner in past 2 months                                                               |                        |                                    |                                  |
| No                                                                                                        | 28/283 (9.9)           |                                    |                                  |
| Yes                                                                                                       | 20/146 (13.7)          | 1.4 (0.8, 2.7; $P = 0.238$ )       |                                  |

*n*, number who have had BV after menopause; *N*, total. Denominators vary due to missing data; TAFE, technical and further education.

**Table 4.** Factors associated with having a BV diagnosis after menopause among Australian postmenopausal women.

| Variable                                                                                                  | Had BV after menopause n/N (%) | Unadjusted OR (95% CI; P-value) | Adjusted OR (95% CI; P-value)  |
|-----------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------------|--------------------------------|
| <b>A. All participants</b>                                                                                |                                |                                 |                                |
| Had BV before menopause                                                                                   |                                |                                 |                                |
| No                                                                                                        | 33/698 (4.7)                   |                                 |                                |
| Yes                                                                                                       | 14/48 (29.2)                   | 8.3 (4.1, 16.9; $P < 0.001$ )   | 7.0 (3.4, 14.7; $P < 0.001$ )  |
| Age                                                                                                       |                                |                                 |                                |
| <60 years                                                                                                 | 29/413 (7.0)                   |                                 |                                |
| 60+ years                                                                                                 | 18/333 (5.4)                   | 0.8 (0.4, 1.4; $P = 0.368$ )    | 1.0 (0.5, 1.9; $P = 0.950$ )   |
| Country of birth                                                                                          |                                |                                 |                                |
| Australia                                                                                                 | 31/431 (7.2)                   |                                 |                                |
| Elsewhere                                                                                                 | 6/145 (4.1)                    | 0.6 (0.2, 1.4; $P = 0.200$ )    |                                |
| Not stated                                                                                                | 10/170 (5.9)                   | 0.8 (0.4, 1.7; $P = 0.567$ )    |                                |
| Highest level of education                                                                                |                                |                                 |                                |
| Secondary school                                                                                          | 11/136 (8.1)                   |                                 |                                |
| TAFE certificate                                                                                          | 15/230 (6.5)                   | 0.8 (0.4, 1.8; $P = 0.574$ )    |                                |
| University degree-either undergraduate or postgraduate                                                    | 21/376 (5.6)                   | 0.7 (0.3, 1.4; $P = 0.304$ )    |                                |
| Currently a smoker                                                                                        |                                |                                 |                                |
| No                                                                                                        | 41/654 (6.3)                   |                                 |                                |
| Yes                                                                                                       | 6/90 (6.7)                     | 1.1 (0.4, 2.6; $P = 0.884$ )    |                                |
| Current hormone replacement therapy (HRT) use                                                             |                                |                                 |                                |
| No                                                                                                        | 36/638 (5.4)                   |                                 |                                |
| Yes                                                                                                       | 11/107 (10.3)                  | 1.9 (0.9, 3.9; $P = 0.072$ )    | 1.6 (0.7, 3.4; $P = 0.224$ )   |
| Douching in past 12 months                                                                                |                                |                                 |                                |
| No                                                                                                        | 43/725 (5.9)                   |                                 |                                |
| Yes                                                                                                       | 4/18 (22.2)                    | 4.5 (1.4, 14.4; $P = 0.010$ )   | 4.2 (1.2, 14.5; $P = 0.026$ )  |
| STI ever                                                                                                  |                                |                                 |                                |
| No/not sure                                                                                               | 27/545 (5.0)                   |                                 |                                |
| Yes                                                                                                       | 20/198 (10.1)                  | 2.2 (1.2, 3.9; $P = 0.013$ )    | 2.1 (1.1, 3.9; $P = 0.025$ )   |
| Sexual identity                                                                                           |                                |                                 |                                |
| Other (includes women who have sex with women/have female partners and women who are bisexual or asexual) | 43/680 (6.3)                   |                                 |                                |
|                                                                                                           | 4/64 (6.3)                     | 3.0 (0.3, 2.8; $P = 0.982$ )    |                                |
| Sex toy use alone in past 12 months                                                                       |                                |                                 |                                |
| No                                                                                                        | 32/469 (6.8)                   |                                 |                                |
| Yes                                                                                                       | 15/270 (5.6)                   | 0.8 (0.4, 1.5; $P = 0.497$ )    |                                |
| Current sexual relationship                                                                               |                                |                                 |                                |
| No                                                                                                        | 17/306 (5.6)                   |                                 |                                |
| Yes                                                                                                       | 30/433 (6.9)                   | 1.3 (0.7, 2.3; $P = 0.452$ )    |                                |
| <b>B. Participants currently in a sexual relationship</b>                                                 |                                |                                 |                                |
| Had BV before menopause                                                                                   |                                |                                 |                                |
| No                                                                                                        | 22/687 (3.2)                   |                                 |                                |
| Yes                                                                                                       | 8/25 (32.0)                    | 14.2 (5.5, 36.5; $P < 0.001$ )  | 10.6 (3.7, 30.2; $P < 0.001$ ) |
| Age                                                                                                       |                                |                                 |                                |
| <60 years                                                                                                 | 19/263 (7.2)                   |                                 |                                |
| 60+ years                                                                                                 | 11/170 (6.5)                   | 0.9 (0.4, 1.9; $P = 0.763$ )    | 1.4 (0.6, 3.2; $P = 0.475$ )   |

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Table 4. (Continued).

| Variable                                                                                                  | Had BV after<br>menopause n/N (%) | Unadjusted OR<br>(95% CI; P-value) | Adjusted OR<br>(95% CI; P-value) |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------|------------------------------------|----------------------------------|
| Country of birth                                                                                          |                                   |                                    |                                  |
| Australia                                                                                                 | 20/251 (8.0)                      |                                    |                                  |
| Elsewhere                                                                                                 | 3/76 (4.0)                        | 0.5 (0.1, 1.6; P = 0.240)          |                                  |
| Not stated                                                                                                | 10/170 (5.9)                      | 0.7 (0.3, 1.6; P = 0.416)          |                                  |
| Highest level of education                                                                                |                                   |                                    |                                  |
| Secondary school                                                                                          | 6/74 (8.1)                        |                                    |                                  |
| TAFE certificate                                                                                          | 11/129 (8.5)                      | 1.1 (0.4, 3.0; P = 0.917)          |                                  |
| University degree-either undergraduate or postgraduate                                                    | 13/228 (5.7)                      | 0.7 (0.3, 1.9; P = 0.461)          |                                  |
| Currently a smoker                                                                                        |                                   |                                    |                                  |
| No                                                                                                        | 27/391 (6.9)                      |                                    |                                  |
| Yes                                                                                                       | 3/41 (7.3)                        | 1.1 (0.3, 3.7; P = 0.921)          |                                  |
| Current HRT use                                                                                           |                                   |                                    |                                  |
| No                                                                                                        | 23/367 (6.3)                      |                                    |                                  |
| Yes                                                                                                       | 7/66 (10.6)                       | 1.8 (0.7, 4.3; P = 0.207)          |                                  |
| Douching in past 12 months                                                                                |                                   |                                    |                                  |
| No                                                                                                        | 26/421 (6.2)                      |                                    |                                  |
| Yes                                                                                                       | 4/12 (33.3)                       | 7.6 (2.1, 26.9; P = 0.002)         | 3.9 (0.8, 18.7; P = 0.088)       |
| STI ever                                                                                                  |                                   |                                    |                                  |
| No/not sure                                                                                               | 19/315 (6.0)                      |                                    |                                  |
| Yes                                                                                                       | 11/118 (9.3)                      | 1.6 (0.7, 3.5; P = 0.233)          |                                  |
| Sexual identity                                                                                           |                                   |                                    |                                  |
| Other (includes women who have sex with women/have female partners and women who are bisexual or asexual) | 27/404 (6.7)                      |                                    |                                  |
|                                                                                                           | 3/29 (10.3)                       | 1.6 (0.5, 5.7; P = 0.457)          |                                  |
| Sex toy use alone in past 12 months                                                                       |                                   |                                    |                                  |
| No                                                                                                        | 20/271 (7.4)                      |                                    |                                  |
| Yes                                                                                                       | 10/159 (6.3)                      | 0.8 (0.4, 1.8; P = 0.699)          |                                  |
| Number of current sexual partners                                                                         |                                   |                                    |                                  |
| 1                                                                                                         | 27/423 (6.4)                      |                                    |                                  |
| ≥2                                                                                                        | 3/10 (30.0)                       | 6.3 (1.5, 25.7; P = 0.010)         | 3.5 (0.7, 18.6; P = 0.145)       |
| Length of time with current/primary partner                                                               |                                   |                                    |                                  |
| >5 years                                                                                                  | 15/340 (4.4)                      |                                    |                                  |
| 5 years or less                                                                                           | 15/93 (16.1)                      | 4.2 (2.0, 8.9; P < 0.005)          | 2.9 (1.2, 7.2; P = 0.019)        |
| Vaginal/anal intercourse in past 12 months                                                                |                                   |                                    |                                  |
| No/less than once a month                                                                                 | 5/165 (3.0)                       |                                    |                                  |
| At least once a month                                                                                     | 25/264 (9.5)                      | 3.3 (1.3, 8.9; P = 0.016)          | 2.6 (0.8, 8.1; P = 0.107)        |
| Condom use during intercourse in past 12 months                                                           |                                   |                                    |                                  |
| No intercourse/intercourse with a condom                                                                  | 2/77 (2.6)                        |                                    |                                  |
| No                                                                                                        | 28/354 (7.9)                      | 3.2 (0.8, 13.8; P = 0.115)         |                                  |
| Lubricant use during intercourse in past 2 months                                                         |                                   |                                    |                                  |
| No intercourse/intercourse without lubricant                                                              | 8/202 (4.0)                       |                                    |                                  |
| Yes                                                                                                       | 22/228 (9.7)                      | 2.6 (1.1, 6.0; P = 0.025)          | 2.1 (0.8, 5.2; P = 0.112)        |
| Receptive oral sex in past 12 months                                                                      |                                   |                                    |                                  |
| No/less than once a month                                                                                 | 16/229 (5.4)                      |                                    |                                  |

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Table 4. (Continued).

| Variable                                     | Had BV after<br>menopause n/N (%) | Unadjusted OR<br>(95% CI; P-value) | Adjusted OR<br>(95% CI; P-value) |
|----------------------------------------------|-----------------------------------|------------------------------------|----------------------------------|
| At least once a month                        | 14/131 (10.7)                     | 2.1 (1.0, 4.5; P = 0.05)           | 0.9 (0.3, 2.2; P = 0.777)        |
| Sex toy use with a partner in past 12 months |                                   |                                    |                                  |
| No                                           | 18/283 (6.4)                      |                                    |                                  |
| Yes                                          | 12/146 (8.2)                      | 1.3 (0.6, 2.8; P = 0.476)          |                                  |

n, number who have had BV after menopause; N, total. Denominators vary due to missing data; TAFE, technical and further education.

We found that a BV diagnosis after menopause was also associated with douching. The evidence of associations between douching and BV can be conflicting<sup>28–30</sup> and the cross-sectional nature of our study design makes it difficult to determine causal associations and whether the douching or the BV came first. Our findings show that a BV diagnosis after menopause was associated with sexual activity. This is consistent with the substantial amount of evidence that suggests that BV is sexually transmissible<sup>1,4,31</sup> and that women diagnosed with BV are more likely to have a comorbid diagnosis of an STI.<sup>3,32</sup> Women in our study who were currently in a sexual relationship of 5 years or less in duration were more likely to report a BV diagnosis after menopause. This is consistent with evidence that suggests that people dating again later in life often lack knowledge of STIs and safer sexual practices, increasing their risk of acquiring BV and other STIs including HIV.<sup>33</sup> A recent study found that STIs are increasing at a faster rate in older women than in younger women.<sup>34</sup>

Our survey found that, similar to reproductive age women,<sup>23</sup> BV in postmenopausal women can negatively impact a woman’s quality of life, requiring support and management. Further, the strongest predictor of having a BV diagnosis after menopause was having had it before menopause, highlighting the importance of primary care physicians being informed about BV and understanding that it can affect a considerable proportion of older women at some stage, so that they can discuss it with their patients. However, research shows that primary care physicians are less likely to have conversations about sexual health with their female patients after menopause and older women are less likely to raise sexual health issues with their doctors,<sup>35,36</sup> potentially placing them at risk of ongoing BV and its associated symptoms and complications.

The diagnosis of BV is commonly made by one of two gold standard diagnostic methods: (1) Nugent scoring; or (2) Amsel criteria. However, these methods have been developed in women of reproductive age and rely on the impact of premenopausal levels of oestrogen on key diagnostic criteria.<sup>37,38</sup> Both of these methods become less suitable for diagnosing BV in women after menopause as endogenous oestrogen declines,<sup>39,40</sup> and can hinder our ability to understand the prevalence and pathogenesis of BV in postmenopausal

women. The development of a more appropriate diagnostic method suitable for BV in women after menopause is crucial.

A key strength of our study is that it is, to the best of our knowledge, one of the first studies to investigate the impact of BV on postmenopausal women’s health and wellbeing and provides data for women across a wide age range (51–90 years). However, our study has a number of limitations to be considered. This was a cross-sectional convenience sample, with women aged 51–59 years and tertiary educated women over-represented. Recall bias cannot be excluded as women were asked about BV diagnoses that may have happened many years earlier and older women were observed to have less knowledge of BV. The latter may be recall bias but may also reflect changes in terminology as BV had previously been known as non-specific vaginitis.<sup>26</sup> Selection bias also cannot be excluded as women who have previously been diagnosed with BV may have been more likely to complete the survey. Furthermore, the questions regarding sexual practices referred to the past 12 months and diagnoses reported by some participants may have been many years earlier. Therefore, some associations will be difficult to interpret given the number of years that may have elapsed. However, over half of the women who had been diagnosed with BV after menopause reported that their most recent episode was within the past 2 years and nearly all reported that their most recent episode was within the past 5 years. However, it is also important to note that these data do not represent BV prevalence estimates. Finally, most questions gave the participants the option to skip therefore there is missing data, and, with the exception of country of birth, this is limited to less than 10%.

Conclusion

Although these are not prevalence data, our study provides evidence that BV occurs in postmenopausal women, is associated with sexual activity, and impacts negatively on their lives. About half the women in our study who reported having a BV diagnosis after menopause described recurrences, distress, and a detrimental effect on their sexual relationships. This highlights the need for research into BV that is not limited to women of reproductive age and includes the

development of a diagnostic method that is suitable for use in women after menopause. This would further our understanding of BV in postmenopausal women and help to address this poorly understood but important area of public health.

## Supplementary material

Supplementary material is available [online](#).

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**Data availability.** Ethics approval was not obtained to make the data publicly available. However, summary statistics are available on written request to the authors.

**Conflicts of interest.** Jane Hocking was a Joint Editor of *Sexual Health* at the time this was submitted but was blinded from the peer-review process for this paper. Jacqueline Coombe is an Associate Editor of *Sexual Health* but was blinded from the peer-review process for this paper. All other authors declare no conflicts of interest.

**Declaration of funding.** JSH was supported by a National Health and Medical Research Council (NHMRC) Senior Research Fellowship (1136117) and CSB is supported by a NHMRC Investigator Grant (1173361).

**Author contributions.** Designed the survey: all authors contributed. Responsible for administering the survey: LLS. Analysed the data: LLS and JSH. Wrote the paper: LLS and JSH. Contributed to drafting/review of final manuscript: all authors.

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