Two Distinct Gonorrhea Trends and Risk Factors Among Women in Australia

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Background: In recent years, gonorrhea notifications have increased in women in Australia and other countries. We measured trends over time and risk factors among Australian Aboriginal and Torres Strait Islander ("Aboriginal") and non-Aboriginal women.

Methods: We conducted a cross-sectional analysis of data from 41 sexual health clinics. Gonorrhea positivity at each patient's first visit (first-test positivity) during the period 2009 to 2016 was calculated. Univariate and multivariate analyses assessed risk factors for first-test positivity in Aboriginal and non-Aboriginal women.

Results: Gonorrhea positivity decreased among Aboriginal women (7.1% in 2009 to 5.2% in 2016, $P < 0.001$) and increased among non-Aboriginal women (0.6%–2.9%, $P < 0.001$). Among Aboriginal women, first-test positivity was independently associated with living in a regional or remote area (adjusted odds ratio [aOR], 4.29; 95% confidence interval [CI], 2.52–7.31; $P < 0.01$) and chlamydia infection (aOR, 4.20; 95% CI,3.22–5.47; $P < 0.01$). Among non-Aboriginal women, first-test positivity was independently associated with greater socioeconomic disadvantage (second quartile: aOR, 1.68 [95% CI, 1.31–2.16; $P < 0.01$]; third quartile: aOR, 1.54 [95% CI, 1.25–1.89; $P < 0.01$]) compared with least disadvantaged quartile: recent sex work (aOR, 1.69; 95% CI, 1.37–2.08; $P < 0.01$), recent injecting drug use (aOR, 1.85; 95% CI, 1.34–2.57; $P < 0.01$), and chlamydia infection (aOR, 2.35; 95% CI, 1.90–2.91; $P < 0.01$). For non-Aboriginal women, being aged 16 to 19 years (aOR, 0.62; 95% CI, 0.49–0.80; $P < 0.01$) compared with those ≥30 years was a protective factor.

Conclusions: These findings highlight 2 different epidemics and risk factors for Aboriginal and non-Aboriginal women, which can inform appropriate health promotion and clinical strategies.

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Recent national reporting has shown that *Neisseria gonorrhoeae* infection (gonorrhea) is increasing among Australian women.[1–3] The gonorrhea notification rate among women in Australia has more than doubled in the past 10 years (from 26 per 100,000 in 2008 to 62 per 100,000 in 2017). In Australia, gonorrhea is a nationally notifiable infection; thus, notifications represent diagnosed and reported cases of gonorrhea. Gonorrhea predominantly affects women aged 15 to 29 years,[1,3] and most women who are infected with gonorrhea will not experience symptoms (estimates range from 67% to 100% asymptomatic).[4] There is also a disparity in notifications according to Indigenous status; in 2017, the gonorrhea notification rate among Aboriginal and Torres Strait Islander (hereafter Aboriginal) women was 15 times higher than that of non-Indigenous women.[5] Estimates of gonorrhea prevalence in Aboriginal women in Australia range from 4.3% to 10.7%.[6,7] The burden of infection is greatest in Aboriginal women aged 16 to 24 years and in remote areas of Australia, where prevalence estimates are around 17%.[8,9]

Increases in gonorrhea infection among women are occurring elsewhere in the world in similar high-income country settings such as Canada,[10] the United States,[11] and England.[12] The disparity in gonorrhea infection rates between mainstream and marginalized populations such as Indigenous women in Canada[10] and among black ethnic minorities in the United Kingdom[12] and the United States[13] echoes the higher rates of gonorrhea experienced by Aboriginal women in Australia and indicates that this is a worldwide problem.

Although current treatments for gonorrhea are highly effective, if left untreated, infection can lead to serious health complications for women. These include pelvic inflammatory disease, ectopic pregnancy, or infertility[14]; adverse pregnancy, and neonatal outcomes such as prematurity and associated low birth weight[15]; and disseminated gonococcal infection including septic arthritis.[16] At a global level, gonorrhea has become an area of public health priority owing to the development of antibiotic resistant strains of the infection.[17]

The "HIV, viral hepatitis and sexually transmissible infections in Australia: Annual surveillance report 2018"[1] (National BBVSTI Surveillance Report) reports on the number of gonorrhea notifications occurring in Australian women. The overall increase in gonorrhea among Australian women masks two quite different national epidemics. In remote areas that have high indigenous populations,[18] the estimated prevalence is very high; however, notifications have been stable over time.[1] In contrast, in metropolitan areas, the estimated prevalence is lower, but notifications are increasing.[1]

The increase in notifications may represent an actual increase in infection; however, changes in testing and screening may be contributing to the observed increase. The introduction of more sensitive nucleic acid amplification testing compared with culture-based testing has been shown to increase detection rates.[19] There has also been an increased focus on chlamydia testing in clinical settings,[20] combined with the implementation of duplex testing for chlamydia-gonorrhea in most Australian pathology laboratories,[21]

which has resulted in a greater number of gonorrhea tests being conducted. These factors may have increased case finding and increased numbers of notifications but may not represent a "real" increase in gonorrhea prevalence.

In Australia, gonorrhea diagnoses are notified by primary health services (which may include general practice, sexual health clinics, hospitals, Aboriginal Community Controlled Health Services) or pathology laboratories.[22,23] There are several groups who are most affected by sexually transmitted infections (STIs) and blood-borne viruses in Australia. These groups—including young people, men who have sex with men, Aboriginal people, and sex workers—are specified in STI screening guidelines, and sexual health services generally cater and target their services toward these populations.[24–27]

Notifications of STIs in Australia frequently do not include Indigenous status.[5] This incompleteness in the data means that some states are excluded from national gonorrhea reporting by Indigenous status, masking trends in notifications. Furthermore, sparse demographic and behavioral information collected in notification data prevents more detailed analyses of infection patterns by exposure category and risk behaviors.[5] Given these national reporting limitations, it would be of particular value to determine if and how infections differ between Aboriginal and non-Aboriginal women.

In this article, we conducted an analysis using the Australian Collaboration for Coordinated Enhanced Sentinel Surveillance (ACCESS), a national sentinel surveillance network of publicly funded sexual health clinics, to determine rates of gonorrhea in women attending these clinics. We aimed to look at risk factors and trends in infection among Aboriginal and non-Aboriginal women to appropriately inform public health and clinical service delivery.

METHODS

Design

We conducted an analysis of data from ACCESS to investigate the epidemiology of gonorrhea in Australian women attending sexual health clinics. The data collection methods of ACCESS have been described elsewhere.[28] Briefly, ACCESS extracts routinely collected and deidentified information on consultations, patient demographics, self-reported sexual and other risk factors, and pathology results from all patients attending participating clinics. Data on sexual and other risk factors are collected from patients through a proforma medical record form or computer assisted self-interview.

Setting

Data were included from the 41 sexual health clinics that were part of the ACCESS network from January 1, 2009, to December 31, 2016. Sexual health clinics were located in New South Wales (n = 31), the Northern Territory (n = 2), Queensland (n = 7), and Victoria (n = 1). Of the sexual health clinics, 36% were in urban areas, 54% in regional areas, and 10% in remote or very remote areas.

Data Sources and Study Variables

Demographic variables included age in years (categorized into 4 age groups), sex and gender, Aboriginal status, and patients' home postcode. Patient postcodes were organized into 2 categories based on standard classification from the Australian Bureau of Statistics[29]: major cities and inner regional areas versus outer regional, remote, and very remote areas. We also classified postcodes by socioeconomic status (SES) using the Australia Bureau of Statistics Index of Relative Socio-economic Advantage and Disadvantage, which calculates a postcode-level marker of SES using characteristics such as average income, occupational skill level, or housing characteristics (such as overcrowding, mortgage, or rental cost).[30] For this analysis, we separated postcodes into quartiles of SES, using the Socio-Economic Indexes for Areas.[30] Clinical presentation variables included testing and results for gonorrhea, chlamydia, HIV status, anogenital symptoms, and known STI contact status. We also extracted and categorized several patient-reported risk factors for the 12 months before attending, which were routinely collected by participating clinics: any involvement in sex work and injecting drug use.

Participants

Participants included in the study were cisgender Aboriginal women and Australian-born non-Aboriginal women who were tested for gonorrhea when attending the clinic for the first time during the study period. Women who did not have complete data on Aboriginal status, postcode, or country of birth were excluded. We excluded women born overseas to focus on gonorrhea endemic to Australia, as sexual health clinics see a large number of travelers.[31] Transgender women were not included in this analysis because patient information systems in the clinics across the network are not set up to accurately collect this information.[32]

Statistical Methods

The study outcomes were time trends in positivity and the factors associated with women's first gonorrhea test during the study period. Gonorrhea positivity was indicated through nucleic acid amplification testing or culture-based testing.[33] Previous studies have found first-test positivity to be a proximal marker of community prevalence[34]; we have used it here to reduce potential biases introduced by repeat testing among individuals. Gonorrhea positivity was stratified by demographic, behavioral/risk factors, and clinical variables, as well as the year of first visit. χ^2 Tests were used to compare categorical differences in demographic, behavioral, and clinical factors between Aboriginal women and non-Aboriginal women.

Next, we used random-effects logistic regression models to assess independent predictors of gonorrhea positivity for Aboriginal and non-Aboriginal women, respectively. Random-effects models were used to account for potential clustering at the clinic level. Univariate models were initially fit with gonorrhea infection at first visit (yes/no) as the outcome variable, and demographic, behavioral, and clinical factors previously mentioned included as the independent variable. To address the missing chlamydia observations, we compared missing and nonmissing observations in the univariate analysis. Missing values showed no difference compared with the baseline, so they were incorporated into the reference level. Factors that were significant in univariate analyses ($P < 0.05$) were included in subsequent multivariate models. Multivariate analyses were also adjusted for symptomatic status; women who are experiencing symptoms are more likely to have gonorrhea, thus including symptomatic women risks overestimating prevalence. As a sensitivity analysis, we tested for interaction in the regional and SES variables. All data were analyzed using Stata version 14.2 (35).

Ethics

The ACCESS project has ethical approval from The Alfred Hospital (reference: 08/SVH/62) and the Aboriginal Health and Medical Research Council of New South Wales (reference: 1099/15).

RESULTS

Characteristics of Patients Tested

From 2009 to 2016, 121,097 women had a gonorrhea test at a sexual health clinic. After excluding those born overseas, with missing Aboriginal status, postcode, and any repeat gonorrhea tests, there were 63,074 women in our sample.

Of these, 6156 women were recorded as Aboriginal (9.8%) and 56,918 women as non-Aboriginal Australian born (90.2%). Table 1 shows the characteristics of the women stratified by Aboriginal status. Aboriginal women in our sample were younger, more likely to live outside Australia's urban areas, and more likely to live in areas categorized as less advantaged than non-Aboriginal women. There were also some behavioral differences, with Aboriginal women more likely to report recent injecting drug use but less likely to report recent sex work.

Gonorrhea Positivity

Overall, at their first visit, 1232 women were diagnosed as having gonorrhea, a positivity across all clinics of 2.0% (95% confidence interval [CI], 1.8%–2.1%). Among Aboriginal women, gonorrhea positivity was 6.8% (95% CI, 6.58%–8.05%) compared with 1.4% among non-Aboriginal women (95% CI, 1.3%–1.5%; $P < 0.001$).

Factors Associated With Gonorrhea Positivity

Tables 2 and 3 outline factors associated with being diagnosed with gonorrhea. In Aboriginal women, after controlling for symptomatic presentations and reported STI contact, we found that living in an outer regional, remote, or very remote area (adjusted odds ratio [aOR], 4.29; 95% CI, 2.52–7.31; $P < 0.01$) and chlamydia infection (aOR, 4.20; 95% CI, 3.22–5.47; $P < 0.01$) were associated with being diagnosed with gonorrhea.

In non-Aboriginal women, after controlling for symptomatic presentations and reported STI contact, we found that being aged 16 to 19 years (aOR, 0.62; 95% CI, 0.49–0.80; $P < 0.01$) was associated with reduced risk of gonorrhea compared with being 30 years and older. Furthermore, living in areas assigned to the middle 2 quartiles of SES (second quartile: aOR, 1.68 [95% CI, 1.31–2.16; $P < 0.01$] and third quartile: aOR, 1.54 [95% CI, 1.25–1.89; $P < 0.01$]) compared with the most advantaged quartile was associated with increased risk, as was sex work in the past year (aOR, 1.69; 95% CI, 1.37–2.08; $P < 0.01$) and chlamydia infection (aOR, 2.35; 95% CI, 1.90–2.91; $P < 0.01$). In a sensitivity analysis, no interactions between Socio-Economic Indexes for Areas quartile and remoteness were found to be significant.

Gonorrhea Positivity Over Time

Figure 1 depicts positivity at first gonorrhea test by year over the study period; each patient could only contribute to this analysis once. In Aboriginal women, there was an overall decrease in gonorrhea positivity in the study period ($P < 0.001$), but this followed a significant increase from 7.1% in 2009 to 10.8% in

TABLE 1. Female Sexual Health Clinic Clients Tested for Gonorrhea at Their First Visit by Aboriginal Status, 2009 to 2016

	All	%	Non-Aboriginal	%	Aboriginal	%	P*
Total	63,074	100	56,918	100	6156	100	
Positive for gonorrhea	1232	2	811	1.4	421	6.8	
Age group, y							
16–19	14,518	23	12,259	21.5	2259	36.7	<0.001
20–24	17,484	27.7	16,167	28.4	1317	21.3	
25–29	11,567	18.3	10,694	18.8	873	14.2	
≥30	19,505	30.9	17,798	31.2	1707	27.7	
Median age	24		25		22		
Area of residence							
Major city	38,713	61.4	36,413	63.97	2300	37.4	<0.001
Inner regional	8786	13.9	8124	14.3	662	10.8	
Outer regional	13,792	21.9	11,103	19.5	2689	43.7	
Remote	1451	2.3	1061	1.9	390	6.3	
Very remote	332	0.5	217	0.4	115	1.9	
Relative socioeconomic advantage and disadvantage							
1st quartile (least advantaged)	13,737	21.8	11,892	20.9	1845	30	<0.001
2nd quartile	13,761	21.8	11,858	20.8	1903	30.9	
3rd quartile	16,542	26.2	14,898	26.2	1644	26.7	
4th quartile (most advantaged)	19,034	30.2	18,270	32.1	764	12.4	
Reported STI contact							
No	60,041	95.2	54,219	95.3	5822	94.6	0.017
Yes	3033	4.8	2699	4.7	334	5.4	
Sex work (past 12 mo)							
No	54,359	86.2	48,715	85.6	5644	91.7	<0.001
Yes	8715	13.8	8203	14.4	512	8.3	
Injecting drug use (past 12 mo)							
No	47,835	75.8	42,876	75.3	4959	80.6	<0.001
Yes	2384	3.8	1976	3.5	408	6.6	
Anogenital symptoms							
No	56,153	89	50,503	88.7	5650	91.8	<0.001
Yes	6921	11	6415	11.3	506	8.2	
Chlamydia infection†							
No	57,409	91	52,176	91.7	5233	85	<0.001
Yes	5439	8.6	4602	8.1	837	13.6	
HIV positive							
No	62,642	99.3	56,539	99.3	6103	99.1	0.759
Yes	432	0.7	379	0.7	53	0.9	

*P value for Pearson χ^2 test for difference in categorical levels between Aboriginal and non-Aboriginal women.

†Records with no chlamydia test excluded.

TABLE 2. Factors Associated With Gonorrhea Positivity Among Aboriginal Women Attending a Sexual Health Clinic, 2009 to 2016

	Gonorrhea Positivity, %	Univariate Model, Crude OR (95% CI)	Multivariate Model, Adjusted OR (95% CI)
All	6.8		
Age, y			
16–19	8	1.06 (0.83–1.36)	1.16 (0.83–1.64)
20–24	8.4	0.75 (0.54–1.02)	1.26 (0.87–1.82)
25–29	6.1	0.55 (0.41–0.72)*	1.09 (0.71–1.67)
≥30	4.5	1	1
Location of residence			
Major city/inner regional	2	1	1
Outer regional/remote/very remote	11.3	6.16 (4.67–8.14)*	4.29 (2.52–7.31)*
Relative socioeconomic advantage and disadvantage			
1st quartile (least advantaged)	3.4	0.72 (0.47–1.12)	0.85 (0.49–1.47)
2nd quartile	7.7	1.74 (1.19–2.54)†	1.43 (0.85–2.42)
3rd quartile	10.8	2.51 (1.73–3.65)*	1.18 (0.75–1.85)
4th quartile (most advantaged)	4.6	1	1
Reported STI contact			
No	5.8	1	1
Yes	25.8	5.68 (4.34–7.43)*	3.33 (2.38–4.64)*
Sex work (past 12 mo)			
No (reference)	7.3	1	1
Yes	2	0.25 (0.13–0.48)*	0.95 (0.46–1.94)
Injecting drug use (past 12 mo)‡			
No (ref)	6.6	1	—
Yes	4.7	0.69 (0.43–1.10)	—
Symptoms			
No (reference)	6.8	1	1
Yes	7.3	1.08 (0.76–1.54)	2.03 (1.29–3.19)*
Chlamydia infection‡			
No (reference)	3.6	1	1
Yes	17.4	5.64 (4.48–7.10)*	4.2 (3.22–5.47)*
HIV positive			
No	6.9	1	—
Yes	5.7	0.82 (0.25–2.63)	—
Year of first visit			
2009 (reference)	7.1	1	1
2010	10.8	1.59 (1.14–2.23)*	1.5 (1.02–2.22)†
2011	10	1.45 (1.02–2.06)†	1.34 (0.89–2.02)
2012	7	0.98 (0.69–1.41)	0.86 (0.55–1.33)
2013	5	0.69 (0.46–1.01)	1 (0.63–1.59)
2014	4.6	0.63 (0.42–0.96)†	0.99 (0.61–1.6)
2015	4.7	0.65 (0.42–1.00)†	1.12 (0.69–1.82)
2016	5.2	0.72 (0.46–1.14)	1.32 (0.78–2.25)

*P < 0.01.
†P < 0.05.
‡Missing values.

2010 ($P = 0.010$) before decreasing to 4.6% in 2014 ($P < 0.001$) and remaining stable onward till 2016 ($P = 0.669$). In contrast, although first-test gonorrhea positivity was lower among non-Aboriginal women, it increased steadily from 0.6% in 2009 to 2.9% in 2016 ($P < 0.001$).

DISCUSSION

In this large study of Australian women attending sexual health clinics, over a period of 8 years, gonorrhea positivity increased more than 4-fold in non-Aboriginal women but decreased among Aboriginal women. Despite the narrowing disparity in burden of infection between the 2 groups, in 2016, gonorrhea positivity in Aboriginal women was still nearly 2 times higher than that in non-Aboriginal women.

Unsurprisingly, and consistent with previous findings,[9,36–38] reported potential STI contact and chlamydia infection were significantly associated with gonorrhea positivity for both Aboriginal and non-Aboriginal women. Non-Aboriginal women were 5 times more likely to be positive for gonorrhea if they had reported potential STI contact, whereas this was only 3 times for Aboriginal women. This more pronounced effect in non-Aboriginal women likely demonstrates differences in screening approaches.[33] Aboriginal women are more likely to be opportunistically screened because of being an "at-risk" group,[25] therefore diluting known STI contact as a predictor of positivity. This finding suggests that non-Aboriginal women are more likely to come to the clinic if they suspect they have an STI.

Consistent with the literature,[1,3] the risk of gonorrhea infection in Aboriginal women living in regional or remote areas was 4-fold that of urban-based Aboriginal women. People who live rurally have poorer access to health services and experience poorer health outcomes. There are a range of explanations for this, which may include that the health services catering to this population are difficult to access geographically, or are culturally inappropriate, or that in these areas there is limited access to preventative methods

TABLE 3. Factors Associated With Gonorrhea Positivity Among Non-Aboriginal Women Attending a Sexual Health Clinic, 2009 to 2016

	Gonorrhea Positivity, %	Univariate Model, Crude OR (95% CI)	Multivariate Model, Adjusted OR (95% CI)
All	1.4		
Age, y			
16–19	1.1	0.72 (0.58–0.88)*	0.62 (0.49–0.8)*
20–24	1.6	1.03 (0.87–1.22)	0.89 (0.73–1.08)
25–29	1.4	0.92 (0.75–1.12)	0.93 (0.75–1.16)
≥30	1.5	1	1
Location of residence			
Major city/inner regional	1.5	1	—
Outer regional/remote/very remote	1.3	0.85 (0.71–1.01)	—
Relative socioeconomic advantage and disadvantage			
1st quartile (least advantaged)	1.5	1.17 (0.96–1.43)	1.27 (0.98–1.64)
2nd quartile	1.4	1.12 (0.91–1.37)	1.68 (1.31–2.16)*
3rd quartile	1.7	1.36 (1.13–1.63)*	1.54 (1.25–1.89)*
4th quartile (most advantaged)	1.2	1	1
Reported potential STI contact			
No	1.2	1	1
Yes	6.1	5.40 (4.53–6.44)*	5.59 (4.53–6.89)*
Sex-work (past 12 mo)			
No	1.3	1	1
Yes	2.2	1.66 (1.40–1.97)*	1.69 (1.37–2.08)*
Injecting drug use (past 12 mo)†			
No	1.6	1	1
Yes	2.7	1.77 (1.34–2.35)*	1.85 (1.34–2.57)*
Symptoms			
No	1.3	1	1
Yes	2.4	1.90 (1.59–2.26)*	1.64 (1.3–2.06)*
Chlamydia infection†			
No	1	1	1
Yes	3.1	3.17 (2.62–3.82)*	2.35 (1.9–2.91)*
HIV positive			
No	1.4	1	—
Yes	1.6	1.11 (0.50–2.50)	—
Year of first visit			
2009	0.6	1	1
2010	0.7	1.13 (0.79–1.62)	1.46 (0.97–2.2)
2011	1.3	2.07 (1.51–2.85)*	2.4 (1.64–3.52)*
2012	1.7	2.65 (1.95–3.62)*	3.05 (2.1–4.43)*
2013	1.3	2.03 (1.46–2.82)*	2.64 (1.79–3.9)*
2014	1.9	3.00 (2.21–4.07)*	3.88 (2.7–5.58)*
2015	1.8	2.86 (2.09–3.92)*	4.38 (3.03–6.33)*
2016	2.9	4.72 (3.52–6.33)*	6.79 (4.78–9.64)*

*$P < 0.01$.
†Missing values.

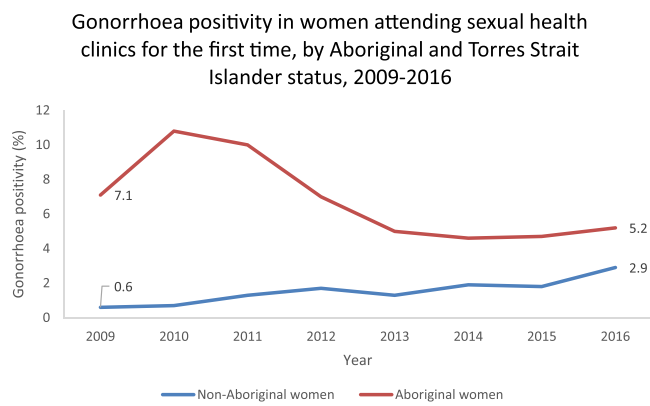

Figure 1. Gonorrhea positivity at first visit to a sexual health clinic among Australian women, by Aboriginal and Torres Strait Islander status, 2009 to 2016.

such as condoms.[3,39,40] This also may reflect that Aboriginal women in these areas attend clinics of a different type to those included in the ACCESS network, such as Aboriginal Community Controlled Health Services.[27] Furthermore, health outcomes for Aboriginal people in rural areas are undoubtedly impacted by structural issues, impacts of colonization[41] and factors relating to the social determinants of health.[42]

Among non-Aboriginal women, older rather than younger non-Aboriginal women are more likely to be diagnosed as having gonorrhea. This differs from other Australian studies, where gonorrhea tends to be higher between the ages of 15 to 24 years[1,3,43]. Furthermore, in Australia, chlamydia is more prevalent among younger women,[5] so it is notable that gonorrhea positivity increased by age, especially among those older than 30 years. The higher prevalence among older women in our study might reflect the different characteristics of non-Aboriginal women attending sexual health clinics.

Non-Aboriginal women from the middle two quartiles of SES had increased risk of gonorrhea infection relative to the most advantaged quartile. This concurs with existing literature, which has shown links between low SES and gonorrhea infection.[38,44] It is difficult to say why SES was not a risk factor in the adjusted analysis for Aboriginal women. It is beyond the scope of this study to explain variations in SES by Aboriginal status and region; however, we did not find an interaction between SES and region, which suggests that other risk factors may be present.

In non-Aboriginal women, behavioral factors such as injecting drug use and sex work were also positively associated with gonorrhea infection. This association has been reported in other studies,[45] and it has been suggested that these 2 variables could be proximal markers for risky practices resulting in increased risk of gonorrhea infection.[45]

Chlamydia is the most prevalent curable STI in Australia,[1] and testing guidelines are based largely around individuals at risk of chlamydia (i.e., young people aged 16–29 years).[33] Gonorrhea screening is only recommended for high-risk groups such as men who have sex with men, sex workers, Aboriginal people living in areas where prevalence is higher than normal (regional and remote areas), and travelers from high-prevalence countries.[33] Given that most women who have gonorrhea are asymptomatic[4] and the median age at which women are diagnosed as having gonorrhea is higher than that of chlamydia,[1] women at risk of gonorrhea could be excluded for opportunistic testing under current guidelines. The inclusion of older women in gonorrhea testing guidelines would increase awareness of and bring attention to this infection among providers and patients.

The overall increase in gonorrhea positivity over time in non-Aboriginal women observed in our study reflects rising diagnoses among women around the country as reported elsewhere.[1,5,46] There are a range of potential factors that could be considered to explain the rise. The increase in opportunistic screening[36] and a focus on testing for chlamydia,[47] combined with the adoption of dual testing methods, would have resulted in a larger number of overall gonorrhea tests. In our study, after adjusting for increased testing patterns (by measuring positivity only among those tested for gonorrhea), there still remained an increase in positivity. Factors that could explain this increase include low condom use,[48] unprotected sex with partners from high prevalence countries,[2] or other risk behaviors such as alcohol use.[40] The national increase in the incidence of gonorrhea documented among female sex workers was associated with increased risk behaviors.[45] There has also been an increase in gonorrhea in men who have sex with men over the same period[1,19]; sex with bisexual men could act as a bridge for transmission of infection to this population.[2] In the context of increasing antibiotic-resistant strains of gonorrhea, it is also important to note that antimicrobial resistance is largely a problem among non-Aboriginal populations, which has implications for treatment.[49]

Consistent with the National BBVSTI Reports,[5] gonorrhea positivity among Aboriginal women has decreased. As per the Australian "Fifth National Aboriginal and Torres Strait Islander Blood Borne Viruses and Sexually Transmissible Infections Strategy"[50]; current efforts with health promotion programs for STI prevention should focus on increasing STI testing coverage, community–co-designed and community-led programs, widespread and equitable access to STI testing and treatment, and culturally safe health service delivery, to ensure that this rate continues to decrease.

A strength of this study is that it reports on data from a large network of 41 sexual health services from 4 Australian jurisdictions, including its most populous. Furthermore, we were able to account for a range of demographic and behavioral indicators in greater detail than is possible through passive surveillance. There are, however, some limitations to consider. Prevalence in clinic settings is usually higher than that in population or community-based studies because sexual health clinics attract people at higher risk of infection, which may lead to overestimation of the burden of disease compared with the general population.[47] Conversely, use of first-test positivity does not measure potentially increased rates of reinfection in such populations. However, these methods have strengths, including offsetting biases associated with differences in case finding, triage, and screening, as well as accessibility and attendance associated with study groups, and are particularly valid methods to examine trends and compare differences. When comparing positivity in clinical population subgroups, it is also important to understand the testing protocols and potential influence on the results. Sexual health clinics generally triage priority groups into the clinics, which would include all Aboriginal people but would exclude many non-Aboriginal women. Indeed, some triage protocols exclude asymptomatic non-Aboriginal women, which is reflected in the higher proportion of non-Aboriginal women who were symptomatic. As a result, positivity among non-Aboriginal women in our sample may seem higher than the population, because only non-Aboriginal women who already have symptoms and thus likely infection are screened.

This article highlights trends in gonorrhea notifications in Australian women. Increasing notifications in non-Aboriginal women and higher risk of infection in those older than 30 years must be addressed through targeted health promotion programs. Despite being outside the predefined "high-risk groups" under current STI testing guidelines,[33] non-Aboriginal women at risk of gonorrhea should also be targeted for opportunistic testing. Among Aboriginal women, higher gonorrhea notification rates in rural and remote areas illustrate the need to target STI prevention programs, ensure access to culturally appropriate health services, and improve health care delivery in these areas.

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For further references, please see "Supplemental References," http://links.lww.com/OLQ/A421.