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Trends in chlamydia and gonorrhoea testing and positivity in Western Australian Aboriginal and non-Aboriginal women 2001-2013: a population based cohort study

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Abstract

Aims: To examine trends in chlamydia and gonorrhoea testing and positivity in Aboriginal and non-Aboriginal women of reproductive age.

Methods: A cohort of 318002 women, born between 1974-1995, residing in Western Australia (WA) was determined from birth registrations and the 2014 electoral roll. This cohort was then probabilistically linked to all records of chlamydia and gonorrhoea nucleic acid amplification tests (NAAT) conducted between 1st January 2001 and 31st December 2013 by two large WA pathology laboratories. Trends in chlamydia and gonorrhoea testing and positivity were investigated over time and stratified by Aboriginality and age group.

Results: The proportion of women tested annually for chlamydia increased significantly between 2001 and 2013 from 24% to 37% in Aboriginal and 4.0% to 8.5% in non-Aboriginal women (both p-values <0.001). Concurrent testing was high (>80%) and so patterns of gonorrhoea testing were similar. Chlamydia and gonorrhoea positivity were substantially higher in Aboriginal compared to non-Aboriginal women; age-, region- and year-adjusted Incidence Rate Ratio's 1.52(95%CI 1.50-1.69, p<0.001), and 11.80(95%CI 10.77-12.91, p<0.001) respectively. Chlamydia positivity increased significantly in non-Aboriginal women aged 15-19 peaking in 2011 at 13.3%(12.5%-14.2%); trends were less consistent among 15-19 year old Aboriginal women but positivity also peaked in 2011 at 18.5%(16.9%-20.2%). Gonorrhoea positivity was 9.7%(9.3%-10.1%), 6.7%(6.4%-7.0%), 4.7%(4.4%-5.0%), and 3.1%(2.8%-3.4%) among Aboriginal women aged respectively 15-19, 20-24, 25-29 and ≥30 year, compared to <1% in all age groups in non-Aboriginal women. Over time, gonorrhoea positivity declined in all age groups among Aboriginal and non-Aboriginal women.

Conclusion: Between 2001 and 2013 in WA chlamydia and gonorrhoea positivity remained highest in young Aboriginal women despite chlamydia positivity increasing among young non-Aboriginal women.

More effective prevention strategies, particularly in young Aboriginal women are needed to address these disparities.

Introduction

Genital *chlamydia trachomatis* infection (chlamydia) is the most frequently reported notifiable infection in Australia and rates have increased substantially over the last 15 years (1-3). Notification rates of *Neisseria gonorrhoea* infection (gonorrhoea) have also increased, albeit not as dramatically(3). Parallel to these increases there has been an increase in testing (3).

Within Australia the rates of diagnosis of both chlamydia and gonorrhoea are significantly higher among the Aboriginal and Torres Strait Islander population (hereafter referred to as Aboriginal)(3). Further, among Aboriginal people the prevalence of chlamydia and gonorrhoea has been found to vary. Chlamydia prevalence has been found to be highest in young Aboriginal people, Aboriginal people living in regional areas, and Aboriginal pregnant females while the highest prevalence of gonorrhoea has been reported among young Aboriginal people, and Aboriginal people living in remote areas of Australia(4).

Annual screening for chlamydia infection has been recommended for all sexually active people aged 15–25 years since 2008 and for 15-29 year-olds from 2012, particularly if they are under age 20 years or Aboriginal (5). However, testing for gonorrhoea is only recommended for individuals thought to be at an increased risk(5). This study aimed to examine trends over 12 years (2001-2013) in chlamydia and gonorrhoea testing and positivity based on individual pathology data in a cohort of Aboriginal and non-Aboriginal women of reproductive age in Western Australia (WA).

Methods

Study population

This study was conducted using population-based record linkage. The linkage was conducted, independent of the study investigators, by the Western Australian Data Linkage Branch (DLB) using personal identifiers such as name, date of birth, address, and sex, to probabilistically link records(6). Linkage accuracy using this process is high with an error rate estimated at 0.11%(7)

A cohort of reproductive aged women residing in WA was constructed by probabilistically linking the WA Birth Registrations Data Collection, which contains a record of all children born and registered in WA from 1974 onwards, and the 2014 WA Electoral Roll. Eligible women were those with either a birth registration between 1974 and 1995 or a record on the WA Electoral Roll with year of birth between 1974 and 1995.

This cohort was then probabilistically linked to all records of chlamydia and gonorrhoea nucleic acid amplification tests (NAAT) conducted between 1st January 2001 and 31st December 2013 by two large WA pathology laboratories. The type of test (chlamydia or gonorrhoea), date of referral, and test result (positive, negative, or equivocal/undetermined) were supplied to the research team.

Statistical Analysis

Only tests recorded after the women's 15th birthday were included in the analysis. Multiple tests for the same infection on the same referral date were counted as one test and considered positive if any of the results were positive. A concurrent or duplex test was defined as having been tested for both chlamydia and gonorrhoea on the same referral date.

The proportion of women tested annually at either of the two laboratories was calculated as a proportion of the total number of women in the cohort who were aged ≥15 years old in that year. Chi-

squared tests were used to compare this proportion in different years (2001 to 2013) and in different age-groups (15-19, 20-24, 25-29 and ≥30 years).

Positivity was defined as the number of positive tests divided by the total number of tests after excluding equivocal results. The numerator and denominator could contain multiple tests (e.g. tests of cure) for the same individual if that person was tested more than once during our study period. Poisson regression using generalized estimating equations and robust standard errors, was used to investigate trends in chlamydia and gonorrhoea positivity over time. All analyse were either adjusted for or stratified by Aboriginality, age at the time of testing, and geographical region of residence. Aboriginality was determined from the Indigenous Status Flag created by the DLB(8). Geographical region was defined, using postcodes, according to WA Health administrative regions as; Metro: North and South Metropolitan, Rural: Great Southern, Wheatbelt and South West, and Remote: Midwest, Kimberly, Pilbara and Goldfields

Sensitivity analysis

To estimate what proportion of women may have been tested for chlamydia or gonorrhoea in labs other than those we linked to(9) and whether it is likely to have changed during our study period, the WA Notifiable Infectious Diseases Database (WANIDD), which contains a record of all chlamydia and gonorrhoea notifications reported to the WA Department of Health under statute(10), was also linked to the cohort. The proportion of chlamydia or gonorrhoea notifications with corresponding positive pathology records were compared by year, age group, region and Aboriginality. Further, as women may not have been resident in WA for the whole study period, analyses were repeated for the sub-group of women with both a birth registration and Electoral Roll record in 2014.

Finally, to investigate if changes in the frequency of retesting could potentially bias the positivity trends, analyses were repeated with positivity calculated using only the first positive test from a

woman in each year and then using only the first test ever recorded for a woman regardless of year. Analyses were performed in SAS 9.4 (SAS Institute, Cary NC, USA).

Ethics

The study was approved by the WA Department of Health HREC (Ref #2012/73) and the WA Aboriginal Health Ethics Committee (Ref 470).

Results

A total of 318002 women were included in the cohort; 14791 (4.7%) were Aboriginal.

Testing trends, 2001- 2013

Between 2001 and 2013, 134980 (42%) women had at least one chlamydia NAAT and 124909 (39%) at least one gonorrhoea NAAT at either of the two laboratories. Testing for both chlamydia and gonorrhoea was higher among Aboriginal women; 80% and 79% of Aboriginal women had been tested at least once for chlamydia and gonorrhoea respectively compared to 41% and 37% of non-Aboriginal women (both $p<0.001$).

Between 2001 and 2013, an increase in the proportion of women tested annually for chlamydia and gonorrhoea was observed, across all age-groups and in both Aboriginal and non-Aboriginal women (Table 1). Among Aboriginal women aged 20-24 years old, the proportion tested annually for chlamydia increased from 27.8% (95%CI 26.2%-29.4%) in 2001 to 42.5% (41.0%-44.1%) in 2013 ($p<0.001$) and in non-Aboriginal women of the same age it increased from 5.1% (4.9%-5.3%) to 11.0% (10.8%-11.2%) ($p<0.001$).

Concurrent testing rates were >80% in both Aboriginal and non-Aboriginal women. Among Aboriginal women the proportion of concurrent gonorrhoea tests, was consistently around 98% throughout the study period; among non-Aboriginal women the proportion increased from 83% in 2001 to 89% in 2013 ($p<0.001$). Due to high concurrent testing, the trends in gonorrhoea NAAT between 2001 and 2013 were similar to those of chlamydia (Table 1).

Chlamydia positivity, 2001-2013

Chlamydia positivity in the cohort was 6.8% (95%CI 6.7%-6.8%) overall although this varied with year, age and Aboriginality (Figure 1). Among Aboriginal women chlamydia positivity was 16.2% (15.7%-16.7%) in 15-19 year olds compared to, 9.4% (9.1%-9.8%), 5.6% (5.3%-5.9%) and 3.1% (2.8%-3.5%) in those aged 20-24, 25-29 and ≥30 years respectively. Among non-Aboriginal women, chlamydia positivity was 10.2% (10.0%-10.5%) 7.3% (7.1%-7.4%), 3.4% (3.3%-3.5%) and 1.8% (1.7%-1.9%) for these age groups respectively. The results of the Poisson regression analysis (Table 2) found that after adjusting for age, region, and year of test, chlamydia positivity was significantly higher in Aboriginal women compared to their non-Aboriginal counterparts (adjusted Incidence Rate Ratio [aIRR] 1.56, 95%CI 1.50-1.69, p<0.001).

Figure 1 shows the trends in chlamydia positivity stratified by age-group and Aboriginality. For 15-19 year old Aboriginal women, chlamydia positivity was relatively stable from 2001-2013 (IRR 1.00[0.99-1.01] p=0.84). Among Aboriginal women aged 20-24, 25-29, and ≥30 years there was a small but significant decline in chlamydia positivity (IRR 0.99[0.98-0.99] p=0.03; 0.98[0.97-1.00] p=0.02; and IRR 0.95[0.91-0.99] p=0.02 respectively).

Chlamydia positivity in young non-Aboriginal women increased significantly over time peaking in 2011 at 13.3% (12.5%-14.2%) and 8.7% (8.2%-9.3%) in women aged respectively 15-19 and 20-24 years. Overall chlamydia positivity in non-Aboriginal women aged 15-19 years increased by 5% per year (IRR 1.05, 95%CI 1.04-1.06, p<0.001) and in those aged 20-24 years by 3% per year (IRR 1.03[1.02-1.04] p<0.001). In non-Aboriginal women aged 25-29 years chlamydia positivity during 2001-2013 was stable (IRR 1.00[0.99-1.01] p=0.88) and in those ≥30 years, there was a significant decline in chlamydia positivity (IRR 0.94[0.91-0.97] p<.0.001).

Gonorrhoea positivity 2001- 2013

Overall gonorrhoea positivity was 1.9% (95%CI 1.9%-2.0%) in the cohort and this varied with year, age and Aboriginality (Figure 2). Gonorrhoea positivity at all ages was substantially higher in Aboriginal than non-Aboriginal women, 9.7% (9.3%-10.1%), 6.7% (6.4%-7.0%), 4.7% (4.4%-5.0%), and 3.1% (2.8%-3.4%) respectively in Aboriginal women aged 15-19, 20-24, 25-29 and ≥30 years compared to 0.6% (0.5%-0.6%), 0.4% (0.3%-0.4%), 0.3% (0.3%-0.4%) and 0.2% (0.2%-0.3%) respectively among non-Aboriginal women. After adjustment for age, region and year of test, gonorrhoea positivity remained a significantly among Aboriginal women compared to their non-Aboriginal counterparts (aIRR 11.57[10.57-12.66] p<0.001) (table 2). Further, compared to metropolitan WA, those residing in rural WA had lower gonorrhoea positivity (aIRR 0.66[0.55-0.78] p<0.001) and in remote WA significantly higher gonorrhoea positivity (aIRR 1.61[1.49-1.74] p<0.001).

Figure 2 shows the trends in gonorrhoea positivity stratified by age-group and Aboriginality. Over time significant decreases in gonorrhoea positivity were observed in Aboriginal women across all age-groups (all p-values <0.001) although it remained substantially higher than in non-Aboriginal women. Similarly, a significant decreases in gonorrhoea positivity were observed in non-Aboriginal women aged 15-19 years (IRR 0.90 95%CI 0.87-0.94, p<0.001), 20-24 years (IRR 0.93[0.90-0.97] p<0.001) and 25-29 years (IRR 0.93[0.88-0.98] p=0.005). Although no significant decline in gonorrhoea positivity was observed in the oldest (≥30 years) age group (IRR 1.04[0.93-1.17] p=0.49) this group still had the lowest percentage positivity in 2013 at 0.2%.

Sensitivity analysis

Comparing notifications in WANIDD to positive pathology records, 52% (11323) of chlamydia and 87% (5020) of gonorrhoea notifications that linked to women in our cohort had a corresponding positive pathology test in the same year. There was no significant difference in the proportion of Aboriginal and non-Aboriginal women with corresponding pathology records (p=0.15 and p=0.14 for chlamydia

and gonorrhoea respectively). However, there was a decrease, in the proportion of notifications with a corresponding pathology record over time from 64% to 43% of chlamydia notifications $p<0.001$ and from 88% to 83% of gonorrhoea notifications $p<0.001$ between 2001 and 2013). This trend was consistent across age groups, Aboriginality and geographical region.

Restricting analyses to the 61% of women with a record in both the birth registrations and 2014 Electoral Roll was consistent with the main analysis.

Overall trends were mostly similar when analyses were repeated with positivity calculated using only the first positive test from a woman in a particular year and excluding all subsequent tests in that year (S1 Appendix Figures A and B), and also from analyses using only the first test ever recorded for a woman (S1 Appendix Figures C and D). There was however a small increase in chlamydia positivity found for Aboriginal women aged 15-24 years when only the first test ever recorded was used (see Appendix for full results).

Discussion

In this large study of WA women we found significant increases in both chlamydia and gonorrhoea testing using NAATs between 2001 and 2013. During this same period, chlamydia and gonorrhoea positivity remained highest in young Aboriginal women, despite chlamydia positivity increasing among young non-Aboriginal women.

To our knowledge this is the first study using individual pathology data to examine patterns of testing and positivity over 12-years and to be able to compare these trends in Aboriginal and non-Aboriginal women. In comparison, other studies have relied on data from the national notification scheme or Medicare(3), been restricted to individual clinics or sexual health services, or have had substantially fewer years of follow-up(9).

Both annual chlamydia and gonorrhoea testing rates were found to have increased during our study period. While the percentage of Aboriginal women tested for chlamydia was significantly higher than non-Aboriginal women in all age groups and across all years, the relative increase in chlamydia testing over time was greater in non-Aboriginal compared to Aboriginal women, rising about 2-fold in non-Aboriginal women compared to about 1.5-fold in Aboriginal women. Modelling work looking at the benefits of routine annual chlamydia screening predicted screening ~30% of 15–24-year-old males and females each year would reduce chlamydia prevalence among women by >70%(11). Assuming that the 52% of notifications that linked to a positive pathology test reflects the proportion of chlamydia tests undertaken at these two laboratories, testing rates among women in this age group in the most recent years would be estimated to be only around 25%.

Consistent with data from the 2015 National Annual Surveillance Report and a report by the WA Department of Health, our results showed chlamydia positivity peaking in 2011(3, 9) and young Aboriginal women having the greatest risk of a positive chlamydia test(3, 12, 13). Also similar to the national report, gonorrhoea positivity was markedly higher (at least 10 times greater) in young

228 Aboriginal women than non-Aboriginal women(3). Findings from the Australian Collaboration for
229 Coordinated Enhanced Sentinel Surveillance (ACCESS) project reported a significant increase in
230 chlamydia positivity among Aboriginal women (2006-2011)(13). Although we found chlamydia
231 positivity rates in this population were relatively stable over our entire study period, when the data
232 were considered over a similar time period (2007-2011) a small increase in positivity was observed,
233 which was also seen in the sensitivity analysis. A recent systematic review of the prevalence of
234 chlamydia and gonorrhoea in Aboriginal Australians reported pooled prevalence's of 12.7% (10.2%-
235 15.2%) and 10.7% (8.4%-13.0%) respectively in women(14), which although not stratified by age, were
236 similar to the positivity rates observed among 15-24 year olds in this study.

237 The introduction of NAAT in the late 1990s (enabling patient self-collected specimens), public health
238 programs to increase awareness of chlamydia, and changes to the guidelines for chlamydia testing to
239 recommend annual opportunistic screening for chlamydia infection in all sexually active young people
240 aged<30 years(5), likely explain the increases in testing for chlamydia that we observed. During 2010–
241 13, there was a scaling up of programs to increase STI testing among priority populations, particularly
242 among Aboriginalpeople(15) and this may be contributing to the observed decrease in chlamydia
243 positivity since 2011. While gonorrhoea testing is only recommend in those thought to be at high risk
244 or in areas of high prevalence(5), we found that concurrent testing of gonorrhoea with chlamydia
245 occurred throughout most of the study period. As others have suggested(16), due to increases in
246 testing, changes in gonorrhoea positivity need to be interpreted with caution. If the increased testing
247 was in low risk women, this may explain the decrease in gonorrhoea positivity that we observed,
248 rather than there being a true decrease in prevalence.

249 Despite the small decrease in recent years, the high levels of chlamydia positivity in young Aboriginal
250 and non-Aboriginal Australian women are concerning. Variations in risk behaviour, such as increasing
251 numbers of sexual partners (17, 18), which have been associated with an increased risk of chlamydia
252 (19) is one possible explanation for the changes in chlamydia positivity. The data used in this study

253 did not contain information on sexual history or behaviour so we were unable to adjust for this.
254 However, increasing chlamydia positivity has been reported in studies that were able to account for
255 changes in sexual risk factors (20). It is also possible that the increases in chlamydia positivity
256 demonstrate better targeting of testing to those at greatest risk, which could also explain the fall since
257 2011.

258 Given the large geographic distances in WA, and the differences in chlamydia and gonorrhoea
259 positivity by age group, Aboriginality and region of residence (Table 2), our analyses cannot distinguish
260 between whether the overall trends observed are indicative of a consistent pattern among all women
261 in the cohort or the result of multiple outbreaks occurring in different populations at different times.
262 A better understanding could be gained by examining trends by smaller geographic units and
263 separated by age and Aboriginality. Furthermore studies looking at differences in the structure of
264 sexual networks between Aboriginal and non-Aboriginal populations may help to provide a greater
265 understanding of the different patterns of chlamydia and gonorrhoea observed and in doing so
266 provide better insight into how to effectively address these differences.

267 Our study strengths include the use of a large representative population cohort of women with a
268 proportion identified as Aboriginal (4.7%) that is consistent with population census data for this age
269 group (4.2% in 2008)(21). Our major limitation is that we were only able to link to records from two
270 of the laboratories servicing WA, so we would not have comprehensive state-wide records for all
271 chlamydia and gonorrhoea tests. Additionally, our analyses focused on trends in NAAT testing and
272 there is the possibility that some women may have been tested by culture either in conjunction with
273 or in place of NAAT (22, 23). Therefore the numbers of tests reported is likely to be an
274 underestimation. However, the coverage from our two pathology labs, based on notifications, was
275 relatively consistent across age groups, Aboriginality, and geographical region.

276 To conclude, this study found that chlamydia positivity remained highest in young Aboriginal women,
277 at around 15%, with little change observed between 2001 and 2013, despite increases in positivity in

young non-Aboriginal women during the same period. Further gonorrhoea positivity was at least 10 times greater in young Aboriginal women than their non-Aboriginal counterparts. More effective prevention strategies and continued surveillance of chlamydia and gonorrhoea testing, positivity by age and risk groups are needed to address these disparities.

Conflicts of interest

None declared.

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295 **Table 1 Proportion of women tested annually for chlamydia and gonorrhoea between 2001 and 2013, by year, age group and Aboriginality**

Percentage of women tested annually for chlamydia at either pathology laboratory								
Year	Non-Aboriginal				Aboriginal			
	15-19yrs	20-24yrs	25-29yrs	≥30yrs*	15-19yrs	20-24yrs	25-29yrs	≥30yrs*
2001	3.5	5.1	3.2		23.4	27.8	20.6	
2002	3.6	5.3	3.4		24.5	29.4	24.4	
2003	3.8	5.7	3.6		25.7	30.9	25.4	
2004	4.0	5.9	4.1	1.7	27.2	31.8	29.3	19.1
2005	5.2	8.0	5.5	3.3	29.3	32.6	28.8	21.2
2006	6.0	8.9	6.3	4.1	30.0	32.8	28.7	23.8
2007	6.9	10.2	7.5	5.0	32.5	36.7	31.6	24.7
2008	6.9	10.5	9.0	6.2	32.3	37.6	33.7	24.4
2009	7.0	10.7	9.2	6.2	32.1	38.5	32.8	26.2
2010	7.0	10.6	9.2	6.1	32.8	38.3	32.5	25.4
2011	8.7	10.6	9.9	6.2	37.8	39.8	33.8	25.2
2012	11.1	11.5	9.9	6.1	45.7	40.2	37.0	28.2
2013	12.2	11.0	9.9	6.0	51.2	42.5	38.3	27.7
Percentage of women tested annually for gonorrhoea at either pathology laboratory								
Year	Non-Aboriginal				Aboriginal			
	15-19yrs	20-24yrs	25-29yrs	≥30yrs*	15-19yrs	20-24yrs	25-29yrs	≥30yrs*
2001	3.0	4.3	2.7		23.2	27.7	20.0	
2002	3.2	4.6	2.9		24.4	29.3	24.0	
2003	3.4	5.0	3.1		25.4	30.4	25.1	
2004	3.5	5.0	3.5	1.5	27.0	31.6	28.8	18.7
2005	4.5	6.9	4.8	2.8	29.0	32.2	28.5	21.1
2006	5.2	7.7	5.5	3.5	29.4	32.3	28.1	23.2
2007	6.1	9.2	6.6	4.3	32.3	36.2	31.1	24.4
2008	6.4	9.5	7.9	5.3	31.7	36.7	32.6	24.0
2009	6.4	9.6	8.0	5.2	30.9	37.2	31.9	25.9
2010	6.4	9.5	8.0	5.2	32.2	37.5	31.7	24.9
2011	8.0	9.5	8.5	5.2	36.9	38.9	32.8	24.5
2012	10.4	10.5	8.7	5.3	45.2	39.6	36.4	27.8
2013	11.4	11.0	8.8	5.2	50.4	42.1	38.0	27.4

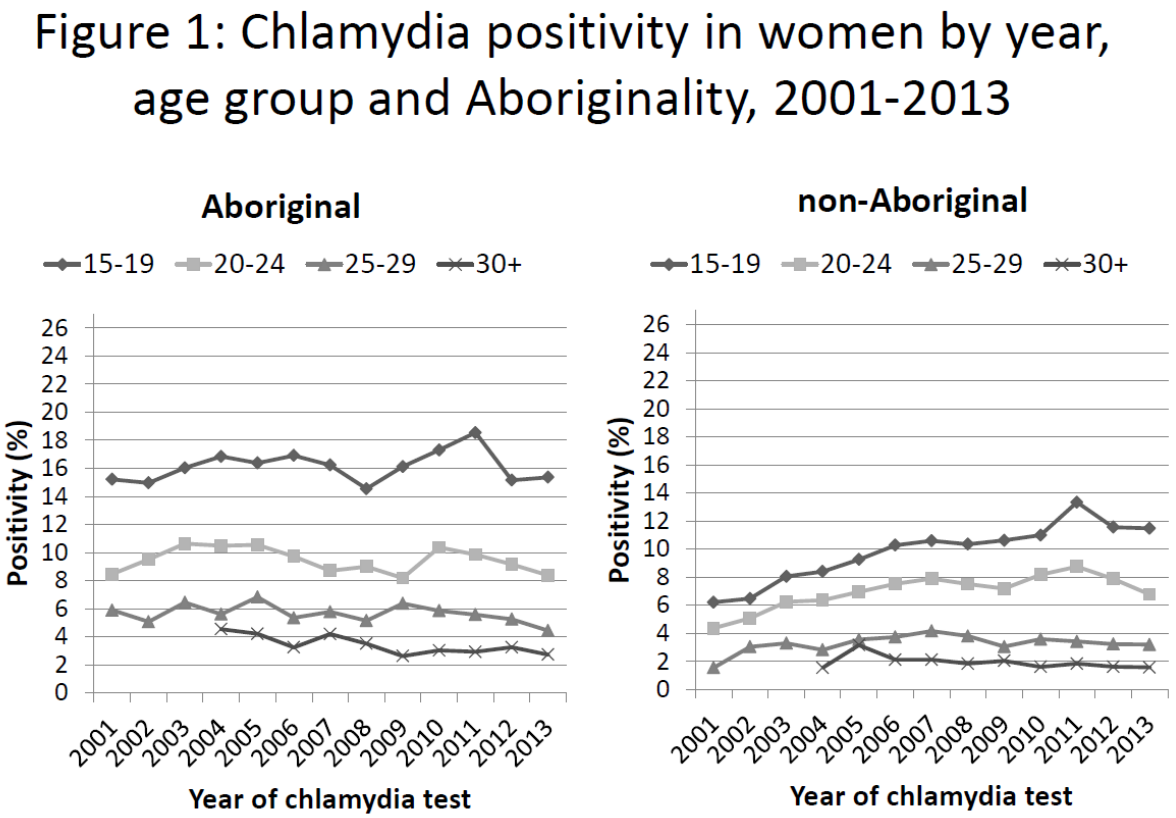
*Trends for the oldest age group (≥ 30 years) are reported from 2004, as per our inclusion criteria the earliest date of birth for women included in the cohort was 1st January 1974.

299 **Table 2 Factors associated with chlamydia and gonorrhoea positivity**

	Univariate		Multivariate	
Factors associated with chlamydia positivity				
	IRR	**P-value**	**aIRR**	**P-value**
Age group				
15-19	1.56 (1.51-1.61)	<.0001	1.54 (1.49-1.58)	<.0001
20-24	1 (Ref)		1 (Ref)	
25-29	0.49 (0.47-0.51)	<.0001	0.50 (0.48-0.52)	<.0001
≥30	0.25 (0.24-0.27)	<.0001	0.26 (0.24-0.28)	<.0001
Aboriginal				
No	1 (Ref)		1 (Ref)	
Yes	1.74 (1.68-1.79)	<.0001	1.56 (1.50-1.69)	<.0001
Year of test				
Per year later	0.97 (0.96-0.97)	<.0001	1.02 (1.02-1.02)	<.0001
Region				
Metro	1 (Ref)		1 (Ref)	
Rural	1.07 (1.02-1.12)	0.002	0.99 (0.95-1.04)	0.79
Remote	1.30 (1.25-1.34)	<.0001	1.00 (0.96-1.04)	0.87
Factors associated with gonorrhoea positivity				
	IRR	**P-value**	**aIRR**	**P-value**
Age group				
15-19	1.77 (1.65-1.90)	<.0001	1.42 (1.32-1.52)	<.0001
20-24	1 (Ref)		1 (Ref)	
25-29	0.70 (0.64-0.77)	<.0001	0.70 (0.64-0.76)	<.0001
≥30	0.44 (0.39-0.50)	<.0001	0.51 (0.45-0.58)	<.0001
Aboriginal				
No	1 (Ref)		1 (Ref)	
Yes	17.54 (16.17-19.01)	<.0001	11.80 (10.77-12.91)	<.0001
Year of test				
Per year later	0.87 (0.86-0.89)	<.0001	0.95 (0.94-0.96)	<.0001
Region				
Metro	1 (Ref)		1 (Ref)	
Rural	0.77 (0.63-0.93)	0.007	0.66 (0.55-0.78)	<.0001
Remote	5.65 (5.19-6.16)	<.0001	1.61 (1.49-1.74)	<.0001

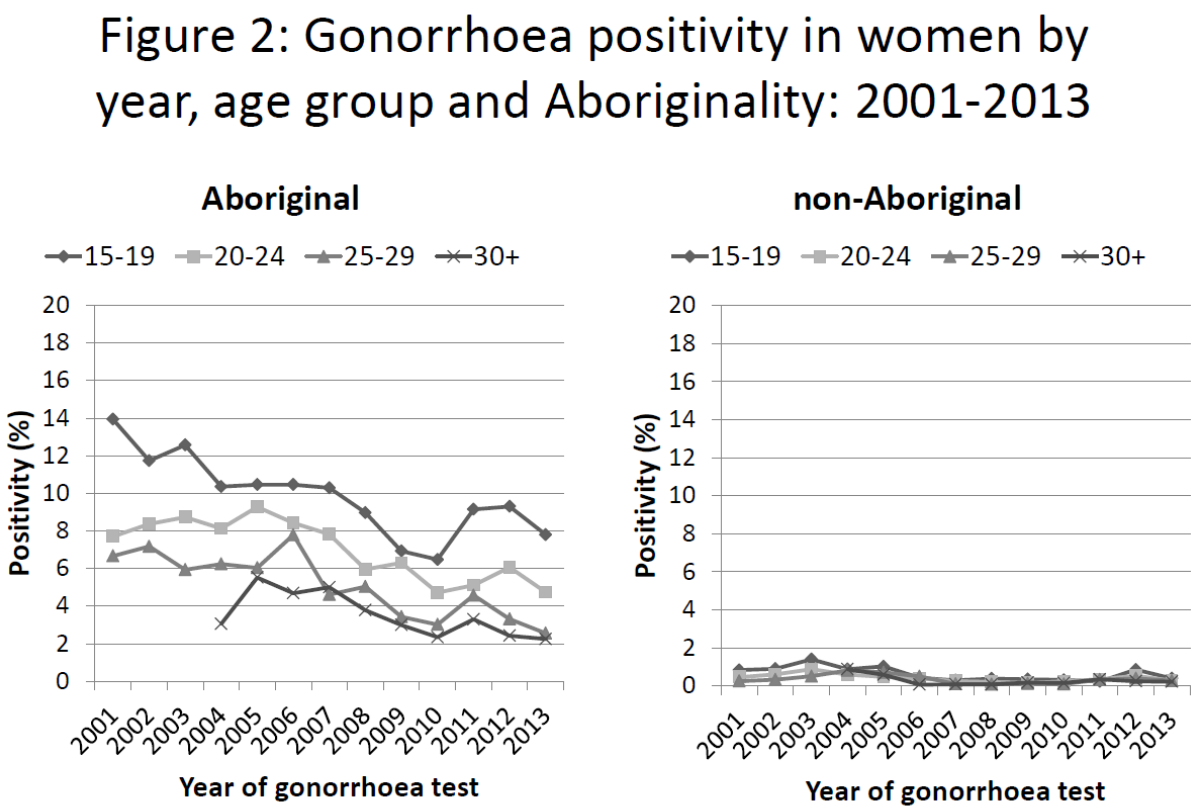
300

301 **Figure 1 Chlamydia positivity in women in WA, 2001-2013**



302

303 **Figure 2 Gonorrhoea positivity in women in WA, 2001-2013**



304

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306

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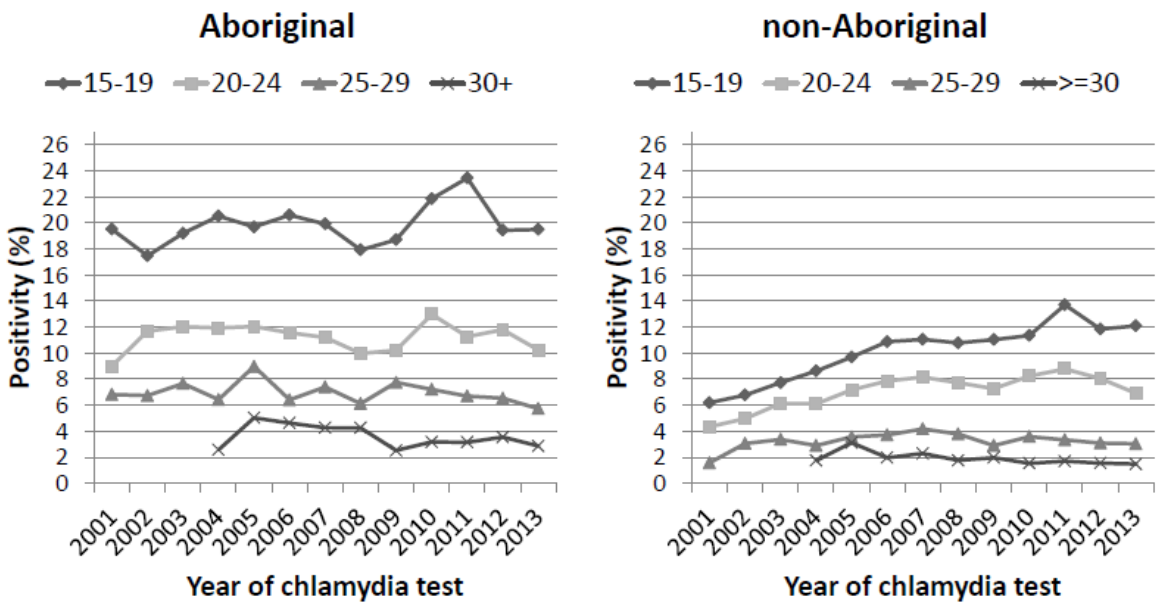
Appendix 1

To investigate if changes in the frequency of retesting could potentially bias the positivity trends, analyses were repeated with positivity calculated using only the first positive test from a woman in a particular year and excluding all subsequent tests in that year, and also from the only first test ever recorded for a woman

Figures A and B show the trends in chlamydia and gonorrhoea positivity when only the first test recorded each year was included and figures C and D when only the first ever test recorded was included. Among Aboriginal women a similar trend in chlamydia positivity was seen when only the first test recorded each year was included, although overall positivity was higher (Figure A) than in the main analysis (Figure 1). When analyses were restricted to only the first test ever recorded there was a small but significant increase in positivity among young Aboriginal women (IRR 1.02, 95%CI 1.01-41.04, p=0.003 and IRR 1.05, 1.02-1.07, p=0.003 among 15-19 and 20-24 year olds respectively) (Figure C). Among non-Aboriginal women the trends in chlamydia positivity were consistent when the different definitions of positivity were used suggesting that it is unlikely that the increase in positivity among young non-Aboriginal women is being driven by higher frequency of repeat testing in the later years. For gonorrhoea positivity, consistent trends in decreasing positivity were seen irrespective of the way positivity was calculated, in both Aboriginal and non-Aboriginal women (Figure B and D).

379

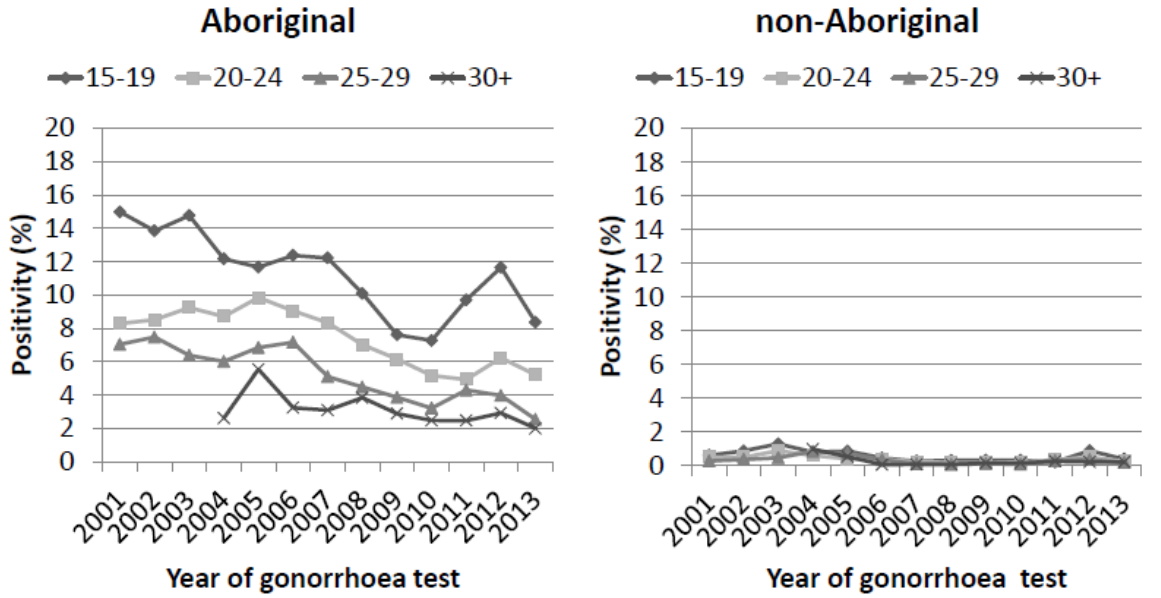
Figure A: Chlamydia positivity* in women by year, age group and Aboriginality, 2001-2013



*Positivity calculated from the first test recorded each year for each woman (a woman may contribute only one entry per year but multiple entries to the analysis)

380

Figure B: Gonorrhoea positivity* in women by year, age group and Aboriginality, 2001-2013

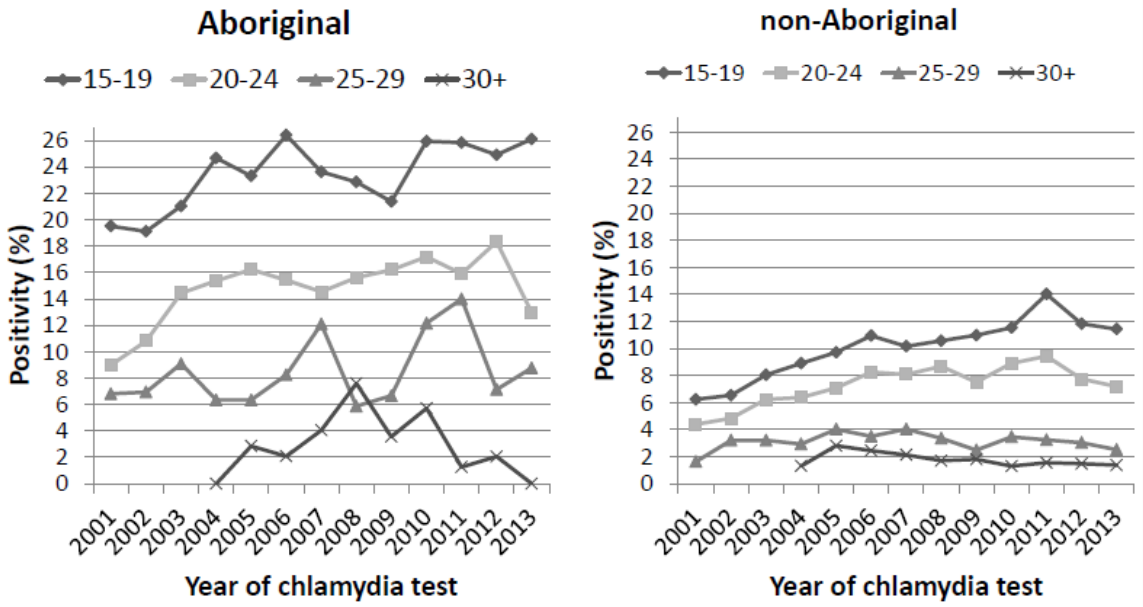


*Positivity calculated from the first test recorded each year for each woman (a woman may contribute 6only one entry per year but multiple entries to the analysis)

381

382

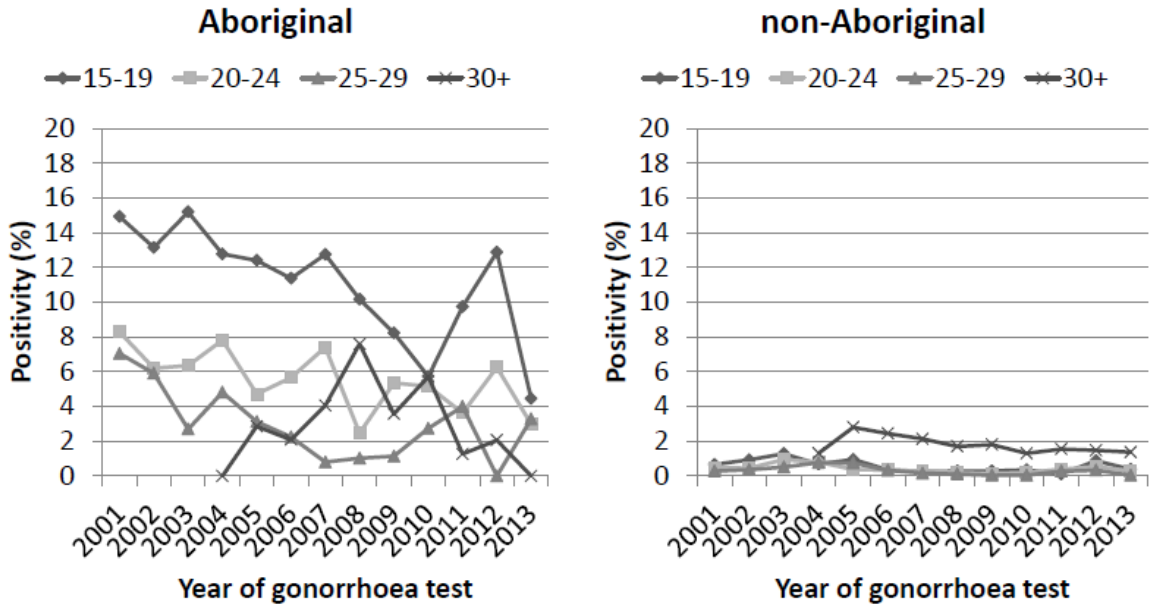
Figure C: Chlamydia positivity* in women by year, age group and Aboriginality, 2001-2013



*Positivity calculated from the first test recorded for each woman (each woman only contributes once to the analysis)

383

Figure D: Gonorrhoea positivity* in women by year, age group and Aboriginality, 2001-2013



*Positivity calculated from the first test recorded for each woman (each woman only contributes once to the analysis)

384