

# Missed opportunities—low levels of chlamydia retesting at Australian general practices, 2008–2009

Anna L Bowring,<sup>1</sup> Maelenn Gouillou,<sup>1</sup> Rebecca Guy,<sup>2</sup> Fabian Y S Kong,<sup>1</sup> Jane Hocking,<sup>3</sup> Marie Pirota,<sup>4</sup> Clare Heal,<sup>5</sup> Tom Brett,<sup>6</sup> Basil Donovan,<sup>2</sup> Margaret Hellard,<sup>1,7,8</sup> on behalf of the ACCESS Collaboration

<sup>1</sup>Centre for Population Health, Burnet Institute, Melbourne, Victoria, Australia

<sup>2</sup>The Kirby Institute, University of New South Wales, New South Wales, Australia

<sup>3</sup>Centre for Women's Health, Gender and Society, University of Melbourne, Carlton, Victoria, Australia

<sup>4</sup>Department of General Practice, University of Melbourne, Carlton, Victoria, Australia

<sup>5</sup>James Cook University, School of Medicine and Dentistry, Mackay Base Hospital, Mackay, Queensland, Australia

<sup>6</sup>General Practice and Primary Health Care Research, School of Medicine, The University of Notre Dame Australia, Fremantle, Western Australia, Australia

<sup>7</sup>Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Victoria, Australia

<sup>8</sup>The Nossal Institute for Global Health, University of Melbourne, Carlton, Victoria, Australia

## Correspondence to

Anna L Bowring, Centre for Population Health, Burnet Institute, 85 Commercial Road, Melbourne, Victoria 3004, Australia (GPO Box 2284, Melbourne, Victoria 3001, Australia);  
annab@burnet.edu.au

Accepted 12 February 2012

Published Online First

10 March 2012

## ABSTRACT

**Objective** Chlamydia reinfection is common and increases the risk of reproductive complications. Guidelines for Australian general practitioners recommend retesting 3–12 months after a positive result but not before 6 weeks. The authors describe retesting rates among 16–29-year-old patients diagnosed as having chlamydia at 25 general practice clinics participating in the Australian Collaboration for Chlamydia Enhanced Sentinel Surveillance system.

**Methods** The authors calculated annual testing and positivity rates for 16–29-year-olds attending in 2008–2009, re-attendance and retesting rates within <6 weeks, 1.5–4 months and 1.5–12 months of a positive test in 2008–2009 and positivity at retest (where results were available).

**Results** There were 50 408 individuals (60.4% women) who attended in 2008–2009. Annually, 7.4% and 7.3% were tested for chlamydia, of whom 9.1% and 8.0% tested positive, respectively. Within 1.5–4 months of a positive test, 24.6% re-attended and were retested (19% tested positive), 31.6% re-attended and were not retested and 43.9% did not re-attend. Within 1.5–12 months, 40% re-attended and were retested (16% tested positive), 40% re-attended and were not retested and 20% did not re-attend. Of individuals re-attending in 1.5–12 months but not retested, 50% had re-attended three or more times in the period. Within 6 weeks of a positive test, 25% were retested.

**Discussion** A high proportion of 16–29-year-olds re-attended general practices in the recommended retest periods, but retesting rates were low and multiple missed opportunities were common. The findings highlight the need for strategies such as electronic clinician prompts, patient recall systems and promotion of retesting guidelines.

## INTRODUCTION

*Chlamydia trachomatis* (hereafter referred to as chlamydia) is the most common notifiable disease in Australia, with most diagnoses among women aged 15–24 years and men aged 15–29 years.<sup>1</sup> Chlamydia prevalence estimates of 3%–5% in Australian women aged 15–24 years have been reported,<sup>2–3</sup> and one study found annual incidence of 4.4% in women aged 15–24 years.<sup>4</sup> Chlamydia reinfection is common, and rates are comparable in men and women.<sup>5</sup> Systematic reviews indicate the median reinfection rate to be 13% among women<sup>6</sup> (follow-up ranged from 3 to 20 months) and 11%

among men (follow-up ranged from 2.5 to 6 months) in active cohorts.<sup>5</sup> An Australian cohort study found that 22% of women under 25 years were reinfected by 12 months, with most reinfections occurring in the first 4–5 months.<sup>4</sup> Compared with a single infection, chlamydia reinfections increase the risk of developing reproductive complications, including pelvic inflammatory disease, ectopic pregnancy and infertility.<sup>7</sup>

Sexual risk behaviours such as inconsistent condom use, new sex partner/s and multiple sex partners are not reliable predictors of reinfection.<sup>6</sup> The most consistently reported determinants of reinfection are younger age,<sup>5–6</sup> incomplete treatment of partner<sup>3–9</sup> and initial coinfection with gonorrhoea.<sup>6</sup> Complete notification and treatment of all partners is important to prevent reinfection.<sup>10–11</sup> However, even in studies utilising patient-delivered partner treatment approaches, repeat infection rates are still high.<sup>11–12</sup> Therefore, retesting continues to have an important role in detecting and managing chlamydia reinfection.

In order to identify and manage reinfection, guidelines for Australian general practitioners advise that retesting be done 3–12 months after a positive chlamydia diagnosis.<sup>13</sup> Other sexual health guidelines also endorse the 3-month retest.<sup>14–15</sup> Retesting within 3–4 weeks post-treatment is not recommended due to the presence of non-viable organisms, which may yield false-positive results,<sup>16</sup> and the guidelines recommend delaying retesting until at least 6 weeks after treatment.<sup>15</sup> A test of cure is not currently recommended, given the high efficacy of azithromycin and low treatment failure rate.<sup>17</sup> That being said, more recently some studies have reported up to 8% probable treatment failure rates.<sup>18</sup>

This is the first Australian study to estimate retesting rates in general practice (GP) clinics, where the majority of chlamydia infections in young people are diagnosed.<sup>19</sup> In this analysis, we assess the extent of chlamydia retesting and positivity at retest in young people diagnosed as having chlamydia infection at 25 GP clinics in Australia in 2008–2009.

## METHODS

### Data collection

Data on all attending 16–29-year-olds were collated from 25 GP clinics participating in the Australian Collaboration for Chlamydia Enhanced

Sentinel Surveillance (ACCESS) system during the study period: 1 January 2008 to 31 December 2009. ACCESS is an enhanced chlamydia sentinel surveillance network involving six distinct clinical networks, including a network of GP clinics. Each network monitors chlamydia testing uptake and positivity in populations at risk of chlamydia. The methods of the ACCESS systems have been described in detail previously.<sup>20</sup> GP clinics were actively recruited through professional networks; clinicians received no additional training around STIs as part of ACCESS. Participating clinics were located across six Australian jurisdictions. Non-identifiable routine clinical and chlamydia testing data were retrospectively extracted from electronic patient records using GRHANITE software.<sup>21</sup>

### Ethics

The project was approved by Royal Australian College of General Practitioners National Research and Evaluation Ethics Committee.

### Analysis

The annual chlamydia testing rate was calculated as the proportion of attending individuals with at least one chlamydia test request in a 12-month period. Annual chlamydia positivity was calculated as the proportion of individuals tested with a positive test in a 12-month period. Individuals with no test result known were excluded from the positivity denominator.

Retesting rates after a chlamydia infection were calculated as the proportion of individuals with a positive chlamydia test that re-attended the same clinic and had a retest request within a given time period: less than 6 weeks (<42 days), 1.5–4 months (42–120 days) and 1.5–12 months (42–365 days). These periods were measured from date of specimen collection at first positive test to date of subsequent test request. The 1.5–4 month retest period focused on the guideline recommendation of retesting in 3 months, the 1.5–12-month period focused on opportunistic retesting up to a year post-chlamydia infection and retesting in under 6 weeks focused on the test of cure, which is not recommended.<sup>13</sup> Retesting analyses were based on a first positive test occurring in the following time periods, allocated to allow adequate follow-up time for retesting according to each retest period: <6 weeks (first positive test in January 2008 to 19 November 2009), 1.5–4 months

(January 2008 to 2 September 2009) and 1.5–12 months (1 January to 31 December 2008).

Chlamydia positivity at retest was calculated as the proportion of the individuals retested in the given time period, where a test result is known, who tested positive at first retest.

In addition to retesting, the proportion of individuals with a positive chlamydia test that re-attended in the given retest period and were not retested and the proportion of individuals that did not re-attend the same clinic within the given retest period were calculated.

In the three retest periods, differences in retesting rates and rates of re-attendance without a retest were assessed according to age group (at first positive test), sex and area of residence (metropolitan/non-metropolitan) using a  $\chi^2$  test to 0.05 significance. Area of residence was defined by the patient postcode according to the Australian Standard Geographical Classification—Remoteness Areas (ASGC-RA), whereby RA 0 was coded as metropolitan and RA 1–4 was coded as non-metropolitan.<sup>22</sup>

All analyses were conducted using Stata V.11.<sup>23</sup>

## RESULTS

### Annual testing and positivity rates

A total of 50 408 individuals aged 16–29 years (median age 23 years) attended 25 GP clinics in the study period; 60% were women. Where obtainable (missing in 4%), 65% resided in metropolitan areas. In 2008, 2338 (7.4%) individuals were tested and 175 (9.1%, 95% CI 7.8 to 10.4) tested positive; in 2009, 2556 (7.3%) individuals were tested and 161 (8.0%, 95% CI 6.9 to 9.3) tested positive.

### Retesting between 1.5 and 4 months of a positive chlamydia test

Of 285 individuals who tested positive between 1 January 2008 and 2 September 2009, 70 (24.6%) re-attended and were retested in 1.5–4 months (table 1); a higher proportion of women (29.2%) than men (14.4%,  $p=0.01$ ) and a higher proportion of 16–19-year-olds (34.2%) than 25–29-year-olds (21.2%;  $p=0.01$ ) were retested. No statistical difference in retesting was detected by area of residence ( $p=0.80$ ). Positivity at retest in 1.5–4 months was 19.0% (95% CI 9.9% to 31.4%) overall, 13.3% (95% CI 5.1% to 26.8%) in women and 38.5% (95% CI 13.9% to 68.4%) in men ( $p=0.04$ ).

**Table 1** Re-attendance and retesting between 1.5 and 4 months after a positive test

	Individuals with positive test*, n	Within 1.5–4 months of initial positive test								
		Re-attended and retested		Re-attended but not retested		Did not re-attend		Positive at retest†		
		n (%)	p Value	n (%)	p Value	n (%)	p Value	n (%)	95% CI	p Value
Overall	285	70 (24.6)		90 (31.6)		125 (43.9)		11 (19.0)	9.9 to 31.4	
Age group, years										
16–19	73	25 (34.2)	<b>0.04</b>	22 (30.1)	0.79	26 (35.6)	0.23	2 (10.0)	1.2 to 31.7	0.45
20–24	134	32 (23.9)		41 (30.6)		61 (45.5)		6 (23.1)	9.0 to 43.6	
25–29	78	13 (16.7)		27 (34.6)		38 (48.7)		3 (25.0)	5.5 to 57.2	
Sex										
Men	90	13 (14.4)	<b>0.01</b>	27 (30.0)	0.70	50 (55.6)	<b>0.01</b>	5 (38.5)	13.9 to 68.4	<b>0.04</b>
Women	195	57 (29.2)		63 (32.3)		75 (38.5)		6 (13.3)	5.1 to 26.8	
Area of residence										
Metropolitan	182	46 (25.3)	0.80	59 (32.4)	0.72	77 (42.3)	0.91	8 (19.5)	8.8 to 34.9	0.95
Non-metropolitan	86	23 (26.7)		26 (30.2)		37 (43.0)		3 (18.8)	4.0 to 45.6	

Statistically significant p values are shown in boldface.

\*Initial positive test between 1 January 2008 and 2 September 2009.

†Based on retest where a result is known; overall 58 (82.9%) of individuals retested in 1.5–4 months have a result known.

An additional 90 (31.6%) individuals re-attended in 1.5–4 months but were not retested (table 1). No statistical difference was detected by sex ( $p=0.70$ ), age group ( $p=0.79$ ) or area of residence ( $p=0.72$ ). Of women re-attending in 1.5–4 months but not retested, 57% re-attended once, 19% re-attended twice and 24% re-attended three or more times. Of men re-attending in 1.5–4 months but not retested, 74% re-attended once, 4% re-attended twice and 22% re-attended three or more times. Women were more likely to have more than one re-attendances without retesting than males (50.8% vs 25.9%,  $p=0.03$ ).

Of individuals initially testing positive, 50 (55.6%) men and 75 (38.5%) women did not re-attend the same clinic within 1.5–4 months ( $p=0.01$ ).

#### Retesting between 1.5 and 12 months of a positive chlamydia test

Of 175 individuals who tested positive in 2008, 70 (40.0%) re-attended and were retested in 1.5–12 months (table 2); a higher proportion of women (46.3%) than men (25.0%) were retested ( $p=0.01$ ). No statistical difference in retesting in 1.5–12 months was detected by age group ( $p=0.81$ ) or area of residence ( $p=0.40$ ). Positivity at retest in 1.5–12 months was 16.1% (95% CI 8.0% to 27.7%) overall, 10.1% (95% CI 3.3% to 21.8%) in women and 41.7% (95% CI 15.2% to 72.3%) in men ( $p=0.01$ ).

An additional 70 (40.0%) individuals re-attended in 1.5–12 months but were not retested (table 2). No statistical difference was detected by sex ( $p=0.69$ ), age group ( $p=0.78$ ) or area of residence ( $p=0.79$ ). Of individuals re-attending in 1.5–12 months but not retested, 8 (36.4%) men and 27 (56.3%) women had re-attended three or more times in this period ( $p=0.12$ ).

Of individuals initially testing positive, 17 (32.7%) men and 18 (14.6%) women did not re-attend the same clinic within 1.5–12 months ( $p=0.01$ ).

#### Retesting within 6 weeks of a positive chlamydia test

Of 308 individuals who tested positive between 1 January 2008 and 19 November 2009, 77 (25.0%) had a retest request within 6 weeks, which is not recommended. The median number of days to retest was 20 days. No statistical difference in retesting within 6 weeks was detected by sex ( $p=0.36$ ), age group ( $p=0.13$ ) or area of residence ( $p=0.13$ ).

Of individuals retested within 6 weeks, 12 (17.7%) went on to receive a second retest at 1.5–4 months (based on initial positive tests occurring in January 2008 to 2 September 2009) and 15

(35.6%) went on to receive a retest at 1.5–12 months (based on initial positive tests in 2008).

#### DISCUSSION

Among a large sample of 16–29-year-olds attending GP in 2008–2009, we determined rates of retesting and repeat positivity after an initial positive chlamydia test. Only 25% of individuals testing positive were retested in the recommended timeframe of 1.5–4 months even though half had re-attended the clinic in this time, and positivity at retest was high.

Repeat testing rates after chlamydia infection were substantially higher than annual testing rates but were lower than recommended. Approximately 7% of attendees were tested within a 12-month period compared with 25% and 40% retested by 4 and 12 months of a positive test, respectively. This may reflect annual testing being largely opportunistic in GP clinics<sup>24</sup> and subject to numerous barriers—particularly time constraints and when unrelated to the presenting complaint.<sup>25</sup> In contrast, retesting is more likely to be done in the context of a sexual health consultation and after the individual is established at risk.

Retesting rates at GP clinics in this study were similar to reported retesting rates in the USA<sup>26, 27</sup> but higher compared with Australian sexual health clinics, which may be explained by variation in clinical service offered and patient presentation. Although sexual health clinics test over 75% of attending individuals annually,<sup>28</sup> retesting rates are lower than seen in GP clinics; among females initially testing positive in 25 GP clinics, 29% were retested within 1.5–4 months compared with 18% retested within 1–4 months at 19 sexual health clinics participating in another ACCESS network.<sup>29</sup> GP clinics provide more opportunities for retesting as young people attend these clinics more regularly for a variety of health reasons.<sup>30</sup> In the present study, this is supported by higher retesting in age groups with higher re-attendance rates. In contrast, sexual health clinics offer a more specific service which is conducive to primary chlamydia testing but multiple attendances are probably less frequent, thus reducing opportunities for retesting after a positive test. It is also possible that patients of the sexual health clinics have their retest at their regular GP, but further research is needed to understand the reasons and circumstances related to chlamydia retesting.

Approximately half of patients with a positive test did not re-attend in 1.5–4 months. Although by 12 months more patients re-attended and additional retesting took place, most

**Table 2** Re-attendance and retesting between 1.5 and 12 months after a positive test

	Individuals with positive test*, n	Within 1.5–12 months of initial positive test								
		Re-attended and retested		Re-attended but not retested		Did not re-attend		Positive at retest		
		n (%)	p Value	n (%)	p Value	n (%)	p Value	n (%)	95% CI	p Value
Overall	175	70 (40.0)		70 (40.0)		35 (20.0)		10 (16.1)	8.0 to 27.7	
Age group, years										
16–19	46	20 (43.5)	0.81	19 (41.3)	0.78	7 (15.2)	0.58	2 (11.8)	1.5 to 36.4	0.84
20–24	83	33 (39.8)		31 (37.3)		19 (22.9)		5 (17.2)	5.8 to 35.8	
25–29	46	17 (37.0)		20 (43.5)		9 (19.6)		3 (18.8)	4.0 to 45.6	
Sex										
Men	52	13 (25.0)	<b>0.01</b>	22 (42.3)	0.69	17 (32.7)	<b>0.01</b>	5 (41.7)	15.2 to 72.3	<b>0.01</b>
Women	123	57 (46.3)		48 (39.0)		18 (14.6)		5 (10.0)	3.3 to 21.8	
Area of residence										
Metropolitan	114	50 (43.9)	0.40	44 (38.6)	0.79	20 (17.5)	0.46	5 (11.1)	3.7 to 24.1	0.05
Non-metropolitan	49	18 (36.7)		20 (40.8)		11 (22.4)		5 (33.3)	11.8 to 61.6	

Statistically significant p values are shown in boldface.

\*Initial positive test between 1 January 2008 and 31 December 2008.

†Based on retest where a result is known; overall 62 (88.6%) individuals retested in 1.5–12 months have a result known.

reinfections occur in 4–5 months and untreated chlamydia can lead to pelvic inflammatory disease in as little as 2 weeks.<sup>4 7</sup> Consequently, distinct strategies are needed to encourage patient re-attendance at 3 months after treatment. A recent systematic review demonstrated phone reminders, and home-based self-collection kits are effective at increasing retesting, while further evaluation of motivational interviewing and SMS reminders is warranted.<sup>31</sup>

Our analysis also demonstrated opportunities where retesting rates could be easily increased at GP clinics. First, in 1.5–4 and 1.5–12 months after a positive test, an additional 32% and 40% of individuals, respectively, re-attended the same clinic but were not retested. Multiple attendances without retesting were common, particularly among women. Computer alerts which prompt clinicians to consider an outstanding medical procedure when a patient attends for their next consultation are used in primary care for various purposes such as immunisation catch ups and pap smears and could be particularly effective for retesting reminders.<sup>32 33</sup> Second, despite guidelines advising against retesting within 6 weeks of chlamydia treatment, a quarter of patients with a positive test were retested in this period, and the majority were not subsequently retested in the recommended retest periods. Although we cannot ascertain the rationale for testing in this period, education and promotion of retesting recommendations to practitioners is warranted. Delaying retesting occurring within 6 weeks until 3 months could increase the retesting rate in the recommended period and enhance detection of reinfection.

Men attending the GP clinics had lower retesting rates than women, which is consistent with previous studies and probably reflective of lower healthcare-seeking behaviour among men in general.<sup>31</sup> As demonstrated in our analysis, men were less likely to re-attend after a positive test by 4 and 12 months, and among those that did re-attend, men attended fewer times than women. These data suggest that different strategies for men and women may be needed to optimise retesting rates. In a GP setting, men may require more active recall strategies or option of home-based self-collection kits.

Positivity at retest was high: 16% and 14% were positive by 4 and 12 months, respectively. Although we were unable to distinguish between reinfections, treatment failure and incomplete treatment, evidence suggests that 84% of repeat infections are due to reinfection by an untreated or new sexual partner.<sup>18</sup> Prevention measures aimed at decreasing reinfection should incorporate behavioural interventions which promote consistent condom use after treatment<sup>34</sup> and partner notification. Patient-Delivered Partner Therapy (PDPT) may be a viable option to increase the proportion of partners being notified and treated<sup>12</sup> and decrease likelihood of patient reinfection compared with standard partner notification.<sup>11 35</sup> PDPT is already used by some Australian GPs, particularly when it is assessed unlikely that the partner will attend,<sup>36</sup> but many GPs still express concerns about its use.<sup>37</sup> Clinical guidelines on the appropriate use of PDPT, education on its safety and effectiveness and supportive legislation would likely increase the acceptance of PDPT by providers and patients alike.<sup>37</sup>

There are a number of limitations to this analysis. We may have underestimated retesting rates if patients received a retest at another service, particularly given young people are less likely to have a regular GP,<sup>38</sup> or may have overestimated retesting rates if patients did not pursue retesting following a retest request. Our analysis is based on 25 sites, so our results may not be generalisable to all Australian GP clinics, and site participation may be biased towards clinicians with a higher than typical

### Box 1 Participating ACCESS sites in GP network, 2008–2009

AK Medical/Dental Clinic, Kelmscott, Western Australia; Brighton Medical Clinic, Brighton, Victoria; Brindabella Family Practice, Queanbeyan, New South Wales; Chancellor Park Family Medical Practice, Sippy Downs, Queensland; Charlestown Family Medical Services, Charlestown, New South Wales; Davey St Medical Centre, Hobart, Tasmania; Duncraig Medical Centre, Duncraig, Western Australia; Eli Waters Medical Centre, Eli Waters, Queensland; Footscray Medical Centre, Footscray, Victoria; Genesis Medical Centre, Brighton, Victoria; Glendale Medical Centre, Glendale, New South Wales; Goulbourn River Group Practice, Seymour, Victoria; Kewarra Family Practice, Kewarra Beach, Queensland; Midway Family Medical Centre, Denistone East, New South Wales; Mooroopna Medical Centre, Mooroopna, Victoria; Nambour Medical Centre, Nambour, Queensland; Newstead Medical, Launceston, Tasmania; O'Brien St Practice, Adelaide, South Australia; Turton St Medical Centre, Sunnybank, Queensland; Wellness Centre Medical Clinic, Malvern East, Victoria; Yepoon Family Practice, Yepoon, Queensland; Young District Medical Centre, Young, New South Wales.

Note: some participating sites prefer not to be named in this paper.

awareness of sexual health and evidence-based guidelines. Nonetheless, observed annual testing rates are comparable to nationally representative data.<sup>39</sup> We are unable to determine the reason for re-attendance and/or retest. Positivity at retest may be biased by clinicians' decision to retest high-risk patients and patients returning due to symptoms or further risk. Due to the small absolute number of individuals undergoing retesting, assessment of demographic associations with retesting rates and repeat positivity was limited.

Despite recommendations for retesting after chlamydia infection, only 25% and 40% of individuals with a positive test were retested by 4 and 12 months, respectively. The high positivity at retest has potential public health consequences, including increased risk of reproductive morbidity and ongoing transmission of infection. These results support the requirement for a 3-month test for reinfection and emphasise the need for a variety of strategies to increase patient re-attendance at 3 months, offer retesting opportunistically and reduce reinfections through partner notification.

### Key messages

- ▶ This is the first Australian study to assess retesting rates after a positive chlamydia test in general practice clinics.
- ▶ One-quarter of 16–29-year-olds are retested for chlamydia in general practice clinics within 1.5–4 months following diagnosis, as recommended.
- ▶ Missed opportunities for retesting when patients re-attend a clinic are common.
- ▶ Multiple strategies are needed to promote retesting guidelines, encourage patient re-attendance and maximise opportunities for retesting.

**Acknowledgements** The authors extend their thanks to all GP clinics which provided data for ACCESS (box 1) and all members of the GP Network Steering Committee, including: Dr Jane Hocking, Dr Douglas Boyle, Dr Tony Merritt, Assoc. Professor Helena Britt, Dr Phyllis Lau, Dr Marie Pirota, Dr Clare Heal, A/Professor Tom Brett, Ms Anna Bowring, Dr Rebecca Guy, Professor Basil Donovan, and A/Professor Margaret Hellard. We also gratefully acknowledge the work of Dr Douglas Boyle and the GRHANITE team at the Rural Health Academic Centre, Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne. ACCESS is overseen by a national coordinating committee comprising of representatives from the Burnet Institute, The Kirby Institute for Infection and Immunity in Society, National Reference Laboratory and the National Perinatal Statistics Unit at the University of New South Wales.

**Contributors** The following co-authors have contributed to the work: ALB in data analysis, manuscript preparation and manuscript review; MG in data analysis; RG in manuscript conception, manuscript preparation and manuscript review; FYSK, JH, MP, CH and TB in manuscript review; BD in surveillance system design and manuscript review and MEH in surveillance system design, manuscript preparation and manuscript review.

**Funding** Australian Collaboration for Chlamydia Enhanced Sentinel Surveillance was funded through the Australian Government Department of Health and Ageing Chlamydia Pilot Program from 2007 to 2010. The authors gratefully acknowledge the contribution to this work of the Victorian Operational Infrastructure Support Program. RG, MH, JH and BD are supported by NHMRC Fellowships.

**Competing interests** None.

**Patient consent** Waiver of consent for the Australian Collaboration for Chlamydia Enhanced Sentinel Surveillance project was approved by Royal Australian College of General Practitioners National Research and Evaluation Ethics Committee (ref. number 07/017).

**Ethics approval** Ethics approval was provided by Royal Australian College of General Practitioners National Research and Evaluation Ethics Committee. NREEC 07/017.

**Provenance and peer review** Not commissioned; externally peer reviewed.

## REFERENCES

1. **Department of Health and Ageing.** *Number of Notifications of Chlamydial Infections, Australia, 2010 by Age Group and Sex. National Notifiable Diseases Surveillance System.* Canberra: Department of health and Ageing, 2011.
2. **Hocking JS,** Willis J, Tabrizi S, *et al.* A chlamydia prevalence survey of young women living in Melbourne, Victoria. *Sex Health* 2006;**3**:235–40.
3. **Kong FY,** Hocking JS, Link CK, *et al.* Sex and sport: chlamydia screening in rural sporting clubs. *BMC Infect Dis* 2009;**9**:73.
4. **Walker J,** Fairley CK, Bradshaw CS, *et al.* The incidence of genital chlamydia trachomatis in a cohort of young Australian women. Abstracts of the 19th Biennial Conference of the International Society for sexually Transmitted diseases research. *Sex Transm Infect* 2011;**87**:A21.
5. **Fung M,** Scott KC, Kent CK, *et al.* Chlamydial and gonococcal reinfection among men: a systematic review of data to evaluate the need for retesting. *Sex Transm Infect* 2007;**83**:304–9.
6. **Hosenfeld CB,** Workowski KA, Berman S, *et al.* Repeat infection with chlamydia and gonorrhoea among females: a systematic review of the literature. *Sex Transm Dis* 2009;**36**:478–89.
7. **Haggerty CL,** Gottlieb SL, Taylor BD, *et al.* Risk of sequelae after Chlamydia trachomatis genital infection in women. *J Infect Dis* 2010;**203**(Suppl 2):S134–55.
8. **LaMontagne SD,** Baster K, Emmett L, *et al.* Incidence and reinfection rates of genital chlamydial infection among women aged 16–24 years attending general practice, family planning and genitourinary medicine clinics in England: a prospective cohort study by the Chlamydia Recall Study Advisory Group. *Sex Transm Infect* 2007;**83**:292–303.
9. **Rietmeijer CA,** Van Bemmelen R, Judson FN, *et al.* Incidence and repeat infection rates of Chlamydia trachomatis among male and female patients in an STD clinic: implications for screening and rescreening. *Sex Transm Dis* 2002;**29**:65–72.
10. **Heijne JC,** Althaus CL, Herzog SA, *et al.* The role of reinfection and partner notification in the efficacy of Chlamydia screening programs. *J Infect Dis* 2011;**203**:372–7.
11. **Schillinger JA,** Kissinger P, Calvet H, *et al.* Patient-delivered partner treatment with azithromycin to prevent repeated Chlamydia trachomatis infection among women: a randomized, controlled trial. *Sex Transm Dis* 2003;**30**:49–56.
12. **Golden MR,** Whittington WLH, Handsfield HH, *et al.* Effect of expedited treatment of sex partners on recurrent or persistent gonorrhoea or chlamydial infection. *N Engl J Med* 2005;**352**:676–85.
13. **Harris M,** Bennet J, Del Mar C, *et al.* *Guidelines for Preventive Activities in General Practice (The 'Red Book')*. 7th edn. Melbourne: The Royal Australian College of General Practitioners, 2009.
14. **Australasian Chapter of Sexual Health Medicine.** *Clinical Guidelines for the Management of Sexually Transmitted Infections Among Priority Populations.* Sydney: The Royal Australasian College of Physicians, Australasian Chapter of Sexual Health Medicine, 2004.
15. **Bourke S.** *National Management Guidelines for Sexually Transmissible Infections.* 7th edn. Melbourne: Sexual Health Society Of Victoria, 2008.
16. **Gaydos CA,** Crotchfelt KA, Howell MR, *et al.* Molecular amplification assays to detect chlamydial infections in urine specimens from high school female students and to monitor the persistence of chlamydial DNA after therapy. *J Infect Dis* 1998;**177**:417–24.
17. **Lau CY,** Qureshi AK. Azithromycin versus doxycycline for genital chlamydial infections: a meta-analysis of randomized clinical trials. *Sex Transm Dis* 2002;**29**:497–502.
18. **Batteiger BE,** Tu W, Ofner S, *et al.* Repeated Chlamydia trachomatis genital infections in adolescent women. *J Infect Dis* 2010;**201**:42–51.
19. **Gulich AE,** de Visser RO, Smith AM, *et al.* Sex in Australia: sexually transmissible infection and blood-borne virus history in a representative sample of adults. *Aust N Z J Public Health* 2003;**27**:234–41.
20. **Guy R,** Kong F, Goller J, *et al.* A new national chlamydia surveillance system in Australia: evaluation of the first stage implementation. *Commun Dis Intell* 2010;**34**:319–28.
21. **Boyle D,** Kong F. A systematic mechanism for the collection and interpretation of display format pathology test results from Australian primary care records. *Electron J Health Inform* 2011;**6**:e18.
22. **Australian Bureau of Statistics.** *Australian Standard Geographical Classification (ASGC) Remoteness Areas (Cat. No. 1216.0).* Canberra: Australian Bureau of Statistics, 2006.
23. **StataCorp.** *Stata Statistical Software: Release 11.* College Station, TX: StataCorp LP, 2009.
24. **Shaw K,** Stephens N, Coleman D, *et al.* Role of the general practitioner in testing for genital Chlamydia trachomatis infection: an analysis of enhanced surveillance data. *Sex Health* 2009;**6**:208–12.
25. **Merritt TD,** Durrheim DN, Hope K, *et al.* General practice intervention to increase opportunistic screening for chlamydia. *Sex Health* 2007;**4**:249–51.
26. **Caggiano ME,** Dumas W, Bertrand TE, *et al.* *Re-testing for Chlamydia trachomatis Infection in Massachusetts Family Planning Clinics.* Abstract P138. Chicago, IL: National STD Prevention Conference, 2008.
27. **Region II IPP Advisory Committee.** *Repeat Testing of Females for Chlamydial Infection: An Evaluation of Current Practices.* Abstract P134. Chicago, IL: National STD Prevention Conference, 2008.
28. **Kirby Institute.** *HIV, Viral Hepatitis and Sexually Transmissible Infections in Australia Annual Surveillance Report 2010.* Sydney: Kirby Institute, The University of New South Wales, 2010.
29. **Guy R,** Wand H, Franklin N, *et al.* Re-testing for chlamydia at sexual health services in Australia, 2004–08. *Sex Health* 2011;**8**:242–7.
30. **Booth ML,** Knox S, Kang M. Encounters between adolescents and general practice in Australia. *J Paediatr Child Health* 2008;**44**:699–705.
31. **Guy R,** Hocking J, Low N, *et al.* Interventions to increase re-screening for repeat chlamydial infection. *Sex Transm Dis* 2012;**39**:136–46.
32. **Scholes D,** Grothaus L, McClure J, *et al.* A randomized trial of strategies to increase chlamydia screening in young women. *Prev Med* 2006;**43**:343–50.
33. **Park IU,** Arney A, Creegan L, *et al.* Retesting for repeat chlamydial infection: family planning provider knowledge, attitudes, and practices. *J Womens Health (Larchmt)* 2010;**19**:1139–44.
34. **Shain RN,** Piper JM, Holden AE, *et al.* Prevention of gonorrhoea and chlamydia through behavioral intervention: results of a two-year controlled randomized trial in minority women. *Sex Transm Dis* 2004;**31**:401–8.
35. **Kissinger P,** Brown R, Reed K, *et al.* Effectiveness of patient delivered partner medication for preventing recurrent Chlamydia trachomatis. *Sex Transm Infect* 1998;**74**:331–3.
36. **Bilardi JE,** Hopkins CA, Fairley CK, *et al.* Innovative resources could help improve partner notification for chlamydia in primary care. *Sex Transm Dis* 2009;**36**:779–83.
37. **Pavlin NL,** Parker RM, Piggan AK, *et al.* Better than nothing? Patient-delivered partner therapy and partner notification for chlamydia: the views of Australian general practitioners. *BMC Infect Dis* 2010;**10**:274.
38. **McRae I,** Yen L, Gillespie J, *et al.* Patient affiliation with GPs in Australia—who is and who is not and does it matter? *Health Policy* 2011;**103**:16–23.
39. **Kong FY,** Guy RJ, Hocking JS, *et al.* Australian general practitioner chlamydia testing rates among young people. *Med J Aust* 2011;**195**:249–52.