Does Living Outside of a Major City Impact on the Timeliness of Chlamydia Treatment? A Multicenter Cross-Sectional Analysis

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Background: Timely treatment of *Chlamydia trachomatis* infection reduces complications and onward transmission. We assessed client, process, and clinic factors associated with treatment delays at sexual health clinics in New South Wales, Australia.

Methods: A retrospective review of 450 consecutive clients with positive chlamydia results (not treated at the time of the consultation) was undertaken at 6 clinics (1 urban, 3 regional, and 2 remote) from October 2013. Mean and median times to treatment were calculated, overall and stratified by process steps and clinic location.

Results: Nearly all clients (446, 99%) were treated, with 398 (88%) treated in ≤14 days and 277 (62%) in ≤7 days. The mean time-to-treatment was 22 days at remote clinics, 13 days at regional and 8 days at the urban clinic ($P < 0.001$). Mean time between the laboratory receipt of specimen and reporting of result was 4.9 in the remote clinics, 4.1 in the regional, and 2.7 days in the urban clinic ($P < 0.001$); and the mean time between the clinician receiving the result until client treatment was15, 5, and 3 days ($P < 0.01$), respectively.

Conclusions: At participating clinics, treatment uptake was high, however treatment delays were greater with increasing remoteness. Strategies to reduce the time-to-treatment should be explored such as point-of-care testing, faster specimen processing, dedicated clinical time to follow up recalls, SMS results to clients, and taking treatment out to clients.

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Treatment of genital *Chlamydia trachomatis* is recommended to reduce the risk of long-term sequelae such as pelvic inflammatory disease and infertility, and to reduce onward transmission. Delays in treatment by as little as 1 to 4 weeks have been shown to result in pelvic inflammatory disease in 2% of clients.[1] National standards in the United Kingdom recommend at least 95% of chlamydia cases should be treated within 30 working days of testing[2]; and in the US national performance measures for timeliness of chlamydia treatment have been set at 14 and at 30 days.[3] There have been a limited number of published reports describing time-to-treatment of chlamydia infections in clinical settings. At sexual health clinics, a national audit in Scotland in 2005 found 73% of clients were treated within 2 weeks[4]; 4 studies conducted in the United States between 2002 and 2008, found the median time-to-treatment ranged from 7 to 18 days[1,5–7]; and In Australia in 2004, an urban clinic reported the median time-to-treatment in those not presumptively treated for chlamydia was 4 days.[8] In primary care, a review of very remote Australian clinics found the mean time-to-treatment ranged from 8 to 21 days in 2001 to 2005[9]; and the median time-to-treatment at a regional antenatal clinic in 2001 to 2003 was 21 days.[10] These studies suggest there are delays in treatment in numerous countries, particularly in regional and remote areas. To our knowledge, there have been no studies directly comparing chlamydia treatment timeliness between urban, regional, and remote clinics or quantitatively exploring client, clinic, and process-related factors that may influence any delay across settings.

In Australia, the prevalence of chlamydia has been shown to be higher in areas of greater geographical remoteness.[11,12] Discrepancies in other health outcomes have been well documented in Australia as remoteness increases.[13,14] People living in regional and remote areas of Australia are more impacted by income and educational disparities resulting in limited access to health care services than their urban counterparts.[15,16] This highlights the importance of ensuring appropriate and accessible health services are available outside of major cities.

We assessed mean and median time-to-treatment of chlamydia infections that had not been treated at the time of specimen collection in selected urban, regional, and remote clinics in New South Wales (NSW). We also assessed the influence of client, clinic, and process factors on timeliness of treatment.

MATERIALS AND METHODS

We conducted a cross-sectional analysis of data collected through a retrospective audit at multiple clinical sites.

Participating Sites

New South Wales is the most populous state in Australia with an estimated 7.6 million residents[17] and accounted for 21,000 of the 83,000 chlamydia notifications in Australia in 2013.[18] In NSW, there are 39 sexual health clinics located across urban, regional, and remote locations to provide services for people at risk of sexually transmissible infections (STIs). Participating sites in this study included the largest urban clinic in Sydney, and 5 clinics in regional and remote towns that the urban clinic provides clinical support to. Of the 5 regional/remote clinics, three were located in towns classed as regional (two as inner regional, one as outer regional) and the only two clinics in NSW located in towns classed as remote (one remote, one very remote).[19] The urban sexual health clinic was staffed by doctors and nurses and the 5 regional/remote area clinics were nurse-led services. The regional clinics received 1–3 monthly visits by a doctor from the urban clinic and the remote clinics a 6 monthly visit. All the clinics are government funded and see clients who fall into priority groups at risk of STIs and HIV as informed by public health surveillance. They are free of charge and do not require Medicare (Australian public health insurance) or private health insurance to access services. Most are open Monday to Friday within normal office hours, with some evening clinics.

At the participating sites, clients who have symptoms or signs of chlamydia, or are sexual contacts of known chlamydia cases, will usually be offered empirical treatment at the time of testing. Asymptomatic clients are screened based on sexual risk and will usually be treated only after receipt of a positive laboratory test result.

The staffing profile and testing and treatment processes across urban, regional and remote clinics are described in Table 1.

Audit

An audit was undertaken between September 1, 2013, and December 31, 2013. A case was defined as a person with a positive chlamydia test result where recall for treatment was initiated after receipt of the laboratory test result. A total of 450 consecutive cases were identified; each clinic identified the most recent positive result as of August 31, 2013, then retrospectively selected consecutive positive results until the quota was met. The quota for each clinic was based on the sample size calculation (see below); 300 from the urban clinic and 150 from regional/remote clinics combined. Each regional/remote clinic identified 30 cases except for the very remote clinic which could identify only 18 cases, and one of the outer regional clinics identified a further 12 cases to meet the overall sample size. The earliest case included was from July 2012 at the urban clinic and March 2008 at the regional and remote clinics, reflecting that fewer patients are seen in the regional/remote clinics.

The following information was extracted for each case; demographics (age, gender, country of birth, Indigenous status, traveler), gender of partner/s, current sex work status, clinical (STI symptoms, concurrent other STIs, previous history of STIs), laboratory and treatment processing dates, and recall attempts and method.

Sample Size

The sample size was calculated under the assumption of moderate effect size (0.5), with a corresponding pooled standard deviation of 14, and 450 cases (150 regional/remote and 300 urban) needed to detect a difference in mean time-to-treatment between urban and regional/remote sites of 7 days, with 80% power and 95% confidence.

Analysis

We calculated the proportion of people who received treatment, the proportion treated in ≤14 days to compare with CDC timeliness targets, and further stratifications of ≤7 days, 8–14 days, 15–30 days, and >30 days. Based on local data,[7] a criterion standard cutoff of treatment ≤7 days was set.

The mean and median times to treatment overall and between different time points along the testing-treatment pathway were calculated (specimen collection to laboratory receipt of specimen; laboratory receipt of specimen to result reported by laboratory; result reported by laboratory to result received by clinician; and result received by clinician to client treated) stratified by location of the clinic. As data collection from urban clinics commenced in July 2012 compared with 2008 at the regional/remote clinics, we compared the mean and median time-to-treatment for regional/remote clinics before and after 2012. We also calculated the number of efforts to recall clients and the type of method use for recall, stratified by clinic location. We grouped inner regional and outer regional together as regional for the analysis.

Mean and medians were calculated with standard deviations (SDs) and interquartile ranges (IQRs), respectively. One-way analysis of variance and Kruskal-Wallis tests were used to compare the mean and medians, and a Pearson χ^2 test used to compare proportions between clinics. We used logistic regression to assess variables associated with time-to-treatment >7 days. Covariates included in the model were gender, age group, Indigenous status, country of birth, sexuality, STI symptoms, coinfection with other STIs, past STIs, traveler or current sex worker status, clinic attended and distance from the clinic. The outcome and main explanatory variables did not have missing data. Level of significance was set at 0.05. Data were analyzed using STATA version 13.1 (StataCorp, College Station, TX).

The study was approved by the South Eastern Sydney Local Health District Human Research Ethics Committee [Ref: 13/329] and the Greater Western HREC [Ref: LNRSSA/14/GWAHS/10].

RESULTS

Data were available from 300 cases from the urban clinic, and 150 from regional/remote clinics; 102 from the regional clinics (42 outer regional, and 60 inner regional) and 48 cases from the remote clinics. Demographics and characteristics of clients attending are shown in Table 2 by clinic location. In the regional/remote clinics significantly higher proportions of clients were female, younger (<25 years), and Aboriginal and Torres Strait Islander peoples; had a concurrent STI or a previous history of STIs; and lived 50 km or more from the clinic. In the urban clinic, there were significantly higher proportions of men who had sex with men, symptomatic clients, sex workers, people self-identifying as travelers (visitors/tourists from overseas), and people born overseas.

Proportion of Clients Treated Within Defined Time Cutoffs

Nearly all clients (n = 446, 99%) were treated; 398 (88%) within 14 days, and 277 (62%) within 7 days. A much lower proportion of cases attending remote and regional clinics were treated within 7 days compared with urban clinics (28.3% vs 42.1% vs 74.2%; $P < 0.001$) and within 14 days (63.1% vs 82.3% vs 95.7%; $P < 0.001$). At the remote clinics; 35% were treated in 8–14 days, and 37% in 15 days or more; at the regional clinics 40% were treated in 8–14 days, and 18% in 15 days or more; and at the urban clinic, 22% were treated in 8–14 days, and 4% in 15 days or more.

TABLE 1. The Staffing Profile and Key Testing and Treatment Processes Across Urban, Regional and Remote Clinics

Process Step	Urban	Regional/Remote
Specimen collection and transport	Several time points throughout the day	Once daily from all clinics or their local laboratories. One outer regional clinic delivered their own pathology specimens to the local laboratory One remote clinic performed outreach visits to areas classed as very remote, and samples from these visits would be brought back to the base clinic by the nurse, for pick up by courier the following day Remote clinics had a courier service Monday to Friday, the regional clinics had a courier service on Saturdays also. No clinics in this study ran weekend appointments.
	Most specimens would be transported from the clinic on the same day as they were performed	All samples from regional and remote clinics were transported from local clinics or local laboratories to one central urban laboratory for processing. Specimens were transported by road from the inner regional, and by air from the outer regional and remote clinics. This step is weather dependent. Once daily pick up meant some specimens would be picked up the day after they were performed, or in the remote clinics 3 days after they were performed if this was on a Friday afternoon.
Laboratory processing of sample	Samples run daily excluding weekends and public holidays.	All samples processed by one central urban laboratory (daily excluding weekends and public holidays).
Clinic notification of laboratory-reported positive results	Printed out automatically overnight to a dedicated laboratory printer in the clinic	Delivered daily by an automatic print run from the central laboratory to the clinic's local laboratory. Exceptions: • one regional clinic (result printed out at the central laboratory and faxed directly to the clinic) • one remote clinic (result delivered to the local laboratory computer, then printed off and faxed to clinic once the sexual health nurse called for the result) Clinics received the results from their local laboratory print run in different ways: • results hand delivered to clinic daily (inner regional) • nurse picked up from laboratory daily (outer regional) • nurse picked up from local laboratory twice weekly (remote)
Clinician receipt of positive result	Hard copy result signed off by clinician once reviewed	Hard copy result signed off by nurse once reviewed
Client notification of positive result	Contacted clients to inform them of positive results and to recall them for treatment as required. SMS (short messaging service or text message) or telephone as first method of contact Standard of care is to attempt contact at least three times and by at least two different methods before classing as lost to follow up	Contacted clients to inform them of positive results and to recall them for treatment as required. All regional and remote clinics use telephone as their first method of contact, all but one regional clinic use SMS as their second line method of contact. If these attempts are unsuccessful then the following are used in varying orders of preference by different clinics: travel to the client, letter, email. Standard of care is to attempt contact at least three times and by at least two different methods before classing as lost to follow up
Treatment of client	Antimicrobial therapy dispensed free of charge to the client in the clinic. • The urban clinic was staffed by a total of 22 doctors and nurses • The population size of the catchment area of the urban clinic was 869,000 over 490 square kilometres	Antimicrobial therapy dispensed free of charge to the client in the clinic. • the 5 regional and remote clinics are staffed by a total of 7 nurses, plus health workers in some clinics. Staff at the urban clinic provide clinical support to the regional and remote clinics by telephone whenever needed. • the population size of the regional and remote clinics combined was 300,775 people over 445,000 square kilometres. • clinics are staffed by nurses authorized to order tests and to provide single dose treatments only. If a client requires a longer course of medication they need to be referred to a local medical officer (LMO) • remote clinic towns have 'fly-in fly-out' visiting doctors rather than resident LMO's who may visit the town only once per week • clinics may have no specialist cover when their only sexual health nurse is on leave • clinics provide outreach to geographically more remote clinics up to once weekly, distances between base and outreach clinics can be far, and this can particularly impact on follow up of patients a number of whom do not have access to phone or internet. Occasionally the sexual health nurse will need to provide outreach to deliver therapy directly to the client.
	Treatment guidelines and protocols are shared between the urban and remote/regional clinics in this study, and remained the same in all clinics for the duration of this study. Standard antimicrobial therapy for chlamydia during this study was: azithromycin 1-g single dose or doxycycline 100 mg twice daily for 7 days)	

TABLE 2. Demographics of Chlamydia Cases by Location of Clinic

	Urban Clinic 300 (67%)	Regional and Remote 150 (33%)	χ^2 *P* Value
Total	300	150	
Gender			<0.001
Male	152 (50.1%)	47 (31.3%)	
Female	148 (49.3%)	102 (68.0%)	
Transgender	0	1 (0.7%)	
Age, y			<0.001
≤19	8 (2.7%)	67 (44.7%)	
20–25	151 (50.3%)	53 (35.3%)	
26–30	73 (24.3%)	13 (8.7%)	
>30	68 (22.7%)	17 (11.3%)	
Indigenous status			<0.001
Aboriginal and/or Torres Strait Islander	1 (0.3%)	82 (54.7%)	
Nonindigenous	298 (99.7%)	67 (44.7%)	
Sexuality			<0.01
Heterosexual	230 (76.7%)	131 (87.3%)	
Homosexual/bisexual	70 (23.3%)	17 (11.3%)	
STI symptoms*			<0.01
Yes	72 (24.0%)	17 (11.4%)	
No	228 (76.0%)	132 (88.6%)	
Concurrent STIs*			<0.05
Yes	35 (11.7%)	31 (20.7%)	
No	264 (88.3%)	119 (79.3%)	
Previous history of STIs			<0.05
Yes	130 (44.4%)	49 (66.4%)	
No	163 (55.6%)	97 (33.6%)	
Traveller†			<0.001
Yes	69 (23.5%)	7 (4.7%)	
No	225 (76.5%)	141 (95.3%)	
Country of birth			<0.001
Australia	56 (18.7%)	144 (96.0%)	
Other	244 (81.3%)	6 (4%.0)	
Current sex worker			<0.001
Yes	39 (13.0%)	1 (0.7%)	
No	260 (87.0%)	149 (99.3%)	
Distance between client residence and clinic			<0.001
<50 km	291 (97.6%)	94 (63.9%)	
50–100 km	3 (1.0%)	31 (21.1%)	
>100 km	4 (1.3%)	22 (15.0%)	

Rectal symptoms (pain, bleeding, tenesmus, discharge).

* HIV, gonorrhea, syphilis, anogenital warts, *Mycoplasma genitalium, Molluscum contagiosum.*

† Client self-identified.

Time-To-Treatment

The mean time-to-treatment was 10 days (SD = 14) overall and varied by clinic location; 22 days at remote clinics (SD = 24), 13 days (SD = 14) at regional, and 8 (SD = 10) days at the urban clinic, $P < 0.001$. The median time-to-treatment was 7 days (IQR = 5–10) overall; 13 at remote clinics (IQR = 7–27), 7 at regional (IQR = 8–13), and 6 (IQR = 4–8) at the urban clinic, $P < 0.001$. We conducted a supplementary analysis after restricting all data to 2012 onward (not presented here). Restricting the data to 2012 onward did not change the findings.

The Testing-Treatment Pathway

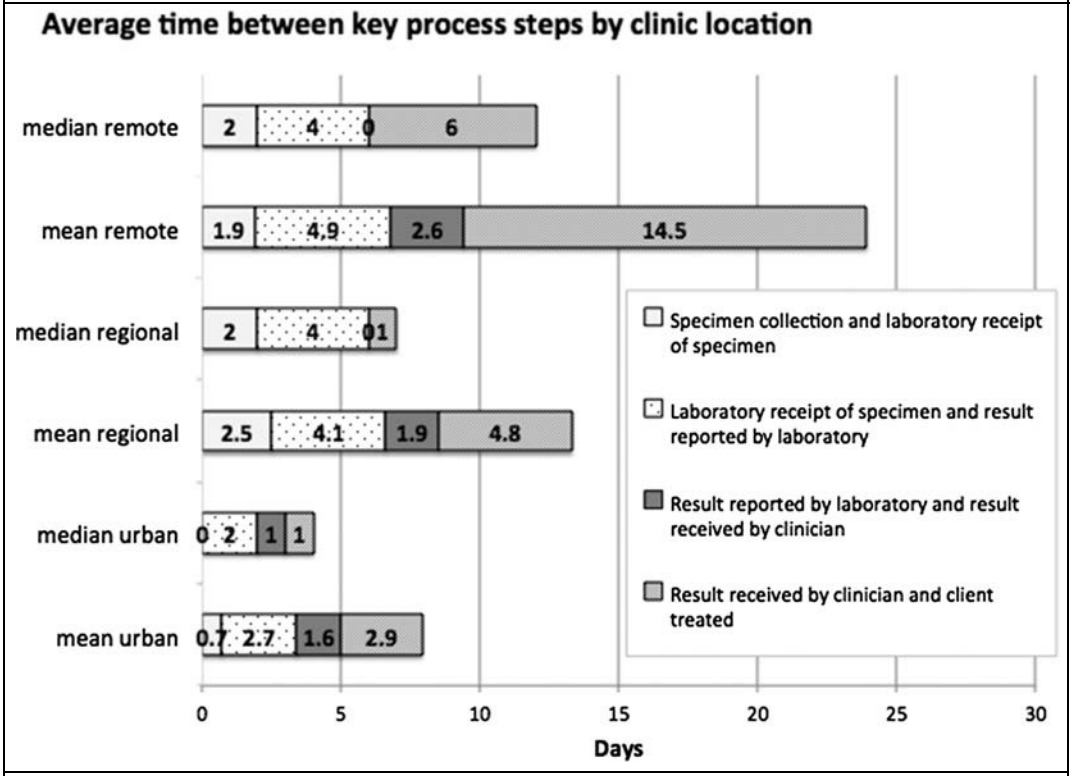
The mean and median number of days between key processing steps are shown in Figure 1. There were delays in the time taken between specimen collection and release reporting of result. Between specimen collection and laboratory receipt of specimen, delays was moderate; mean = 1.9 days (SD = 1.5) in the remote clinics, 2.5 days (SD = 2.0) in the regional and 0.7 days (SD = 1.9) in the urban clinic, $P < 0.001$; and median = 2 day (IQR = 1–3) versus 2 (IQR = 1–3) and 0 (IQR = 0–1) days, respectively, $P < 0.001$. Between laboratory receipt of specimen and laboratory reporting of result, delays were greater; 4.9 days (SD = 4.6) in the remote clinics, 4.1 days (SD = 2.3) in the regional clinics and 2.7 (SD = 2.4) in the urban clinic, $P < 0.001$; median = 4 days (IQR = 2–7), 4 (IQR = 2–6), and 2 (IQR = 1–4) days, respectively ($P < 0.001$).

There was also a delay in the time between result reported by the laboratory and the client receiving treatment. This time point involves 2 steps; result reported by laboratory to result received by clinician, and result received by clinician to client receiving treatment. The time to clinician receipt of results after results had been reported by the laboratory was short; however, it took longer to recall and treat the client with variation by clinic (mean = 15 days [SD = 23]) in the remote clinics, 5 days (SD = 13.5) in the regional clinics and 3 days (SD = 10) in the urban clinic ($P < 0.01$; median = 6 [IQR = 0–20]) versus 1 (IQR = 0–4) and 1 (IQR = 0–3) day, respectively ($P < 0.001$; Fig. 1). The longer mean than median time in this step reflects a subset of people in whom there were much longer delays than most people.

Recall Efforts

Overall, 36% of clients required at least 2 contact attempts. A significantly higher proportion of clients in the remote clinics required 4 contact attempts compared with the regional and urban

Duration of key process steps. Number of days between:		Urban clinic	Regional clinics	Remote clinics	p value*
Overall time between specimen collection and client treatment	Mean (SD)	7.5 (9.7)	12.6 (14.3)	21.6 (23.9)	<0.001
	Median (IQR)	6 (4-8)	7 (8-13)	13 (7-27)	<0.001
Specimen collection and laboratory receipt of specimen	Mean (SD)	0.7 (1.9)	2.5 (2.0)	1.9 (1.5)	<0.001
	Median (IQR)	0 (0-1)	2 (1-3)	2 (1-3)	<0.001
Laboratory receipt of specimen and result reported by laboratory	Mean (SD)	2.7 (2.4)	4.1 (2.3)	4.9 (4.6)	<0.001
	Median (IQR)	2 (1-4)	4 (2-6)	4 (2-6.5)	<0.001
Result reported by laboratory and result received by clinician	Mean (SD)	1.6 (3.6)	1.9 (4.4)	2.6 (7.5)	0.40
	Median (IQR)	1 (1-1)	0 (0-2)	0 (0-1.5)	<0.001
Result received by clinician and client treated	Mean (SD)	2.9 (9.6)	4.8 (13.5)	14.5 (22.6)	<0.01
	Median (IQR)	1 (0-3)	1 (0-4)	6 (0-20)	<0.001



* One way ANOVA used to compare means, and Kruskal Wallis test used to compare medians

Figure 1. Mean and Median times between key processing steps in urban, regional and remote clinics.

clinic (15.2% vs 1.0% vs 6.7%; $P < 0.01$). Contact methods were by phone, SMS (short messaging service/text message), email, letter, or home visit. SMS was used to contact 35% clients at the urban clinics as the first method of contact with 60% contacted through telephone, whereas SMS was used in only 1% clients at both regional and remote clinics as the first method of contact, compared with 80% and 94% by telephone at regional and remote clinics, respectively.

Factors Associated With Delayed Treatment

In bivariate analysis, factors associated with delayed treatment (>7 days) were age <20 years, identifying as Aboriginal and Torres Strait Islander, being asymptomatic when tested, having a concurrent STI, being born overseas, attending a remote or clinic, and living >50 km from clinic (Table 3). A multivariate analysis was not performed due to small individual cell numbers.

DISCUSSION

This study of chlamydia treatment timeliness in urban, regional and remote areas of NSW found nearly all (99%) cases received treatment, and most (88%) cases were treated in ≤14 days. However in remote and regional clinics the mean time-to-treatment was longer and a higher proportion of cases received

TABLE 3. Factors Associated With Timeliness of Treatment (Median Time to Treatment >7 d)

Characteristic	Treated in >7 Days, n (%)	Odds Ratio (95% CI)
Gender		
Female	103 (41.7%)	1.4 (0.9–2.1)
Male	67 (33.8%)	1
Age, y		
≤ 19	46 (63.0%)	3.6 (1.8–6.9)
20–25	78 (38.4%)	1.3 (0.8–2.2)
26–30	19 (22.1%)	0.6 (0.3–1.2)
> 30	27 (32.1%)	1
Indigenous status		
Aboriginal and/or Torres Strait Islander	51 (63.0%)	3.5 (2.1–5.7)
Nonindigenous	119 (32.8%)	1
Sexuality		
Homosexual	29 (33.3%)	0.8 (0.5–1.2)
Heterosexual	141 (39.5%)	1
STI symptoms*		
Yes	23 (26.1%)	0.5 (0.3–0.8)
No	147 (41.2%)	1
Concurrent STIs*		
Yes	33 (50.0%)	1.8 (1.0–3.0)
No	137 (36.1%)	1
Previous history of STIs		
Yes	63 (63%)	0.8 (0.5–1.2)
No	106 (41.1%)	1
Traveler†		
Yes	26 (35.1%)	0.8 (0.5–1.4)
No	142 (39.0%)	1
Country of birth		
Other	72 (29.0%)	0.4 (0.3–0.6)
Australia	98 (49.5%)	1
Current sex worker		
Yes	15 (37.5%)	1.0 (0.5–1.9)
No	154 (38.0%)	1
Clinic attended		
Remote clinics	33 (71.7%)	7.3 (3.6–14.6)
Regional clinics	60 (58.8%)	4.1 (2.6–6.6)
Urban clinics	77 (25.8%)	1
Distance from the clinic		
< 50 km	130 (34.0%)	1
50–100 km	19 (55.9%)	2.4 (1.2–4.8)
> 100 km	16 (64.0%)	3.3 (1.4–7.7)

* Urethral or vaginal discharge, dysuria, abnormal vaginal bleeding, pelvic pain/dyspareunia, testicular pain, rectal symptoms (pain, bleeding, tenesmus, discharge).

† HIV, gonorrhea, syphilis, anogenital warts, *Mycoplasma genitalium, Molluscum contagiosum.*

‡ Client self-identified.

treatment that was delayed by 15 days or more compared to the urban clinic (37% vs 18% vs 4%). The main delays in regional and remote clinics occurred between the laboratory receipt of specimen and reporting of the laboratory result, and during the time taken to recall clients once results were received by the clinician.

In remote clinics, the time taken to recall clients was the greatest cause of delay.

The bivariate analysis showed that the remoteness of the clinic was strongly associated with treatment delay. Other factors associated with treatment delay were being younger, being Aboriginal and Torres Strait Islander, and living >50 km from clinic; however, all these factors were more common among clients attending regional/remote clinics. We were unable to conduct a separate analysis for remote clinics due to insufficient sample size, so it is possible that some of these factors are inter-related.

To reduce the time between the laboratory receipt of specimen and laboratory reporting, there may be a need to reduce laboratory processing times in the regional/remote settings. Other steps which accounted for a small time delay were transport times and provision of results by the laboratory to the clinician. Strategies to reduce transport time could include more regular collection of specimens from the regional/remote services for transport to the central urban laboratory, or the consideration of local molecular point of care testing at the clinic or local laboratory.[20] There is also potential to streamline the process of sending results to clinicians. In response to these study results, results are now being faxed to one of the remote clinics from the local laboratory daily.

The duration from receipt of results by the clinician to client treatment was the greatest delay, longest remote, and regional clinics, The mean estimates showed much greater delays than the median, suggesting there was a subset of people who took significantly longer to return for treatment. This is also reflected in the recall efforts made, with a higher proportion of clients at remote clinics requiring 4 recall attempts. One option is to provide more dedicated clinical time for clinicians to follow-up recalls, and enable them to conduct outreach to deliver treatment to clients if needed. A recent qualitative study in Australia suggested that increased support for healthcare workers in remote locations, such as dedicated clinical time to manage results, could be beneficial.[11] Another option is the use of SMS mobile phone text messaging. SMS was used more commonly at the urban clinics to communicate positive test results and facilitate recall, but rarely used at the regional/remote clinics. Use of SMS to improve timeliness of treatment was used by a regional Australian sexual health clinic with 72% of clients receiving treatment within one day of receiving the message,[21] and in the UK it reduced the mean time-to-treatment from 15 days to 9 days.[22] It is also possible that enabling patients to collect their treatment at a location closer to their home could reduce the time to treatment. After this study concluded a pharmacy opened in one of the remote outreach clinic areas accepting faxed prescriptions from the sexual health clinic. This enables clients to access medication without having to return to the clinic, the main disadvantage being that clients must pay for medication accessed via a private pharmacy. Molecular point of care testing is another option which could be used to reduce the mean time-to-treatment. These tests are currently being trialled in remote primary health services in Australia where there is a very high prevalence of chlamydia and gonorrhea and close to 20% of people with a positive test do not return for treatment.[23,24] The benefits of using molecular point of care testing in regional/remote areas of NSW where there are delays in treatment but high uptake of treatment overall would need further investigation.

This study has some limitations. First, we did not collect data on clinical outcomes in the cases studied, which limits our ability to interpret the impact of delayed treatment. Second, the earliest case included from the urban clinic was 2012 compared to 2008 from the non-urban clinics, which could have introduced selection bias. However, the mean time-to-treatment was similar before and after 2012 and there was no major policy or structural changes over the study period. Finally, the study only included 5 clinics in regional/remote areas so the results may not be generalizable to all other clinics in regional/remote locations, it would depend on their patient population and local protocols. In Australia, three other independent studies in remote locations, across four states, have however reported similar delays.[9,10,25] Also, in a recent qualitative study, clinical staff at remote health services confirmed the main delays were receiving the result and recalling patients.[11]

In conclusion, this study found a significant discrepancy in the timeliness of chlamydia treatment by geographical remoteness in Australia. Treatment delay was greatest at regional and remote

clinics and was most marked at the stages requiring laboratory processing and recall of clients, with a third of clients at remote clinics treated after 2 weeks and many recall efforts made. Delays in treatment can lead to clinical complications and onwards transmission, and a difference in treatment times between clinics within the same state represents an unacceptable inequity. Strategies to reduce delays in the current pathway should be explored and focus on faster specimen processing and more timely treatment once the positive result is received such as dedicated clinical time for recalls, use of SMS, more accessible treatment, and point-of-care testing.

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