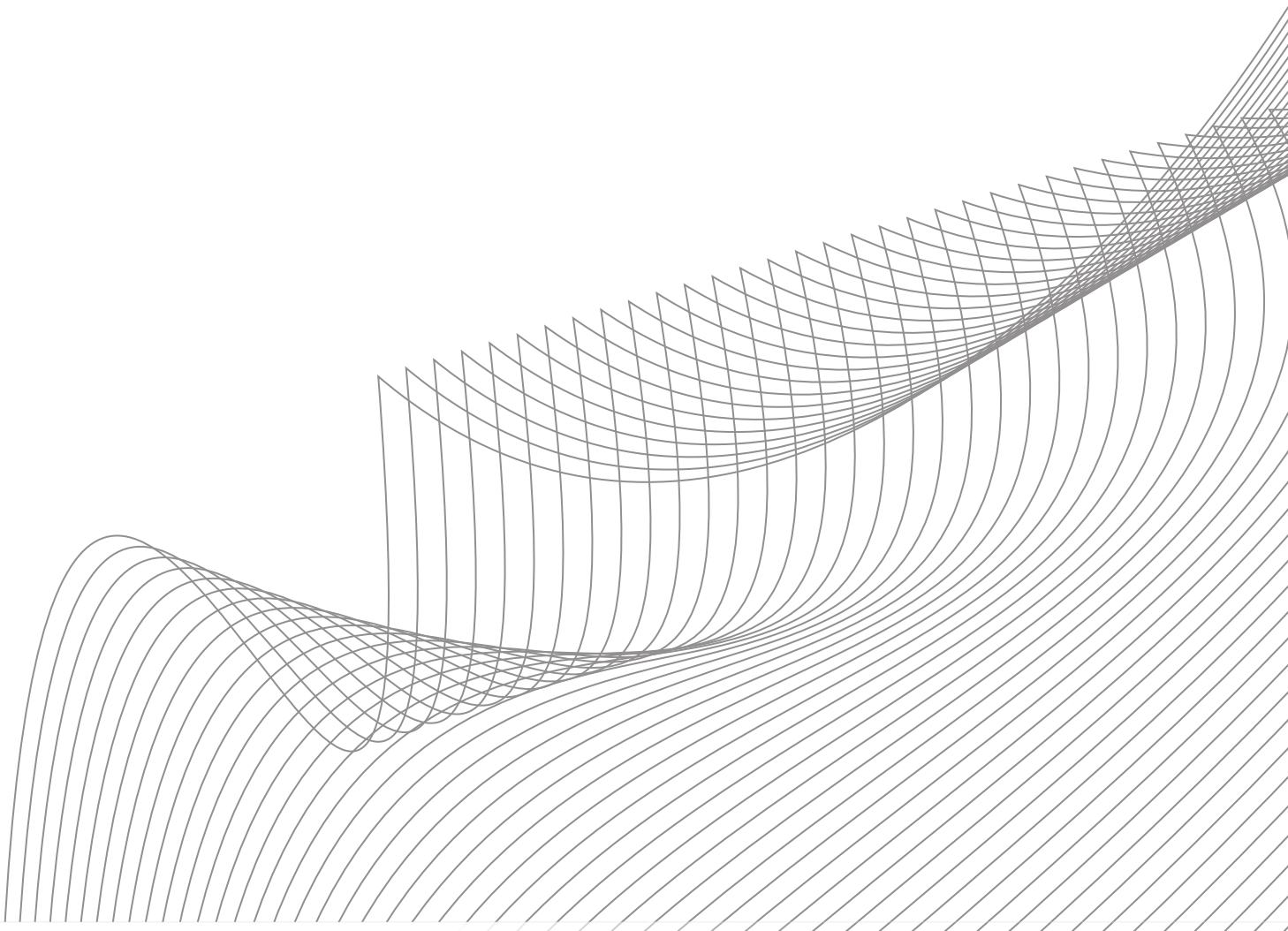
Australian Government
Department of Health and Aged Care

2023 · Volume 47

Communicable Diseases Intelligence

Epidemiology of syphilis in the Nepean and Blue Mountains Local Health District between 1 October 2009 and 30 September 2019

Sheena R Kakar, George Truman, Jane Thomas, Eva YH Jackson, Bradley L Forssman



https://doi.org/10.33321/cdi.2023.47.17
Electronic publication date: 23/3/2023
http://health.gov.au/cdi

Communicable Diseases Intelligence
ISSN: 2209-6051 Online

This journal is indexed by Index Medicus and Medline.

Communicable Diseases Network Australia
Communicable Diseases Intelligence contributes to the work of the Communicable Diseases Network Australia.
http://www.health.gov.au/cdna

Communicable Diseases Intelligence (CDI) is a peer-reviewed scientific journal published by the Office of Health Protection, Department of Health and Aged Care. The journal aims to disseminate information on the epidemiology, surveillance, prevention and control of communicable diseases of relevance to Australia.

Website
http://www.health.gov.au/cdi

Contacts
CDI is produced by the Office of Health Protection, Australian Government Department of Health and Aged Care, GPO Box 9848, (MDP 6) CANBERRA ACT 2601

Email:
cdi.editor@health.gov.au

Submit an Article
You are invited to submit your next communicable disease related article to the Communicable Diseases Intelligence (CDI) for consideration. More information regarding CDI can be found at: http://health.gov.au/cdi.

Further enquiries should be directed to:

cdi.editor@health.gov.au.

Original article

Epidemiology of syphilis in the Nepean and Blue Mountains Local Health District between 1 October 2009 and 30 September 2019

Sheena R Kakar, George Truman, Jane Thomas, Eva YH Jackson, Bradley L Forssman

Abstract

Background

Syphilis is a nationally notifiable sexually transmitted infection (STI). Rates of syphilis notifications have been on the increase in Australia. Given these increases, we wanted to study the epidemiological trends of syphilis notifications in the Nepean Blue Mountain Local Health District (NBMLHD) over a ten-year period across different healthcare settings.

Methods

All syphilis notifications in residents in the NBMLHD in the ten-year period between 1 October 2009 and 30 September 2019 were included in the study. Separate analyses were performed for all syphilis notifications, as well as for infectious syphilis and for syphilis acquired > 2 years ago or of unknown duration. We described age distribution and demographic profile and risk factors of all syphilis notifications. Notification trends were studied and crude incidence rates were calculated. Notifications were stratified by stage of syphilis, sex, and geographical location.

Results

In the study duration, a total of 342 notifications of syphilis were received. Of these, 187 were infectious syphilis and 155 were related to infections acquired > 2 years ago and/or of unknown duration. The majority of notifications were in men: 281 (82%). Overall, syphilis notifications increased over the ten-year study period. The crude incidence rates for infectious syphilis were significantly higher in the second five-year period overall (7.78/100,000 population per year compared to 5.28/100,000 population per year; incidence rate ratio (IRR): 1.47; 95% confidence interval (95% CI): 1.10–1.97; $p < 0.01$), as well as for males (14.44/100,000 population per year compared to 9.7/100,000 population per year; IRR: 1.49; 95% CI: 1.09–2.03; $p < 0.01$). There were significant increases in syphilis notifications in males < 35 years of age, from 39 such notifications in the first five-year period (27.5% of all syphilis notifications in this period) to 83 notifications in the second five-year period (42.1% of all notifications in this period), $p < 0.05$.

Conclusion

In keeping with national trends, notifications in our study increased. Significant increases were noted in notifications among males under 35 years of age. This supports the continued investment in sexual health promotion activities aimed at young sexually active men. Expansion of screening activities to include women and older people would help detect any increase in cases in these groups.

Increase in engagement with general practitioners will support them to provide opportunistic STI screens to sexually-active attendees. National screening recommendations remain applicable to this population.

Keywords: Syphilis; sexually transmitted infections; men who have sex with men; MSM; sexual health

Introduction

Syphilis is a nationally notifiable sexually transmitted infection (STI). It is an infection of public health significance; if not treated in a timely manner, it can cause morbidity including cardiovascular and neurologic sequelae and gummatous involvement of any organ system. It can also be transmitted from mother to foetus in utero, causing congenital syphilis with devastating impacts on the baby. In Australia in 2018, there were 5,078 infectious syphilis notifications, up from 2,063 in 2014, an increase of 146%. Similarly, the infectious syphilis notification rate increased from 9/100,000 population per year in 2014 to 20.8/100,000 population per year in 2018, an increase of 131%. In 2018, there were 4,330 infectious syphilis notifications among males and 725 among females, suggesting transmission is predominantly due to maletomale sexual contact. However, between 2014 and 2018, there has been an increase in notifications among women of over 300% (from 165 to 725 notifications), suggesting increasing heterosexual transmission.[1]

The rate of notification of infectious syphilis in the Aboriginal and Torres Strait Islander population is considerably higher than that in the non-Indigenous population (101.2 per 100,000 population per year and 18 per 100,000 population per year, respectively, in 2017). Further, there has been an ongoing increase in syphilis notification among the Aboriginal and Torres Strait Islander population in regional and remote communities, related to a recognised outbreak starting in Western Australia and then spreading to the Northern Territory, Queensland and South Australia.[1]

Nepean and Blue Mountains Local Health District (NBMLHD) has a unique geographical reach, including both urban and semi-rural areas. It is different to the other metropolitan New South Wales (NSW) health districts which have a purely urban population. According to the *Socio-Economic Indexes for Area (SEIFA) 2006, Index of Socio-economic Disadvantage*,[i] NBMLHD has Local Government Areas (LGAs) at both ends of the spectrum, with Lithgow at the lower end (scoring 937) and Blue Mountains (1,051), Hawkesbury (1,033) and Penrith (1,006) at the higher end with relative advantage.[2] In keeping with other STIs, syphilis has well-established socioeconomic and geographical links, with high rates in areas of disadvantage and remoteness. These trends have been seen internationally[3,4] as well as elsewhere in Australia.[5]

The study aimed to analyse the epidemiological trends of syphilis notifications in the NBMLHD over a 10 year period, from 1 October 2009 to 30 September 2019, across different healthcare settings. In particular, we wanted to assess if the epidemiological trends were different in NMBLHD compared to national data, given the population it serves has varying geographical and demographic characteristics. The study was approved by the NBMLHD Human Research Ethics Committee (HREC) in January 2020.

Methods

Routinely, notifications of positive syphilis serology and positive nucleic acid amplification tests on swabs are reported by pathology laboratories to public health authorities as per the current *Public Health Act 2010*.[6] These notifications are received from testing laboratories by tvhe NBM Public Health Unit (PHU) both in hard copy and electronically. The PHU then follows up on these notifications by seeking information via a surveillance form from the

i See https://www.abs.gov.au/ausstats/abs@.nsf/mf/2039.0.

treating physicians. This a standard form that is used across all districts in NSW. Information collected included demographic detail, risk factors, clinical information, treatment and contact tracing. If the diagnosing physician is a general practitioner (GP), this is usually followed up by a phone call from the NBMLHD sexual health medical officer to assist the physician in management and contact tracing. Managing physicians complete the routine surveillance form and return it to the PHU. This surveillance information is entered into a secure web based database (Notifiable Conditions Information Management System, NCIMS).

For the purposes of the study, notifications in the district were retrieved from NCIMS. All syphilis notifications in residents in the NBMLHD in the ten-year period between 1 October 2009 and 30 September 2019 were included in the study. Data were de-identified. We determined the age distribution, the demographic profile and the distribution of risk factors for all syphilis notifications between 1 October 2009 and 30 September 2019. The notifications were also classified into infectious syphilis (likely acquired in the previous two years) and syphilis acquired greater than 2 years ago and/or of unknown duration, based on clinical information and likelihood of duration from acquisition. Primary, secondary and early latent syphilis were included in infectious syphilis while tertiary syphilis and late latent syphilis were included in syphilis acquired greater than 2 years ago and/or unknown duration.

To get a visual assessment of the notification trends, we presented them in a graph using MS Excel. To study the changes in notifications that occurred over the ten-year study period, notifications were divided into the first five-year period (1 October 2009 – 30 September 2014) and the second five-year period (1 October 2014 – 30 September 2019). Separate analyses were performed for all syphilis, infectious syphilis and syphilis acquired > 2 years ago or of unknown duration. Two-by-two Chi-square tests with Yates corrections were calculated for comparing each five-year period and other characteristics such as sex, age and geographical area (where appropriate). To further explore notification trends, comparisons were made between the crude incidence rates in the first and second five-year period in the duration of interest. Crude incidence rates were calculated using the 2011 census counts of person usual place of residence for the first five-year period and the 2016 census counts of person usual place of residence for the second five year period.

Results

Between 1 October 2009 and 30 September 2019, a total of 342 notifications of syphilis were received. Demographic characteristics of these notifications are presented in Table 1. Of these notifications, 187 (54.7%) were new infections/infectious syphilis and 155 (45.3%) were related to infections acquired > 2 years ago and/or of unknown duration. The majority of notifications (281; 82%) were in men. Of the 235 notifications for which this information was available, a large number (109; 46.4%) were diagnosed in sexual health clinics, followed by general practice (95; 40.4%), with a smaller proportion diagnosed in other settings including hospitals and other specialists (31; 13.2%). Risk history was not available for all notifications but where noted, 18 notifications (5.3%) were current users of human immunodeficiency virus (HIV) pre-exposure prophylaxis (PrEP), six cases (1.8%) identified as sex workers and 86 (35.2%) were born overseas. Notifications were stratified based on LGA of residence, with Penrith LGA having the largest number of notifications (217; 63.5%) followed by Blue Mountains (59; 17.3%).

Annual notifications of syphilis by stage and sex in NBMLHD for 2010 to 2019 are shown in Figure 1. Overall, syphilis notifications increased over the 10 year study period, with larger increases seen in infectious syphilis. In that 10 year period, notifications for infectious syphilis in males increased from about 10 to about 35 per year. Additionally, notifications of syphilis acquired > 2 years ago or of unknown duration in males increased from about 5 to about 15 per year.

Table 1: Demographic characteristics of syphilis notifications in the Nepean and Blue Mountains Local Health District, Australia, 1 October 2009 to 30 September 2019

		Number of notifications received		
Category	**Characteristic**	**Infectious syphilis (187; 54.7%)**	**Syphilis of > 2 years / unknown duration (155; 45.3%)**	**Total (342)**
Age group	15–34 years	85	37	122
	> 35 years	102	88	220
Sex	Male	170	111	281
	Female	17	43	60
	Transgender	0	1	1
Country of birth	Australia	74	40	114
	Overseas: English-speaking countries[a]	11	13	24
	Overseas: other countries	17	21	38
	Missing	85	81	166
LGA[b] of residence	Penrith	117	100	217
	Blue Mountains	33	26	59
	Hawkesbury	27	19	46
	Lithgow	9	8	17
	Missing	1	2	3
Site of testing	Sexual health clinic	82	27	109
	General practice	61	39	100
	Other specialists	12	12	24
	Missing	77	32	109
PrEP[c]	Yes	16	2	18
	No	57	31	88
	Missing	114	122	236
Sex work		3	3	6

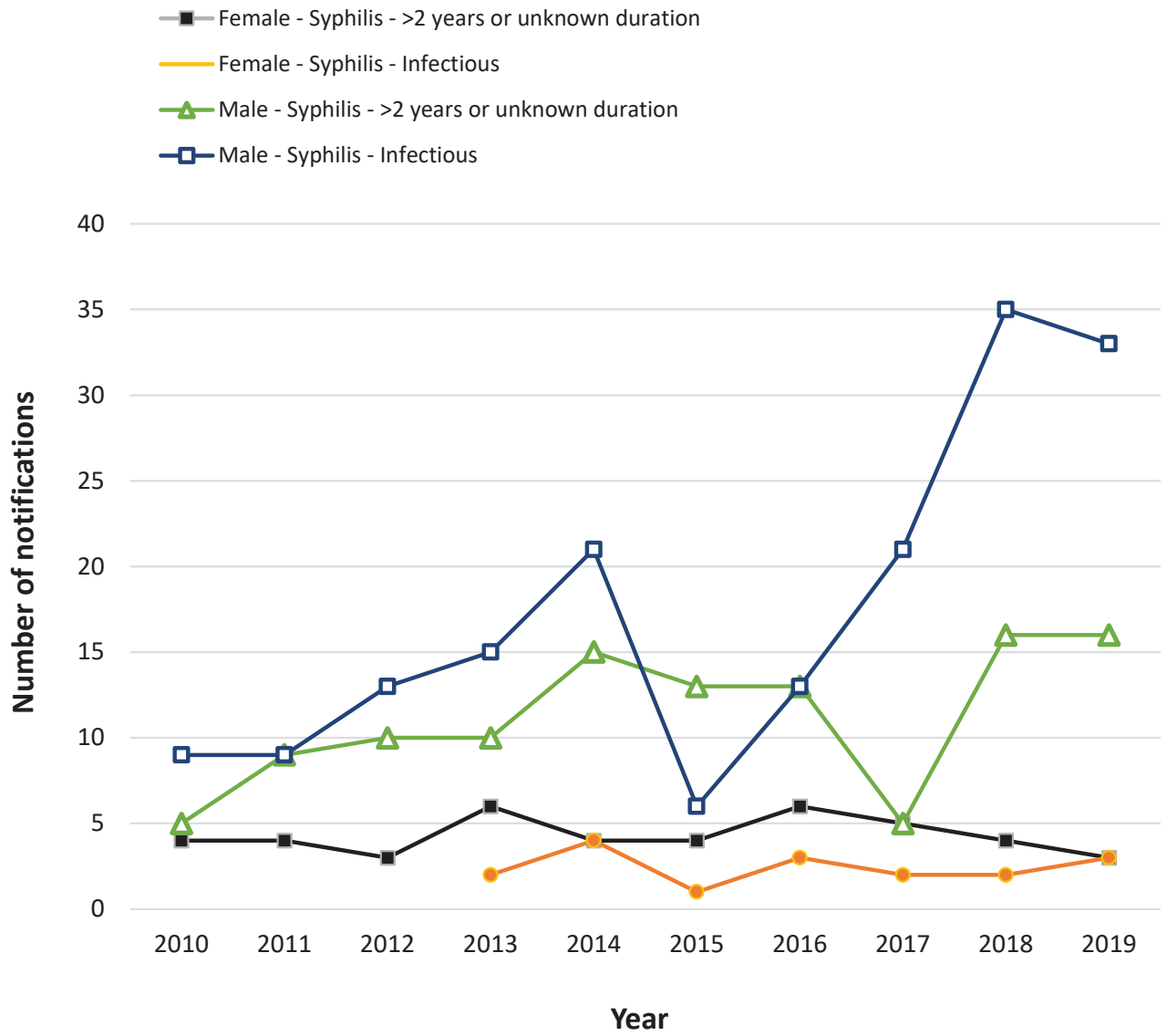
a Category includes Canada, New Zealand, United Kingdom and United States of America.

b Local Government Area.

c Pre-exposure prophylaxis.

The crude incidence rates were significantly higher for infectious syphilis in the second five-year period overall, 7.78/100,000 population per year compared to 5.28/100,000 population per year in the first five-year period, with an incidence rate ratio (IRR) of 1.47 and a 95% confidence interval (95% CI) of 1.10–1.97 ($p < 0.01$), as well as for men, 14.44/100,000 population per year in the second five-year period compared to 9.7/100,000 population per year in the first five-year period (IRR: 1.49; 95% CI: 1.09–2.03; $p < 0.01$). The crude incidence rate of infectious syphilis was higher in the second five-year period for women (1.34/100,000 population per year compared to 0.99/100,000 population per year across the first five-year period), though this was not statistically significant. These results are shown in Table 2.

Figure 1: Annual notifications of infectious syphilis and syphilis acquired > 2 years or of unknown duration for males and females in NBMLHD, 2010 to 2019.



Overall, for notifications of all syphilis, there were significant increases in males < 35 years of age, with case increasing from 39 (27.5% of all syphilis notifications) in the first five-year period to 83 (42.1% of all syphilis notifications) in the second five-year period, $p < 0.05$. Also, for all syphilis notifications, there was a statistically significant increase in the percentage of cases from Penrith LGA, from 83 (58.5%) in the first five-year period to 134 (67%) in the second five-year period, $p < 0.05$. Infectious syphilis notifications also increased from 25 (34.2%) in the first five-year period to 60 (52.6%) in the second five-year period, $p < 0.05$. The numbers of notifications also increased in women across both the categories of 'all syphilis' and 'infectious syphilis', though these increases were not statistically significant. Table 3 presents this information.

Discussion

This study is the only published comprehensive epidemiological assessment of syphilis notifications in the greater Western Sydney region to date. We found that all syphilis notifications had increased in the ten-year study period. Crude incidence rates of infectious syphilis had increased significantly in the second half of the study period overall and in men. Increases in all syphilis notifications were likely driven by increases in men < 35 years of age and amongst

Table 2: Crude incidence rates (number of cases per 100,000 people per year) and rate ratios for each 5 year period by staging of syphilis and sex

Condition	Sex[a]	Incidence rate			p value[c,d]
		First period 1 Oct 2009 – 30 Sep 2014	Second period 1 Oct 2014 – 30 Sep 2019	RR (95% CI)[b]	
Syphilis of >2 years or unknown duration	Male	7.05	8.74	1.24 (0.85–1.80)	NS
	Female	3.00	2.95	0.98 (0.54–1.79)	NS
	All	5.00	5.87	1.17 (0.86–1.61)	NS
Infectious syphilis	Male	9.70	14.44	1.49 (1.09–2.03)	< 0.01
	Female	0.99	1.34	1.34 (0.51–3.53)	NS
	All	5.28	7.78	1.47 (1.10–1.97)	< 0.01

a Sex of one person was transgender and omitted from sex analyses, but included in all.

b RR: rate ratio calculated as second period rate/ first period rate; CI: confidence interval.

c Fisher's exact text.

d NS: not significant.

people residing in Penrith LGA. Men aged < 35 years also had significant increases in infectious syphilis notifications in the second half of the study period.

Notifications of syphilis increased in men, particularly those under 35 years of age. It is likely that this transmission is predominantly accounted for by maletomale sexual contact, in keeping with national trends.[1] The increased uptake of HIV PrEP may have had a part to play in this increase in notifications, though we were unable to show association in our study. While we found a small proportion of people (18; 5.3%) reported using PrEP, a majority of notifications (236; 67.3%) lacked any PrEP-related data. However, it is important to note that this field was only added in 2018 in the surveillance form. Since 1 April 2018, PrEP has been available on the Pharmaceutical Benefits Scheme (PBS). Prior to this it was only available via private script or in clinical trials. There is evidence of behaviour change following uptake of PrEP, such as an increase in number of sexual partners and decrease in condom use.[7–9] Further, amongst PrEP users in Australia, STI notification had increased compared to rates in the group in the pre-enrolment period.[9] Other research suggests that rates of STIs in similar subgroups of PrEP users were on an upward trend before PrEP was introduced and that this trend has continued.[10] The increase in local notifications in men is likely to be partly explained by the expanding uptake of PrEP; the existing upward trajectory prior to theintroduction of PrEP is also in keeping with current evidence. Overall, in our district, more detailed socio-demographic and behavioural predictors are needed to draw appropriate conclusions about these trends.

The increase in number of notifications in females is also noteworthy, despite lacking statistical significance. Similar pattern of increase has been observed in female notifications nationally, suggesting heterosexual spread, and is accompanied by the risk of congenital syphilis.[11] Of note, there were no congenital syphilis notifications in our district in the period of interest and only one female reported pregnancy (with syphilis of unknown duration). In comparison, nationally from 2009 to 2018 there were 46 cases of congenital syphilis notified in Australia with eight cases notified in 2018.[1] Special emphasis needs to be given to pregnant women and rescreening in pregnancy closer to term.[12,13] Locally in the NBMLHD, we have developed closer ties between the sexual health

Table 3: Comparison between numbers of notifications in the first and second five-year periods of the study interval, in relation to sex, age and geographical area

		First five-year period 1 Oct 2009 – 30 Sep 2014		Second five-year period 1 Oct 2014 – 30 Sep 2019		χ^{2} [a]	p value[b]
		n	%	n	%		
All syphilis notifications							
Condition	Syphilis of unknown duration	69	48.6	86	43.0	0.83	NS
	Infectious syphilis	73	51.4	114	57.0		
Sex[c]	Female	28	19.7	32	16.1	0.53	NS
	Male	114	80.3	167	83.9		
Age group	15-34 years	39	27.5	83	42.1	7.13	< 0.05
	≥ 35 years	103	72.5	114	57.9		
Geographical area	Penrith LGA	83	58.5	134	67.0	2.16	< 0.05
	Remainder of NBMLHD	59	41.5	66	33.0		
Infectious syphilis							
Sex[c]	Female	7	9.6	10	8.8	0.005	NS
	Male	66	90.4	104	91.2		
Age group	15-34 years	25	34.2	60	52.6	5.35	< 0.05
	≥ 35 years	48	65.8	54	47.4		
Geographical area	Penrith LGA	45	61.6	72	63.2	0.003	NS
	Remainder of NBMLHD	28	38.4	42	36.8		
Infectious syphilis in men							
Age group	15-34 years	25	37.9	53	51.0	2.28	NS
	≥ 35 years	41	62.1	51	49.0		
Geographical area	Penrith LGA	40	60.6	63	60.6	0.02	NS
	Remainder of NBMLHD	26	39.4	41	39.4		

a Degrees of freedom for all tests = 1.

b NS: not significant.

c Sex of one person was transgender and omitted from sex analyses.

clinic and the PHU to identify notifications in women of reproductive age and to ensure rapid access to clinical services. Development of national and state guidelines would assist in early linkage into appropriate management. Studies indicate that STI rates in older women are also on the increase, even as the burden of disease remains higher in the younger population.[14] This remains an important consideration for screening in the older age group.

Across the district, the largest increases in notification were found in Penrith LGA, with the limitation that this refers to postcode of residence and may not be indicative of where the infection was acquired. Penrith is home to 196,066 people. It is a relatively young district with a median age of 34 years. Its diversity is similar to Australia on the whole, with 68% of the population born in Australia. This proportion is comparable to the Australian population data at 66.7%.[15] Our study was

conducted between 2009 and 2019, with very similar findings to nationally-collected data in a similar period (2009-2018). This does suggest that syphilis notifications in this region follow national epidemiological trends, despite the variations in demographics across NBMLHD. Thus, national screening recommendations remain applicable to this population.

A large number of notifications were from sexual health clinics, followed closely by general practitioners. It is widely recognised that GPs play a key role in screening and managing STIs across Australia and they are likely to see more asymptomatic attendees.[16] On the other hand, sexual health clinics are anecdotally more likely to see more symptomatic people and are mandated to care for high-risk population groups. A larger number of people attend GP clinics compared to the sexual health services and increased opportunistic testing is likely to detect asymptomatic syphilis. This highlights an area for intervention to increase testing and sustain the screening efforts and therefore to assist in diagnosis of syphilis and other STIs via general practice.

The study validity is limited by data incompleteness, which was encountered in several fields. As these fields are reliant on clinician notifications, working with local Primary Health Networks to increase awareness of the purpose of these notifications may help to improve completion rates. Indigenous status was not presented or analysed on account on very small numbers.

This research can be extended by reviewing notifications of syphilis in 2020 and 2021, years that had coronavirus disease 2019 (COVID-19)-related lockdowns. Research in Melbourne suggests that people continued to seek healthcare when symptomatic, but the impact of COVID-19 on asymptomatic screening has not been quantified.[17] Recent surveys indicate that while self-reported sexual activity in the lockdown periods slowed, it did not completely stop,[18] highlighting the importance of encouraging populations back into screening routines. Reviewing syphilis notification data in the years with lockdowns and the subsequent years will help ascertain if the transmission of syphilis has slowed or increased and to what extent.

Conclusion

This improved understanding of syphilis epidemiology in our district will help inform sexual health promotion strategies locally but also across NSW. While men who have sex with men are frequently described as at higher risk of syphilis (and other STIs) in NSW, our data suggests that notifications in females were also on the increase, therefore this population should also have tailored health promotion messaging. The study supports the continued investment in sexual health promotion activities aimed at young sexually active males. The expansion of traditional risk groups to include women and older people would help detect any increase in cases in these groups. Finally, it is recommended that sexual health clinics and public health units increase local engagement with GPs and primary health networks. Supporting primary health care providers in offering STI screens to their sexually active populations will help reach people who may be less likely to visit a sexual health clinic. This is particularly relevant in the current post-COVID-19 context, with the reopening of society and potentially increased sexual activity.

Author details

Dr Sheena R Kakar[1,2]

Mr George Truman[2]

Ms Jane Thomas[2]

Dr Eva YH Jackson[1]

Associate Professor Bradley L Forssman[1]

1. Nepean and Nepean and Blue Mountains Sexual Health and HIV Service, Nepean and Blue Mountains Local Health District

2. Nepean and Blue Mountains Public Health Unit, Nepean and Blue Mountains Local Health District

Corresponding author

Dr Sheena R Kakar

Nepean and Blue Mountains Sexual Health and HIV Service, Court Building, Derby St, Kingswood NSW 2747

Phone: 47342057

Email: Sheena.Kakar@health.nsw.gov.au

References

1. Kirby Institute. *HIV, viral hepatitis and sexually transmissible infections in Australia. Annual surveillance report 2018*. Sydney: University of New South Wales, Kirby Institute; 2018. Available from: https://kirby.unsw.edu.au/sites/default/files/kirby/report/KI_Annual-Surveillance-Report-2018.pdf.

2. New South Wales Government Department of Health (NSW Health), Nepean Blue Mountains Local Health District (NBMLHD). Our Region. [Internet.] Sydney: NSW Health, NBMLHD; 27 April 2022. [Accessed on 25 July 2022.] Available from: https://www.nbmlhd.health.nsw.gov.au/about-us/about-our-region.

3. Kimball AA, Torrone EA, Bernstein KT, Grey JA, Bowen VB, Rickless DS et al. Predicting emergence of primary and secondary syphilis among women of reproductive age in US counties. *Sex Transm Dis*. 2021;49(3):177–183. doi: https://doi.org/10.1097/OLQ.0000000000001573.

4. Johnson KA, Snyder RE, Tang EC, de Guzman NS, Plotzker RE, Murphy R et al. Geospatial social determinants of health correlate with disparities in syphilis and congenital syphilis cases in California. *Pathogens*. 2022;11(5):547. doi: https://doi.org/10.3390/pathogens11050547.

5. Aung E, Chen M, Fairley C, Higgins N, Williamson D, Tomnay J et al. Spatial and temporal epidemiology of infectious syphilis in Victoria, Australia, 2015–2018. *Sex Transm Dis*. 2021;48(12):e178–82. doi: https://doi.org/10.1097/OLQ.0000000000001438.

6. New South Wales Register of Legislation. *Public Health Act 2010 No 127*. [Legislation.] Sydney: Government of New South Wales; 4 October 2022. [Accessed on 13 January 2023.] Available from: https://legislation.nsw.gov.au/view/html/inforce/current/act-2010-127#sec.81.

7. Oldenburg CE, Nunn AS, Montgomery M, Almonte A, Mena L, Patel RR et al. Behavioral changes following uptake of HIV pre-exposure prophylaxis among men who have sex with men in a clinical setting. *AIDS Behav*. 2017;22(4):1075-1079. doi: https://doi.org/10.1007/s10461-017-1701-1.

8. Prestage G, Maher L, Grulich A, Bourne A, Hammoud M, Vaccher S et al. Brief report: changes in behavior after PrEP initiation among Australian gay and bisexual men. *J Acquir Immune Defic Syndr*. 2019;81(1):52–6. doi: https://doi.org/10.1097/QAI.0000000000001976.

9. Traeger MW, Cornelisse VJ, Asselin J, Price B, Roth NJ, Willcox J et al. Association of HIV preexposure prophylaxis with incidence of sexually transmitted infections among individuals at high risk of HIV infection. *JAMA*. 2019;321(14):1380–90. doi: https://doi.org/10.1001/jama.2019.2947.

10. McManus H, Grulich AE, Amin J, Selvey C, Vickers T, Bavinton B et al. Comparison of trends in rates of sexually transmitted infections before vs after initiation of HIV preexposure prophylaxis among men who have sex with men. *JAMA Netw Open*. 2020;3(12):e2030806. doi: https://doi.org/10.1001/jamanetworkopen.2020.30806.

11. Gomez GB, Kamb ML, Newman LM, Mark J, Broutet N, Hawkes SJ. Untreated maternal syphilis and adverse outcomes of pregnancy: a systematic review and meta-analysis. *Bull World Health Organ*. 2013;91(3):217–26. doi: https://doi.org/10.2471/BLT.12.107623.

12. Shahrook S, Mori R, Ochirbat T, Gomi H. Strategies of testing for syphilis during pregnancy. *Cochrane Database Syst Rev*. 2014;(10):CD010385. doi: https://doi.org/10.1002/14651858.CD010385.pub2.

13. Albright CM, Emerson JB, Werner EF, Hughes BL. Third-trimester prenatal syphilis screening: a cost-effectiveness analysis. *Obstet Gynecol*. 2015;126(3):479–85. doi: https://doi.org/10.1097/AOG.0000000000000997.

14. Bourchier L, Malta S, Temple-Smith M, Hocking J. Do we need to worry about sexually transmissible infections (STIs) in older women in Australia? An investigation of STI trends between 2000 and 2018. *Sex Health*. 2020;17(6):517–24. doi: https://doi.org/10.1071/SH20130.

15. Australian Bureau of Statistics (ABS). Penrith (C). 2016 Census All persons QuickStats. [Webpage.] Canberra: ABS. [Accessed on 15 July 2022.] Available from: https://www.abs.gov.au/census/find-census-data/quickstats/2016/LGA16350.

16. Santella AJ, Pollack A, Harrison C, Sawleshwarkar SN, Britt HC, Hillman RJ. Management rates of sexually transmissible infections by Australian general practitioners, 2000–2012. *Sex Health*. 2014;11(1):52–7. doi: https://doi.org/10.1071/SH13179.

17. Gilbert M, Chang HJ, Ablona A, Salway T, Ogilvie GS, Wong J et al. Accessing needed sexual health services during the COVID-19 pandemic in British Columbia, Canada: a survey of sexual health service clients. *Sex Transm Infect*. 2022;98(5):360–5. doi: https://doi.org/10.1136/sextrans-2021-055013.

18. Coombe J, Kong FYS, Bittleston H, Williams H, Tomnay J, Vaisey A et al. Love during lockdown: findings from an online survey examining the impact of COVID-19 on the sexual health of people living in Australia. *Sex Transm Infect*. 2020;97(5):357–62. doi: https://doi.org/10.1136/sextrans-2020-054688.