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Australian Gonococcal Surveillance Programme Annual Report, 2024

Monica M Lahra, Siobhan M Hurley, Sebastiaan J van Hal and Tiffany R Hogan for the National Neisseria Network, Australia

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GPO Box 9848, Canberra ACT 2601

Website: **cdc.gov.au/cdi**

Email: **cdi.editor@health.gov.au**

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Abstract

The Australian Gonococcal Surveillance Programme (AGSP) has continuously monitored antimicrobial resistance in *Neisseria gonorrhoeae* (NG) for more than 40 years through the system of jurisdictional Neisseria reference laboratories, the National Neisseria Network (NNN). In 2024, a total of 10,702 isolates across Australia, from public and private sectors, were tested for *in vitro* antimicrobial susceptibility by standardised methods. In 2024, the AGSP captured antimicrobial susceptibility data for 24.0% of all gonococcal infection notifications nationally. The current treatment recommendation for gonorrhoea, for the majority of Australia, continues to be dual therapy with ceftriaxone and azithromycin.

In 2024, of NG isolates tested, 0.51% (55/10,702) met the World Health Organization (WHO) criterion for decreased susceptibility (DS) to ceftriaxone, defined as a minimum inhibitory concentration (MIC) ≥ 0.125 mg/L. This proportion of isolates meeting the ceftriaxone DS criterion was more than double that reported in 2023 (0.22%), with the majority from New South Wales and Victoria. Genomic analysis indicated that 76.4% of these isolates (42/55) possessed the mosaic *penA 60.001* allele, the key target associated with ceftriaxone resistance.

Resistance to azithromycin was reported in 4.6% of NG isolates nationally, proportionally stable since 2019. Of these, 0.43% (46/10,702) exhibited high-level resistance to azithromycin (MIC value ≥ 256 mg/L), with cases reported across Australia, predominantly in New South Wales and Victoria.

There were nine isolates in 2024 that had an extensively drug-resistant (XDR) phenotype: i.e., displaying both high-level resistance to azithromycin and decreased susceptibility to ceftriaxone (MIC ≥ 0.125 mg/L). When added to the five XDR isolates reported during 2022–2023, this brings the total to 14 XDR NG isolates reported in Australia since 2022. Genomic analyses of the nine XDR isolates reported in 2024 indicated the presence of the mosaic *penA 60.001* allele and identified the isolates as belonging to sequence type (ST) 16406, consistent with recent reports from Europe, England and Southeast Asia of an increase in detection since 2022. Travel information, where available, indicates most were associated with travel or contact in the Asia-Pacific region.

In 2024, penicillin resistance was found in 30.8% of gonococcal isolates, and ciprofloxacin resistance in 57.5% of isolates where tested, although there was variation by jurisdiction particularly in remote settings, where acquisition of cultures for antimicrobial susceptibility testing is low.

Tetracycline resistance has been reported in the AGSP in recent years, coincident with increasing use of doxycycline post-exposure prophylaxis for syphilis and chlamydia. Nationally 35.2% of NG isolates in 2024 were tetracycline resistant, with variation by jurisdiction. No isolates were resistant to spectinomycin; data for gentamicin, whilst no breakpoints are defined, are reported by the AGSP as these data are reportable to the WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS). The emergence of antimicrobial resistant NG in Australia has largely occurred through importation, spread and local transmission. In 2024, in Australia and overseas, increased detection of drug-resistant NG isolates is of significant concern as the threat for the future of the current recommended therapeutic agents is increasingly evident, and no ideal alternate therapeutic agent has been identified. Disease prevention strategies under investigation for the future include the MenB-4C vaccine, designed to protect against meningococcal disease but shown to be moderately effective against gonorrhoea in various populations, although the duration of protection is uncertain. The AGSP continues to monitor antimicrobial resistance and to identify emerging resistant clones by enhanced surveillance approaches, to inform strategies for disease management and treatment of gonorrhoea in Australia.

Keywords: antimicrobial resistance; disease surveillance; gonococcal infection; *Neisseria gonorrhoeae*

Introduction

The National Neisseria Network (NNN) was established in the late 1970s and comprises jurisdictional *Neisseria* reference laboratories across Australia. The NNN laboratories provide reference-level services for the pathogenic *Neisseria* species: *N. gonorrhoeae* (NG) and *N. meningitidis*. The Australian Gonococcal Surveillance Programme (AGSP) is a key activity of the NNN and has been operational for more than 40 years.[1] Over these decades, the AGSP has reported the emergence of resistance to all antibiotics used in the treatment of gonorrhoea. In 2017, the first evidence of sustained spread of multi-drug-resistant gonorrhoea was reported,[2] followed in 2018 by coincident reports from Australia and the United Kingdom of the first extensively-drug-resistant (XDR) NG isolates.[3–5] The emergence of NG antimicrobial resistance (AMR) in Australia has largely occurred following introduction of multi-resistant strains from overseas.[5,6] The importation and spread of antimicrobial resistant strains remains an ongoing concern for disease control strategies, and is a focus of the work of the NNN.

Since the introduction of dual therapy for gonorrhoea in 2014, the background rate of NG isolates with decreased susceptibility (DS) to ceftriaxone (minimum inhibitory concentration (MIC) value ≥ 0.125 mg/L) has remained low, ranging from 0.03% to 0.51%.[7] Continuous AMR surveillance remains imperative to detect the emergence and spread of resistant strains, threatening empirical therapeutic regimens.[6,8] The increased proportion of gonococcal isolates resistant to azithromycin in recent years has also heightened concerns about future treatment strategies, and remains an important focus of ongoing surveillance.

Notification rates of gonococcal infections in Australia increased by 127% between 2014 and 2023 (from 67.9 to 153.9 per 100,000 population per year). There was a temporal decrease between 2019 and 2022, coincident with the coronavirus disease 2019 (COVID-19) restrictions in 2019 to 2021.[9] In 2024, the notifications increased by 10.4% (163.8 per 100,000 population per year).[10] In 2023, gonococcal disease rates were significantly higher in the Aboriginal and Torres Strait Islander population (541.0 per 100,000 population per year), approximately four times the rate observed in the non-Indigenous population (134.9 per 100,000 population per year). The highest rates were reported in remote and very remote areas (1,819.3 per 100,000 population per year).[11,12] Whilst gonococcal disease rates are highest in Australia in remote and very remote areas, historically NG AMR in these regions has remained low.

Molecular diagnostics have increasingly replaced bacterial culture and antimicrobial susceptibility testing (AST) in the last two decades. The corollary of this is a reduction in gonococcal isolates available for AMR surveillance.[9,11] Molecular tests for antimicrobial resistance detect known genetic targets associated with resistance; however, these assays do not detect novel resistance mechanisms. Uniquely, in some remote regions of Australia, molecular assays are used to detect penicillin resistance in NG,[13,14] the first documented use of such testing for NG AMR detection and surveillance.[13,14] These data have informed local treatment guidelines:[14,15] in 2023, increased reports of penicillinase-producing *Neisseria gonorrhoeae* (PPNG) in the Northern Territory led to changes in treatment recommendations for gonorrhoea to dual therapy with ceftriaxone and azithromycin.[15]

Strategies for treatment and control of gonorrhoea are based on regimens resulting in cure in at least 95% of cases. Surveillance data of antibiotics in clinical use are critical to monitor AMR, to detect imported or novel resistance, and to inform treatment guidelines.[16] The World Health Organization (WHO) has called for enhanced surveillance as a fundamental component of its Global Action Plan to control the spread and impact of gonococcal AMR.[7]

Methods

Gonorrhoea infections are notifiable under legislation in Australia to the National Notifiable Diseases Surveillance System (NNDSS). The isolates tested by the NNN and reported by the AGSP represent a subset of all notified cases. The NNN laboratories test gonococcal isolates for susceptibility to ceftriaxone, azithromycin, penicillin, ciprofloxacin, spectinomycin and tetracycline. In addition, many NNN laboratories are testing gentamicin; these data were first reported by the AGSP in 2020 and this reporting continues in 2024.

AST is performed using standardised methodology to determine the MIC value, the lowest antibiotic concentration that inhibits *in vitro* growth under defined conditions. The coordinating lab for the NNN, the WHO Collaborating Centre for Sexually Transmitted Infection and Antimicrobial Resistance (WHO CC, Sydney), conducts a programme-specific quality assurance program.[17] Each jurisdiction submits gonococcal AST data on a quarterly basis to the WHO CC, Sydney. Where available, the AGSP collects data on the sex of the patient, the country of acquisition of infection, and the site of infection. Data collected across jurisdictions are predominantly from urban centres. Data from the Northern Territory and Western Australia are further divided into non-remote and remote regions determined at the jurisdictional level.

Results

Proportion of gonococcal infections with antimicrobial susceptibility testing

In 2024, there were 44,554 gonococcal infections notified in Australia;[10] of these, 10,702/44,554 (24.0%) had isolates available for AST performed by the NNN laboratories (Table 1). This is reflected in Figure 1, which plots AGSP culture-confirmed cases against combined culture and culture-independent cases.

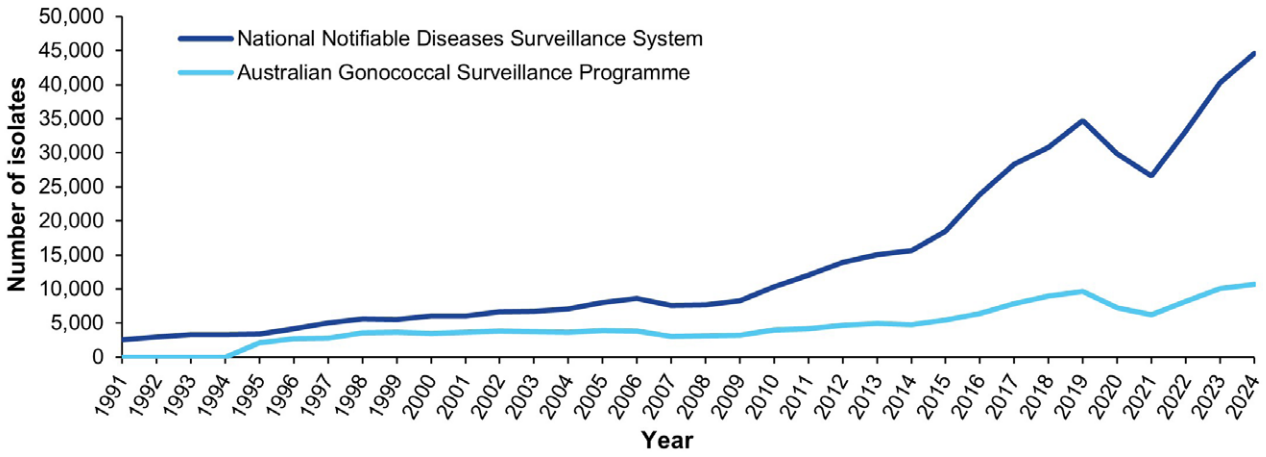
Across jurisdictions, the proportion of diagnoses made by culture varies, ranging from 7.6% to 52.4% as shown in Table 1. The lowest proportion for cultures is from the remote and very remote communities of the Northern Territory and Western Australia. The proportion is highest from the Australian Capital Territory and reflects the effectiveness of laboratory referrals in that jurisdiction, in part due to the relatively small number of notifications.

Table 1: Number of Australian Gonococcal Surveillance Programme gonococcal isolates tested as a proportion of National Notifiable Diseases Surveillance System (NNDSS) gonorrhoea notifications, Australia, 2024,[a] by state or territory

State or territory	Number of isolates tested	Number notified to NNDSS	Number of isolates tested/number of cases notified (%)
Australian Capital Territory	248	473	52.4%
New South Wales	3,684	14,048	26.2%
Northern Territory	175	2,314	7.6%
Queensland	1,456	8,374	17.4%
South Australia	658	2,474	26.6%
Tasmania	88	330	26.7%
Victoria	3,247	11,297	28.7%
Western Australia	1,146	5,244	21.9%
Australia	**10,702**	**44,554**	**24.0%**

a Source: National Communicable Diseases Surveillance dashboard.[10]

Figure 1: Number of gonococcal disease cases reported to the National Notifiable Diseases Surveillance System, compared with *Neisseria gonorrhoeae* isolates available for laboratory testing by the Australian Gonococcal Surveillance Programme, Australia,[a] 1991–2024



a Source: National Communicable Disease Surveillance Dashboard. Accessed 22 April 2025.[10]

Gonococcal isolates by sex, site and jurisdiction tested

There were 8,479 isolates tested in 2024 from males (8,479/10,702; 79.2%) and 2,087 (2,087/10,702; 19.5%) from females (Table 2). 136 isolates (1.3%) were from patients whose sex was not recorded, or was recorded as 'other'. The proportion of gonococcal isolates from males and females has remained stable over recent years (2009–2023), ranging between 17% and 22% for females and between 78% and 83% for males.[18] The infected site was reported as 'other' or not specified for 147 isolates from males and for 62 isolates from females (Table 2). Isolates from urine samples were regarded as genital tract isolates.

Table 2: Gonococcal isolates, Australia, 2024, by sex, site and jurisdiction[a] tested

Sex	Site	ACT[a]	NSW	NT	Qld	SA	Tas.	Vic.	WA	Australia
Male	Genital	83	1,491	107	624	312	31	1,229	657	4,534
	Rectal	69	996	5	255	114	16	957	52	2,464
	Pharynx	59	501	4	110	44	24	521	37	1,300
	DGI[b]	0	7	2	13	2	0	8	2	34
	Other/NS[c]	0	43	1	56	13	5	18	11	147
	Total	**211**	**3,038**	**119**	**1,058**	**485**	**76**	**2,733**	**759**	**8,479**
Female	Genital	28	491	52	324	149	12	336	348	1,740
	Rectal	1	19	0	10	7	0	12	8	57
	Pharynx	6	83	0	22	5	0	77	21	214
	DGI	0	2	1	9	0	0	1	1	14
	Other/NS	1	9	2	30	4	0	12	4	62
	Total	**36**	**604**	**55**	**395**	**165**	**12**	**438**	**382**	**2,087**
Other	Genital	1	20	1	0	6	0	22	1	51
	Rectal	0	9	0	0	1	0	20	0	30
	Pharynx	0	6	0	0	0	0	16	0	22
	DGI	0	0	0	0	0	0	0	0	0
	Other/NS	0	0	0	0	0	0	0	0	0
	Total	**1**	**35**	**1**	**0**	**7**	**0**	**58**	**1**	**103**
Unknown	Genital	0	4	0	1	0	0	7	3	15
	Rectal	0	1	0	2	0	0	6	1	10
	Pharynx	0	2	0	0	1	0	5	0	8
	DGI	0	0	0	0	0	0	0	0	0
	Other/NS	0	0	0	0	0	0	0	0	0
	Total	**0**	**7**	**0**	**3**	**1**	**0**	**18**	**4**	**33**
Total		**248**	**3,684**	**175**	**1,456**	**658**	**88**	**3,247**	**1,146**	**10,702**

a ACT: Australian Capital Territory; NSW: New South Wales; NT: Northern Territory; Qld: Queensland; SA: South Australia; Tas.: Tasmania; Vic.: Victoria; WA: Western Australia.

b DGI: Disseminated gonococcal infection.

c NS: not specified.

Antimicrobial resistance profile of *Neisseria gonorrhoeae*

For 2024, the numbers and proportions of gonococcal isolates resistant to azithromycin, ciprofloxacin and penicillin are shown in Table 3. There continues to be variation across jurisdictions, as well as in remote settings compared to non-remote settings.

Table 3: Number and proportion (%) of gonococcal isolates with resistance to azithromycin, ciprofloxacin and penicillin reported, Australia, 2024, by state or territory

State or territory	2024 Number of isolates tested	Resistance Azithromycin[a]		2024 Number of isolates tested[b]	Resistance Ciprofloxacin		Resistance Penicillin	
		n	%		n	%	n	%
Australian Capital Territory	248	7	2.8	241	136	56.4	47	19.5
New South Wales	3,684	130	3.5	2,767	1,571	56.8	895	32.3
Queensland	1,456	51	3.5	1,433	922	64.3	407	28.4
South Australia	658	30	4.6	658	368	55.9	153	23.3
Tasmania	88	4	4.5	88	55	62.5	25	28.4
Victoria	3,247	201	6.2	3,221	1,920	59.6	1,160	36.0
Northern Territory non-remote	97	2	2.1	95	20	21.1	15	15.8
Northern Territory remote	78	1	1.3	78	3	3.8	4	5.1
Western Australia non-remote	1,071	62	5.8	1,070	579	54.1	275	25.7
Western Australia remote	75	1	1.3	75	21	28.0	19	25.3
Australia	**10,702**	**489**	**4.6**	**9,726**	**5,595**	**57.5**	**3,000**	**30.8**

a Includes resistant and high-level resistant strains.

b A subset of NG isolates (9,726/10,702; 91%,) underwent AST with ciprofloxacin and penicillin.

Ceftriaxone

Gonococcal isolates with ceftriaxone MIC values ≥ 0.125 mgL are considered to have DS in accordance with WHO.[7] The AGSP have detected and reported ceftriaxone DS, and isolates with a ceftriaxone MIC value ≥ 0.064 mg/L, in Australia since 2001 (Tables 4 and 5). In 2024, there were 55 ceftriaxone DS[7] isolates reported across Australia, from New South Wales (23); Victoria (18); non-remote Western Australia (6); Queensland (4); South Australia (3); and Tasmania (1). This was a greater than two-fold increase in reporting of ceftriaxone DS NG from 2023 (0.22%), with the increase resulting largely from New South Wales and Victoria. Genomic analysis from the NNN Laboratories of 42/55 isolates (76.4%) with ceftriaxone MIC ≥ 0.125 mg/L (range: 0.125–1 mg/L) detected the *penA* allele *60.001*, the key alteration encoding the penicillin binding protein 2 associated with ceftriaxone resistance. Three (3) of 55 isolates (5.5%) had ceftriaxone MIC ≥ 0.125 mg/L and carried the *penA 237.001* allele, which shares 98.7% sequence homology with *penA 60.001*. These isolates belonged to multi-locus sequence type (MLST) ST-1901, consistent with the FC-428 clone lineage.[19] Public Health investigations were conducted at the jurisdictional level, with limited available travel history, and concerningly, 5 of the 42 cases reported no travel was involved with acquisition of the infection, indicating local transmission.

Nine (9) of the 55 isolates (16.4%) with ceftriaxone DS (MIC ≥ 0.125 mg/L) had an extensively drug resistant (XDR) profile,[19] with additional resistance to penicillin and ciprofloxacin and high-level azithromycin resistance (MIC value, ≥ 256 mgL). These XDR isolates were reported from Victoria (4), Western Australia (3), Queensland (1) and South Australia (1), and were identified by genomics as ST-16406, with the mosaic *penA 60.001* allele detected, the same sequence type reported in 2022.[20] Where available, travel information was reported as Asia-Pacific contact; three infections were reported to be locally acquired.

Azithromycin

Low-level azithromycin resistance is linked to mutations in ribosomal proteins and the multiple transferable resistance (Mtr) CDE efflux pump, while high-level resistance is associated with 23S rRNA mutations.[21] Nationally, in 2024, azithromycin resistance was detected in 4.6% of isolates (Table 3), similar to the proportion reported in 2023 (4.5%).[22] Since 2012, the rate of azithromycin resistance increased from 1.3% to a peak of 9.3% in 2017, then declined to 3.9% in 2020, and has since remained stable, ranging from 3.9% to 4.7% between 2021 and 2024 (Table 6). Azithromycin-resistant NG was reported in all jurisdictions in Australia and resistance rates were highest in Victoria (6.2%), non-remote Western Australia (5.8%), South Australia (4.6%), and Tasmania (4.5%) (Tables 5 and 6). In 2024, high-level resistance to azithromycin (MIC ≥ 256 mg/L) was detected in 46 isolates (including those 9 NG with an XDR profile) across Australia from New South Wales (26), Victoria (8), Queensland (5), non-remote Western Australia (3), South Australia (2) and the Australian Capital Territory (2). The number of detections of these isolates increased from 27 (27/10,105) in 2023; the total of 46 is the highest number of isolates displaying high-level azithromycin resistance ever reported by the AGSP. Genomic analysis identified ST-11200 as the most common sequence type, accounting for 60.9% (28/46) of these isolates, all from males and largely reported from New South Wales (22/28).

Penicillin

Penicillin resistance results from ß-lactamase production and/or from the aggregation of chromosomally-controlled resistance mechanisms. These are denoted respectively as PPNG and chromosomally-mediated resistance to penicillin (CMRP). In 2024, in Australia, 3,000 isolates (3,000/9,726; 30.8%) were penicillin resistant (Table 3), similar to reports in 2023 (3,102/10,105; 30.7%).[22] The proportion of penicillin-resistant isolates has fluctuated in the range 22–44% between 2008 and 2023.[18] In 2024, the penicillin-resistant NG were 82.7% PPNG (2,480/3,000) and 17.3% CMRP (520/3,000).

In 2024, there were 173 isolates tested with penicillin from the Northern Territory, with 78 referred from remote areas (Alice Springs, Katherine, Tennant Creek, and Arnhem Land regions) and 95 from Darwin and surrounding urban areas (non-remote). Of the NG isolates from remote areas, 4 were penicillin resistant, PPNG (4/78; 5.1%). In 2024, there were 1,145 isolates tested with penicillin from Western Australia, with 75 referred from remote regions and 1,070 from urban and suburban Perth (non-remote). Penicillin resistance was reported in 19/75 (25%) of remote cases, of which 16 (16/19; 84.2%) were PPNG and three were CMRP.

Ciprofloxacin

In 2024, ciprofloxacin resistance was reported in 5,595 isolates (57.5%), lower than in 2022 (63.3%)[20] and 2023 (60.3%) (Table 3).[22] Ciprofloxacin has not been recommended in Australia as a first-line therapy for gonococcal infections since the late 1990s. As reported by the AGSP, the rate of ciprofloxacin resistance progressively declined in Australia since 2008, from a peak of 71%, before reaching a nadir of 25.6% in 2018.[18] The increase in ciprofloxacin resistance from 52.9% in 2021 to 63.3% in 2022 can be attributed to an extent to the expansion of the ST-7827 clone, particularly in New South Wales.[23]

Table 4: Number and proportion (%) of gonococcal isolates with ceftriaxone MIC values ≥ 0.064 mg/L, Australia, 2014 to 2024, by state or territory

State or territory	*Neisseria gonorrhoeae* isolates with ceftriaxone MIC values ≥ 0.064 mg/L																					
	2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Australian Capital Territory	2	2.7	0	0	1	0.9	0	0	4	1.9	1	0.5	0	0	1	0.5	6	2.8	1	0.4	**10**	**4.0**
New South Wales	119	7.1	52	2.7	45	2.0	13	0.5	30	0.8	44	1.2	30	1.2	18	0.9	332	12	238	6.6	**132**	**3.6**
Queensland	21	3.2	7	1.0	32	3.7	11	0.9	18	1.3	16	1.0	17	1.1	4	0.4	8	0.6	32	2.1	**25**	**1.7**
South Australia	2	1.0	9	3.6	2	0.6	2	0.6	3	1.3	9	1.6	0	0	4	1.4	18	3.9	8	1.4	**10**	**1.5**
Tasmania	0	0	0	0	1	3.6	0	0	4	7.3	1	2.1	0	0	1	1.4	0	0	0	0	**1**	**1.1**
Victoria	95	6.6	25	1.5	19	1.1	48	2.1	83	3.2	42	1.6	18	1.1	25	1.3	82	3.3	66	2.4	**108**	**3.3**
Northern Territory non-remote	3	3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1.1	3	2.9	**4**	**4.1**
Northern Territory remote	1	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Western Australia non-remote	14	3.6	5	1.3	9	1.3	9	1.4	14	2.1	11	1.5	3	0.4	1	0.2	9	1.9	6	0.6	**10**	**0.9**
Western Australia remote	1	0.9	0	0	0	0	0	0	0	0	2	2.4	0	0	0	0	0	0	0	0	**0**	**0**
Australia	**258**	**5.4**	**98**	**1.8**	**109**	**1.7**	**83**	**1.1**	**156**	**1.7**	**126**	**1.3**	**68**	**0.9**	**54**	**0.9**	**456**	**5.6**	**354**	**3.5**	**300**	**2.8**

Table 5: Proportion (%) of gonococcal isolates tested in Australia with ceftriaxone MIC values at 0.064 mg/L and ≥ 0.125 mg/L[7] and resistance to azithromycin, 2010 to 2024

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Number of isolates tested nationally	4,100	4,230	4,718	4,897	4,804	5,411	6,378	7,835	9,006	9,668	7,222	6,254	8,199	10,105	**10,702**
Ceftriaxone MIC 0.064 mg/L	4.80%	3.20%	4.10%	8.20%	4.80%	1.70%	1.65%	1.02%	1.67%	1.19%	0.87%	0.83%	5.05%	3.29%	**2.29%**
Ceftriaxone DS[a] MIC ≥ 0.125 mg/L	0.10%	0.10%	0.30%	0.60%	0.60%	0.10%	0.05%	0.04%	0.06%	0.11%	0.07%	0.03%	0.51%	0.22%	**0.51%**
Ceftriaxone total (MIC values, ≥ 0.064 mg/L)	4.90%	3.30%	4.40%	8.80%	5.40%	1.80%	1.70%	1.06%	1.73%	1.30%	0.94%	0.86%	5.56%	3.51%	**2.80%**
Azithromycin resistance	n/a	1.1%	1.3%	2.1%	2.5%	2.6%	5.0%	9.3%	6.2%	4.6%	3.9%	4.7%	3.9%	4.5%	**4.6%**

a DS: decreased susceptibility.

Table 6: Number and proportion (%) of gonococcal isolates with resistance to azithromycin, Australia, 2014 to 2024, by state or territory

State or territory[a]	2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
ACT	7	9.3	0	0	8	7.1	3	2.1	18	8.7	14	7.1	9	6.1	6	3.2	7	3.2	5	1.9	**7**	**2.8**
NSW	33	2.0	43	2.3	82	3.6	261	9.3	230	6.5	215	6.0	181	7.0	191	9.9	109	4.0	165	4.6	**130**	**3.5**
Qld	23	3.5	42	5.8	10	1.2	61	4.9	68	4.9	32	1.9	43	2.9	14	1.2	32	2.3	41	2.7	**51**	**3.5**
SA	1	0.5	7	2.8	68	19.5	46	12.8	7	3.0	11	2.0	1	0.3	3	1.0	3	0.7	17	2.9	**30**	**4.6**
Tas.	1	3.3	1	4.3	4	14.3	5	9.0	3	6.0	1	2.0	0	0	4	5.8	5	5.2	8	5.9	**4**	**4.5**
Vic.	33	2.3	30	1.8	93	5.4	304	13.5	217	8.3	161	6.2	29	1.7	59	3.1	144	5.8	159	5.8	**201**	**6.2**
NT non-remote	0	0	0	0	1	1.9	1	1.7	1	1.5	1	1.8	2	3.9	1	2.0	1	1.1	4	3.8	**2**	**2.1**
NT remote	0	0	0	0	0	0	1	0.6	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1.3**
WA non-remote	21	5.3	15	3.8	51	7.6	40	6.4	16	2.5	12	1.6	18	2.6	18	3.7	16	3.3	57	5.9	**62**	**5.8**
WA remote	0	0	0	0	1	0.8	4	3.4	1	0.9	1	1.2	1	0.9	0	0	0	0	2	3	**1**	**1.3**
Australia	**119**	**2.5**	**138**	**2.6**	**318**	**5.0**	**726**	**9.3**	**561**	**6.2**	**448**	**4.6**	**284**	**3.9**	**296**	**4.7**	**317**	**3.9**	**458**	**4.5**	**489**	**4.6**

a ACT: Australian Capital Territory; NSW: New South Wales; Qld: Queensland; SA: South Australia; Tas.: Tasmania; Vic.: Victoria; NT: Northern Territory; WA: Western Australia.

Tetracyclines

To optimise reporting of tetracycline resistance in NG, from 2018, NNN reference laboratories have performed tetracycline MIC testing where possible. This replaces historical breakpoint testing for high-level tetracycline-resistant *N. gonorrhoeae* (TRNG) (MIC ≥ 16 mg/L) reported by the AGSP as an epidemiological marker for plasmid-mediated resistance. Tetracycline resistance is defined as MIC ≥ 2 mg/L. Nationally in 2024, 82.0% of isolates were tested (8,775/10,702); of tested isolates, 35.2% (3,086/8,775) were tetracycline resistant. Tetracycline resistance data are presented by jurisdiction and aggregated for Australia as shown in Table 7.

Spectinomycin

In 2024, all isolates tested (8,138/10,702; 76.0%) were susceptible to spectinomycin.

Gentamicin

In 2024, gentamicin susceptibility testing data was available for 1,728 isolates from all jurisdictions excepting South Australia. The median MIC value was 4 mg/L; and the range was ≤ 1.0–16 mg/L. There are no gentamicin breakpoints defined for NG.

Table 7: Number and proportion (%) of gonococcal isolates with resistance to tetracycline (MIC ≥ 2 mg/L), Australia, 2024, by state or territory

	Number of isolates tested	Tetracycline resistance MIC ≥ 2 mg/L	
State or territory	2024	n	%
Australian Capital Territory	240	54	22.5%
New South Wales	2,536	800	31.5%
Queensland	1,429	491	34.4%
South Australia	3	0	0%
Tasmania	88	34	38.6%
Victoria	3,173	1,389	43.8%
Northern Territory non-remote	85	14	16.5%
Northern Territory remote	76	2	2.6%
Western Australia non-remote	1,070	288	26.9%
Western Australia remote	75	14	18.7%
Australia	**8,775**	**3,086**	**35.2%**

Discussion

In 2024, the number of notifications of NG infections in Australia was 44,554, an increase of 28% from the pre-pandemic notifications to the NNDSS in 2019 (34,742).[10] The NNN jurisdictional reference laboratories reported data from clinical testing of 10,702 NG isolates (representing 24.0% of infections) from urban and remote settings, in both public and private health sectors. The remote regions of Western Australia and the Northern Territory continue to report the highest rates of gonococcal disease, relatively low rates of AMR, and low numbers of isolates available for AST.

From 2016 to 2018, AGSP isolates with ceftriaxone DS (MIC value ≥ 0.125 mg/L) were stable in the range 0.04–0.06%.[8,18] However, in 2019, this increased to 0.11% (Table 5) then decreased during 2020–2021 coincident with public health containment measures for COVID-19. In 2022, the AGSP reported a surge in the number and proportion of isolates with ceftriaxone MIC values ≥ 0.064 mg/L, largely attributed to the expansion of a clone of limited genomic diversity of sequence type ST-7827, detected in both male and female patients in New South Wales. These ST-7827 isolates had a non-mosaic *penA* allele, and all were susceptible to azithromycin, but were resistant to ciprofloxacin.[23] In 2023 and 2024 the detection of ST-7827 NG subsided in Australia. This has been seen in other settings, where similarly NG ST-7827 rates increased rapidly in Norway during 2016–2018, then waned.[24]

In 2024, there was a marked increase of isolates with ceftriaxone MIC values ≥ 0.125 mg/L, with 55 cases compared with 27 reported in 2023.[22] In 2024, isolates with ceftriaxone DS were reported by the AGSP from New South Wales (23); Victoria (18); Western Australia (6); Queensland (4); South Australia (3); and Tasmania (1). Of these, 42/55 (76%), from multiple jurisdictions (New South Wales (18), Victoria (13), Western Australia (5), South Australia (3), Queensland (2) and Tasmania (1)), were confirmed by whole genome sequencing to harbour the mosaic *penA* allele *60.001*. This allele is responsible for key alterations in the penicillin binding protein 2 associated with ceftriaxone resistance. The ceftriaxone MIC values associated with these 42 isolates ranged from 0.125 to 1.0 mg/L. Of the cases with available travel history, most had confirmed travel or links to the Asia Pacific region; however, five cases (5/42) occurred in individuals with no history of travel, suggesting local transmission. A 2022 report from the United Kingdom (UK),[25] describing a surge in detection of NG isolates harbouring the *penA 60.001* allele, heightened concerns regarding emergence of gonococcal AMR.

Nine (9) of the 55 ceftriaxone MIC ≥ 0.125 mg/L isolates reported from Australia in 2024 had an extensively drug-resistant (XDR)[26] profile (ceftriaxone MIC: 0.125–0.50 mg/L; azithromycin MIC ≥ 256 mg/L); all harboured the mosaic *penA 60.001* allele, and were reported from Victoria (4), Western Australia (3), Queensland (1) and South Australia (1). The first reports of XDR NG were from Australia (two unrelated cases, one with a travel history in the Asia-Pacific) and one from the UK (with a travel link to Thailand) in 2018.[4,25] On genomic analysis, there was limited diversity between the 2018 UK and Australian XDR isolates, suggesting these isolates belonged to the same gonococcal clone.[3] In 2022, two further cases were reported, one in Austria with travel links in Cambodia,[27] and another in the UK with contact in the Asia-Pacific.[28] Genomic analysis found the 2022 UK and European isolates to be identical[28] and related to the case reported in the UK in 2018. These findings strongly suggest these strains are in circulation in the Asia-Pacific.[28] The detection of a further four such isolates in Victoria in 2023, which were also genomically similar to earlier investigations, amounts to 14 reports of XDR NG in Australia since 2022 and is extremely concerning.

Azithromycin resistance has been reported by the AGSP since 2007. Following the introduction of dual therapy in 2014, resistance to azithromycin in all jurisdictions of Australia has been observed (Table 6), increasing from 2016, and peaking at 9.3% in 2017. However, rates halved in 2019 (4.6%), and have remained relatively stable nationally for the last five years (3.9% to 4.7%), with some variation across the jurisdictions. In 2024, azithromycin resistance was highest in Victoria (6.2%), non-remote Western Australia (5.8%), South Australia (4.6%) and Tasmania (4.5%).

In 2013, high-level resistance (HLR: MIC ≥ 256 mg/L) to azithromycin in gonococci was reported for the first time in Australia.[29] Since then, there have been sporadic reports of NG isolates with HLR to azithromycin in Australia annually; none were reported in 2021. In 2022, nine such isolates were reported nationally and notably this number increased to 27 in 2023[20,22] and increased again to 46 in 2024, the highest number reported to date. These isolates were largely contributed from New South Wales (26/46) and Victoria (8/46) and the majority were isolated from male patients. Whilst data from the jurisdictions regarding travel history are limited, some cases were associated with overseas travel to South America, Africa and Europe.

In 2024, penicillin resistance was reported in 30.8% of isolates (3,000/10,702), an increase from 2020 (26.6%). The proportion of penicillin-resistant isolates has been reported in the range 22–44% between 2008 and 2023.[18] In 2024, of the penicillin-resistant isolates, the majority were PPNG (82.7%; 2,480/3,000); the remaining 17.3% (520/3,000) were CMRP. With regards to the isolates from remote regions, of the 78 isolates from remote Northern Territory, four were penicillin resistant, PPNG (5%). There were 75 isolates from remote Western Australia: 19 (25.3%) were penicillin resistant, 16 were PPNG and three were CMRP.

In 2024, ciprofloxacin resistance was reported in 57.5% of tested isolates, lower than 60.3% in 2023 and 63.3% in 2022.[18] The rate of ciprofloxacin resistance reported in Australia had progressively declined from 71% in 2008 to 25.6% in 2018. The increase in ciprofloxacin resistance from 2021 can be attributed, to an extent, to the expansion of the ST-7827 clone, particularly in New South Wales.[23] With regards to the remote regions of Australia, of the 78 isolates from remote Northern Territory, three were ciprofloxacin resistant (3.8%) and of the 75 isolates from remote Western Australia, 21 were ciprofloxacin resistant (28.0%).

In 2024, gentamicin susceptibility testing data were available for 1,728 NG isolates from New South Wales, Tasmania, Western Australia, the Australian Capital Territory and the Northern Territory. The median MIC value was 4 mg/L; the range was ≤ 1.0–16 mg/L. There are no gentamicin breakpoints defined for NG. The inclusion of gentamicin as an indicator for ongoing surveillance by the AGSP is in line with the requirements of the WHO Global Antimicrobial Resistance Surveillance System (GLASS).

Nationally in 2024, tetracycline resistance was tested in 82.0% of isolates (8,775/10,702); of isolates tested, 35.2% (3,086/8,775) were tetracycline resistant. The highest rate was reported from Victoria (43.8%), with resistance reported in other jurisdictions (excluding remote Northern Territory and Western Australia) in the range 16–39%, noting there are no data from South Australia. Tetracycline resistance has been reported in the AGSP in recent years coincident with increasing use of doxycycline post-exposure prophylaxis for syphilis and chlamydia.

In 2024, several concerning observations are reported by the AGSP: the surge in NG isolates detected nationally with the *penA 60.001* allele; the detection of isolates with an XDR profile from Victoria, Western Australia, Queensland and South Australia; and the increase in notifications of isolates with high level resistance to azithromycin, primarily from New South Wales and Victoria. These findings mirror reports from the United Kingdom and Europe,[25,27,30–32] where similar detections and local transmission have been reported. The ideal alternate treatment to ceftriaxone is yet to be identified, and in the global context culture is rarely performed, and rapid diagnostic assays to determine ceftriaxone susceptibility to facilitate stewardship are not commercially available. Disease prevention strategies under investigation for the future include the MenB-4C vaccine, designed to protect against meningococcal disease, but shown to be moderately effective against gonorrhoea in various populations, although the duration of protection is uncertain.

Additional clinical, public health and laboratory investigations have been implemented as part of the response to these events. These include follow up, test of cure, genomic analysis at the jurisdictional level, and investigations regarding travel history. Strategies to prevent infection, including when travelling, are critical. The findings from this report underscore the ongoing importance of surveillance based on bacterial culture and AST of NG to inform future therapeutic strategies; to monitor for the presence and spread of resistant isolates; and to detect instances of treatment failure.

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Author details

Monica M Lahra[1, 2]

Siobhan M Hurley[1]

Sebastiaan van Hal[3,4]

Tiffany R Hogan[1]

1. Neisseria Reference Laboratory and World Health Organization Collaborating Centre for STI and AMR, Sydney. NSW Health Pathology, Microbiology, The Prince of Wales Hospital, Randwick, NSW, 2031, Australia
2. School of Medical Sciences, Faculty of Medicine, The University of New South Wales, NSW, 2052, Australia
3. New South Wales Health Pathology, Microbiology, Royal Prince Alfred Hospital Camperdown, NSW, Australia
4. School of Medicine, University of Sydney

Corresponding author

Professor Monica M Lahra

World Health Organization Collaborating Centre for STI and AMR, Sydney and, Neisseria Reference Laboratory, NSW Health Pathology, Microbiology, The Prince of Wales Hospital, Randwick, NSW, 2031

School of Medical Sciences, Faculty of Medicine, the University of New South Wales, NSW, 2052 Australia

Telephone: +61 2 9382 3678

Facsimile: +61 2 9382 3720

Email: monica.lahra@health.nsw.gov.au

References

1. Lahra MM, George CR, Whiley DM. The Australian Gonococcal Surveillance Programme 1979–2017. *Microbiol Aust*. 2017;38(4):175–9. doi: https://doi.org/10.1071/MA17062.
2. Lahra MM, Martin I, Demczuk W, Jennison AV, Lee KI, Nakayama SI et al. Cooperative recognition of internationally disseminated ceftriaxone-resistant *Neisseria gonorrhoeae* strain. *Emerg Infect Dis*. 2018;24(4):735–40. doi: https://doi.org/10.3201/eid2404.171873.
3. Whiley DM, Jennison A, Pearson J, Lahra MM. Genetic characterisation of *Neisseria gonorrhoeae* resistant to both ceftriaxone and azithromycin. *Lancet Infect Dis*. 2018; 18(7):717–8. doi: https://doi.org/10.1016/S1473-3099(18)30340-2.
4. European Centre for Disease Prevention and Control (ECDC). Rapid risk assessment: extensively drug-resistant (XDR) Neisseria gonorrhoeae in the United Kingdom and Australia. [Internet.] Stockholm: ECDC; 7 May 2018. Available from: https://www.ecdc.europa.eu/en/publications-data/rapid-risk-assessment-extensively-drug-resistant-xdr-neisseria-gonorrhoeae-united.
5. Tapsall JW, Limnios EA, Murphy DM. Analysis of trends in antimicrobial resistance in *Neisseria gonorrhoeae* isolated in Australia, 1997–2006. *J Antimicrob Chemother*. 2008;61(1):150–5. doi: https://doi.org/10.1093/jac/dkm434.
6. Hanrahan JK, Hogan TR, Buckley C, Trembizki E, Mitchell H, Lau CL et al. Emergence and spread of ciprofloxacin-resistant *Neisseria gonorrhoeae* in New South Wales, Australia: lessons from history. *J Antimicrob Chemother*. 2019;74(8):2214–9. doi: https://doi.org/10.1093/jac/dkz182.
7. World Health Organization (WHO). *Global action plan to control the spread and impact of antimicrobial resistance in Neisseria gonorrhoeae*. Geneva: WHO; 2012. [Accessed on 8 June 2025.] Available from: https://apps.who.int/iris/handle/10665/44863.
8. Armstrong BH, Limnios A, Lewis DA, Hogan T, Kundu R, Ray S et al. Is gentamicin a viable therapeutic option for treating resistant *Neisseria gonorrhoeae* in New South Wales? *Commun Dis Intell (2018)*. 2021;45. doi: https://doi.org/10.33321/cdi.2021.45.12.
9. Lahra MM, Hogan TR, Armstrong BH, for the National Neisseria Network. Australian Gonococcal Surveillance Programme Annual Report, 2021. *Commun Dis Intell (2018)*. 2022;46. doi: https://doi.org/10.33321/cdi.2022.46.52.
10. Australian Government Department of Health, Disability and Ageing. National Notifiable Diseases Surveillance System (NNDSS) data visualisation tool. [Webpage.] Canberra: Australian Government Department of Health, Disability and Ageing; 14 December 2022. [Accessed on 22 April 2025.] Available from: https://www.health.gov.au/resources/apps-and-tools/national-notifiable-diseases-surveillance-system-nndss-data-visualisation-tool.
11. King J, McManus H, Kwon JA, Gray R, McGregor S, Kirby Institute. *HIV, viral hepatitis and sexually transmissible infections in Australia: annual surveillance report 2024: sexually transmissible infections*. Sydney: University of New South Wales, Kirby Institute; 2024. Available from: https://www.kirby.unsw.edu.au/sites/default/files/documents/Annual_Surveillance_Report_2024_STI_1.pdf.
12. Naruka E, King J, Miller A, Thomas JR, Monaghan R, McGregor S. *Bloodborne viral and sexually transmissible infections in Aboriginal and Torres Strait Islander peoples: annual surveillance report 2024*. Sydney: University of New South Wales, Kirby Institute; 2024. Available from: https://data.kirby.unsw.edu.au/atsi-report.
13. Goire N, Freeman K, Tapsall JW, Lambert SB, Nissen MD, Sloots TP et al. Enhancing gonococcal antimicrobial resistance surveillance: a real-time PCR assay for detection of penicillinase-producing *Neisseria gonorrhoeae* by use of noncultured clinical samples. *J Clin Microbiol*. 2011;49(2):513–8. doi: https://doi.org/10.1128/JCM.02024-10.

14. Speers DJ, Fisk RE, Goire N, Mak DB. Non-culture *Neisseria gonorrhoeae* molecular penicillinase production surveillance demonstrates the long-term success of empirical dual therapy and informs gonorrhoea management guidelines in a highly endemic setting. *J Antimicrob Chemother*. 2014;69(5):1243–7. doi: https://doi.org/10.1093/jac/dkt501.

15. Northern Territory Government Department of Health (NT Health), Centre for Disease Control. *Public Health Alert: Penicillinase-producing Neisseria gonorrhoeae (PPNG): changes treatment recommendations for gonorrhoea NT wide*. Darwin: NT Health; 23 October 2023. Available from: https://health.nt.gov.au/__data/assets/pdf_file/0006/1288635/health-alert-penicillinase-producing-neisseria-gonorrhoeae-231023.pdf.

16. Tapsall J, World Health Organization (WHO) Anti-Infective Drug Resistance Surveillance and Containment Team. *Antimicrobial resistance in Neisseria gonorrhoeae*. Geneva: WHO; 2001. [Accessed on 12 June 2025.] Available from: https://apps.who.int/iris/handle/10665/66963.

17. Tapsall JW, Australian Gonococcal Surveillance Programme. Use of a quality assurance scheme in a long-term multicentric study of antibiotic susceptibility of *Neisseria gonorrhoeae*. *Genitourin Med*. 1990;66(1):8–13. doi: https://doi.org/10.1136/sti.66.1.8.

18. *Communicable Diseases Intelligence* website. Australian Gonococcal Surveillance Programme (AGSP) annual reports 2008–2023. [Webpage.] Canberra: Australian Government Department of Health and Aged Care, Interim Australian Centre for Disease Control; 2025. [Accessed on 12 June 2025.] Available from: https://ojs.cdi.cdc.gov.au/index.php/cdi/catalog/category/Gonococcal_AGSP_annual_reports.

19. Bercot B, Caméléna F, Mérimèche M, Jacobsson S, Sbaa G, Mainardis M et al. Ceftriaxone-resistant, multidrug-resistant *Neisseria gonorrhoeae* with a novel mosaic *penA-237.001 gene*, France, June 2022. *Euro Surveill*. 2022;27(50):2200899. doi: https://doi.org/10.2807/1560-7917.ES.2022.27.50.2200899.

20. Lahra MM, van Hal SJ, Hogan TR, for the National Neisseria Network. Australian Gonococcal Surveillance Programme Annual Report, 2022. *Commun Dis Intell (2018)*. 2023;47. doi: https://doi.org/10.33321/cdi.2023.47.45.

21. Laumen JGE, Manoharan-Basil SS, Verhoeven E, Abdellati S, De Baetselier I, Crucitti T et al. Molecular pathways to high-level azithromycin resistance in *Neisseria gonorrhoeae*. *J Antimicrob Chemother*. 2021;76(7):1752–8. doi: https://doi.org/10.1093/jac/dkab084.

22. Lahra MM, van Hal SJ, Hogan TR. Australian Gonococcal Surveillance Programme Annual Report, 2023. *Commun Dis Intell (2018)*. 2025;49. doi: https://doi.org/10.33321/cdi.2025.49.007.

23. van Hal SJ, Whiley DM, Le T, Ray S, Kundu RL, Kerr E et al. Rapid expansion of *Neisseria gonorrhoeae* ST-7827 clone in Australia, with variable ceftriaxone phenotype unexplained by genotype. *J Antimicrob Chemother*. 2023;78(9):2203–8. doi: https://doi.org/10.1093/jac/dkad221.

24. Osnes MN, Didelot X, Korne-Elenbaas J, Alfsnes K, Brynildsrud OB, Syversen G et al. Sudden emergence of a *Neisseria gonorrhoeae* clade with reduced susceptibility to extended-spectrum cephalosporins, Norway. *Microb Genom*. 2020;6(12):mgen000480. doi: https://doi.org/10.1099/mgen.0.000480.

25. Day M, Pitt R, Mody N, Saunders J, Rai R, Nori A et al. Detection of 10 cases of ceftriaxone-resistant *Neisseria gonorrhoeae* in the United Kingdom, December 2021 to June 2022. *Euro Surveill*. 2022;27(46):2200803. doi: https://doi.org/10.2807/1560-7917.ES.2022.27.46.2200803.

26. Tapsall JW, Ndowa F, Lewis DA, Unemo M. Meeting the public health challenge of multidrug- and extensively drug-resistant *Neisseria gonorrhoeae*. *Expert Rev Anti Infect Ther*. 2009;7(7):821–34. doi: https://doi.org/10.1586/eri.09.63.

27. Pleininger S, Indra A, Golparian D, Heger F, Schindler S, Jacobsson S et al. Extensively drug-resistant (XDR) *Neisseria gonorrhoeae* causing possible gonorrhoea treatment failure with ceftriaxone plus azithromycin in Austria, April 2022. *Euro Surveill*. 2022;27(24):2200455. doi: https://doi.org/10.2807/1560-7917.ES.2022.27.24.2200455.

28. Jennison AV, Whiley D, Lahra MM, Graham RM, Cole MJ, Hughes G et al. Genetic relatedness of ceftriaxone-resistant and high-level azithromycin resistant *Neisseria gonorrhoeae* cases, United Kingdom and Australia, February to April 2018. Euro Surveill. 2019;24(8):1900118. doi: https://doi.org/10.2807/1560-7917.ES.2019.24.8.1900118.

29. Lahra MM, Australian Gonococcal Surveillance Program. Australian Gonococcal Surveillance Programme annual report, 2013. *Commun Dis Intell Q Rep*. 2015;39(1):E137–45. doi: https://doi.org/10.33321/cdi.2015.39.8.

30. Maubaret C, Caméléna F, Mérimèche M, Braille A, Liberge M, Mainardis M et al. Two cases of extensively drug-resistant (XDR) *Neisseria gonorrhoeae* infection combining ceftriaxone-resistance and high-level azithromycin resistance, France, November 2022 and May 2023. *Euro Surveill*. 2023;28(37):2300456. doi: https://doi.org/10.2807/1560-7917.ES.2023.28.37.2300456.

31. Caméléna F, Mérimèche M, Brousseau J, Mainardis M, Verger P, Le Risbé C et al. Emergence of extensively drug-resistant *Neisseria gonorrhoeae*, France, 2023. *Emerg Infect Dis*. 2024;30(9):1903–6. doi: https://doi.org/10.3201/eid3009.240557.

32. van Hal SJ, Sherry N, Coombs G, Mowlaboccus S, Whiley DM, Lahra MM. Emergence of an extensively drug-resistant *Neisseria gonorrhoeae* clone. *Lancet Infect Dis*. 2024;24(9):e547–8. doi: https://doi.org/10.1016/S1473-3099(24)00486-9.