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He Pūtaiao, He Tāngata

ANTIMICROBIAL RESISTANCE IN *NEISSERIA GONORRHOEAE* IN NEW ZEALAND: 2023

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Disclaimer

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INTRODUCTION

Gonorrhoea is one of the most common sexually transmitted infections (STI) globally, with 82.4 million new cases among adults aged 15–49 in 2020 (World Health Organization, 2024). Untreated gonorrhoea can result in serious sequelae, including pelvic inflammatory disease, vertical transmission and increased HIV transmission (Moore, 2016) (Tsevat, 2017) (Greenberg, 1979).

Antimicrobial resistance (AMR) in *Neisseria gonorrhoeae* (*N. gonorrhoeae*), which is the causative agent of gonorrhoea, is a growing public health threat globally. Resistance to almost all major classes of antibiotics, including penicillins, tetracyclines, sulphonamides, quinolones, and macrolides, has been documented in *N. gonorrhoeae* (World Health Organization, 2024) (Unemo M. L., 2019) (Unemo M. L., 2021).

Dual antibiotic therapy with ceftriaxone and azithromycin is the first-line treatment for gonorrhoea recommended in many countries, including in New Zealand (New Zealand Sexual Health Society) (Gonorrhoea guide: Key information and resources , 2022) (Unemo M. R., 2020). Dual antibiotic therapy was initially recommended to counteract increasing global incidence of ceftriaxone resistant *N. gonorrhoeae* (Unemo M. W., 2018). However, in recent years, ceftriaxone resistance globally has remained low whilst azithromycin resistance has increased, and there has been a growing number of reports of treatment failure using this dual therapy (Radovanovic, 2022) (Merrick, 2022) (NSW Health, 2024). Evidence of sustained transmission of high-level azithromycin resistance and concern about the effects of azithromycin on other pathogens and on the microbiome has led some jurisdictions, including the United Kingdom (UK) and United States (USA), to recommend single-agent ceftriaxone for uncomplicated gonorrhoea (Fifer, 2020) (Cyr, 2020).

Reduced susceptibility or resistance to ceftriaxone, currently the last option for first-line empiric gonorrhoea monotherapy, has also emerged, including in Australia (NSW Health, 2024). A recent sentinel site study undertaken as part of the WHO Enhanced Gonococcal Antimicrobial Surveillance Programme (EGASP) in Cambodia also found of 306 isolates tested, 47 (15.4%) were resistant to ceftriaxone (MIC >0.125 mg/L) and 44 (14.4%) were non-susceptible (ECOFF MIC >1 mg/L) to azithromycin. Of note, 19/306 (6.2%) isolates were resistant to ceftriaxone, cefixime, azithromycin and ciprofloxacin and considered to be extremely drug resistant (XDR) (Ouk, 2024).

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HISTORY OF AMR *N. GONORRHOEAE* SURVEILLANCE IN NEW ZEALAND

Antimicrobial susceptibility testing (AST) for *N. gonorrhoeae* has been conducted in New Zealand (NZ) intermittently since 1976. Following sporadic surveys, quarterly analysis of data collected by sentinel laboratories was undertaken between 2005 and 2008, due to rising resistance to ciprofloxacin, the first line antibiotic at that time. Annual reporting by laboratories continued from 2009 to 2012, and from 2013 AST data was collected with STI laboratory surveillance data.

From 2013 to 2016, reporting of *N. gonorrhoeae* AMR focused on penicillin and ciprofloxacin resistance. Resistance to penicillin increased from 4.5% in 2013 to 14.9% in 2016, although decreasing numbers of isolates were available for AST (422 in 2013 to 168 in 2016), as a result of increased nucleic acid amplification (NAAT)-based testing since 2015. Resistance to ciprofloxacin ranged from 26.2% to 36.3%, also with decreasing numbers of isolates tested (1055 in 2013 to 831 in 2016). Penicillin and ciprofloxacin resistance results are currently of limited clinical utility, as penicillin is not used, and ciprofloxacin is now a third line agent for gonorrhoea treatment. Isolates with reduced susceptibility to ceftriaxone were reported from 2014 to 2016, although the total isolates tested was not reported. The number of isolates reported was one, eight, and four in 2014, 2015, and 2016 respectively. Azithromycin resistance was included for the first time in the 2016 Annual STI surveillance report. No resistance was detected, however only 79 isolates from three District Health Boards were tested (The Institute of Environmental Science and Research Ltd., 2019).

In addition to the routine collation of susceptibility data from diagnostic laboratories for surveillance, periodic *N. gonorrhoeae* AMR surveys were undertaken in 2014/15 and 2018/19 when laboratories were asked to send all *N. gonorrhoeae* isolates to ESR for analysis. With increased NAAT-based testing since 2015, fewer isolates have been available for AST (The Institute of Environmental Science and Research Ltd., 2023). The most recent AMR survey conducted by ESR in 2018/19 included 344 isolates provided by laboratories, with most isolates coming from the Auckland region. Two (0.6%) of the 344 isolates displayed reduced susceptibility to ceftriaxone and six (1.7%) had an azithromycin MIC >1.0 mg/L (The Institute of Environomental Science and Research Ltd, 2021). While a small number of isolates with reduced susceptibility to ceftriaxone have been identified, resistance to ceftriaxone has yet to be reported in NZ (The Institute of Environmental Science and Research Ltd., 2023).

Although surveillance for *N. gonorrhoeae* infections (including AMR surveillance) has been ongoing for many years, gonorrhoea was not made notifiable until the Health (Protection) Amendment Act 2016 came into force in January 2017. This did not change the process by which gonorrhoea notification and AST data are collected, however, and the same process remains in place.

METHODS

The collection, collation, and initial cleaning of laboratory data for *N. gonorrhoeae* are described in the 2023 Supplementary Annual Report dashboard methods (The Instititute of Environmental Science and Research Ltd., 2024). Data from this process are stored in a SQL server database. These data include AST data for *N. gonorrhoeae* for ceftriaxone, azithromycin, penicillin, ciprofloxacin, and tetracyclines. The data are extracted from SQL into R for cleaning and analysis.

Data cleaning of AST results changed in 2023 from manual coding to using the 'AMR' R package which is more automated and uses a standardised reference table (Berends, 2022). Some manual coding was still required before utilising the 'AMR' package. As a result of these changes, some historical results presented in this report may differ to those presented previously; any notable differences in trends as a result of this are discussed in the commentary. The 'AMR' R package is standardised and used internationally for the cleaning, analysis and reporting of AMR data.

AMR isolate numbers, testing methods and reporting practices vary between laboratories. Results received include minimum inhibitory concentration (MIC), zone diameter (ZD) and interpreted susceptibility data (SIR). Free-text data are entered by many laboratories, and multiple unique responses and transcription errors are received. Most New Zealand diagnostic laboratories use the EUCAST guidelines for interpreting results; therefore, EUCAST breakpoints are used where possible (European Committee on Antimicrobial Susceptibility Testing (EUCAST), 2023). EUCAST do not provide zone diameter breakpoints for *N. gonorrhoeae*, hence, when ZD results are received, the Clinical and Laboratory Standards Institute (CLSI) breakpoints are used. Both EUCAST and CLSI breakpoints are available using the 'AMR' R package which routinely updates breakpoint tables using WHONET (World Health Organization, n.d.).

To analyse AST results from cultures, MIC values were prioritised for AST interpretation and reporting, and substituted with SIR or ZD values if missing. Data were restricted to individuals with a National Health Index (NHI) or personal identifier (PID). 'The first isolate within an episode' approach was used to identify one AST result per episode of infection, although manual checks for any resistant/non-susceptible isolates were undertaken prior to this. First isolates were identified by using the NHI or PID as an identifier and episode days applied was 21 days.

For azithromycin, neither EUCAST or CLSI provide susceptibility breakpoints but provide an epidemiological cut-off value (ECOFF) which is MIC = 1.0 mg/L. Isolates with an MIC above the ECOFF are considered non-wild type; that is, they are likely to contain acquired resistance mechanism(s) to the antibiotic. Azithromycin results received with an MIC >1.0 mg/L are not confirmed with the sending laboratory and assumed to be correct. These isolates are reported as "*MIC >1*.0 mg*/L"* rather than Resistant as reported previously; this is consistent with both EUCAST and CLSI terminology.

For ceftriaxone, if any result is received with an MIC >0.125 mg/L, ESR attempts to confirm this with the reporting laboratory; to-date no confirmed results with an MIC >0.125 mg/L have been received. We used a combination of EUCAST (to determine resistance, MIC >0.125 mg/L) and World Health Organization (WHO) guidelines (0.06 to 0.125 mg/L) to determine decreased susceptibility (DS). Ceftriaxone results interpreted as decreased susceptibility using WHO guidelines are referred to as such, to underscore the use of these guidelines for surveillance purposes only.

The MIC breakpoints used to interpret AST results for penicillin, ciprofloxacin and tetracycline in this report are based on EUCAST clinical breakpoint tables (version 13.0), published in January

2023 (European Committee on Antimicrobial Susceptibility Testing 2023). Tetracycline breakpoints using EUCAST changed in 2023 with resistance being redefined as MIC as >0.5 mg/L compared to >1.0 mg/L in previous years. This means that some isolates with an MIC of 1.0 mg/L reported as susceptible in previous years would now be considered resistant when applying the new breakpoint. Zone diameters for all antimicrobials were interpreted using CLSI 2023 breakpoints.

The MIC and zone diameter breakpoints used to interpret AST results are displayed in Table 1 and Table 2. For simplicity, in this report results for ciprofloxacin, penicillin and tetracyclines interpreted as 'Intermediate' using CLSI zone diameter breakpoints or 'Susceptible, increased exposure' using EUCAST MIC breakpoints are referred to as 'Intermediate susceptibility'.

Table 1: Minimum inhibitory concentration (MIC) standards for interpreting antimicrobial susceptibility testing results

Antimicrobial	MIC breakpoint for susceptibility (mg/L)	MIC breakpoint for intermediate susceptibility (mg/L)	MIC breakpoint for resistance (mg/L)
Ceftriaxone	<0.06	0.06 to 0.125*	>0.125
Ciprofloxacin	≤0.03	0.06	>0.06
Penicillin	≤0.06	0.12 to 1	>1
Tetracyclines	≤0.5	-	>0.5
	MIC ECOFF (mg/L)	MIC >1.0 mg/L (non-wild type)	
Azithromycin	≤1	>1.0mg/L	

MIC, minimum inhibitory concentration.
* Decreased susceptibility category based upon World Health Organization surveillance guidelines; only used for surveillance reporting – this is not a clinical breakpoint.

Table 2: Zone diameter (ZD) breakpoints for interpreting antimicrobial susceptibility testing results using CLSI

Antimicrobial	Zone diameter for susceptibility (mm)	Zone diameter for intermediate susceptibility (mm)	Zone diameter for resistance (mm)
Azithromycin	≥30	-	-
Ceftriaxone	≥35	-	-
Ciprofloxacin	≥41	28-40	≤27
Penicillin	≥47	27-46	≤26
Tetracyclines	≥38	31-37	≤30

RESULTS

CULTURE AND ANTIMICROBIAL SUSCEPTIBILITY TESTING

A detailed breakdown of gonorrhoea infection and culture numbers for 2023 is presented in Table 3. In 2023, 1,726/7,794 (22%) of the reported gonococcal cases had a culture test. Of these, 1,288 were positive for gonorrhoea, and AST was undertaken and reported to ESR for 1,246 (97%) isolates for ceftriaxone and 835 (65%) isolates for azithromycin. Te Manawa Taki (Waikato and surrounding districts) and Te Waipounamu (South Island) reported the highest proportion of culture testing among positive cases (29% and 25% respectively) and AST for ceftriaxone (98% each). Te Manawa Taki reported the highest proportion of AST for azithromycin (85%).

Table 3: Total number of gonococcal infections, culture tests, positive culture results, ceftriaxone AST results and azithromycin AST results by region: 2023

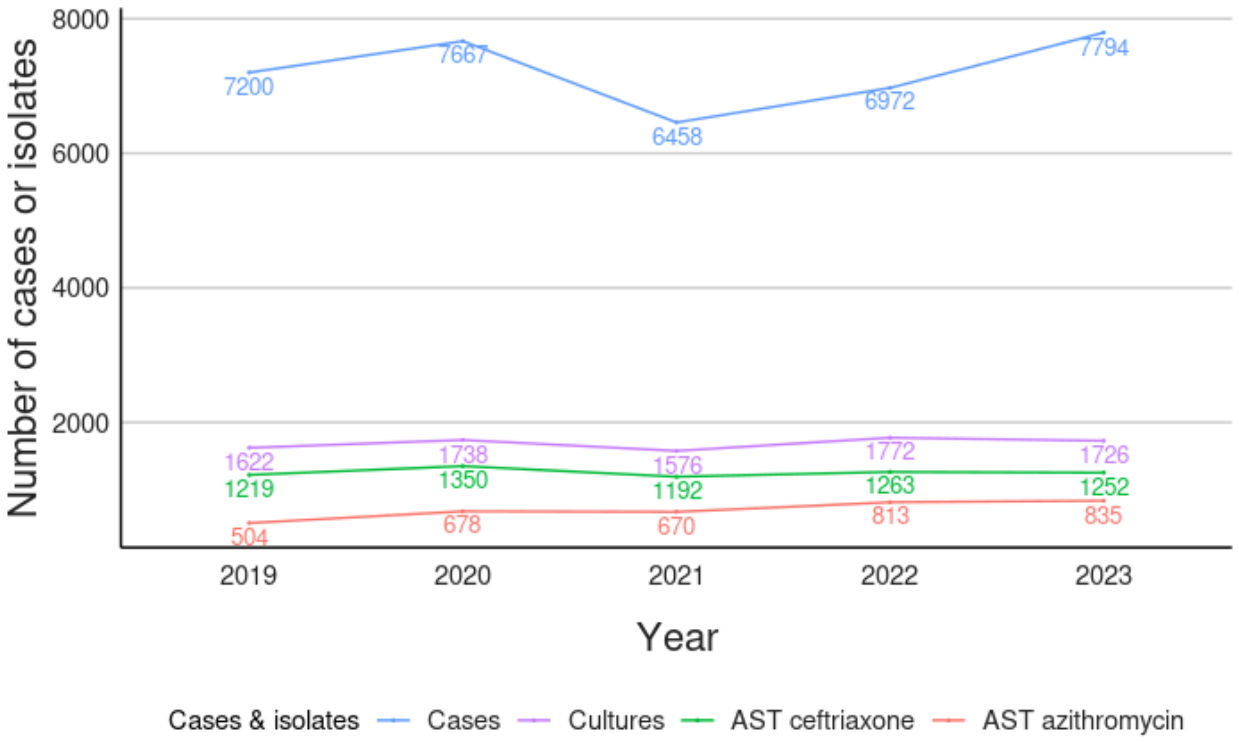
Region	No. of infections[1]	No. of culture tests[2]	No. of positive culture results[3]	No. of Azithromycin AST results[4]	No. of Ceftriaxone AST results[4]
Central	1,271	168 (13%)	121	0[5]	108 (89%)
Northern	4,159	921 (22%)	627	424 (68%)	607 (97%)
Te Manawa Taki	1,288	371 (29%)	294	249 (85%)	289 (98%)
Te Waipounamu	1,076	266 (25%)	246	162 (66%)	242 (98%)
Total	**7,794**	**1,726 (22%)**	**1,288**	**835 (65%)**	**1,246 (97%)**

[1] Infections exclude multiple positive results within a defined period of time.
[2] Deduplicated to exclude multiple positive results within the same episode. % of infections among individuals with a known NHI or PID (personal identifier) who had a culture test.
A 'period of testing' created for results with known NHI or PID and in the same year and month.
All 'periods of testing' without a positive result removed.
All episodes of gonorrhoea with a culture test in the same 'period of testing' included, with 'PCR only' episodes removed.
Calculated number of gonorrhoea cases per region with a known NHI/PID where a culture test was taken.
[3] Of all the culture tests taken, these returned a positive result. A person with a gonococcal infection may return a negative culture test for several reasons, including: an extended transport time resulting in an unviable isolate; testing during the same infection but after treatment has started; and testing from a different anatomical site of the infection.
[4] Includes all positive culture results received with completed Antimicrobial Susceptibility Testing (AST) data in order of preference from minimum inhibitory concentration (MIC) results to SIR results (Susceptible; Susceptible, increased exposure/Intermediate; or Resistant) to disk diffusion results. % of AST results from no. of positive culture results.
[5] Laboratories in the Central Region do not undertake Azithromycin AST.

Numbers of gonorrhoea cases and isolates undergoing azithromycin and ceftriaxone AST from 2019 to 2023 are shown in Figure 1. Annual gonorrhoea notifications decreased in 2021 by 16%, then increased nearly 8% and 12% in 2022 and 2023 respectively. The proportion of cases with a culture test reported, increased slightly from 22% in 2019 to 25% in 2022, decreasing to 22% in 2023.

The percentage of cases undergoing ceftriaxone AST has remained relatively steady between 2019 to 2022, increasing from 16.9% in 2019 to 18.3% in 2021. The percentage of cases undergoing ceftriaxone AST decreased in 2023 to 16.0% (1,246/7,794). The proportion of cases undergoing azithromycin testing increased from 7.0% in 2019 (504/7,200) to 11.7% in 2022, and 10.7% in 2023 (835/7,794). It is not clear whether this increase is due to increased testing or increased reporting. [The proportion of cases undergoing azithromycin susceptibility testing in 2022 was previously incorrectly reported as 18.2%.].

Figure 1: Number of gonorrhoea cases reported and isolates subsequently undergoing antimicrobial susceptibility testing for azithromycin and ceftriaxone in New Zealand: 2019–2023



AZITHROMYCIN & CEFTRIAXONE RESISTANCE

Table 4 shows the proportion of deduplicated *N. gonorrhoeae* isolates (rather than gonorrhoea cases) with azithromycin MIC >1.0 mg/L and decreased susceptibility to ceftriaxone. No isolates have been reported as resistant to ceftriaxone. The percentage of isolates with decreased susceptibility to ceftriaxone remains low, fluctuating between 0.4% and 1.2% between 2019 and 2023. Decreased susceptibility to ceftriaxone is a category used for surveillance purposes only and is not a clinical breakpoint.

Table 4: Azithromycin, MIC>1.0 mg/L and decreased susceptibility to ceftriaxone for N. gonorrhoeae in New Zealand: 2019–2023

	2019	2020	2021	2022	2023
Azithromycin, (MIC >1.0 mg/L)	16/504 (3.2%)	61/678 (9.0%)	36/670 (5.4%)	12/813 (1.5%)	27/835 (3.2%)
Ceftriaxone, decreased susceptibility (MIC 0.06 to 0.125 mg/L)	5/1216 (0.4%)	14/1338 (1.0%)	14/1183 (1.2%)	8/1258 (0.6%)	9/1246 (0.7%)

Due to very few isolates with decreased susceptibility, and no isolates with resistance to ceftriaxone, further trends are difficult to identify (Table 5). By sex, a similar proportion of isolates with decreased susceptibility to ceftriaxone were reported for males (8, 0.7%) and females (2, 1.0%). No clear differences were discernible by age and ethnicity. By region, seven isolates (2.4%) with decreased susceptibility were reported from Te Manawa Taki, with one isolate respectively from the Northern and Central regions. The highest number of isolates with decreased susceptibility were from urogenital sites (4), with 1 pharyngeal specimen.

The proportion of isolates with azithromycin MIC >1.0 mg/L has also fluctuated between 2019 and 2023, with a peak of 9.0% in 2020, a low of 1.5% in 2022, then increasing slightly in 2023 to 3.2% (Table 6). Further trends in azithromycin susceptibility are shown in Appendix Table 2. The proportion of isolates with azithromycin MIC >1.0 mg/L by sex fluctuates by year due to low isolates counts.

By age, the proportion of isolates with azithromycin MIC >1.0 mg/L is fairly evenly distributed in most reporting years, except for 2020 and 2021 where a higher number and proportion of isolates was reported amongst those aged 30 years or older. There were no clear trends in azithromycin MICs by ethnicity; those of European/other and Māori ethnicity had slightly higher numbers and proportions in 2020 and 2021, but there was little difference in all other reporting years.

In 2023, the highest proportion of isolates with azithromycin MIC >1.0 mg/L were reported in Te Manawa Taki (7.2%), followed by Northern region (1.9%). As in previous years, Central region did not report azithromycin AST results in 2023.

By specimen site, the highest number of specimens with azithromycin AST results reported were from urogenital sites (597, 68.1%), followed by anorectal sites (170, 19.4%) and the pharynx (96, 10.9%), although these differ notably by sex (Table 10). Between 2020–2023 of all the isolates from females with MIC >1.0 mg/L, 92–93% were from the urogenital site, and 3–6% from the anorectal site. Amongst males, of all the isolates with MIC >1.0mg/L; 79% were from the urogenital site in 2019, decreasing to 63% in 2023; 17–23% were from the anorectal site, fluctuating among reporting years, while there was a notable increase from the pharyngeal site, increasing from 1.5% in 2019 to 13% in 2023.

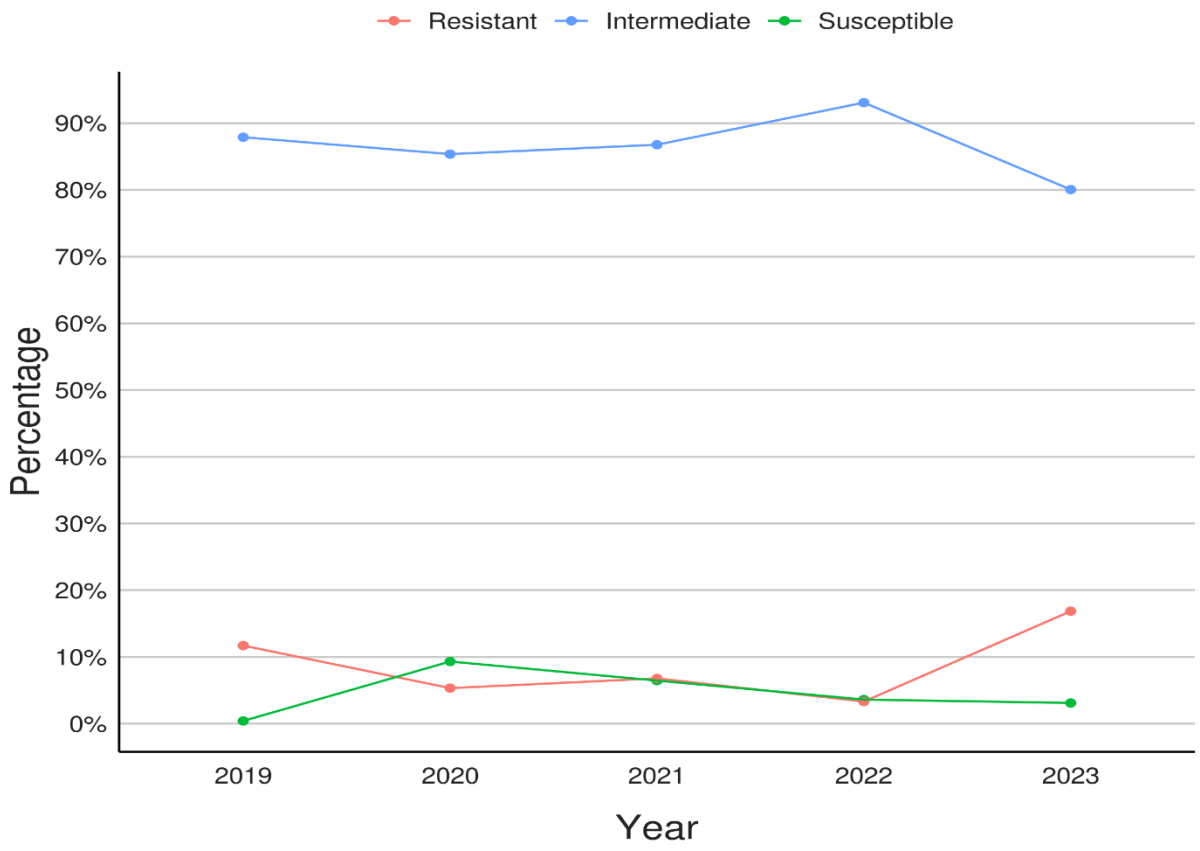
PENICILLIN RESISTANCE

AST reporting for penicillin remains very low in the Central and Northern regions with less than 20 results reported across both regions each year except for 2020 when Central reported 65 AST results. The vast majority of testing is undertaken in Te Manawa Taki and Te Waipounamu regions, with approximately 150 AST results reported per year from each region across the reporting years.

Resistance to penicillin fluctuated between 11.7% in 2019 and 3.3% in 2022; this increased to 16.8% in 2023 (Figure 2). Intermediate resistance to penicillin has remained steady but very high (>85%) for all reporting years except 2023 when 80% of isolates had intermediate susceptibility to penicillin. Susceptible isolates remain low at 3% in 2023, and below 10% for the whole reporting period. Further trends in penicillin susceptibility are shown in (Table 7).

By sex, the proportion of isolates with intermediate susceptibility to penicillin was highest among females in 2023 at 86%, compared to 79% amongst males. Intermediate susceptibility to penicillin ranged from 80–99% among isolates from females and 86–92% from males between 2019 and 2022. By age and ethnicity, intermediate resistance to penicillin has fluctuated. Penicillin AST methods differ across laboratories, with some using disc diffusion and others MIC gradient strip testing, with different brands of strip tests. These differences in methods may yield different results across laboratories.

Figure 2: Proportion of *N. gonorrhoea* isolates by susceptibility* to penicillin in New Zealand: 2019–2023

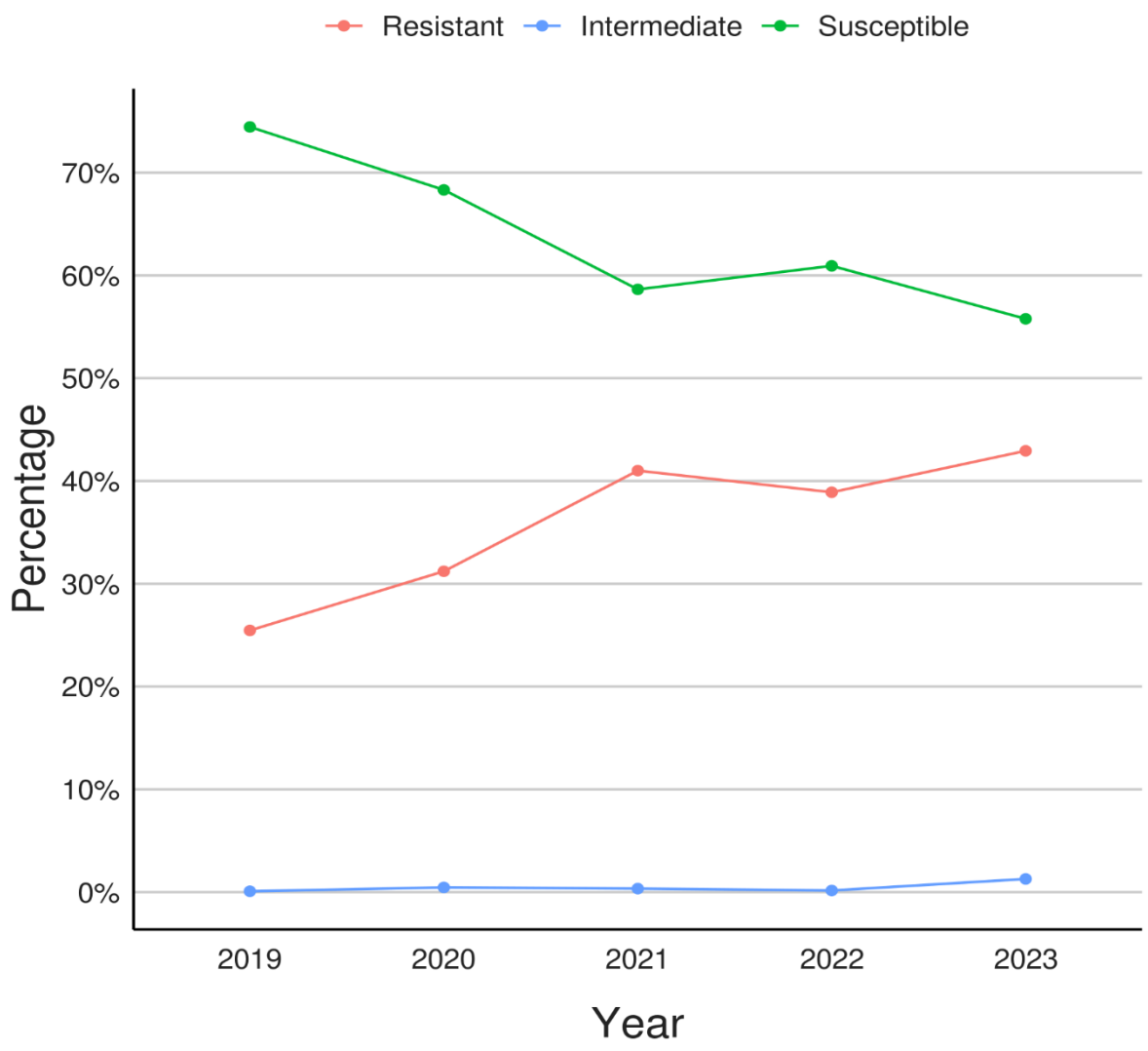


* Results reported as Intermediate include those interpreted using CLSI 'Intermediate' breakpoints and EUCAST 'Susceptible, increased exposure' breakpoints.

CIPROFLOXACIN RESISTANCE

Isolates with intermediate susceptibility to ciprofloxacin represent <1% (<10 isolates) of AST each year and are not discussed or presented in the summary table (Table 8); they are shown in Figure 3. Ciprofloxacin resistance has increased steadily from 25% in 2019, to 43% in 2023; correspondingly, susceptibility has decreased from 74% to 56%. By sex, resistance to ciprofloxacin increased amongst isolates from males from 27% in 2019 to 45% in 2021; it has since fluctuated and was 47% in 2023. Similarly, resistance in isolates from females increased from 22% in 2019 to 27% in 2020 but decreased in 2021 and remained steady in 2022 and 2023 (19% both years). By age, the proportion of resistant isolates (between 43–53% since 2021) is highest amongst those aged 30 years and older across all years, with those aged 25–29 years reporting a similarly high proportion in 2021 and 2023. By ethnicity, across all reporting years, the highest proportion of resistant isolates (between 47–59% since 2021) were seen among isolates from people of Asian ethnicity followed by European/other ethnicities.

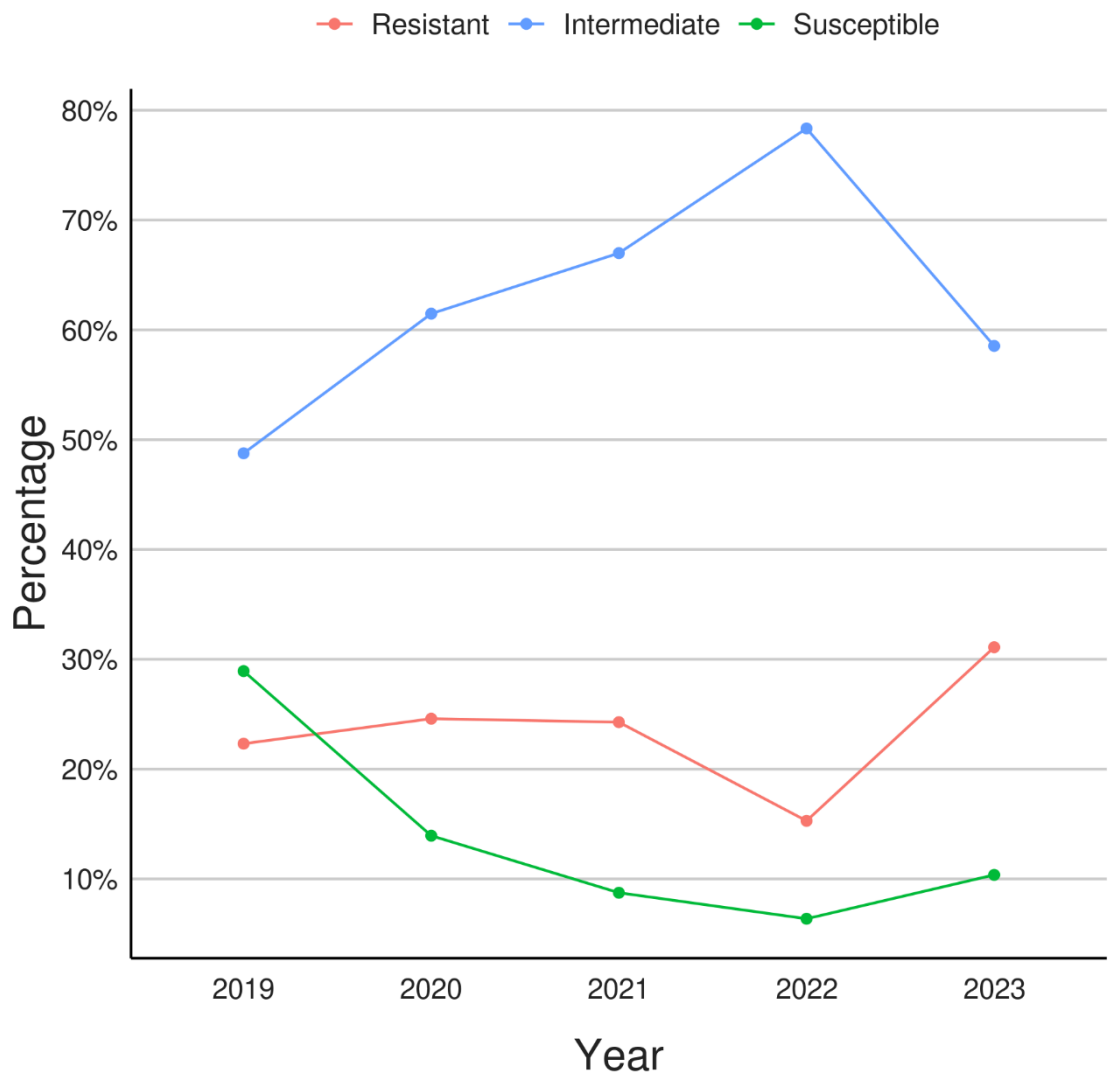
Figure 3: Proportion of *N. gonorrhoea* isolates by susceptibility to ciprofloxacin in New Zealand: 2019–2023



TETRACYCLINE RESISTANCE

As in previous years, tetracycline AST results for 2023 were received from only one region (Te Waipounamu), except for two isolate results received from the Northern region in 2022 and 2023 (Table 9). The number of isolates tested increased from 100–122 annually between 2019–2021 to 164 isolates in 2023. Resistance to tetracycline fluctuated from 22–25% between 2019 and 2021, then decreased to 14% (22/157) in 2022 before doubling to 30% (49/164) in 2023 (Figure 4). Although the MIC breakpoints changed in 2023, the majority of results are received interpreted (SIR instead of MIC or ZD data), therefore the impact of the new breakpoints is unclear. Although the number of resistant isolates is highest amongst males each year, the proportion of resistant isolates was highest amongst females in 2019 and 2020, highest amongst males in 2021, and very similar in 2022 and 2023. Given low isolate numbers, there are no trends by age and ethnicity to report.

Figure 4: Proportion of *N. gonorrhoeae* isolates by susceptibility to tetracycline in New Zealand: 2019–2023



DISCUSSION

To date there have been no reported gonococcal isolates that are resistant to ceftriaxone in New Zealand, and levels of decreased susceptibility remain low, at 0.7% in 2023. Almost all gonococcal isolates (97%) with a positive culture underwent AST for ceftriaxone in 2023. Due to low numbers of isolates with decreased susceptibility to ceftriaxone, further descriptive analysis of these isolates is limited. In 2023, quarter 4, Australia reported two ceftriaxone-resistant isolates (0.07%, MIC ≥0.125 mg/L). They also report isolates with an MIC of 0.06 mg/L as decreased susceptibility to ceftriaxone; the proportion of isolates with this result has decreased from 5.1% in 2022 to 2.4% in 2023 Q4 (Lahra M. H., 2024).

The proportion of isolates with azithromycin MIC >1.0 mg/L has fluctuated over time, decreasing from 9.0% (61/678) in 2020 to 1.5% (12/813) in 2022, and then 3.2% (27/835) in 2023. The highest MIC reported to-date is 32 mg/L in 2023, with an additional four isolates reported with an MIC of 16 mg/L in 2020 (n=1), 2022 (n=1) and 2023 (n = 2). In 2023, 17/27 (63%) of isolates (MIC >1.0 mg/L) had an MIC of 2 mg/L.

In 2023 Q4, Australia reported 129 of 2,719 (4.7%) isolates tested as resistant to azithromycin (as defined by each jurisdiction), with nine isolates exhibiting high-level resistance (MIC ≥ 256mg/L) (Lahra M. H., 2024).

While the relatively low levels of azithromycin MIC >1.0 mg/L and no documented ceftriaxone resistant isolates in New Zealand in 2023 are reassuring, continued vigilance is required to detect and monitor the spread of resistant *N. gonorrhoeae* and maintain the effectiveness of current gonorrhoea treatment in New Zealand. This is particularly important in the context of the increases in ceftriaxone-resistant and azithromycin-resistant *N. gonorrhoeae* globally, including our closest neighbours, Australia (NSW Health, 2024).

In addition to molecular testing for diagnosis, ongoing bacterial culture of *N. gonorrhoeae* is required for monitoring AMR. In 2023, culture was undertaken for only 22% of gonococcal infections, a slight decrease compared to 2019–2022 (22–24%). The proportion of all infections providing a positive culture on which AST could be performed was 16.5% in 2023; this is lower than reported in Australia in 2022 (24%) (Lahra M. H., 2024). Comparisons with UK and US AMR surveillance is difficult due to difference in the sentinel surveillance systems in use (Public Health England, 2021) (Centers for Disease Control and Prevention, 2022).

New Zealand *N. gonorrhoeae* AMR data are not systematically sampled and are influenced by swabbing practices. Cultures are primarily taken in sexual health services, with sampling bias potentially affecting generalisability of resistance profiles. An improved understanding of the demographics of those swabbed, including through the integration of clinical and laboratory data, may provide insight. To fully understand site of infection, sexual behaviour is an important consideration, however this is not collected with laboratory data and laboratory results cannot currently be routinely linked with clinical notifications. There are a number of known challenges with the quality of New Zealand *N. gonorrhoeae* AMR data, including a lack of standardisation of results, transcription errors resulting from the manual data entry process, and random errors. Efforts were made to confirm results with all laboratories, particularly reports of decreased susceptibility to ceftriaxone and azithromycin MIC > 1mg/L, however some errors may persist. Further, the small number of isolates tested, and differential reporting practices across laboratories limits the identification of spatial patterns in resistance. Finally, inconsistencies in AST methods between laboratories, and changes in AST practices that occurred between 2019–2024 may have influenced the results presented in this report. These include differences in testing methodologies, materials, and interpretation standards used for each antibiotic across many labs.

Effective surveillance of *N. gonorrhoeae* AMR is crucial for the early detection of resistant strains and to ensure treatment guidelines are appropriate. Continued efforts to increase the proportion of cases for which isolates are referred for culture and which are tested for susceptibility to important antimicrobials across all regions are recommended.

APPENDICES

Table 5: Number & proportion (%) of gonococcal isolates by susceptibility to ceftriaxone*, New Zealand, 2019–2023 by sex, age, ethnicity, region, and specimen site

	2019		2020		2021		2022		2023	
Sex	**S**, N = 1,211[1]	**DS** N = 5[1]	**S**, N = 1,324[1]	**DS**, N = 14[1]	**S**, N = 1,169[1]	**DS**, N = 14[1]	**S**, N = 1,250[1]	**DS**, N = 8[1]	**S**, N = 1,237[1]	**DS**, N = 9[1]
Female	338 (99%)	2 (0.6%)	304 (97%)	8 (2.6%)	195 (97%)	6 (3.0%)	224 (98%)	4 (1.8%)	190 (99%)	2 (1.0%)
Male	873 (100%)	3 (0.3%)	1,020 (99%)	6 (0.6%)	974 (99%)	8 (0.8%)	1,026 (100%)	4 (0.4%)	1,047 (99%)	7 (0.7%)
Age group										
0–14	15 (100%)	0	10 (100%)	0	7 (100%)	0	0	0	0	0
15–19	119 (100%)	0	103 (99%)	1 (1.0%)	99 (100%)	0	102 (100%)	0	113 (100%)	0
20–24	279 (100%)	1 (0.4%)	289 (99%)	3 (1.0%)	222 (98%)	4 (1.8%)	303 (99%)	3 (1.0%)	269 (100%)	0
25–29	293 (100%)	1 (0.3%)	314 (98%)	5 (1.6%)	271 (99%)	2 (0.7%)	273 (100%)	1 (0.4%)	271 (99%)	3 (1.1%)
30–39	328 (100%)	1 (0.3%)	371 (100%)	1 (0.3%)	359 (99%)	4 (1.1%)	345 (99%)	3 (0.9%)	337 (99%)	5 (1.5%)
40+	177 (99%)	2 (1.1%)	237 (98%)	4 (1.7%)	211 (98%)	4 (1.9%)	227 (100%)	1 (0.4%)	247 (100%)	1 (0.4%)
Ethnicity										
Asian	99 (100%)	0	112 (99%)	1 (0.9%)	120 (98%)	2 (1.6%)	118 (99%)	1 (0.8%)	140 (99%)	2 (1.4%)
European/Other	497 (99%)	3 (0.6%)	487 (100%)	2 (0.4%)	447 (100%)	2 (0.4%)	507 (100%)	2 (0.4%)	497 (100%)	0
Māori	294 (100%)	1 (0.3%)	326 (98%)	5 (1.5%)	297 (98%)	5 (1.7%)	331 (100%)	1 (0.3%)	276 (100%)	0
Pacific	166 (100%)	0	186 (100%)	0	167 (99%)	1 (0.6%)	197 (99%)	2 (1.0%)	184 (100%)	0
Unknown	155 (99%)	1 (0.6%)	213 (97%)	6 (2.7%)	138 (97%)	4 (2.8%)	97 (98%)	2 (2.0%)	140 (95%)	7 (4.8%)
Region										
Central	123 (100%)	0	146 (99%)	2 (1.4%)	105 (99%)	1 (0.9%)	99 (100%)	0	108 (100%)	0
Northern	583 (99%)	3 (0.5%)	626 (100%)	3 (0.5%)	573 (99%)	6 (1.0%)	561 (99%)	4 (0.7%)	606 (100%)	1 (0.2%)
Te Manawa Taki	197 (99%)	1 (0.5%)	276 (97%)	9 (3.2%)	265 (97%)	7 (2.6%)	298 (99%)	4 (1.3%)	282 (98%)	7 (2.4%)
Te Waipounamu	308 (100%)	1 (0.3%)	276 (100%)	0	226 (100%)	0	292 (100%)	0	241 (100%)	1 (0.4%)
Specimen Site										
Ano-rectal	80 (99%)	1 (1.2%)	117 (100%)	0	141 (99%)	1 (0.7%)	134 (100%)	0	166 (100%)	0
Other/Unknown	88 (100%)	0	66 (100%)	0	45 (96%)	2 (4.3%)	45 (100%)	0	36 (100%)	0
Pharyngeal	8 (100%)	0	33 (100%)	0	48 (96%)	2 (4.0%)	64 (98%)	1 (1.5%)	88 (98%)	2 (2.2%)
Urogenital	1,035 (100%)	4 (0.4%)	1,108 (99%)	14 (1.2%)	935 (99%)	9 (1.0%)	1,007 (99%)	7 (0.7%)	947 (99%)	7 (0.7%)

[1]N (row % per year, rounding to 1 decimal place if low counts)

DS = Decreased Susceptibility (MIC 0.06 to 0.125mg/L). Not a clinically important MIC breakpoint; reported for surveillance purposes only

* No Resistant isolates (MIC >0.125mg/L) reported

Table 6: Number & proportion (%) of gonococcal isolates with azithromycin MIC>1.0mg/L*, New Zealand, 2019–2023 by sex, age, ethnicity and region

	2019		2020		2021		2022		2023	
Sex	S[1] N = 488[3]	MIC >1[2] N = 16[3]	S[1] N = 617[3]	MIC >1[2] N = 61[1]	S[1] N = 634[1]	MIC >1[2] N = 36[1]	S[1] N = 801[1]	MIC >1[2] N = 12[1]	S[1] N = 808[1]	MIC >1[2] N = 27[1]
Female	118 (99%)	1 (0.8%)	127 (95%)	6 (4.5%)	108 (97%)	3 (2.7%)	146 (98%)	3 (2.0%)	131 (98%)	3 (2.2%)
Male	370 (96%)	15 (3.9%)	490 (90%)	55 (10%)	526 (94%)	33 (5.9%)	655 (99%)	9 (1.4%)	677 (97%)	24 (3.4%)
Age group										
0–14	6 (100%)	0	1 (100%)	0	3 (100%)	0	0	0	0	0
15–19	46 (100%)	0	42 (95%)	2 (4.5%)	44 (94%)	3 (6.4%)	58 (100%)	0 (0%)	61 (94%)	4 (6.2%)
20–24	98 (95%)	5 (4.9%)	133 (94%)	9 (6.3%)	103 (94%)	6 (5.5%)	200 (99%)	3 (1.5%)	160 (97%)	5 (3.0%)
25–29	126 (98%)	2 (1.6%)	156 (92%)	13 (7.7%)	157 (97%)	5 (3.1%)	157 (98%)	3 (1.9%)	184 (96%)	8 (4.2%)
30–39	137 (96%)	6 (4.2%)	180 (90%)	20 (10%)	200 (94%)	12 (5.7%)	244 (99%)	2 (0.8%)	228 (97%)	6 (2.6%)
40+	75 (96%)	3 (3.8%)	105 (86%)	17 (14%)	127 (93%)	10 (7.3%)	142 (97%)	4 (2.7%)	175 (98%)	4 (2.2%)
Ethnicity										
Asian	34 (100%)	0 (0%)	57 (95%)	3 (5.0%)	71 (96%)	3 (4.1%)	73 (99%)	1 (1.4%)	107 (99%)	1 (0.9%)
European/Other	196 (96%)	9 (4.4%)	183 (86%)	31 (14%)	230 (93%)	17 (6.9%)	305 (98%)	6 (1.9%)	308 (97%)	10 (3.1%)
Māori	92 (97%)	3 (3.2%)	138 (91%)	13 (8.6%)	160 (95%)	8 (4.8%)	217 (99%)	3 (1.4%)	165 (97%)	5 (2.9%)
Pacific	56 (100%)	0 (0%)	74 (96%)	3 (3.9%)	77 (97%)	2 (2.5%)	117 (99%)	1 (0.8%)	98 (97%)	3 (3.0%)
Unknown	110 (96%)	4 (3.5%)	165 (94%)	11 (6.3%)	96 (94%)	6 (5.9%)	89 (99%)	1 (1.1%)	130 (94%)	8 (5.8%)
Region										
Central	1 (100%)	0	0	1 (100%)	1 (100%)	0	0	0	0	0
Northern	219 (96%)	10 (4.4%)	310 (95%)	17 (5.2%)	318 (93%)	24 (7.0%)	367 (99%)	3 (0.8%)	416 (98%)	8 (1.9%)
Te Manawa Taki	151 (98%)	3 (1.9%)	217 (95%)	11 (4.8%)	217 (97%)	7 (3.1%)	283 (98%)	5 (1.7%)	231 (93%)	18 (7.2%)
Te Waipounamu	117 (98%)	3 (2.5%)	90 (74%)	32 (26%)	98 (95%)	5 (4.9%)	151 (97%)	4 (2.6%)	161 (99%)	1 (0.6%)
Specimen Site										
Ano-rectal	66 (94%)	4 (5.7%)	88 (83%)	18 (17%)	121 (93%)	9 (6.9%)	123 (97%)	4 (3.1%)	163 (100%)	0
Other/Unknown	9 (90%)	1 (10%)	8 (89%)	1 (11%)	15 (94%)	1 (6.3%)	7 (100%)	0	12 (92%)	1 (7.7%)
Pharyngeal	8 (100%)	0	24 (75%)	8 (25%)	41 (87%)	6 (13%)	64 (98%)	1 (1.5%)	86 (97%)	3 (3.4%)
Urogenital	405 (97%)	11 (2.6%)	497 (94%)	34 (6.4%)	457 (96%)	20 (4.2%)	607 (99%)	7 (1.1%)	547 (96%)	23 (4.0%)

[1] Susceptible isolates MIC <1mg/L

[2] MIC>1 denotes isolates with MIC >1mg/L* No isolates with high-level resistance (MIC >256mg/L) reported in NZ

[3] N (row % per year, rounding to 1 decimal place if low counts)

Table 7: Number & proportion (%) of gonococcal isolates by susceptibility to penicillin, New Zealand, 2019–2023 by sex, age, ethnicity and region

	2019			2020			2021			2022			2023		
Sex	**S**, N = 1[1]	**I**, N = 218[1]	**R**, N = 29[1]	**S**, N = 35[1]	**I**, N = 321[1]	**R**, N = 20[1]	**S**, N = 19[1]	**I**, N = 256[1]	**R**, N = 20[1]	**S**, N = 12[1]	**I**, N = 310[1]	**R**, N = 11[1]	**S**, N = 11[1]	**I**, N = 285[1]	**R**, N = 60[1]
Female	1 (2%)	59 (89%)	6 (9%)	13 (14%)	74 (80%)	5 (5%)	4 (8%)	43 (90%)	1 (2%)	0	67 (99%)	1 (2%)	2 (3%)	56 (86%)	7 (11%)
Male	0	159 (87%)	23 (13%)	22 (8%)	247 (87%)	15 (5%)	15 (6%)	213 (86%)	19 (8%)	12 (5%)	243 (92%)	10 (4%)	9 (3%)	229 (79%)	53 (18%)
Age group															
0–14	0	4 (100%)	0	1 (33%)	2 (67%)	0	0	1 (100%)	0	0	0	0	0	0	0
15–19	0	14 (100%)	0	3 (13%)	18 (78%)	2 (9%)	1 (6%)	15 (94%)	0	1 (4%)	22 (96%)	0	2 (7%)	24 (77%)	5 (16%)
20–24	0	46 (90%)	5 (10%)	12 (14%)	68 (82%)	3 (4%)	1 (2%)	41 (91%)	3 (7%)	4 (5%)	71 (92%)	2 (3%)	3 (4%)	59 (80%)	12 (16%)
25–29	0	53 (87%)	8 (13%)	5 (7%)	63 (84%)	7 (9%)	6 (10%)	53 (84%)	4 (6%)	1 (2%)	59 (94%)	3 (5%)	4 (6%)	55 (79%)	11 (16%)
30–39	1 (1%)	62 (86%)	9 (13%)	8 (7%)	106 (89%)	5 (4%)	8 (8%)	79 (81%)	10 (10%)	5 (5%)	91 (93%)	2 (2%)	2 (2%)	71 (80%)	16 (18%)
40+	0	39 (85%)	7 (15%)	6 (8%)	64 (88%)	3 (4%)	3 (4%)	67 (92%)	3 (4%)	1 (1%)	67 (93%)	4 (6%)	0	76 (83%)	16 (17%)
Ethnicity															
Asian	0	10 (71%)	4 (29%)	1 (9%)	9 (82%)	1 (9%)	1 (8%)	8 (67%)	3 (25%)	0	13 (100%)	0	0	23 (74%)	8 (26%)
European/ Other	0	93 (89%)	11 (11%)	12 (9%)	110 (87%)	5 (4%)	3 (3%)	98 (89%)	9 (8%)	5 (3%)	155 (95%)	4 (2%)	4 (3%)	117 (78%)	29 (19%)
Māori	1 (2%)	43 (90%)	4 (8%)	6 (7%)	80 (89%)	4 (4%)	7 (9%)	69 (85%)	5 (6%)	6 (5%)	113 (92%)	4 (3%)	4 (4%)	83 (87%)	8 (8.4%)
Pacific	0	2 (67%)	1 (33%)	0	14 (82%)	3 (18%)	3 (20%)	11 (73%)	1 (7%)	0	10 (91%)	1 (9%)	2 (12%)	11 (65%)	4 (24%)
Unknown	0	70 (89%)	9 (11%)	16 (12%)	108 (82%)	7 (5%)	5 (7%)	70 (91%)	2 (3%)	1 (5%)	19 (86%)	2 (9%)	1 (2%)	51 (81%)	11 (17%)
Region															
Central	0	1 (33%)	2 (67%)	9 (14%)	52 (80%)	4 (6%)	4 (29%)	10 (71%)	0	1 (17%)	4 (67%)	1 (17%)	2 (18%)	8 (73%)	1 (9.1%)
Northern	0	16 (100%)	0	2 (14%)	10 (71%)	2 (14%)	6 (33%)	12 (67%)	0	0	4 (100%)	0	1 (11%)	7 (78%)	1 (11%)
Te Manawa Taki	0	78 (93%)	6 (7%)	19 (13%)	119 (83%)	6 (4%)	9 (6%)	134 (91%)	4 (3%)	11 (7%)	147 (91%)	3 (2%)	7 (6%)	134 (87%)	13 (8.4%)
Te Waipounamu	1 (1%)	123 (85%)	21 (14%)	5 (3%)	140 (92%)	8 (5%)	0	100 (86%)	16 (14%)	0	155 (96%)	7 (4%)	1 (1%)	136 (75%)	45 (25%)

[1]N (row % per year, rounding to 1 decimal place if low counts)

Table 8: Number & proportion (%) of gonococcal isolates susceptible or resistance to ciprofloxacin, New Zealand, 2019–2023 by sex, age, ethnicity and region

	2019		2020		2021		2022		2023	
Sex	**S**, N = 880[1]	**R**, N = 301[1]	**S**, N = 893[1]	**R**, N = 408[1]	**S**, N = 685[1]	**R**, N = 479[1]	**S**, N = 769[1]	**R**, N = 491[1]	**S**, N = 695[1]	**R**, N = 535[1]
Female	255 (78%)	73 (22%)	215 (73%)	80 (27%)	155 (80%)	38 (20%)	184 (81%)	44 (19%)	151 (79%)	37 (19%)
Male	625 (73%)	228 (27%)	678 (67%)	328 (32%)	530 (54%)	441 (45%)	585 (57%)	447 (43%)	544 (52%)	498 (47%)
Age group										
0–14	10 (71%)	4 (29%)	9 (82%)	2 (18%)	6 (100%)	0	0	0	0	0
15–19	96 (83%)	20 (17%)	76 (77%)	22 (22%)	78 (80%)	18 (19%)	67 (65%)	36 (35%)	89 (79%)	24 (21%)
20–24	200 (74%)	72 (26%)	222 (77%)	64 (22%)	153 (69%)	68 (30%)	206 (67%)	102 (33%)	168 (62%)	95 (35%)
25–29	226 (79%)	60 (21%)	214 (68%)	98 (31%)	153 (56%)	119 (44%)	180 (65%)	94 (34%)	152 (55%)	119 (43%)
30–39	228 (71%)	92 (29%)	212 (60%)	142 (40%)	197 (55%)	162 (45%)	187 (54%)	160 (46%)	170 (50%)	166 (49%)
40+	120 (69%)	53 (31%)	160 (67%)	80 (33%)	98 (47%)	112 (53%)	129 (57%)	99 (43%)	116 (47%)	131 (53%)
Ethnicity										
Asian	65 (66%)	33 (34%)	74 (66%)	37 (33%)	49 (41%)	71 (59%)	50 (42%)	69 (58%)	61 (43%)	80 (56%)
European/Other	331 (67%)	162 (33%)	277 (58%)	195 (41%)	226 (51%)	214 (48%)	271 (53%)	240 (47%)	238 (48%)	252 (51%)
Māori	238 (81%)	54 (18%)	233 (73%)	87 (27%)	207 (70%)	89 (30%)	219 (66%)	112 (34%)	177 (64%)	96 (35%)
Pacific	142 (89%)	17 (11%)	156 (86%)	25 (14%)	111 (66%)	55 (33%)	150 (75%)	49 (25%)	122 (66%)	61 (33%)
Unknown	104 (75%)	35 (25%)	153 (71%)	64 (29%)	92 (65%)	50 (35%)	79 (79%)	21 (21%)	97 (66%)	46 (31%)
Region										
Central	103 (87%)	16 (13%)	116 (78%)	33 (22%)	59 (58%)	43 (42%)	43 (43%)	56 (56%)	50 (46%)	58 (54%)
Northern	463 (80%)	115 (20%)	435 (70%)	184 (30%)	288 (50%)	285 (49%)	298 (53%)	267 (47%)	334 (55%)	273 (45%)
Te Manawa Taki	117 (66%)	59 (34%)	204 (73%)	74 (27%)	191 (70%)	80 (30%)	229 (75%)	75 (25%)	208 (72%)	76 (26%)
Te Waipounamu	197 (64%)	111 (36%)	138 (54%)	117 (46%)	147 (67%)	71 (32%)	199 (68%)	93 (32%)	103 (43%)	128 (53%)

[1]n (row % per year, rounding to 1 decimal place if low counts)

Table 9: Number & proportion (%) of gonococcal isolates by susceptibility to tetracycline, New Zealand, 2019–2023 by sex, age, ethnicity and region

	2019			2020			2021			2022			2023		
Sex	**S**, N = 35[1]	**I**, N = 59[1]	**R**, N = 27[1]	**S**, N = 17[1]	**I**, N = 75[1]	**R**, N = 30[1]	**S**, N = 9[1]	**I**, N = 69[1]	**R**, N = 25[1]	**S**, N = 10[1]	**I**, N = 123[1]	**R**, N = 24[1]	**S**, N = 17[1]	**I**, N = 96[1]	**R**, N = 51[1]
Female	14 (52%)	6 (22%)	7 (26%)	2 (8.0%)	15 (60%)	8 (32%)	0	10 (91%)	1 (9.1%)	1 (4.2%)	20 (83%)	3 (13%)	2 (7.4%)	16 (59%)	9 (33%)
Male	21 (22%)	53 (56%)	20 (21%)	15 (15%)	60 (62%)	22 (23%)	9 (9.8%)	59 (64%)	24 (26%)	9 (6.8%)	103 (77%)	21 (16%)	15 (11%)	80 (58%)	42 (31%)
Age group															
0–14	1 (50%)	1 (50%)	0	0	0	0	0	0	0	0	0	0	0	0	0
15–19	0	1 (50%)	1 (50%)	0	3 (60%)	2 (40%)	0	4 (100%)	0	0	5 (71%)	2 (29%)	0	6 (75%)	2 (25%)
20–24	6 (29%)	8 (38%)	7 (33%)	5 (25%)	10 (50%)	5 (25%)	2 (17%)	5 (42%)	5 (42%)	4 (11%)	29 (81%)	3 (8.3%)	3 (9.7%)	20 (65%)	8 (26%)
25–29	12 (36%)	15 (45%)	6 (18%)	2 (8.3%)	16 (67%)	6 (25%)	2 (14%)	7 (50%)	5 (36%)	1 (3.0%)	28 (85%)	4 (12%)	3 (8.8%)	18 (53%)	13 (38%)
30–39	10 (26%)	21 (54%)	8 (21%)	6 (14%)	28 (65%)	9 (21%)	3 (7.9%)	27 (71%)	8 (21%)	2 (4.5%)	33 (75%)	9 (20%)	5 (11%)	24 (55%)	15 (34%)
40+	6 (25%)	13 (54%)	5 (21%)	4 (13%)	18 (60%)	8 (27%)	2 (5.7%)	26 (74%)	7 (20%)	3 (8.1%)	28 (76%)	6 (16%)	6 (13%)	28 (60%)	13 (28%)
Ethnicity															
Asian	2 (25%)	3 (38%)	3 (38%)	0	6 (75%)	2 (25%)	0	5 (63%)	3 (38%)	0	9 (100%)	0	4 (17%)	16 (70%)	3 (13%)
European/ Other	18 (24%)	42 (56%)	15 (20%)	9 (14%)	41 (62%)	16 (24%)	3 (4.6%)	52 (80%)	10 (15%)	6 (6.1%)	80 (82%)	12 (12%)	9 (9.6%)	55 (59%)	30 (32%)
Māori	11 (61%)	5 (28%)	2 (11%)	5 (17%)	16 (53%)	9 (30%)	3 (14%)	9 (43%)	9 (43%)	3 (8.6%)	25 (71%)	7 (20%)	3 (14%)	9 (43%)	9 (43%)
Pacific	0	0	1 (100%)	2 (33%)	2 (33%)	2 (33%)	3 (50%)	1 (17%)	2 (33%)	0	2 (100%)	0	0	2 (33%)	4 (67%)
Unknown	4 (21%)	9 (47%)	6 (32%)	1 (8.3%)	10 (83%)	1 (8.3%)	0	2 (67%)	1 (33%)	1 (7.7%)	7 (54%)	5 (38%)	1 (5.0%)	14 (70%)	5 (25%)
Region															
Central	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern	0	0	0	0	0	0	0	0	0	0	0	2 (100%)	0	0	2 (100%)
Te Manawa Taki	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Te Waipounamu	35 (29%)	59 (49%)	27 (22%)	17 (14%)	75 (61%)	30 (25%)	9 (8.7%)	69 (67%)	25 (24%)	10 (6.5%)	123 (79%)	22 (14%)	17 (10%)	96 (59%)	49 (30%)

[1]n (row % per year, rounding to 1 decimal place if low counts)

Table 10: Azithromycin AST by specimen site

	2019		2020		2021		2022		2023	
Specimen Site	Female, N = 143[1]	Male, N = 410[1]	Female, N = 149[1]	Male, N = 598[1]	Female, N = 127[1]	Male, N = 588[1]	Female, N = 156[1]	Male, N = 695[1]	Female, N = 145[1]	Male, N = 732[1]
Ano-rectal	1 (0.7%)	71 (17%)	6 (4.0%)	112 (19%)	4 (3.1%)	137 (23%)	6 (3.8%)	131 (19%)	8 (5.5%)	162 (22%)
Other/Unknown	2 (1.4%)	9 (2.2%)	2 (1.3%)	9 (1.5%)	1 (0.8%)	16 (2.7%)	1 (0.6%)	6 (0.9%)	2 (1.4%)	12 (1.6%)
Pharyngeal	2 (1.4%)	6 (1.5%)	2 (1.3%)	36 (6.0%)	4 (3.1%)	53 (9.0%)	5 (3.2%)	66 (9.5%)	2 (1.4%)	94 (13%)
Urogenital	138 (97%)	324 (79%)	139 (93%)	441 (74%)	118 (93%)	382 (65%)	144 (92%)	492 (71%)	133 (92%)	464 (63%)

[1]n (column % per year, rounding to 1 decimal place if low counts)

Note: these results are not deduplicated and include results for all isolates that underwent AST. Thus isolate numbers will be higher than those reported in Appendix Table 1 and Appendix Table 2 as those report one result per episode

Table 11: Ceftriaxone AST by specimen site

	2019		2020		2021		2022		2023	
Specimen Site	Female, N = 379[1]	Male, N = 915[1]	Female, N = 347[1]	Male, N = 1,124[1]	Female, N = 227[1]	Male, N = 1,024[1]	Female, N = 237[1]	Male, N = 1,078[1]	Female, N = 206[1]	Male, N = 1,098[1]
Ano-rectal	4 (1.1%)	81 (8.9%)	6 (1.7%)	127 (11%)	4 (1.8%)	149 (15%)	6 (2.5%)	139 (13%)	8 (3.9%)	165 (15%)
Other/Unknown	43 (11%)	52 (5.7%)	33 (9.5%)	45 (4.0%)	17 (7.5%)	38 (3.7%)	5 (2.1%)	46 (4.3%)	3 (1.5%)	37 (3.4%)
Pharyngeal	3 (0.8%)	6 (0.7%)	2 (0.6%)	38 (3.4%)	5 (2.2%)	56 (5.5%)	5 (2.1%)	66 (6.1%)	2 (1.0%)	95 (8.7%)
Urogenital	329 (87%)	776 (85%)	306 (88%)	914 (81%)	201 (89%)	781 (76%)	221 (93%)	827 (77%)	193 (94%)	801 (73%)

[1]n (column % per year, rounding to 1 decimal place if low counts)

Note: these results are not deduplicated and include results for all isolates that underwent AST. Thus, isolate numbers will be higher than those reported in Appendix Table 1 and Appendix Table 2 as those report one result per episode

Science for Communities
He Pūtaiao, He Tāngata

INSTITUTE OF ENVIRONMENTAL
SCIENCE AND RESEARCH LIMITED

Kenepuru Science Centre
34 Kenepuru Drive, Kenepuru, Porirua 5022
PO Box 50348, Porirua 5240
New Zealand
T: +64 4 914 0700 **F:** +64 4 914 0770

Mt Albert Science Centre
120 Mt Albert Road, Sandringham, Auckland 1025
Private Bag 92021, Auckland 1142
New Zealand
T: +64 9 815 3670 **F:** +64 9 849 6046

NCBID – Wallaceville
66 Ward Street, Wallaceville, Upper Hutt 5018
PO Box 40158, Upper Hutt 5140
New Zealand
T: +64 4 529 0600 **F:** +64 4 529 0601

Christchurch Science Centre
27 Creyke Road, Ilam, Christchurch 8041
PO Box 29181, Christchurch 8540
New Zealand
T: +64 3 351 6019 **F:** +64 3 351 0010

www.esr.cri.nz