

TUBERCULOSIS ANTIMICROBIAL RESISTANCE IN NEW ZEALAND: 2021 – 2024

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SUMMARY

- Of the total confirmed tuberculosis (TB) disease cases reported between 2021 and 2024, 92.1% were culture-positive (1052/1142). Of these culture positive isolates, antimicrobial susceptibility data were available for 1048 isolates: 262 isolates in 2021, 231 in 2022, 249 in 2023, and 306 isolates in 2024.
- Between 2021 and 2024, 83.1% (871/1048) of *Mycobacterium tuberculosis* complex isolates were fully susceptible to tested antimicrobials and 10.9% (114/1048) were resistant to a single antimicrobial agent. The percentage of isolates resistant to at least two antimicrobials increased from 4.6% in 2021 to 7.5% in 2024. Between 2021 and 2024, three isolates with resistance to five or more antimicrobial agents were identified, all in 2024.
- The proportion of isolates with resistance to isoniazid has been steadily increasing since 2015, despite a small decrease observed during the COVID-19 pandemic (2019-2020) and reached its highest value in 2024 (11.1%).
- Antimicrobial resistance was higher in isolates from cases born outside of New Zealand. While resistance was higher for all antimicrobials routinely tested, the difference was only significant for isoniazid ($p \leq .01$).
- Between 2021 and 2024, antimicrobial susceptibility was higher among isolates from TB cases in Pacific peoples and Māori than among isolates from other ethnic groups.
- Between 2021 and 2024, there were 23 cases (2.2%) of rifampicin-resistant-TB (RR-TB) and 19 (1.8%) cases of multidrug-resistant-TB (MDR-TB), adding to a total of 51 RR-TB and 43 MDR-TB cases identified in New Zealand in the past 10 years.
- All MDR-TB cases identified to date were born outside of New Zealand and most (39/43, 90.7%) were of Asian ethnicity.
- There has been no significant trend in the number of MDR-TB cases detected since 2015, but there has been an increase in the percentage of resistant cases observed between 2023 (1.2%) and 2024 (2.3%).
- Two pre-extensively drug-resistant TB (preXDR-TB) cases were identified from 2021 to 2024, both in 2024, adding to a total of five cases identified in the past 10 years.
- None of the MDR-TB isolates identified between 2021 and 2024 met the criteria for extensively drug-resistant TB (XDR-TB). To 31 December 2024, only one case of XDR-TB was identified in New Zealand (in 2010).

INTRODUCTION

The purpose of this report is to describe the antimicrobial resistance (AMR) of isolates belonging to the *Mycobacterium tuberculosis* (*M. tuberculosis*) complex from tuberculosis (TB) cases in New Zealand between 2021 and 2024 and to examine the trends for TB AMR data in New Zealand over time.

AMR is a growing threat to global public health, that occurs when microorganisms develop the ability to survive exposure to antimicrobials that would normally kill them or inhibit their growth. [1] The emergence and spread of antimicrobial-resistant pathogens interferes with treatment of common infections and life-saving procedures, increasing risks to life and health system costs.

Tuberculosis remains a significant contributor to the global AMR burden. [2] Although largely preventable and curable, TB continues to pose major challenges when drug resistance occurs. This includes rifampicin-resistant TB (RR-TB), multidrug-resistant TB (MDR-TB), pre-extensively drug-resistant TB (pre-XDR TB), and extensively drug-resistant TB (XDR-TB).

RR-TB is a form of TB that is resistant to rifampicin, a key first-line anti-tuberculosis drug, while MDR-TB is a form of TB caused by bacteria that is resistant to and, therefore, cannot be treated by isoniazid and rifampicin, the two most effective first-line TB drugs. [3]

Pre-XDR TB refers to RR-TB or MDR-TB with additional resistance to any fluoroquinolone, and XDR-TB is RR-TB or MDR-TB with resistance to a fluoroquinolone and at least one additional Group A drug, such as bedaquiline or linezolid. [4, 5] These more complex resistance patterns require longer and more complex treatment regimens, using second and third-line antimicrobials, which are often expensive and associated with significant side effects for patients.

In 2024, among cases tested for RR-TB worldwide, 4.6% were found to be pre-XDR TB or XDR-TB. [2] In contrast, New Zealand has historically had low levels of overall antimicrobial resistance in TB, with only one case of XDR-TB reported in 2010 and no further cases identified since. [6] However, the risk of drug-resistant TB remains present, particularly due to ongoing international travel and migration, and the potential importation of resistant strains. Ongoing surveillance is essential to monitor resistance trends, support treatment guidelines and the public health response.

METHODS

DATA SOURCES

TB disease case notification data recorded in EpiSurv, the national notifiable diseases database, is used in this report. All data presented are based on information recorded in EpiSurv as of 10 June 2026. Changes made to EpiSurv data by National Public Health Service (NPHS) staff after this date will not be reflected in this report. Consequently, future data analysis may produce revised results.

Within EpiSurv, TB cases are defined and reported as either confirmed or probable cases, in accordance with the National Public Health Service communicable disease control manual. [7] For the purpose of this report, only confirmed TB cases are included. Probable cases are excluded, as laboratory confirmation is not required for their classification.

TB cases included in this report are further classified as either new cases (active TB in a person who has never previously been treated for TB or has active disease from a new genotype) or relapse or reactivation cases (active TB in a person whose tuberculosis has been non-infectious or quiescent following full, partial or no treatment). [4]

Laboratory data, including species identification and antimicrobial susceptibility testing, are provided by the mycobacteriology laboratories at LabPlus, Waikato Hospital and Canterbury Health Laboratories. These data were integrated with epidemiological data held in EpiSurv.

LABORATORY METHODS

Antimicrobial susceptibility and resistance gene testing

First-line phenotypic antimicrobial susceptibility testing (AST) is routinely undertaken by the mycobacteriology laboratories at LabPlus, Waikato Hospital and Canterbury Health Laboratories. All *M. tuberculosis* complex isolates are referred to the National Tuberculosis Reference laboratory at LabPlus for whole genome sequencing (WGS) and, where indicated, additional susceptibility testing, including testing to second-line anti-tuberculous agents.

Phenotypic susceptibility results carried out include susceptibility to isoniazid (tested at concentrations of 0.1 and 0.4 mg/L, to detect both low-level and high-level isoniazid resistance, respectively), rifampicin, ethambutol and pyrazinamide using the BACTEC® MGIT 960 system or the Wayne's pyrazinamidase assay.

Molecular methods are used to support and complement phenotypic AST, particularly for the rapid detection of resistance in cases with a high index of suspicion of drug resistance. These methods include Cepheid GeneXpert® system, line probe assays (Hain Lifescience GenoType® MTBDRplus and MTBDRsl), whole genome sequencing (implemented in 2024), and targeted polymerase chain reaction assays for genes such as *rpoB* and *katG*. These assays detect mutations associated with resistance to key drugs, including isoniazid, rifampicin, fluoroquinolones and aminoglycosides.

Susceptibility testing and species identification results are sent to PHF Science and integrated with the TB epidemiological information recorded in EpiSurv.

Inclusion criteria for antimicrobial resistance analysis

Antimicrobial susceptibility data in this report are restricted to TB cases where an isolate of *M. tuberculosis* complex was obtained. An isolate is considered as resistant if either the phenotypic susceptibility testing demonstrated resistance or molecular testing identifies a mutation associated with resistance according to the WHO TB Mutation Catalogue. [8]

Culture-negative cases, confirmed only by molecular diagnostic testing on the primary sample were excluded from the primary antimicrobial resistance analysis but are described in the results.

ANALYTICAL METHODS

The analytical methods used in this report are outlined below.

Dates

In this report, data are presented by the date the case was notified and focuses on susceptibility data for cases of TB notified between 2021 and 2024 and trends since 2015.

Percentages

Percentages are calculated with the denominator as the total number of isolates for which information was recorded, unless otherwise specified.

Ethnicity

Ethnic groups presented are based on a prioritised classification of ethnicity, with the Māori ethnic group prioritised first, followed by Pacific peoples, Asian, and European/Other (which includes New Zealand European, Middle Eastern, Latin American, and African ethnic groups). Level 2 ethnicity classification was used for further analysis as required. [9]

Country of birth

Countries of birth were grouped into regions according to the Statistics New Zealand standard.

Statistical analysis

The Chi-square test or Fisher's exact test, as appropriate, was used to determine the significance of observed differences, with a *p*-value of $\leq .05$ used to assess statistical significance.

RESULTS

CULTURE CONFIRMATION AND SPECIATION

Between 2021 and 2024, a total of 1052 confirmed cases of TB notified in EpiSurv were culture positive, of which 1015 (96.5%) were new TB cases and 37 (3.5%) were relapse/reactivation cases.

All isolates were identified as belonging to the *M. tuberculosis* complex, including five isolates identified as *Mycobacterium bovis* (5/1052, 0.5%). *M. bovis* isolates were identified in 2021 and 2022.

Of the new TB cases with pulmonary disease reported between 2021 and 2024, 96.6% (604/625) were culture positive.

Susceptibility testing was not available for four culture positive cases, all from new TB cases, including one *M. bovis* isolate, and these were excluded.

ANTIMICROBIAL SUSCEPTIBILITY

Antimicrobial susceptibility data were available for 1048 *M. tuberculosis* complex culture-positive TB cases between 2021 and 2024. During this period, there were 262 isolates tested for susceptibility to at least one antimicrobial in 2021, 231 isolates in 2022, 249 isolates in 2023 and 306 isolates in 2024. The percentage of isolates resistant to each of the four antimicrobials routinely tested is shown in Table 1.

Table 1. Antimicrobial resistance of *M. tuberculosis* complex isolates, 2021 to 2024

Antimicrobial	2021		2022		2023		2024		Total	
	Total ^a	No. resistant (%) ^b	Total ^a	No. resistant (%) ^b	Total ^a	No. resistant (%) ^b	Total ^a	No. resistant (%) ^b	Total ^a	No. resistant (%) ^b
Isoniazid (0.1 mg/L)	262	24 (9.2)	231	24 (10.4)	248	25 (10.1)	306	34 (11.1)	1047	107 (10.2)
Isoniazid (0.4 mg/L) ^c	219	16 (7.3)	194	16 (8.2)	205	15 (7.3)	245	25 (10.2)	863	72 (8.3)
Rifampicin ^d	262	6 (2.3)	231	4 (1.7)	249	4 (1.6)	305	9 (3.0)	1047	23 (2.2)
Ethambutol	262	2 (0.8)	231	4 (1.7)	248	1 (0.4)	303	4 (1.3)	1044	11 (1.1)
Pyrazinamide	262	3 (1.1)	231	9 (3.9)	246	7 (2.8)	301	11 (3.7)	1040	30 (2.9)
MDR-TB ^e	262	5 (1.9)	231	4 (1.7)	248	3 (1.2)	305	7 (2.3)	1046	19 (1.8)

^a Totals refer to the total number of isolates tested for each specific antimicrobial in the period assessed.

^b Includes resistance alone or in combination with other antimicrobials.

^c All isolates resistant to isoniazid at the standard concentration of 0.1 mg/L were also tested at the higher concentration of 0.4 mg/L.

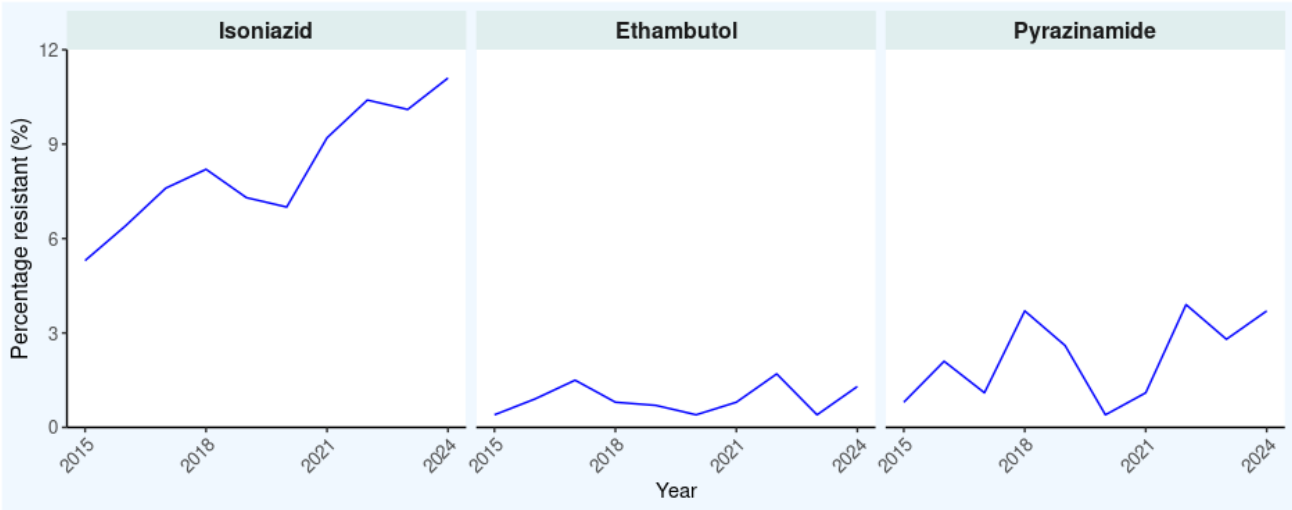
^d Rifampicin-resistant TB (RR-TB).

^e MDR-TB: isolates resistant to both isoniazid and rifampicin.

In addition to the 1048 culture positive cases between 2021 and 2024, a further 17 confirmed TB cases had molecular antimicrobial resistance testing performed on the primary diagnostic sample but were not culture positive. These cases have been excluded from the antimicrobial resistance analysis as they did not meet inclusion criteria. No resistance determinants were identified in 16 of the 17 cases, while one case (1/17, 5.9%) was genotypically resistant to both isoniazid and rifampicin, meeting the definition of MDR-TB.

Figure 1 provides the trend in resistance for the antimicrobials routinely tested in New Zealandⁱ, including resistance alone or in combination with other antibiotics. The percentage of resistance to isoniazid has been steadily increasing since 2015, despite a small decrease observed during the COVID-19 pandemic (2019–2020) and has reached its highest value in 2024 (11.1%), while monoresistance of isoniazid fluctuated between 3.9% and 5.2% during the period assessed (Table 2). For pyrazinamide, the percentage of resistance has returned to levels observed prior to 2020, with 3.9% resistance observed in 2022, decreasing to 2.8% in 2023 and increasing again to 3.7% in 2024. No clear trend is observed for ethambutol in the past 10 years but an increase in percentage of resistance was observed in 2024 when compared to 2023 (0.4 to 1.3%, respectively) in 2024 (Figure 1).

Figure 1. Antimicrobial resistance of *M. tuberculosis* complex isolates by antimicrobial and year, 2015 to 2024*



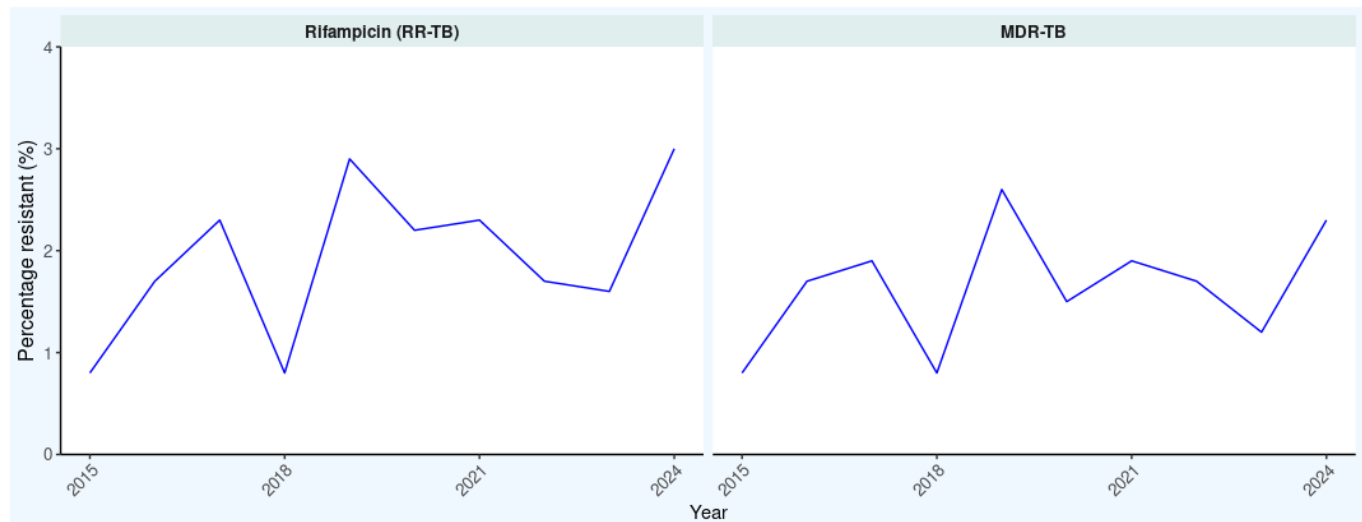
*Isoniazid refers to isolates resistant to isoniazid at the standard concentration of 0.1 mg/L.

Between 2021 and 2024, there were 23 cases of RR-TB (2.2%), of which 19 (1.8%) were also isoniazid resistant and met the definition for MDR-TB. In the past 10 years, a total of 51 RR-TB cases, including 43 MDR-TB cases have been identified (average of 1.9% and 1.6% of isolates tested, respectively).

ⁱ Except for rifampicin resistance, which is presented in Figure 2.

There has been no significant trend in the number of RR-TB or MDR-TB cases detected since 2015, but an increase in percentage of RR-TB and MDR-TB cases compared with the total number of culture positive *M. tuberculosis* complex cases was observed between 2023 (1.6 and 1.2%, respectively) and 2024 (3.0% and 2.3%, respectively). The highest percentage of RR-TB was observed to date in 2024 (3.0%), while the highest percentage of MDR-TB to date was observed in 2019 (2.6%) (Figure 2).

Figure 2. Percentage of *M. tuberculosis* complex isolates that are RR-TB and MDR-TB by year, 2015 to 2024



* MDR-TB: isolates resistant to both isoniazid and rifampicin.

There were two culture confirmed MDR-TB isolates between 2021 and 2024 that were identified as preXDR-TB, both in 2024. None of the MDR-TB isolates identified between 2021 and 2024 were detected as being XDR-TB through additional susceptibility testing. Only one case of XDR-TB has been identified in New Zealand to date (in 2010). [6]

Between 2021 and 2024, 83.1% (871/1048) of *M. tuberculosis* complex isolates were fully susceptible to tested antimicrobials in New Zealand and 10.9% (114/1048) were resistant to only one agent (Table 2). The percentage of isolates resistant to at least two antimicrobials has increased from 4.6% in 2021 to 7.5% in 2024. In 2024, three isolates were found to be resistant to five agents or more, the first time this has been identified among *M. tuberculosis* complex isolates in New Zealand.

Table 2. Antimicrobial resistance patterns for *M. tuberculosis* complex isolates, 2021 to 2024

	Resistance pattern ^a	2021 n (%)	2022 n (%)	2023 n (%)	2024 n (%)	Total n (%)
Fully susceptible		213 (81.3)	188 (81.4)	215 (86.3)	255 (83.3)	871 (83.1)
Resistant to 1 agent		37 (14.1)	27 (11.7)	22 (8.8)	28 (9.2)	114 (10.9)
	H	13 (5.0)	9 (3.9)	13 (5.2)	12 (3.9)	47 (4.5)
	R	-	-	1 (0.4)	2 (0.7)	3 (0.3)
	E	-	1 (0.4)	-	-	1 (0.1)
	Z	1 (0.4)	5 (2.2)	5 (2.0)	7 (2.3)	18 (1.7)
	S	23 (8.8)	12 (5.3)	2 (0.8)	1 (0.3)	38 (3.6)
	F	-	-	1 (0.4)	4 (1.3)	5 (0.5)
	Y	-	-	-	1 (0.3)	1 (0.1)
	A	-	-	-	1 (0.3)	1 (0.1)
Resistant to 2 agents		7 (2.7)	10 (4.3)	7 (2.8)	19 (6.2)	43 (4.1)
	HR ^b	-	1 (0.4)	-	3 (1.0)	4 (0.4)
	HE	-	-	-	1 (0.3)	1 (0.1)
	HZ	-	1 (0.4)	-	1 (0.3)	2 (0.2)
	HS	5 (1.9)	6 (2.6)	1 (0.4)	4 (1.3)	16 (1.5)
	HT	1 (0.4)	1 (0.4)	6 (2.4)	9 (2.9)	17 (1.6)
	RS	1 (0.4)	-	-	-	1 (0.1)
	SF	-	1 (0.4)	-	-	1 (0.1)
	AY	-	-	-	1 (0.3)	1 (0.1)
Resistant to 3 agents		2 (0.8)	4 (1.7)	5 (2.0)	-	11 (1.0)
	HRE ^b	1 (0.4)	-	1 (0.4)	-	2 (0.2)
	HRZ ^b	-	1 (0.4)	1 (0.4)	-	2 (0.2)
	HRT ^b	1 (0.4)	-	1 (0.4)	-	2 (0.2)
	HET	-	1 (0.4)	-	-	1 (0.1)
	HZS	-	1 (0.4)	-	-	1 (0.1)
	HZT	-	1 (0.4)	1 (0.4)	-	2 (0.2)
	HST	-	-	1 (0.4)	-	1 (0.1)
Resistant to 4 agents		3 (1.1)	2 (0.9)	-	1 (0.3)	6 (0.6)
	HREZ ^b	-	-	-	1 (0.3)	1 (0.1)
	HRET ^b	1 (0.4)	2 (0.9)	-	-	3 (0.3)
	HRZS ^b	1 (0.4)	-	-	-	1 (0.1)
	HRZT ^b	1 (0.4)	-	-	-	1 (0.1)
Resistant to 5 agents or more		-	-	-	3 (1.0)	3 (0.3)
	HRESP ^b	-	-	-	1 (0.3)	1 (0.1)
	HREZFT ^b	-	-	-	1 (0.3)	1 (0.1)
	HRZFAT ^b	-	-	-	1 (0.3)	1 (0.1)
Total isolates		262	231	249	306	1048

^a H = isoniazid resistance at the standard concentration of 0.1 mg/L; R = rifampicin; E = ethambutol; Z = pyrazinamide; S = streptomycin; F = any fluoroquinolone (moxifloxacin, levofloxacin, ciprofloxacin and/or ofloxacin); A = aminoglycosides (amikacin or kanamycin); T = ethionamide; Y = capreomycin.

^b MDR-TB, multidrug-resistant tuberculosis: resistant to at least isoniazid and rifampicin.

Country of birth

Table 3 compares antimicrobial resistance among isolates from culture-positive TB cases born in New Zealand and cases born outside New Zealand, for which susceptibility results were available. Most culture-positive TB cases between 2021 and 2024 were born outside of New Zealand (934/1048 cases, 89.1%). Antimicrobial resistance was overall significantly higher in cases born outside New Zealand and while resistance was higher for all antimicrobials routinely tested, the difference was only statistically significant for isoniazid ($p \leq .05$).

Table 3. Antimicrobial resistance of *M. tuberculosis* complex isolates by birthplace category, 2021 to 2024

	Born in New Zealand (n = 114)		Born outside New Zealand (n = 934)		p-value ^a
	No.	%	No.	%	
Fully susceptible					
	108	94.7	763	81.7	< .001
Resistant to: ^b					
Isoniazid ^c	2	1.8	105	11.3	.002
Rifampicin	0	-	23	2.5	.164
Ethambutol	0	-	11	1.2	.620
Pyrazinamide	4	3.5	26	2.8	.559
MDR-TB ^d					
	0	-	19	2.0	.253

^a Rates compared by the Chi-square test or Fisher's Exact test, as appropriate.

^b Includes resistance alone or in combination with other antimicrobials.

^c Isoniazid resistance at the standard concentration of 0.1 mg/L.

^d Multidrug-resistant tuberculosis – resistant to at least isoniazid and rifampicin.

All MDR-TB cases identified between 2021 and 2024 were born outside New Zealand. All 43 MDR-TB cases that have been reported in the last 10 years were born outside New Zealand. Most MDR-TB cases identified in New Zealand were born in the Indian subcontinent (18/43 cases, 41.8%) and Southeast Asia (14/43 cases, 32.6%).

Ethnicity

Between 2021 and 2024, susceptibility to all antimicrobials tested was higher for *M. tuberculosis* complex isolates from TB cases in Pacific peoples (93.6% susceptible) and Māori (92.2% susceptible) (Table 4).

Table 4. Antimicrobial resistance of *M. tuberculosis* complex isolates by ethnicity, 2021 to 2024

	Māori (n = 51)		Pacific peoples (n = 125)		Asian (n = 771)		European/Other (n = 96) ^b	
	No.	%	No.	%	No.	%	No.	%
Fully susceptible^a								
	47	92.2	117	93.6	622	80.7	80	83.3
Resistant to:^c								
Isoniazid ^d	1	2.0	3	2.4	99	12.9	4	4.2
Rifampicin ^e	0	-	2	1.6	21	2.7	0	-
Ethambutol	0	-	0	-	11	1.4	0	-
Pyrazinamide	3	5.9	0	-	24	3.1	3	3.2
MDR-TB^f								
	0	-	0	-	19	2.5	0	-

^a Excludes five cases with ethnicity unknown.

^b Includes Middle Eastern, Latin American, and African ethnic groups.

^c Includes resistant alone or in combination with other antimicrobials.

^d Isoniazid resistant at the standard concentration of 0.1 mg/L.

^e Rifampicin-resistant tuberculosis – RR-TB

^f Multidrug-resistant tuberculosis – resistant to at least isoniazid and rifampicin.

Between 2021 and 2024, RR-TB was mostly identified in TB cases of Asian ethnicity, and all cases of MDR-TB have been identified in cases of Asian ethnicity (Level 1). Of 19 MDR-TB cases identified between 2021 and 2024, eight cases were of Indian ethnicity, eight cases were of Southeast Asian ethnicity and three were of other Asian ethnic groups (Level 2). Of the 43 MDR-TB cases that have occurred in the last 10 years, most were in cases of Asian ethnicity (39 cases, 90.7%), including 16 cases of Indian ethnicity, 13 cases of Southeast Asian ethnicity and 10 of other Asian ethnic groups.

Relapse/reactivation cases

During 2021 and 2024, 3.5% (37/1048) of the culture-positive cases for which susceptibility data was available were relapse/reactivation cases. Information about previous treatment was recorded for 33/37 relapse/reactivation cases and all had received previous anti-tuberculosis drug treatment.

Antimicrobial resistance among new cases of TB and relapse/reactivation cases is shown in Table 5. There was no difference in antimicrobial resistance between isolates from new TB cases and isolates from relapse/reactivation cases.

Table 5. Antimicrobial resistance of *M. tuberculosis* complex cases (new TB cases and relapse/reactivation cases), 2021 to 2024

	New cases (n = 1011)	Relapse/reactivation cases			
		All (n = 37)		Previously treated ^a (n = 33)	
	n (%)	%	p-value ^b	%	p-value ^b
Fully susceptible					
	840 (83.1)	31 (83.8)	.911	28 (84.8)	.790
Resistant to:^c					
Isoniazid ^d	104 (10.3)	3 (8.1)	1.000	3 (9.1)	1.000
Rifampicin	21 (2.1)	2 (5.4)	.193	2 (6.1)	.162
Ethambutol	9 (0.9)	2 (5.4)	.055	1 (3.0)	.276
Pyrazinamide	29 (2.9)	1 (2.8)	1.000	1 (3.1)	1.000
MDR-TB^e					
	17 (1.7)	2 (5.4)	.142	2 (6.1)	.119

^a Information on previous treatment was reported for 33 of the 37 relapse/reactivation cases, all recorded as being treated.

^b Rate compared with new TB cases by the Chi-square test or Fisher's Exact test, as appropriate.

^c Includes resistance alone or in combination with other antimicrobials.

^d Isoniazid resistance at the standard concentration of 0.1 mg/L.

^e Multidrug-resistant tuberculosis – resistant to at least isoniazid and rifampicin.

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