Te Whatu Ora
Health New Zealand

Auckland region – 2020 public health surveillance report

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This document is available for download at **www.arphs.govt.nz/surveillance**.

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Contents

Basic terms, definitions and acronyms used in this report

The disease notifications ARPHS receives are assessed against nationally determined surveillance case definitions published in the **Ministry of Health Communicable Disease Control Manual**[1]. These notifications are classified into "cases under investigation", "probable cases" and "confirmed cases". Those cases that do not meet the surveillance case definitions for a confirmed or probable case after all the information has been analysed and assessed are classified as "not a case". The term "cases" in this report therefore refers to probable and confirmed cases.

Age groups comply with agreed national reporting age group categories. Incidence is expressed as crude rates, which are defined as the number of cases for a defined population based on 2018-estimated mid-year population statistics. Population statistics are sourced from Statistics New Zealand.

Ethnicity is prioritised ethnicity as per the Ethnicity Data Protocols, September 2017 and rates are based on Ministry of Health Prioritised Population projections off a 2018 base (Source: Statistics New Zealand). Rates for ethnicity are expressed as crude rates and have not been age standardised.

AIAL	Auckland International Airport Limited
AMR	Antimicrobial resistance
ARC	Aged Residential Care
ARF	Acute rheumatic fever
ARI	Acute respiratory infection
ARPHS	Auckland Regional Public Health Service
CFR	Case fatality rate
CHF	Chronic heart failure
CRS	Congenital rubella syndrome
ED	Emergency department
EHI	Environmental health indicator/s
ELS	Early Learning Services

[1]Communicable Disease Control Manual: https://www.health.govt.nz/publication/communicable-disease-control-manual

ESR	Institute of Environmental Science and Research
GAS	Group A Streptococcus
GP	General practitioner
GU	Genito-urinary
HAV	Hepatitis A virus
HBV	Hepatitis B virus
HD	Hansen’s Disease (Leprosy)
HFMD	Hand, foot and mouth disease
HiB	Haemophilus influenza B
HSDIRT	Hazardous Substances Disease and Injury Reporting Tool
HUS	Haemolytic uraemic syndrome
ICU	Intensive Care Unit
IgM	Immunoglobulin
IHD	Ischaemic heart disease
ILI	Influenza-like illness
IPD	Invasive pneumococcal disease
LSCS	Lower Segment Caesarean Section
LTB	Latent tuberculosis (TB)
LTBI	Latent tuberculosis (TB) infection
MDR	Multi-drug resistant
MDT	Multi-drug therapy
MELAA	Middle Eastern, Latin American, African
MI	Myocardial infarction
MIC	Minimum inhibitory concentrations
MIF	Managed isolation facility

MLST	Multilocus sequence typing
MO	Medical Officer
MPI	Ministry for Primary Industries
MSM	Men who have sex with men
NDCMS	Notifiable Diseases and Case Management System
NFD	Not further defined
NGO	Non-government organisation
NIR	National Immunisation Register
NOS	Not otherwise specified
PCR	Polymerase chain reaction
PFGE	Pulsed-field gel electrophoresis
POAL	Ports of Auckland
POR	Porin Protein
PSP	Paralytic shellfish poisoning
RNA	Ribonucleic acid
RRV	Ross River virus
RSV	Respiratory Syncytial Virus
SACNZS	Source Attribution Campylobacteriosis in New Zealand Study
SARI	Severe acute respiratory infection
SMO	Senior Medical Officer
STEC	Shiga toxin-producing *E. Coli*
TB	Tuberculosis
TTP	Thrombotic thrombocytopenic purpura
VTEC	Verocytotoxin-producing *E. coli*
VZV	Varicella zoster virus

WGS Whole genome sequencing

WHO World Health Organisation

Executive summary

2020 was a particularly unique year. The COVID-19 pandemic (first identified in Wuhan, China) in late 2019 quickly spread across the globe. The first case identified in New Zealand was on 26 February 2020. The two largest outbreaks in New Zealand were March to May 2020 and August to September 2020.

Surveillance of all notifiable diseases demonstrated very different patterns from a typical year. This was a result of many factors, including severely restricted international borders, domestic lockdowns, access to primary care and access to testing facilities.

The overall mortality rate was lower in New Zealand in 2020 compared to previous years. This was the opposite trend to that seen in most other nations. This was due to COVID-19 fatalities being very low and COVID-19 measures also limiting the introduction of other illnesses into New Zealand, while also slowing down transmission for many illnesses and diseases. Most significantly there was no circulating influenza in 2020.

While only a few notifiable diseases exhibited typical case numbers (including tuberculosis and yersiniosis) the great majority had fewer detections. It was hypothesised that certain diseases associated with social determinants may spike in numbers (e.g. acute rheumatic fever and meningococcal disease) because of staying at home, however the opposite was recorded. Theories to explain this include better hand hygiene, staying at home when unwell, reduced international travel and fewer circulating pathogens.

Late in the year there was an unseasonal increase of institutional gastroenteritis outbreaks. This was not unique to Auckland or even New Zealand. A change in cleaning products disinfectants in Early Learning Services (ELS), from hypochlorite to other ‘COVID-targeting’ disinfectants, may have made a major contribution. Furthermore, reliance on alcohol-based hand sanitiser, used widely for hand hygiene, may have been a factor (with soap and water preferable for avoiding norovirus).

Epidemiologists will reflect on 2020 for years to come. There is an opportunity to learn from the disease trends, explained in the chapters that follow, to better understand disease transmission in the context of these peculiar times of lockdowns and travel restrictions.

1 Summary

Throughout 2020, the infectious disease burden in the Auckland region was assessed using the Auckland Regional Public Health Service (ARPHS) Surveillance Strategy. This utilises the national surveillance system EpiSurv, and ARPHS' independent Notifiable Diseases and Case Management System (NDCMS).

Any disease outbreaks notified to ARPHS are promptly identified and investigated. Weekly information regarding key surveillance triggers is routinely disseminated to selected external stakeholders in the *NDCMS Surveillance Report*.

Figure 1 shows the disease notification process. The diseases that are notifiable to the Medical Officer of Health are listed on the **Ministry of Health** website. Not all notifiable diseases and conditions come to ARPHS' attention so the operational reality is a subset of these.

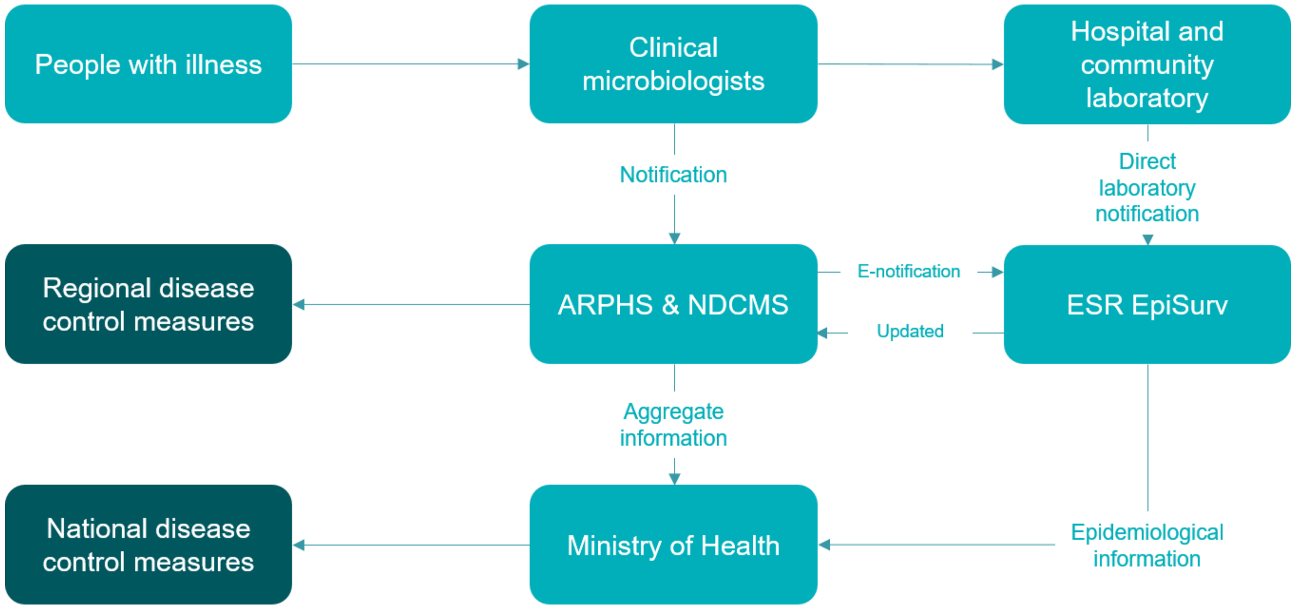


Figure 1: ARPHS' notifiable disease notification process

Burden of disease for notifiable diseases in the Auckland region 2020

The year 2020 will always be remembered for the COVID-19 pandemic and the widespread global disruption it caused. Outbreak measures not seen for many decades were implemented. These included:

- border controls
- the introduction and use of isolation and quarantine facilities
- lockdowns
- mask-wearing
- social distancing and
- other infection control measures

These measures also impacted the transmission rates for other communicable diseases to varying degrees. ARPHS received half the number of non-COVID notifications (3,415) in 2020 compared with 2019 (6,977), a drop of 51 per cent.

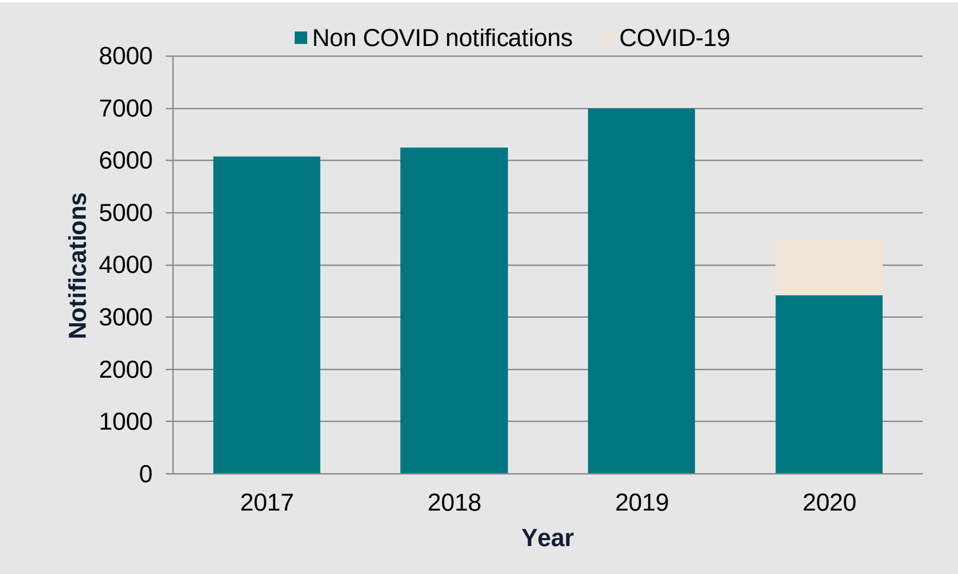


Figure 2: Probable and confirmed notifications in the Auckland region (2017-2020)

The greatest number of notifications was campylobacteriosis with 1,403 cases (although this was a reduction of 20 per cent for the year). COVID-19 was the next most frequent notifiable disease with 1,063 cases, and a further 820 notifications that were investigated and deemed not to be cases.

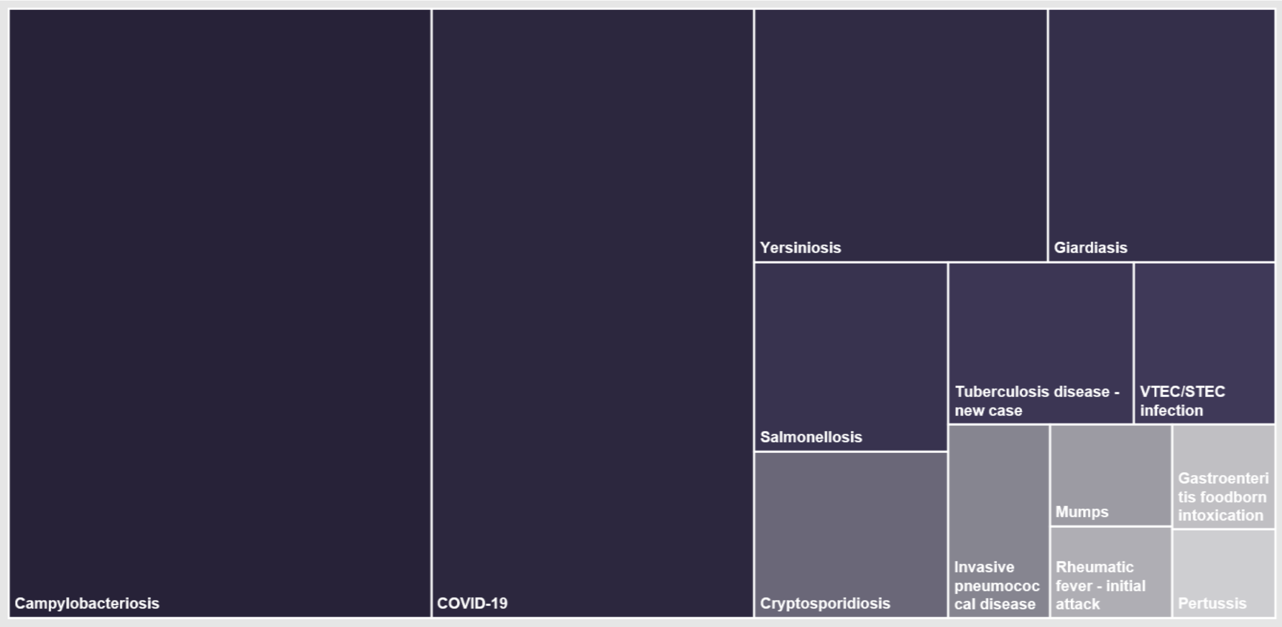


Figure 3: Proportion of diseases most commonly reported to ARPHS (2020)

Some disease notifications increased during 2020. These included:

- gastroenteritis and foodborne intoxication caused by *Vibrio parahaemolyticus*, which was associated with the consumption of contaminated mussels in the South Island.
- listeriosis notifications, which typically number around five to eight per year, reached 12 for 2020.

Some disease notifications remained the same. These included:

- tuberculosis which remained stable in its reporting throughout the year.
- yersiniosis, which dipped sharply during the March 2020 lockdown but recovered to normal levels within weeks of the lockdown measure being removed.

The remainder of the notifiable and viral diseases monitored dropped sharply during the March 2020 lockdown and remained down for the remainder of the year.

- Low risk enterics such as campylobacteriosis, cryptosporidiosis, salmonellosis and giardiasis were down 20 to 50 per cent on 2019.
- High risk enterics such as typhoid, paratyphoid and shigellosis were down 40 to 70 per cent and hepatitis A was down 79 per cent.
- Of the vaccine-preventable diseases:
  - mumps dropped 61 per cent.
  - pertussis, which was on the increase before lockdown, dropped by 84 per cent from 315 cases in 2019 to 50 cases in 2020.
  - measles was already very low and was subsequently eliminated.
  - rheumatic fever dropped by 25 per cent.
  - meningococcal disease by 80 per cent.

- measles transmission was already very low and community transmission of the virus halted in early 2020.

Viral diseases also deserve special mention:

- **There were virtually no influenza viruses detected after the March 2020 lockdown and this was sustained for the rest of the year** (notwithstanding two cases of influenza B detected in late December 2020 in a Managed Isolation facility (MIF) for returning travellers. Further transmission of this was halted).

- **There is typically a respiratory syncytial virus increase in early June each year (week 24 of the calendar year), but this also did not occur in 2020.** There were a few sporadic isolations and there were published reports from paediatricians that the number of children presenting to hospital with respiratory infections was well down[2]. 181 outbreaks were reported in 2020, well up from the 134 reported in 2019.

Outbreaks

Of the 181 outbreaks in 2020, 25 were non-foodborne outbreaks, and 17 of these 25 were related to COVID-19.

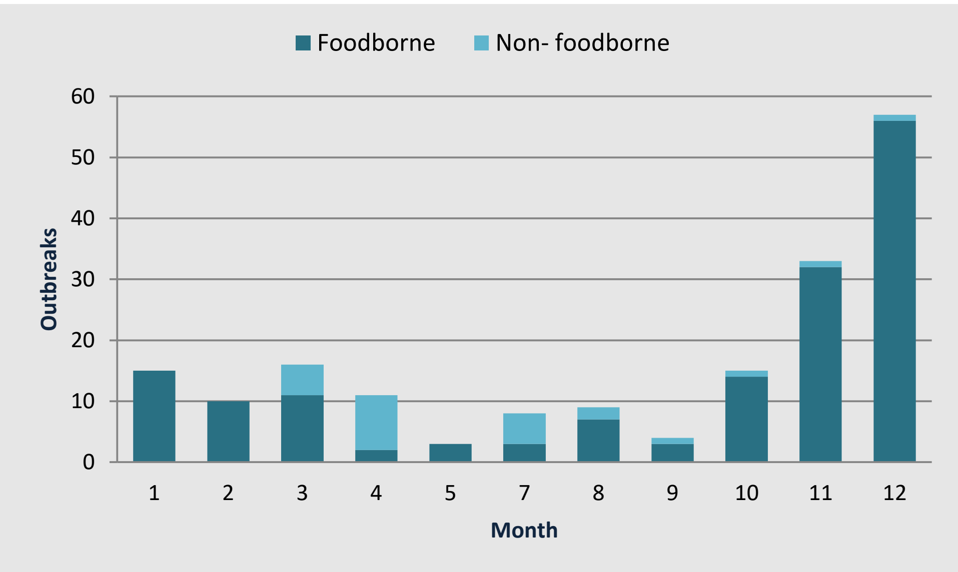


Figure 4: Outbreaks in the Auckland region (2020)

Of the 156 foodborne outbreaks over two thirds (65 per cent) occurred in the last quarter of 2020.

[2] Trenholme A, Webb R, Lawrence S, Arrol S, Taylor S, Ameratunga S, et al. COVID-19 and Infant Hospitalizations for Seasonal Respiratory Virus Infections, New Zealand, 2020. Emerg Infect Dis. 2021;27(2):641-643. https://doi.org/10.3201/eid2702.204041

A causative agent was found in 49 per cent of the foodborne outbreaks. There were 80 outbreaks of gastroenteritis for which a cause could not be found or was not sought. We would expect the majority of these ‘unknown cause’ outbreaks to also be norovirus outbreaks as the majority occurred during December 2020, at a time when there was a regional increase in gastroenteritis outbreaks at Early Learning Services (ELS) and primary schools.

Typically, there are 10 to 15 outbreaks reported per month, reducing over the winter months and increasing in spring and early summer. In 2020 there were 10 to 15 outbreaks reported in the first quarter as expected, then this dropped off dramatically to two to seven per month for the second and third quarters. In the last quarter the number increased markedly, peaking in December with 56 foodborne outbreaks, the majority in ELS and primary schools. The cause of this increase is hypothesised to be a shift in disinfectant selection in ELS and schools to non-hypochlorite agents (as these institutions thought they were using a product that would target COVID-19 better) and a reported change in these institutions from using soap and water for hand hygiene to using alcohol gels (which are not effective against norovirus).

What makes us sick in the Auckland region

Foodborne diseases (2,713) make up the majority of notifications followed by vaccine preventable diseases (1,097), airborne diseases (including TB), then environmental diseases.

Vector-borne diseases came in with the lowest numbers since 2011 and hepatitis A levels were at the lowest on record (accessible EpiSurv records go back to 2006).

Morbidity, mortality and case fatality of notifiable diseases, Auckland region 2020

The incidence, morbidity, mortality, and case-fatality rates of notifiable diseases reported in 2020 are shown in Table 1.

Table 1: Morbidity, mortality and case fatality rates of notifiable diseases in the Auckland region (2020)

	Cases	Morbidity rate		Hospitalisation			
Disease	Auckland region cases	Auckland region per 100,000	Rest of NZ per 100,000	Auckland region cases	(%)	Died	Case fatality rate (%)
Botulism	0	-	-	-	-	0	-
Brucellosis	1	0.06	0.09	1	100	0	-
Campylobacteriosis	1403	80.6	118.3	16	1	0	-
Chikungunya fever	2	0.1	0.1	0	0	0	-
COVID-19	1071	61.5	33.8	65	6	6	0.6
Cryptosporidiosis	176	10.1	17.0	1	1	0	-
Dengue fever	24	1.4	0.8	13	54	1*	4.2
Diphtheria	0	-	-	-	-	-	-
Gastroenteritis - unknown cause	10	0.6	4.7	0	0	0	-
Gastroenteritis / foodborne intoxication	59	3.4	4.7	9	15	0	-
Giardiasis	314	18.0	25.2	1	0.3	0	-
Haemophilus influenzae type b	1	0.06	0.09	1	100	0	-
Hepatitis A	12	0.7	0.3	7	58	0	-
Hepatitis B	5	0.3	0.5	4	80	0	-
Hepatitis C	2	0.1	0.9	1	50	0	-
Hepatitis NOS	5	0.3	0.2	3	60	0	-
Invasive pneumococcal disease	107	6.1	7.5	92	86	5*	4.6
Latent tuberculosis infection	38	2.2	2.9	0	0	0	
Legionellosis	38	2.2	4.0	33	87	2	5.5
Leprosy	1	0.06	0.06	1	100	0	
Leptospirosis	5	0.3	1.8	3	60	0	
Listeriosis	12	0.7	0.6	12	100	2	16.6
Listeriosis - perinatal	2	0.1	0.03	2	100	-	-
Malaria	9	0.5	0.2	7	78	-	-
Measles	7	0.4	0.06	2	29	-	-
Meningococcal disease	12	0.7	0.7	12	100	-	-
Mumps	68	3.9	2.3	7	10	-	-
Murine Typhus	0	-	0.06	-	-	-	-
Paratyphoid fever	9	0.5	0.2	8	89	0	-
Pertussis	51	2.9	3.7	12	24	0	-
Q fever	0	-	-	-	-	-	-
Rheumatic fever - initial attack	68	3.9	2.3	68	100	0	-

Rheumatic fever - recurrent attack	7	0.4	0.1	7	100	0	-
Rickettsial disease	1	0.06	0.06	1	100	0	-
Ross River virus infection	0	-	0.09	-	-	-	-
Salmonellosis	200	11.5	15.5	57	29	0	-
Shigellosis	40	2.3	1.1	9	23	0	-
Taeniasis	3	0.2	0.06	1	33	0	-
Tuberculosis disease - new case	164	9.4	4.6	102	62	5*	3
Tuberculosis disease - relapse or reactivation	7	0.4	0.06	3	43	0	-
Tuberculosis infection - on preventive treatment	5	0.3	-	0	0	0	-
Typhoid fever	17	1.0	0.2	13	76	0	-
VTEC/STEC infection	124	7.1	22.2	33	27	1*	0.8
Yersiniosis	406	23.3	26.0	16	4	0	-
Zika virus	0	-	0.03	-	-	0	-

Denotes disease-associated death, not a direct cause of death.

2 Vector-borne diseases

This chapter includes information about the most common arboviral diseases seen in New Zealand, and malaria, another vector-borne disease. Mosquito interceptions are also covered.

Key points

- 2020 dengue notifications were down 75 per cent from 2019 and the majority of infections were imported from the Cook Islands and Fiji. The predominant dengue serotype was DEN1 with some DEN2.
- There were few or no other arboviruses infections due to chikungunya, Ross River or Zika virus.
- Malaria importations were the lowest for 10 years.
- As in 2019, there were no *Aedes aegypti* interceptions in 2020 compared with two in 2018, 14 in 2017 and two in 2016.

2.1 Arboviral diseases

Arbovirus refers to a group of viruses that are transmitted by arthropod vectors. The word arbovirus is an acronym (ARthropod-BOrne virus). Symptoms of arbovirus infection generally occur three to 15 days after exposure to the virus and last three or four days. The most common clinical features of infection are fever, rash, headache, and malaise, for dengue fever and chikungunya; haemorrhagic fever and encephalitis may also occur. Zika virus is also sexually transmissible and can cause neurological impairment in the developing foetus.

For arboviruses, the vectors are commonly mosquitoes, ticks, sand-flies and other arthropods that consume the blood of vertebrates for nutrition or developmental purposes. New Zealand does not currently have a suitable environment for sustaining populations of a competent arboviral disease vector. However, as global warming progresses mosquitoes capable of transmitting the viruses are moving further from the equator into areas which previously did not harbour the mosquito.

2.1.1 Dengue fever

Dengue fever, also known as 'break-bone fever', is a mosquito-borne tropical disease caused by the dengue virus.

Symptoms include fever, headache, muscle and joint pains, and a characteristic skin rash that is similar to measles. In a small proportion of cases the disease develops into the potentially life-threatening severe dengue (previously referred to as haemorrhagic fever and characterised by bleeding, low levels of blood platelets and blood plasma leakage), or into dengue shock syndrome. Severe illness, and dengue with haemorrhagic features, is more likely in people previously infected with one of the four known serotypes of dengue virus (DEN1, DEN2, DEN3, DEN4), who are subsequently infected with a different serotype.

This was well demonstrated by an increase in dengue notifications in 2014 coinciding with an outbreak of DEN3 in the Pacific. In 2017, DEN3 was replaced by DEN2 as the predominant serotype. The number of severe dengue fever cases was noticeably higher in 2017 and 2018 compared with other years due to this change in circulating serotype from DEN3 to DEN2 in the Pacific, particularly in Samoa.

24 cases of dengue fever were reported for the Auckland region in 2020, down from 98 in 2019 and 187 in 2018. Dengue had been increasing gradually between 2010 and 2018 but a downturn was observed in 2019, followed by a major drop in cases in 2020 due to COVID-19 travel restrictions (Figure 5). The incidence rate for the Auckland region was 1.4 cases per 100,000, compared with 0.8 cases per 100,000 for the rest of New Zealand.

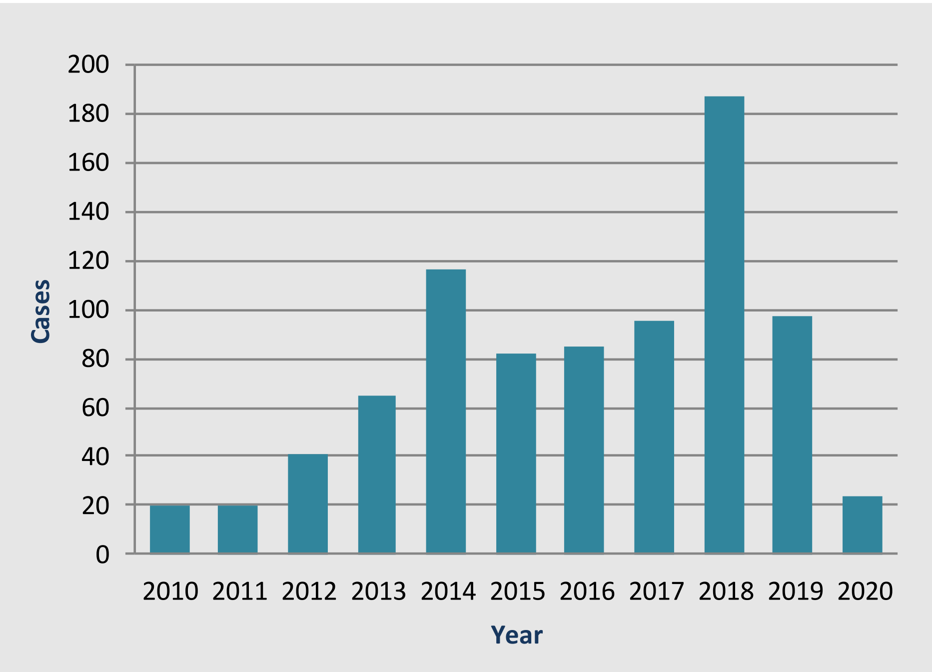


Figure 5: Dengue fever cases in the Auckland region (2010 – 2020)

Hospitalisation (when recorded) occurred in 54 per cent of cases – compared to 46 per cent in 2019 and 66 per cent in 2018. There was one dengue-associated death in a case with pre-existing liver disease.

Dengue notifications are characteristically higher in the first quarter of the year when many local residents take holidays or visit friends and relatives in the Pacific region. In 2020 this changed with the onset of COVID-19 and subsequent travel restrictions (Figure 6).

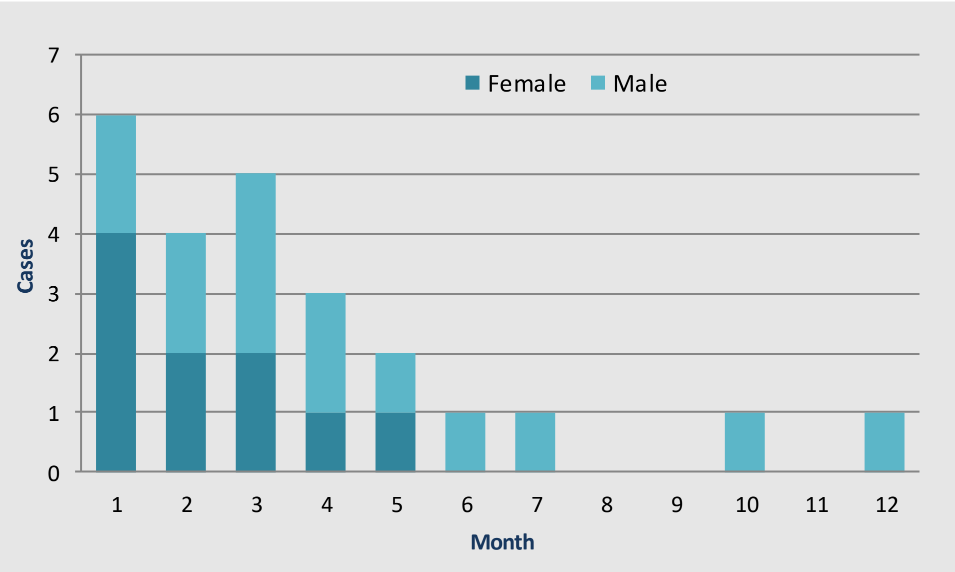


Figure 6: Dengue fever cases by month in the Auckland region (2020)

All notified cases were confirmed by one or more laboratory tests: NS1 antigen, dengue PCR and in a reducing number of cases, anti-dengue IgM.

Age-specific incidence rates were highest in the 60–69-year age group compared with previous years where the 30–39 and 40-49-year age groups had higher incidence rates.

Table 2: Age and gender distribution and age-specific incidence rates of dengue fever in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000
15 to 19		1	1	0.9
20 to 29	6	2	8	2.9
30 to 39	2	4	6	1.8
40 to 49	1		1	0.4
50 to 59	1	1	2	0.5
60 to 69	1	5	6	3.8
70+		2	2	1.4
Total	11	15	26	1.4

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

People of Pacific ethnicity usually account for the majority of cases but in 2019 and 2020 the highest incidence rate was in the European or Other and Asian ethnic groups with 1.9 and 1.3 cases per 100,000 respectively (Table 3). More detailed ethnicity data are shown in Table 4.

Table 3: Ethnic and gender distribution and ethnic specific incidence rates of dengue fever in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000
Asian	3	4	7	1.3
European or Other	6	9	15	1.9
Pacific Peoples	1	1	2	0.9
Total	10	14	24	1.4

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

Table 4: Detailed ethnicity distribution of dengue fever in the Auckland region (2020)

Ethnicities	Total
Chinese	1
Cook Islands Māori	2
Fiji Indian	1
Indian	3
NZ European	12
Other Asian	1
Other European	3
Southeast Asian	1
Total	24

Table 5: Source countries of dengue fever notification in the Auckland region (2020)

Source Country	Total
Cook Islands	10
Fiji	5
India	2
Indonesia	3
Paraguay	1
Peru	1
Thailand	1
Vietnam	1
Total	24

Of the 24 cases, 10 were serotyped. Five were serotype DEN1, three were serotype DEN2, and two were serotype DEN44 (Table 6).

Table 6: Dengue fever serotypes by source country in the Auckland region (2020)

Serotype	Source Country	Total
Serotype DEN1	Cook Islands	3
	Fiji	2
Serotype DEN2	Cook Islands	2
	Indonesia	1
Serotype DEN4	Indonesia	1
	Paraguay	1
Total		10

2.1.2 Chikungunya

Chikungunya is an infection caused by the Chikungunya virus. It features the sudden onset of fever, usually lasting two to seven days, and joint pains, typically lasting weeks or months. The mortality rate is a little less than 1 in 1000.

The virus is mainly passed to humans by two species of mosquito of the genus *Aedes*: *A. albopictus* and *A. aegypti*. These mosquitoes are not endemic to New Zealand, but they are widely distributed across the Pacific Islands. Animal reservoirs of the virus include monkeys, birds, cattle and rodents. This is in contrast to dengue, for which only humans and primates are hosts.

Two cases of chikungunya were reported in 2020 - both in the first quarter before COVID-19 lockdowns. The incidence rate of chikungunya for the Auckland region was 0.1 cases per 100,000, the same as for the rest of New Zealand. Cases were aged between 30 and 60 years old.

The source countries for the confirmed cases were India (1) and Thailand (1).

2.1.3 Ross River virus

Ross River virus (RRV) is a small encapsulated single-strand RNA alphavirus endemic to Australia, Papua New Guinea and other South Pacific islands. It is responsible for a type of mosquito-borne non-lethal but debilitating tropical disease known as Ross River fever, previously termed ‘epidemic polyarthritis’. The virus is suspected to be enzootic in populations of various native Australian mammals and has been found on occasion in horses.

There were no cases notified for the 2020 year, down from two in 2019 and five in 2017. Typically, there are only one or two cases notified in the Auckland region each year.

2.1.4 Zika virus

Zika virus is a member of the *Flaviviridae* virus family, along with dengue, yellow fever, West Nile and Japanese encephalitis viruses. In humans, it causes a disease known as Zika fever.

The first outbreak of the disease outside of Africa and Asia was in April 2007, on the island of Yap in the Federated States of Micronesia. As such, it could be considered an emerging pathogen. This illness is characterised by rash, conjunctivitis and arthralgia, and was initially mistaken for dengue.

There were no cases of Zika notified in 2020. The last case was in 2019 following travel from Myanmar.

2.2 Malaria

Malaria is a mosquito-borne infectious disease of humans and other animals caused by parasitic protozoa (a group of single-celled microorganisms) belonging to the genus *Plasmodium*. The disease is transmitted by an infected female *Anopheles* mosquito. Five species of *Plasmodium* can infect and be spread by the mosquito-to-human route. Most deaths are caused by *P. falciparum* because *P. vivax, P. ovale*, *P. knowlesi* and *P. malariae* generally cause a milder form of malaria.

There were nine cases of malaria notified in 2020, compared with 13 in 2019 (similar to the previous four years (Figure 7). The incidence rate of malaria for the Auckland region was 0.5 cases per 100,000, compared with 0.2 cases per 100,000 for the rest of New Zealand.

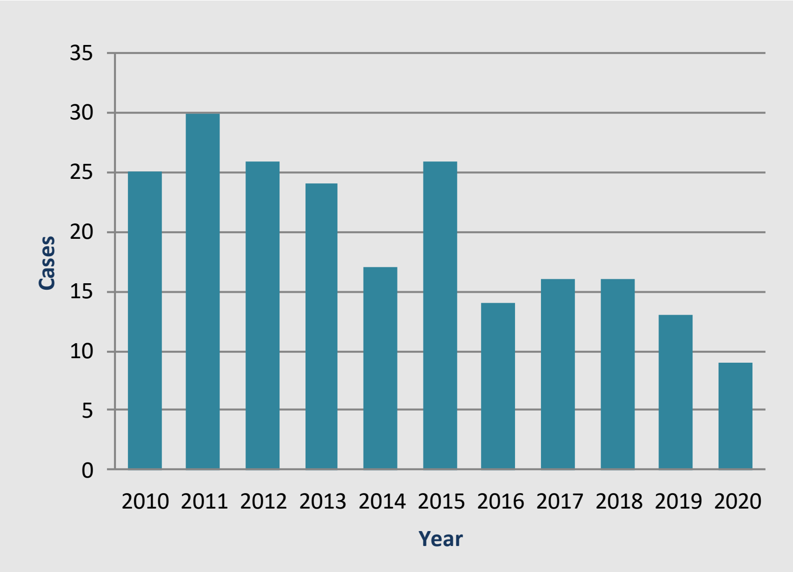


Figure 7: Malaria cases by year in the Auckland region (2010 – 2020)

All cases were overseas acquired. Four were identified as having *P. falciparum*, and five *P. vivax*. Seven of the cases were hospitalised, and there were no deaths.

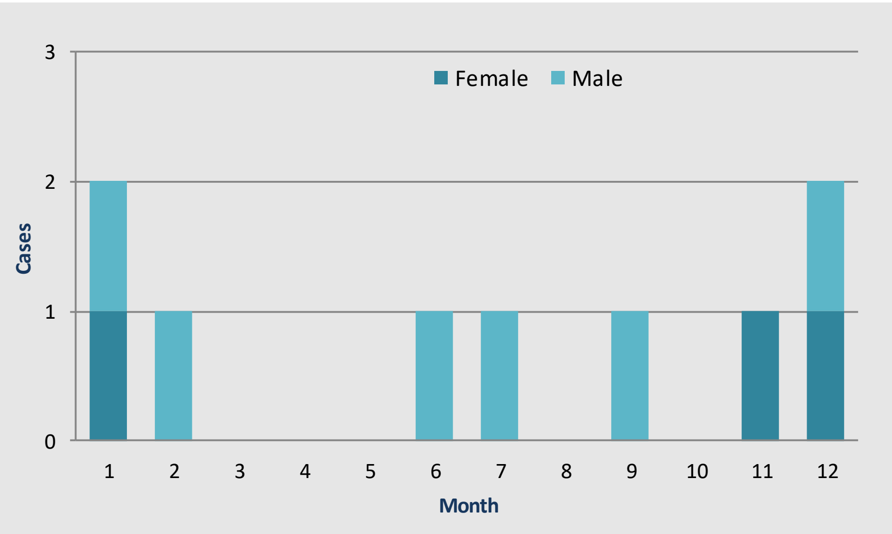


Figure 8: Malaria cases by month and sex in the Auckland region (2020)

The age-specific incidence rate was similar across the age groups but the male to female ratio was 2:1 (Table 7).

Table 7: Age and gender distribution and age-specific incidence rates of reported malaria cases in the Auckland region (2020)

Age group	Female	Male	Total	Rates per 100,000
1 to 4		1	1	1.2
5 to 9	1		1	0.9
20 to 29		3	3	1.1
40 to 49	2	1	3	1.3
60 to 69		1	1	0.6
Total	3	6	9	0.5

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand)

Incidence rates by ethnic group are displayed in Table 8. Four of the nine cases acquired their illness in Africa, two in India and single cases elsewhere are shown in Table 9.

Table 8: Ethnic-gender distribution and ethnic-specific incidence rates of malaria in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rates per 100,000
Asian		3	3	0.6
European or Other	2		2	0.5
Pacific Peoples	1	1	2	0.9
Total	3	6	9	0.5

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Table 9: Overseas-acquired malaria cases by country of origin in the Auckland region (2020)

Source Country	Total
India	2
Uganda	2
Afghanistan	1
Ghana	1
Sudan	1
Papua New Guinea	1
Solomon Islands	1
Total	9

2.3 Mosquito interceptions

Both *Aedes albopictus* and *Aedes aegypti* are mosquito vectors for dengue, and are also important vectors for the Chikungunya and Zika viruses. These mosquitoes have not been able to establish populations in Aotearoa to date, so fortunately New Zealand does not have a competent vector for autochthonous spread of these arboviruses. As global warming continues, the distribution of these mosquito species has drifted further south (and north) bringing the disease vector to formerly temperate climates.

As in 2019, there were no *Aedes aegypti* interceptions in 2020 compared with two in 2018, 14 in 2017 and two in 2016. Details of the specimens identified and their source country are shown in Table 10.

Ports of Auckland (POAL) routine surveillance detected 49 mosquito interceptions at the border in 2020 compared with 47 in 2019. Of the 49 all but one involved *Culex quinquefasciatus*, frequently mixed with *Culex pervigilans*, and other *Culex* species.

Auckland International Airport (AIAL) reported two incursions, one of which involved endemic species *Culex quinquefasciatus* and the other which was a non-mosquito species.

Other transitional facilities detected five further incursions, of which two were the mosquito species *Culex quinquefasciatus* and *Culex pervigilans*. The other three were non-mosquito species.

Table 10: Specimen identification of ARPHS mosquito interceptions/incursions in the Auckland region (2020)

Species	POAL	AIAL	Trans. facilities	Country of origin
Aedes aegypti*				
Aedes notoscriptus				
Aedes stimulans*				
Culex Hutchison*				
Culex pervigilans	17		1	NZ Traps
Culex quinquefasciatus	48	1	1	NZ Traps
Culex sp.	5			NZ Traps
Non mosquito species		2	3	Various
Total number of mosquito interceptions	49	3	5	

*Denotes an exotic species

Source: ARPHS Biosecurity Logging Database 2020

2.4 Leptospirosis

Leptospirosis is an infection caused by corkscrew-shaped bacteria called *Leptospira*. Symptoms can range from none, to mild (such as headaches, muscle pain and fevers), to severe, with bleeding from the lungs, or meningitis. If the infection causes jaundice, kidney failure and bleeding it is known as Weil's disease.

Up to 13 different genetic types of *Leptospira* may cause disease in humans. It is transmitted by both wild and domestic animals. The most common animals that spread the disease are rodents. It is often transmitted by animal urine - or by water or soil containing animal urine - coming into contact with breaks in the skin, eyes, mouth or nose. Outbreaks often occur after major flooding.

There were five cases of leptospirosis notified in 2020 compared with 11 in 2019 and 13 in 2018 (Figure 9). Notifications had been increasing since 2014, but this may be due to increased volume or sensitivity of laboratory testing. All cases were adults aged 45 to 66 years; three were male and two were female. Three required hospitalisation, but there were no deaths. Two cases occurred during the first quarter of 2020 and the remaining three cases were notified in the last quarter of the year.

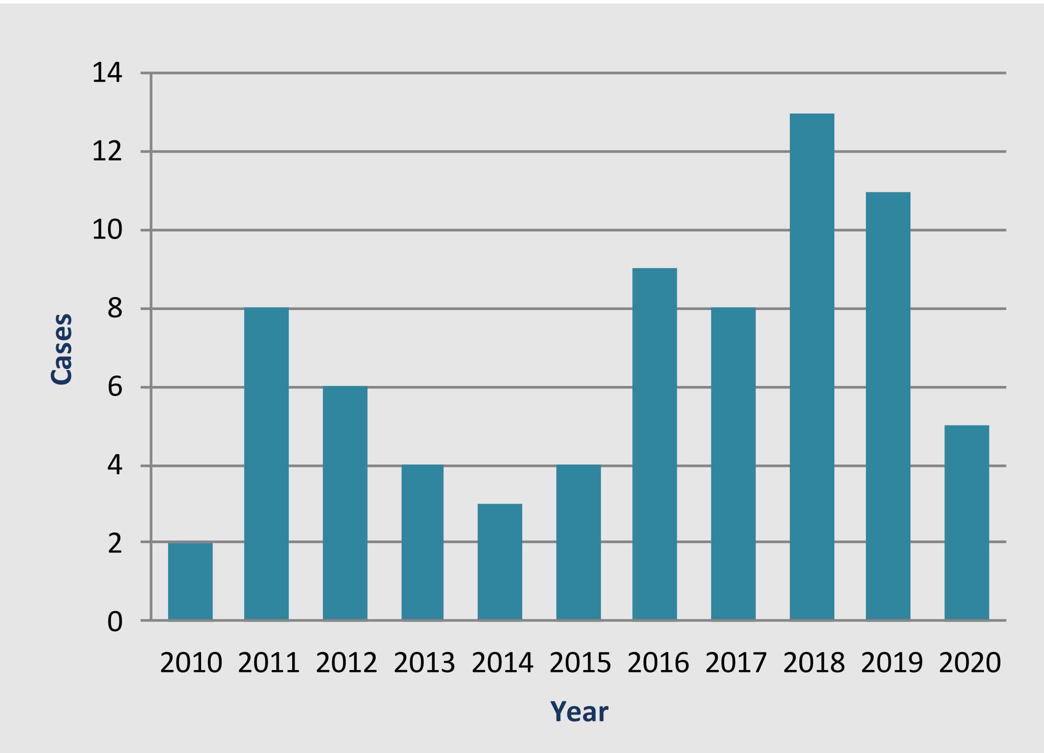


Figure 9: Leptospirosis cases by year in the Auckland region (2010-2020)

Of the five cases, two were sheep and cattle farmers, one case attributed the illness to clearing out a creek on the property, one had unvaccinated pet rats, and one case worked as a rat and stoat catcher in their spare time.

3 Foodborne diseases and viral hepatitis

Key points

- Paratyphoid and typhoid notifications in 2020 were at the lowest level in the past decade. Nearly all notifications occurred in the first quarter of 2020 before the March and April COVID-19 lockdown.
- Shigellosis notifications were well below average, with only one or two confirmed cases per month following the COVID lockdown.
- Verotoxin E. coli (VTEC) notifications were halved in 2020 but there were three cases of haemolytic uraemic syndrome (HUS)
- All of the low risk enterics notifications (for campylobacteriosis, cryptosporidiosis, giardiasis and salmonellosis) were lower in 2020. The exception was yersiniosis, which recovered to normal levels after the first lockdown. People of Chinese ethnicity and children under the age of five were over-represented amongst yersiniosis cases.
- Gastroenteritis increased markedly in the fourth quarter, peaking in December. The majority of cases occurred in ELS and primary schools. The cause was thought to be a shift in disinfectant selection to non-hypochlorite agents, with staff at these institutions believing these products would be more effective against COVID-19 and also a reported change in many institutions using alcohol gels for hand hygiene (which are not effective against norovirus) instead of soap.

3.1 Enteric fevers

Enteric fever (typhoid and paratyphoid fever) is caused by faecal-oral transmission of *Salmonella enterica* serotypes Typhi or Paratyphi. About 27 million people suffer from enteric fever each year, with about 200,000 deaths, almost exclusively in the developing world.

The incidence of these neglected illnesses in some parts of South Asia is as high as 1,600 cases per 100,000. Due to the ready availability of over-the-counter antibiotics there is increasing antibiotic resistance and enteric fever is becoming harder to treat.

A total of 26 cases of enteric fevers were reported in 2020, down from 43 cases in 2019 and well below the 10-year average. Of the 26 cases, 17 (65 per cent) were typhoid fever and 9 (35 per cent) were paratyphoid fever (Table 11, Figure 10).

Table 11: Classification of enteric fever cases in the Auckland region (2010-2020)

Year	Paratyphoid fever	Typhoid fever	Total
2010	8	20	28
2011	7	36	43
2012	11	30	41
2013	16	39	55
2014	9	28	37
2015	14	32	46
2016	15	28	43
2017	24	46	70
2018	10	29	39
2019	13	30	43
2020	9	17	26

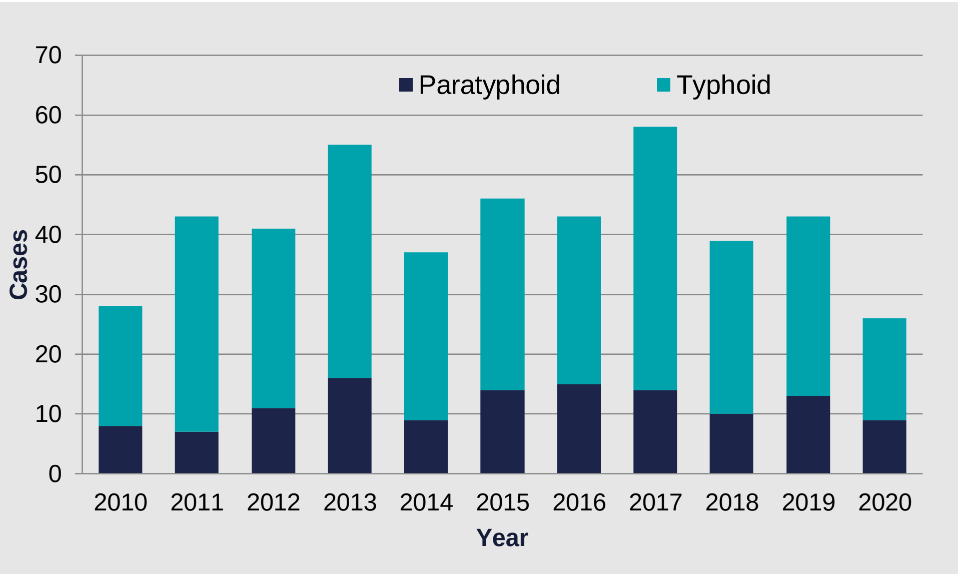


Figure 10: Classification of enteric fever cases in the Auckland region (2010-2020)

3.1.1 Typhoid fever

Typhoid fever (also known simply as typhoid) is a common worldwide bacterial disease. It is transmitted by ingesting food or water contaminated with the *Salmonella typhi*-containing faeces of an infected person. In New Zealand most cases acquire the infection while travelling overseas or through contact with visitors from abroad.

The incidence rate for the Auckland region was 1.0 case per 100,000 in 2020, compared with 0.2 per 100,000 for the rest of New Zealand.

The majority of typhoid cases (13) were reported during the first quarter, after which notifications dropped off coinciding with COVID restrictions on travel (Figure 11). The majority of cases required hospitalisation (76 per cent). There were no deaths.

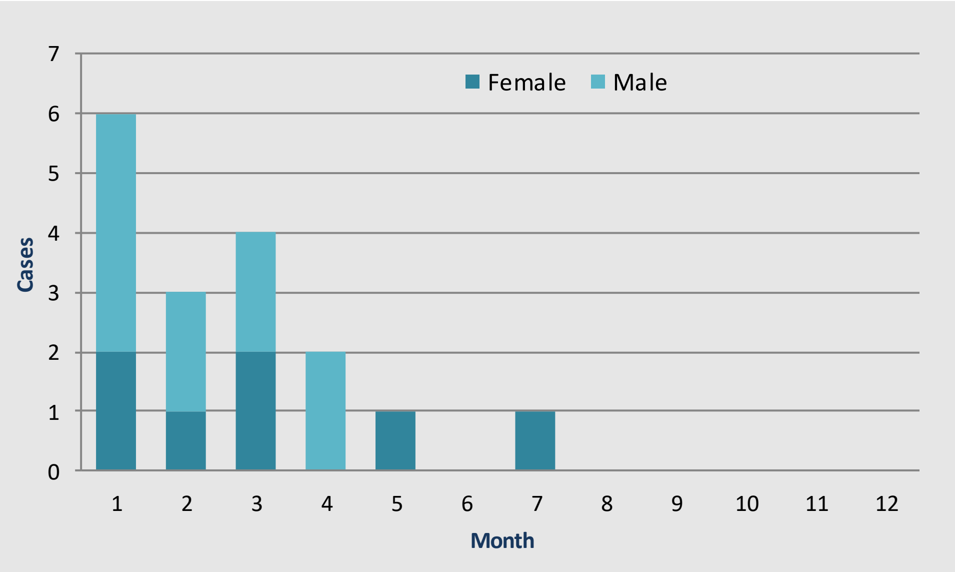


Figure 11: Monthly distribution of typhoid cases by gender in the Auckland region (2020)

For 2020 and 2019 the age-specific incidence rates were highest in young children, compared with 2018 when the rates were higher in adults and the 10-to-14-year-old age group (Table 12). The overall male to female ratio was 1.4:1. The majority of cases (13) were from Asian ethnic groups, three were Pacific Peoples and there was one classified as European or Other (Table 13*).*

Table 12: Age-gender distribution and age-specific incidence rates of typhoid in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1 year	1		1	4.6
1 to 4	2	1	3	3.5
5 to 9				0.0
10 to 14		2	2	1.8
15 to 19	1		1	0.9
20 to 29	1	3	4	1.4
30 to 39	1	2	3	1.1
40 to 49	1		1	0.4
50 to 59				0.0
60 to 69		2	2	1.3
70+				0.0
Total	7	10	17	1.0

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand)

Table 13: Ethnic group distribution and ethnic-specific incidence rates of typhoid cases in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	5	8	13	2.5
European or Other	1		1	0.1
Māori				
Pacific Peoples	1	2	3	1.3
Unknown				
Total	7	10	17	1.0

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Thirteen of the seventeen cases were overseas acquired; the majority were from India (10) and the remainder from Pakistan (2) and South America (1) (Table 14). Of the four locally-acquired cases, three were from the Pacific community and one was of Asian ethnicity.

Table 14: Country of origin for overseas-acquired typhoid fever cases in the Auckland region (2020)

Source Country	Total
India	10
Pakistan	2
South America	1
Total	13

3.1.2 Paratyphoid fever

Paratyphoid fever is an enteric illness caused by one of the following three serotypes of *Salmonella (S) enterica* subspecies enterica: *Salmonella* Paratyphi A, *Salmonella* Paratyphi B and *Salmonella* Paratyphi C. Like *Salmonella* Typhi, they are transmitted by means of contaminated water or food. Paratyphoid fever bears similarities to typhoid fever and the two are referred to by the common name ‘enteric fever’, but the clinical course of paratyphoid fever is more benign. *Salmonella* Paratyphi B var Java cases (12) were previously classified as a paratyphoid fever notification, but these have now been reclassified and are managed as salmonellosis.

A total of nine cases of paratyphoid fever were notified in 2020, a reduction from 13 in 2019 and similar to the 10 cases in 2018. This is an incidence rate of 0.5 cases per 100,000 compared to the rest of New Zealand (0.2 per 100,000). Cases were notified predominantly in the first quarter of the year and only four cases occurred after COVID-19 travel restrictions commenced.

The male to female ratio was 2:1 with all of the female cases occurring between the ages of 10 and 29 years. Male cases were more evenly spread between all the age groups between 1 and 39. All cases were hospitalised. There were no deaths. The predominant ethnic groups affected were Asian (8) and NZ European or Other (1).

All cases were overseas acquired. Countries of origin included India (6) Cambodia (2) and Vietnam (1). All cases were Paratyphi A. There were no Paratyphi B cases detected in 2020.

3.2 Other high risk enterics

3.2.1 Shigellosis

Shigellosis is also known as bacillary dysentery. It is a foodborne illness caused by infection by *Shigella* genus bacteria. Shigellosis rarely occurs in animals other than humans. The causative organism is frequently found in water polluted with human faeces, and is transmitted via the faecal-oral route. The usual mode of transmission is person-to-person or faecal hand-to-mouth spread.

In 2020, the incidence rate for the Auckland region was 2.3 cases per 100,000, approximately double the incidence rate for the rest of New Zealand (1.1 per 100,000).A total of 40 cases of shigellosis were notified. This was a 69 per cent reduction in cases compared to the 127 reported in 2019 (Figure 12). Typically, there are fewer notifications in the winter months. The peak months were January and February. This is usually driven by the local population visiting friends and relatives overseas (Figure 13). Hospitalisation was reported in 37 per cent of cases; there were no deaths.

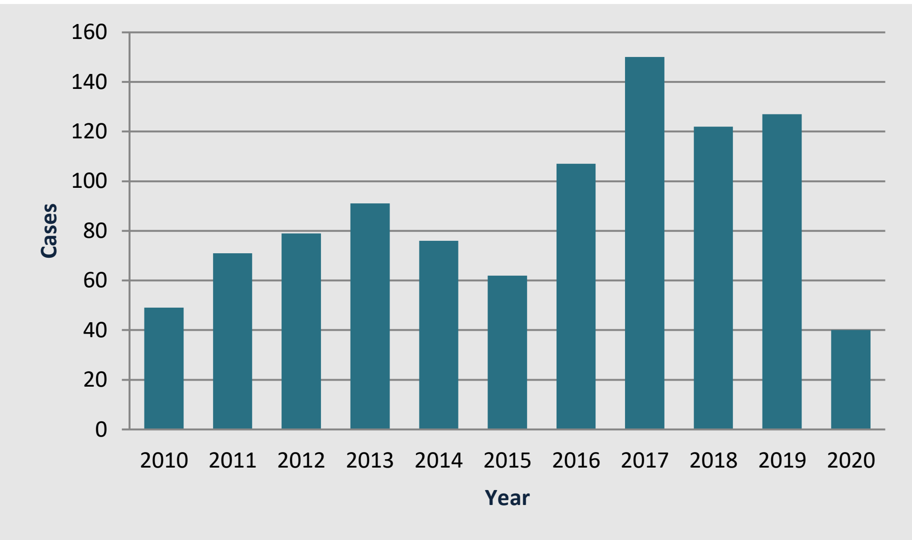


Figure 12: Shigellosis cases in the Auckland region (2009 - 2020)

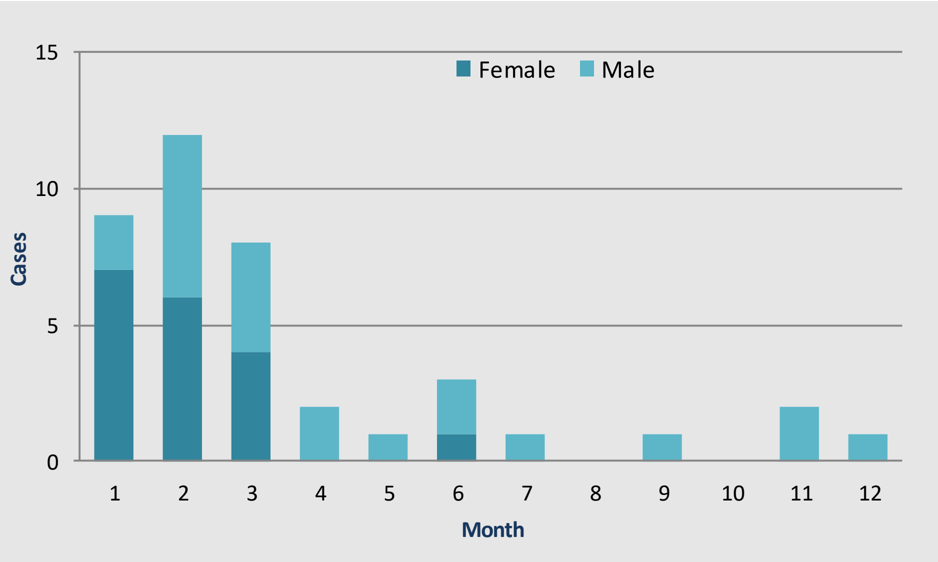


Figure 13: Monthly distribution by gender of shigellosis cases in the Auckland region (2020)

The age-gender distribution and age-specific incidence rates shows a wide distribution, with the highest incidence in children aged less than five years (Table 15). The male to female ratio is 1.2:1.

Table 15: Age-gender distribution and age-specific incidence rates of shigellosis in the Auckland region (2020)

Age group	Female	Male	Total	Incidence rate per 100,000*
<1 year		1	1	4.6
1 to 4	4	6	10	11.6
5 to 9	2	3	5	4.3
10 to 14		1	1	0.9
15 to 19		2	2	1.8
20 to 29	3	2	5	1.8
30 to 39	3	2	5	1.8
40 to 49	1	2	3	1.3
50 to 59	3	1	4	1.9
60 to 69				
70+	2	2	4	2.7
Total	18	22	40	2.3

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

The highest incidence was seen in Pacific Peoples, with 3.9 cases per 100,000 (Table 16). Tongan and Samoan ethnicities (8) made up 20 per cent of all cases (Table 16).

Table 16: Ethnic-group distribution and gender-specific incidence rates of shigellosis in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*.
Asian	4	8	12	2.3
European or Other	8	7	15	1.9
Māori	3	1	4	2.0
Pacific Peoples	3	6	9	3.9
Unknown				
Total	18	22	40	2.3

*Ethnicity rates are total response estimates for 2020 based on 2018 (Source: Statistics New Zealand)

Sixteen of the 40 cases were overseas-acquired (40 per cent). Countries of origin included India (6), Indonesia (2), and the remainder as shown in Table 17.

Table 17: Country of origin for shigellosis cases in the Auckland region (2020)

Source Country	Total	Proportion (%)
India	6	38
Indonesia	2	13
Pakistan	1	6
Fiji	1	6
Hong Kong	1	6
Samoa	1	6
China, People's Republic of	1	6
Vanuatu	1	6
Philippines	1	6
Mexico	1	6
Total	16	100

Various serotypes were identified throughout the year: *Shigella flexneri* (50 per cent), *Shigella sonnei* (45 per cent) and *Shigella boydii* (5 per cent). The most common subtype acquired locally was *Shigella sonnei* Biotype g. All *Shigella* isolates were from stool specimens (Table 18).

Table 18: Shigella isolates in the Auckland region (2020)

Serotype	2018	2019	2020
***Shigella sonnei* Biotype a**	19	19	6
***Shigella sonnei* Biotype f**	1	1	
***Shigella sonnei* Biotype g**	31	45	11
***Shigella sonnei* untyped**	1		1
***Shigella flexner*i 1a**	2	4	4
***Shigella flexneri* 1b**	31	11	2
***Shigella flexneri* 1c**	5	6	1
***Shigella flexneri* 2a**	7	11	6
***Shigella flexneri* 2b**	1	2	3
***Shigella flexneri* 3a**	2	1	1
***Shigella flexneri* 3b**	1	5	1
***Shigella flexneri* 4a**	1		
***Shigella flexneri* 4av**		2	
***Shigella flexneri* 4b**		4	
***Shigella flexner*i 6 Biotype Boyd 88**	6	11	
***Shigella flexneri* X**		1	
***Shigella flexneri* Y**	2		
***Shigella flexneri* Yv**	1	2	
***Shigella flexner*i untyped**	2	1	2
***Shigella boydii* 1**	1		
***Shigella boydii* 2**	1		
***Shigella boydii* 10**	1		
***Shigella boyd*ii 18**			1
***Shigella boydii* untyped**			1
***Shigella dysenteriae* 3**	1		
Other/unknown	5	1	
Total	122	127	40

Shigella sonnei Biotype g and *Shigella sonnei* Biotype a were the most common serotypes in 2019 and 2020, displacing the *Shigella flexneri* serotypes which were predominant in 2018*.*

Of the 11 *Shigella sonnei* Biotype g cases identified, three were acquired overseas from Hong Kong, Indonesia and Mexico. Four of the six Shigella *sonnei* Biotype a cases were acquired overseas from the Philippines, Fiji, Samoa and Vanuatu.

There were no *Shigella flexneri 6* Boyd 88 serotype cases reported (compared with 11 in 2019). This serotype is typically associated with travel to Samoa.

Four of the six Shigella *flexneri* 2A cases reported overseas travel from India (3) and Pakistan (1).

Overseas travellers returning from India accounted for six cases but across four different serotypes.

Of the 24 locally-acquired cases, risk factors included:

- Contact with others with similar symptoms (6)
- Consumption of raw fish, raw shellfish or other seafood e.g. kina, sea slug (5)
- MSM (4)
- Recreational swimming at a river stream or beach (3)
- Recreational swimming in a public swimming pool (1)
- Contact with faecal material e.g. changing nappies (2)
- Visiting friends and relatives (1)
- Consumption of untreated bore or rainwater (1).

3.2.2 Vero-toxigenic *E. coli* / Shiga toxin-producing *E. coli* (VTEC/STEC)

Escherichia coli (E. coli) bacteria normally live in the intestines of people and animals. Most *E. coli* are harmless and an important part of a healthy human intestinal tract. However, some *E. coli* are pathogenic, meaning they can cause illness, either diarrhoea, or illness outside of the intestinal tract. One group of pathogenic *E. coli* produces a toxin called shiga toxin. This toxin is capable of damaging the gut lining, blood cells and kidney. Around five to 10 per cent of those who are diagnosed with VTEC/STEC infections develop a potentially life-threatening complication known as haemolytic uraemic syndrome (HUS).

HUS is a disease characterised by haemolytic anaemia (anaemia caused by destruction of red blood cells), acute kidney failure (uraemia), and a low platelet count (thrombocytopenia). It predominantly, but not exclusively, affects children.

Prior to the introduction of PCR-based testing in mid-2015 the VTEC incidence rate for the Auckland region was 3.5 cases per 100,000 (30 to 50 cases). By the end of 2016 the incidence rate had increased to 12 cases per 100,000 due to a larger number of cases being detected by the more sensitive testing method.

The 2020 incidence rate for the Auckland region was 7.1 cases per 100,000, with a total of 125 probable and confirmed cases for the year. Throughout 2018 and 2019 most of New Zealand moved to PCR-based testing, and the incidence rate for the rest of New Zealand subsequently increased from 11.8 cases per 100,000 in 2017 to 22.2 cases per 100,000 in 2020.

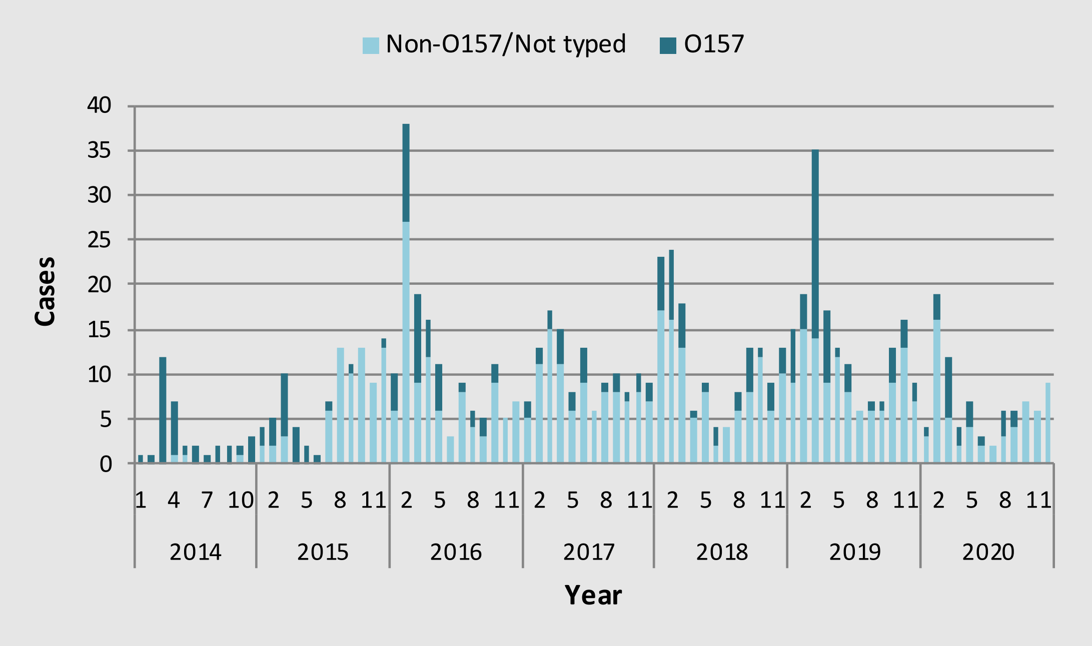


Figure 14: VTEC serotypes O157 and non-O157 by year and month for the Auckland region (2014-2020)

Since the change in laboratory testing in 2015, the proportion of *E. Coli* O157 to non-O157 cases has decreased from 87 per cent in 2014 to 26 per cent in 2015 and 2016 (Figure 14 and Table 19). This proportion of *E. Coli* O157 cases has remained largely unchanged since 2015 suggesting the new testing methodology is detecting more non-O157 cases.

Table 19: Impact of the June 2015 introduction of PCR testing on the proportion of O157 to non-O157 cases reported (2014 – 2020)

Year	Non O157 (%)	O157 (%)
2014	13	87
2015	74	26
2016	74	26
2017	80	20
2018	72	28
2019	70	30
2020	72	28

A total of 125 cases of VTEC were reported in 2020, down from 243 cases in 2019. This represents a 49 per cent decrease. In previous years 214 cases were reported in 2018 and 177 were reported in 2017 (Figure 15).

Cases occurred throughout the year, with the majority of notifications occurring in the first quarter (Figure 16). Hospitalisation occurred in 32 cases (26 per cent).

There were three reported cases of HUS; two were associated with the O157 strain and one was identified as having the O153/178:H32 strain. There was unfortunately one death in a 40-to-49-year-old male with a pre-existing condition and he was found to have a perforation of the distal ileum at post mortem. The serotype in this case was O38:H26.

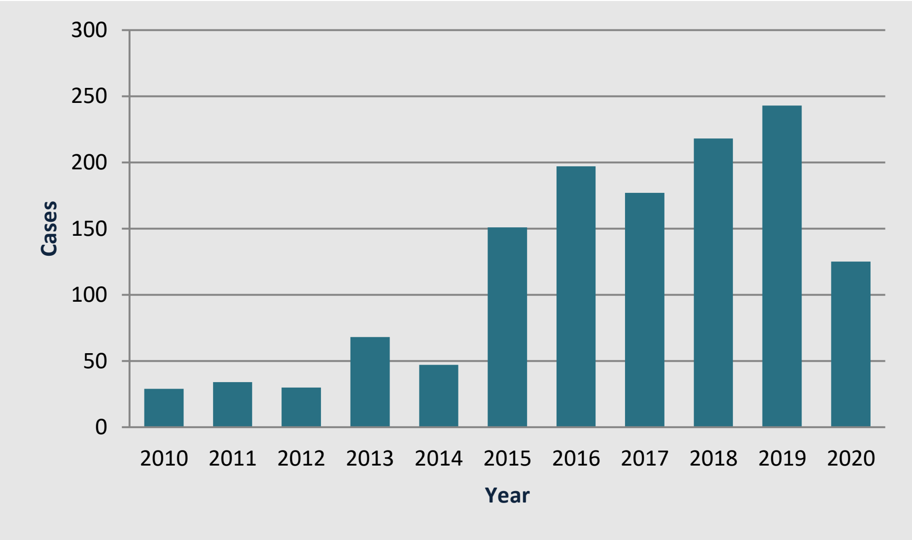


Figure 15: VTEC cases in the Auckland region (2010-2020)

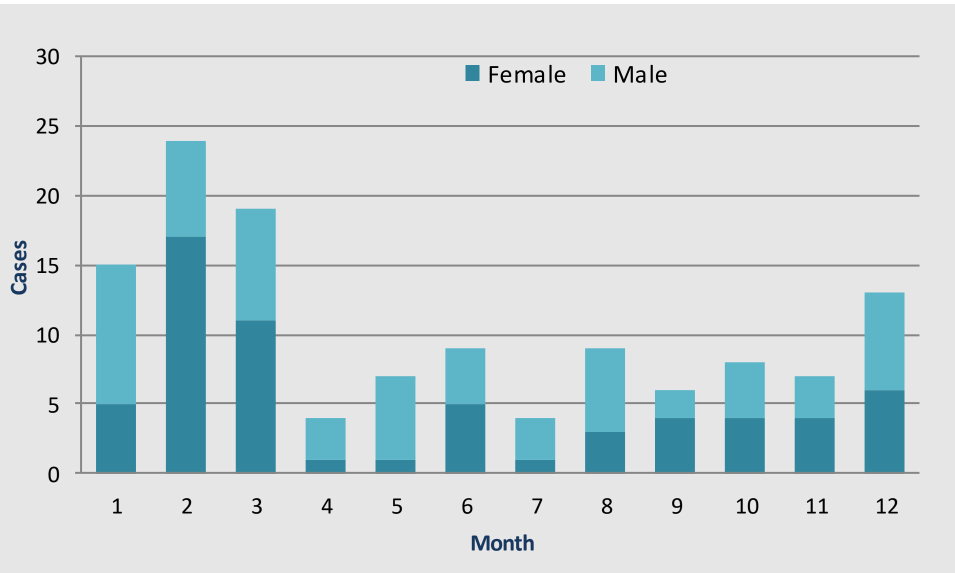


Figure 16: Monthly distribution of VTEC cases in the Auckland region by gender (2020)

The highest incidence rates were seen in babies and children aged between zero and five years old, with males in this age group more likely to have VTEC/STEC than females. This has also been observed in previous years. There was a predominance of female cases in the 20 to 29 year-old and 50 to 59 year-old age groups (Table 20) suggesting the caregiver role is a risk factor.

Table 20: Age and gender distribution and age-specific incidence rates of VTEC in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1 year	2	5	7	32.5
1 to 4	4	14	18	20.9
5 to 9	3	6	9	7.8
10 to 14	2	4	6	5.3
15 to 19	4	1	5	4.5
20 to 29	12	4	16	5.8
30 to 39	2	6	8	2.9
40 to 49	7	4	11	4.9
50 to 59	10	6	16	7.4
60 to 69	8	4	12	7.6
70+	8	9	17	11.6
Total	62	63	125	7.2

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

The highest incidence rate was seen in the European or Other ethnic group. These groups represented 65 per cent of all cases notified (Table 21).

Table 21: Ethnic distribution and gender-specific incidence rates of VTEC in the Auckland region (2020)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	7	13	20	3.8
European or Other	43	38	81	10.4
Māori	6	8	14	6.9
Pacific Peoples	6	4	10	4.3
Unknown				
Total	62	63	125	7.2

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

In most situations more than one risk factor was present, especially for those on farms where there was contact with farm animals and untreated tank water (Table 22). These risk factors have not changed substantially since 2016, although there was an obvious decrease in overseas-acquired cases in 2020 due to COVID-19 travel restrictions.

Table 22: Risk factors associated with VTEC in the Auckland region (2017-2020)

Risk factors	Cases	% present 2017	% present 2018	% present 2019	% present 2020
Overseas acquired	0	18	24	12	0
Untreated water supply	17	11	17	15	14
Contact with farm animals	19	17	16	12	16
Contact with domestic pets	36	42	47	37	36
Contact with faeces or manure	18	20	22	13	15
Contact with confirmed case or person with similar illness	13	11	14	9	11
Recreational water contact	0	1	1	2	0
Consumption of home kill meat	0	4	4	5	0

Source: NDCMS (overseas-acquired cases are excluded from the denominator for locally-acquired cases).

3.3 Low risk enterics

3.3.1 Salmonellosis

Salmonellosis is an infection caused by *Salmonella* bacteria. Most people infected with *Salmonella* develop diarrhoea, fever, vomiting, and abdominal cramps 12 to 72 hours after infection. In most cases the illness lasts four to seven days and most people recover without treatment. In some cases, the diarrhoea may be so severe that the patient becomes dangerously dehydrated and is hospitalised.

The 2020 incidence rate for the Auckland region was 11.5 cases per 100,000. This was lower than the incidence rate for the rest of New Zealand (15.5 per 100,000). A total of 200 cases of salmonellosis were reported, well down from the 369 cases in 2019. This represented a 46 per cent reduction (Figure 17).

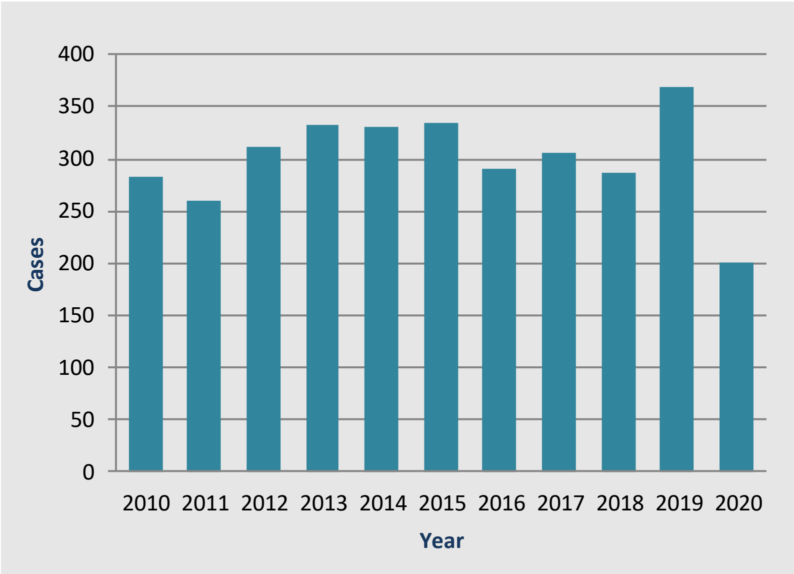


Figure 17: Salmonellosis cases in the Auckland region (2010-2020)

The first quarter was the peak period for salmonellosis notifications, followed by a sudden drop coinciding with the COVID-19 lockdowns in April and September (Figure 18).

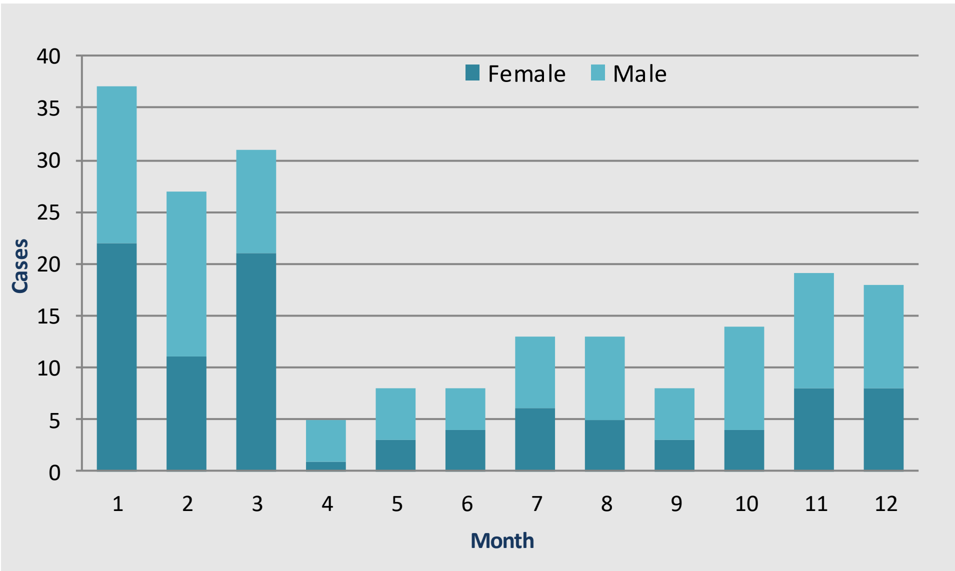


Figure 18: Monthly distribution by gender of salmonellosis cases in the Auckland region (2020)

The incidence rate was highest in those aged under five years old (Table 23), and especially for those aged under one year old. This is the typical demography of salmonellosis. The incidence rates were highest among the European or Other ethnicity group, followed closely by Pacific Peoples (Table 24). Just over a quarter (29 per cent) of salmonellosis cases were hospitalised in 2020 compared with 28 per cent in 2019. There were no deaths.

Table 23: Age and gender distribution and age-specific incidence rates of salmonellosis in the Auckland region (2020)

Age group	Female	Male	Total	Incidence rate per 100,000*
<1 year	6	8	14	65.1
1 to 4	14	26	40	46.5
5 to 9	11	4	15	13.0
10 to 14	2	3	5	4.4
15 to 19	6	7	13	11.6
20 to 29	15	8	23	8.3
30 to 39	8	7	15	5.5
40 to 49	12	12	24	10.6
50 to 59	8	16	24	11.2
60 to 69	6	6	12	7.6
70+	7	8	15	10.3
Total	95	105	200	11.5

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand)

Table 24: Ethnic distribution and gender-specific incidence rates of salmonellosis in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	16	25	41	7.8
European or Other	55	55	110	14.1
Māori	7	11	18	9.2
Pacific Peoples	16	13	29	12.5
Unknown	1	1	2	-
Total	95	105	200	11.5

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Salmonella serotype analysis was undertaken by ESR. From the 200 cases 191 samples underwent serotyping. The majority of salmonellosis was caused by *Salmonella Typhimurium* or presumptive *Salmonella Typhimurium*. The next most common serotype was *Salmonella Enteriditis* which emerged towards the end of the year as a possible outbreak strain in the South Island (bean sprouts were implicated).

Most of the other serotypes were spread sporadically throughout the year, with lower numbers reported in the winter months (Table 25).

Table 25: Selected serotypes identified for salmonellosis in the Auckland region (2020)

Serotype	Cases
Salmonella Typhimurium	44
Presumptive *Salmonella Typhimurium*	40
Salmonella Enteritidis	33
Salmonella Bovismorbificans	13
***Salmonella* spp. positive PCR**	7
***Salmonella Paratyphi B* var Java**	6
Salmonella Brandenburg	6
Salmonella Saintpaul	4
Salmonella Weltevreden	4
Salmonella Panama	3
Salmonella Infantis	3
Salmonella Thompson	3
Salmonella Give	2
Salmonella Stanley	2
Salmonella Derby	2
Salmonella Newport	2
Salmonella Rubislaw	2
***Salmonella enterica* subsp. *enterica* (I) ser. 1,4,12: b : -**	1
Salmonella Muenster	1
Salmonella Lansing	1
Salmonella Bareilly	1
Salmonella Heidelberg	1
Salmonella Mbandaka	1
Group B *Salmonella* isolated	1
Salmonella Schwarzengrund	1
Salmonella Pensacola	1
***Salmonella enterica* subsp. *salamae* (II) ser. 1, 13, 23 : m, t**	1
Salmonella Aberdeen	1
Salmonella Rissen	1
Salmonella Hvittingfoss	1
Salmonella Anatum	1
Salmonella Virchow	1
Total	191

Overseas travel normally accounts for 35 to 40 per cent of cases but for 2020, with overseas travel restrictions, this dropped to just 12 per cent of cases. All of these occurred in the first quarter prior to lockdown. The top source countries were Australia (4), Indonesia (3), Philippines (2) and Fiji (2).

Other risk factors are as follows:

- Nearly half of cases reported direct contact with pets.
- One in ten had contact with manure or compost.

- Recreational swimming was reported in 17 per cent of cases.
- One in 10 cases implicated a restaurant or food premises.

Of the foods consumed, chicken was the most frequently eaten by cases with salmonellosis, with over a quarter also consuming cold sliced-meat products. However, the presence of *salmonella* bacteria was not detected in any of the products submitted for testing.

Table 26: Risk factors for salmonellosis in the Auckland region (2017 - 2020*)

Risk factor	2017 (%)	2018 (%)	2019 (%)	2020 (%)
Case overseas during the incubation period	41	35	36	12
Case travelled within NZ during the incubation period*	9	6	6	8
Contact with a confirmed case/another unwell person *	8	9	6	10
Contact with overseas visitors			5	2
Environmental risk factors*				
Direct contact with pets	39	44	48	43
Implicated restaurant or premises	19	27	25	11
Contact with manure or compost	8	3	20	11
Recreational swimming (sea, pool and other)	10	17	7	17
Untreated water from tank, bore or stream	9	12	7	6
Farm visit	9	8	7	8
Consumed food at large gathering	7	21	22	10
Contact with animal faeces	5	8	7	7
Contact with sick animals	2	1	1	2
Contact with human faeces/vomit	5	1	7	5
Foods*				
Chicken	49	72	53	61
Other meats and poultry products	39	46	49	41
Take away foods or deliveries	22	33	27	23
Tofu / soy products	5	5	6	8
Cold sliced meat (ham, saveloys, salami, frankfurters, other)	22	32	23	26
Raw eggs	2	4	8	6
Sesame seed products	2	4	11	6
Untreated raw milk		1	2	0

*Excludes those cases who acquired their illness overseas.

Note: Denominator excludes cases where the question was not asked

3.3.2 Campylobacteriosis

Campylobacter enteritis is a zoonotic disease with clinical and epidemiological features similar to that of salmonellosis. Transmission may occur when food is cross-contaminated by raw poultry or other meat.

The incidence rate for the Auckland region was 80.6 cases per 100,000, considerably less than the incidence rate for the rest of New Zealand (118.3 cases per 100,000).

A total of 1,403 cases were reported. This was 22 per cent less than on the 1,795 cases reported in 2019, and 47 per cent less than the 2,065 cases reported in 2018 (Figure 19).

Campylobacter shows a typical seasonal distribution, with lower levels seen during winter, followed by an increase during spring and a peak in early summer (Figure 20). There was a major dip in cases in the first three quarters of 2020, associated with the COVID-19 lockdowns in March and April. Notifications returned to normal levels by the fourth quarter.

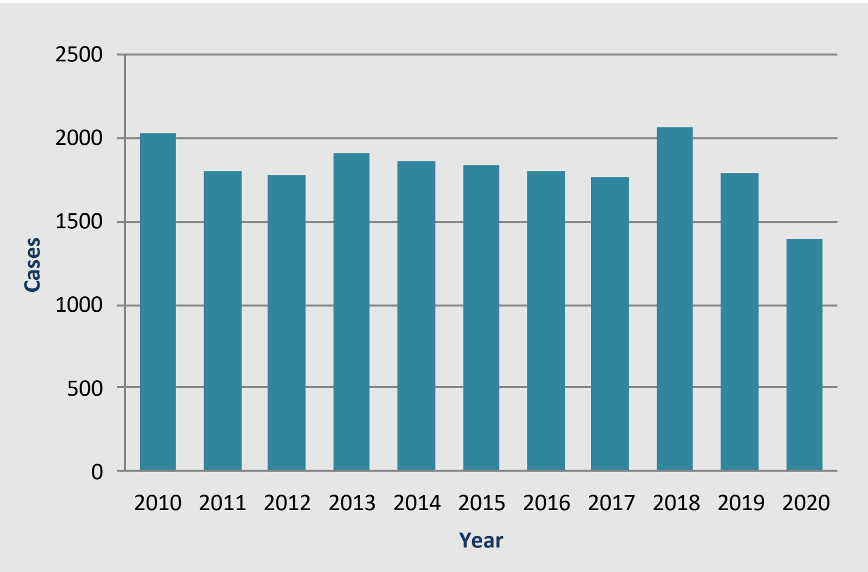


Figure 19: Campylobacteriosis cases in the Auckland region (2010-2020)

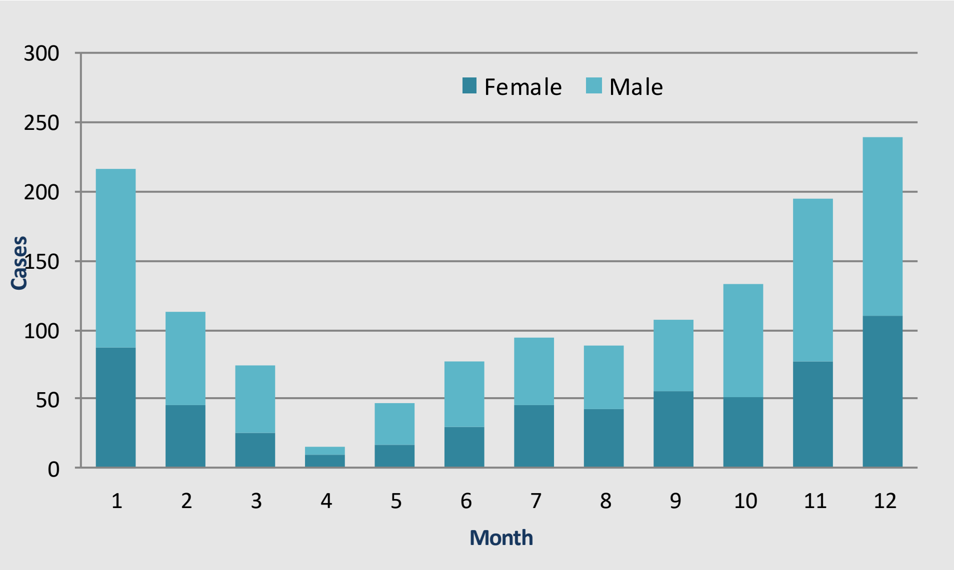


Figure 20: Monthly distribution of campylobacteriosis by gender in the Auckland region (2020)

The incidence rate was highest in the elderly, especially the over 70s, followed by those aged under five (Table 27). Males were slightly more likely to be affected, with a male to female ratio of 1.4:1.

Table 27: Age and gender distribution and age-specific incidence rates of campylobacteriosis in the Auckland region (2020)

Age group	Female	Male	Total	Incidence rate per 100,000*
<1 year	9	18	27	125.5
1 to 4	47	73	120	139.5
5 to 9	25	41	66	57.4
10 to 14	14	31	45	40.0
15 to 19	24	46	70	62.7
20 to 29	114	114	228	82.0
30 to 39	52	94	146	53.8
40 to 49	70	84	154	67.9
50 to 59	64	104	168	78.1
60 to 69	85	86	171	108.7
70+	91	117	208	142.3
Total	595	808	1403	80.6

* Rates are based on estimated mid-year population, 2020 (Source: Statistics New Zealand)

Waitematā DHB had the largest number of reported campylobacteriosis cases (594), and Auckland DHB the least (389). Typically, Counties Manukau DHB records the lowest numbers and this may represent a change in health-seeking behaviour in South Auckland due to concerns over COVID-19.

The highest incidence rate was seen in the European or Other ethnic group (123.0 per 100,000), which was more than double the rate for Māori, and nearly four times that for

Pacific Peoples. The incidence for Asian ethnicity, while still well below the European or Other rate, is approximately the same as Māori and higher than that of Pacific Peoples at 36.9 cases per 100,000 (Table 28).

Table 28: Ethnic distribution and gender-specific incidence rates of campylobacteriosis in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*.
Asian	90	142	232	44.3
European or Other	421	541	962	123.0
Māori	39	63	102	50.5
Pacific Peoples	38	48	86	36.9
Unknown	7	14	21	-
Total	595	808	1403	80.6

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

3.3.3 Cholera

Cholera is an infection of the small intestine caused by the bacterium *Vibrio cholerae*. The main symptoms are watery diarrhoea and vomiting. This may result in dehydration and, in severe cases, greyish-bluish skin. Transmission occurs primarily by drinking water or eating food that has been contaminated by the faeces of an infected person, including asymptomatic cases.

There were no cases of cholera in 2020.

The last previous confirmed case of cholera was notified in 2018.

3.3.4 Cryptosporidiosis

Cryptosporidiosis, also known as “crypto”, is a parasitic disease caused by *Cryptosporidium*, a protozoan parasite. It affects the intestines and typically causes an acute short-term infection. It is spread through the faecal-oral route, often through contaminated water.

The main symptom is self-limiting diarrhoea in people with intact immune systems. In immunocompromised individuals, such as people with AIDS, the symptoms may be particularly severe. Cryptosporidiosis is often associated with animal contact, contaminated drinking water, and recreational water contact, and is a useful environmental health indicator in this regard.

The incidence rate for the Auckland region was 10.1 cases per 100,000. This was well below the incidence rate for the rest of New Zealand (22.8 per 100,000).

A total of 176 cryptosporidiosis cases were reported in 2020, well down on the 311 cases notified in 2019 and the 574 cases 2018. The cause of the decrease in 2019 is not known and a further decrease observed in 2020 is probably due to COVID-19 restrictions and changes in hand hygiene behaviour (Figure 21).

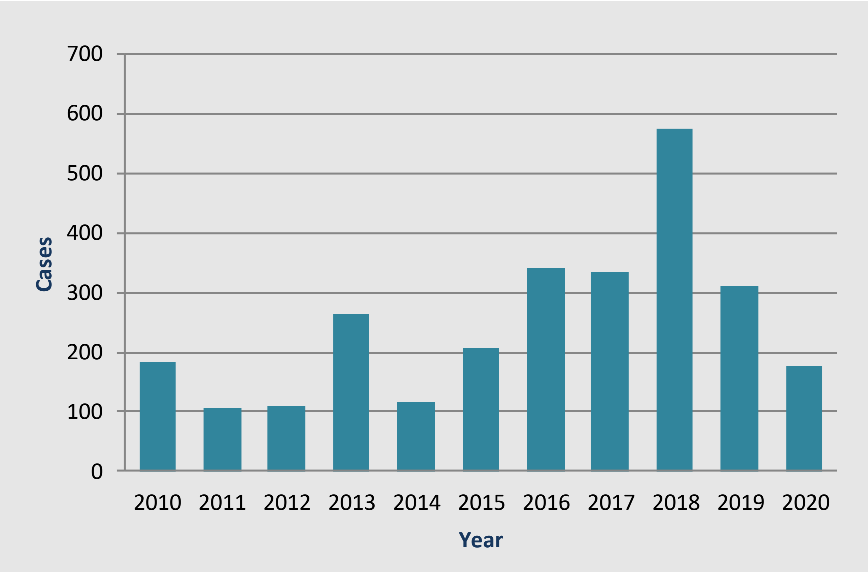


Figure 21: Cryptosporidiosis cases in the Auckland region (2010-2020)

Cryptosporidiosis shows a typical seasonal distribution, with peak levels in late summer and early autumn, then lower levels during winter. There was a marked drop off in March and April notifications following lockdowns, and an increase in spring during the lambing and calving seasons, which typically start in August. Notifications tailed off by the year's end, to the lowest levels seen in years. Hospitalisation data is incomplete and only one case is recorded as requiring hospitalisation. There were no deaths.

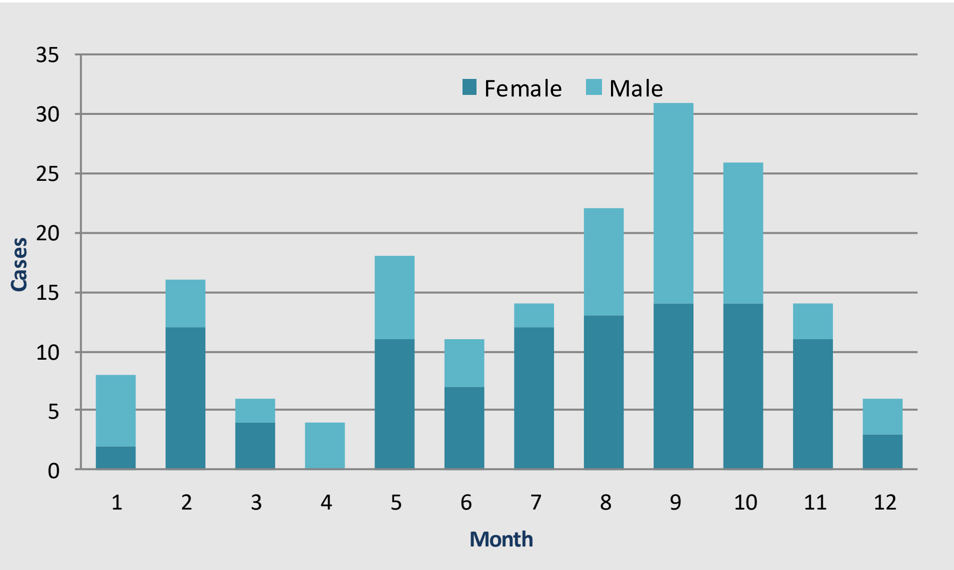


Figure 22: Monthly distribution of cryptosporidiosis cases by gender in the Auckland region (2020)

The age specific incidence rate was highest in children aged one to four years, followed by those in the 30- to 39-year-old age group. Typically, infants aged under one year old have a higher incidence rate, but this was not the case in 2020. We would speculate that changes in behaviour with regard to social mixing, attendance at day care and improved hand hygiene across the population may have played a part in this drop off in cases in infants (Table 29). The female to male ratio remained the same overall at 1.4:1 but, as seen in previous years, there was an increase in females in the 30- to 39-year-old age group, where the ratio was 4.2:1.

Table 29: Age and gender distribution and age-specific incidence rates of cryptosporidiosis in the Auckland region (2020)

Age group	Female	Male	Total	Incidence rate per 100,000*
<1 year	1	0	1	4.6
1 to 4	13	21	34	39.5
5 to 9	8	5	13	11.3
10 to 14	4	5	9	8.0
15 to 19	4	1	5	4.5
20 to 29	16	19	35	12.6
30 to 39	30	7	37	13.6
40 to 49	11	5	16	7.1
50 to 59	8	5	13	6.0
60 to 69	4	2	6	3.8
70+	4	3	7	4.8
Total	103	73	176	10.1

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

The incidence rate was highest for the European or Other ethnic group, with 18.8 cases per 100,000, more than three times the incidence of any of the other ethnic groups (Table 30).

Table 30: Ethnic distribution and gender-specific incidence rates of cryptosporidiosis in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	9	4	13	2.5
European or Other	87	60	147	18.8
Māori	4	7	11	5.4
Pacific Peoples	1	1	2	0.9
Unknown	2	1	3	-
Total	103	73	176	10.1

* Rates are based on Ministry of Health Prioritised Pop Projection off 2018 base (Source: Statistics New Zealand)

Routine interviews of cryptosporidiosis cases ceased in October 2017, so the data reported no longer contains risk factor data.

3.3.5 Giardiasis

Giardiasis (usually known in New Zealand as 'giardia') is a zoonotic parasitic disease caused by the flagellate protozoan *Giardia lamblia*. The giardia organism inhabits the digestive tract of a wide variety of domestic and wild animal species, as well as humans. It is the most common pathogenic parasitic infection in humans.

The incidence rate for the Auckland region was 18.0 cases per 100,000, considerably less than for the rest of New Zealand (25.2 per 100,000).

A total of 313 cases of giardiasis were reported in 2020, nearly half of the 544 reported in 2019 (Figure 23). Hospitalisation data are incomplete, and only one hospitalisation was recorded. There were no deaths.

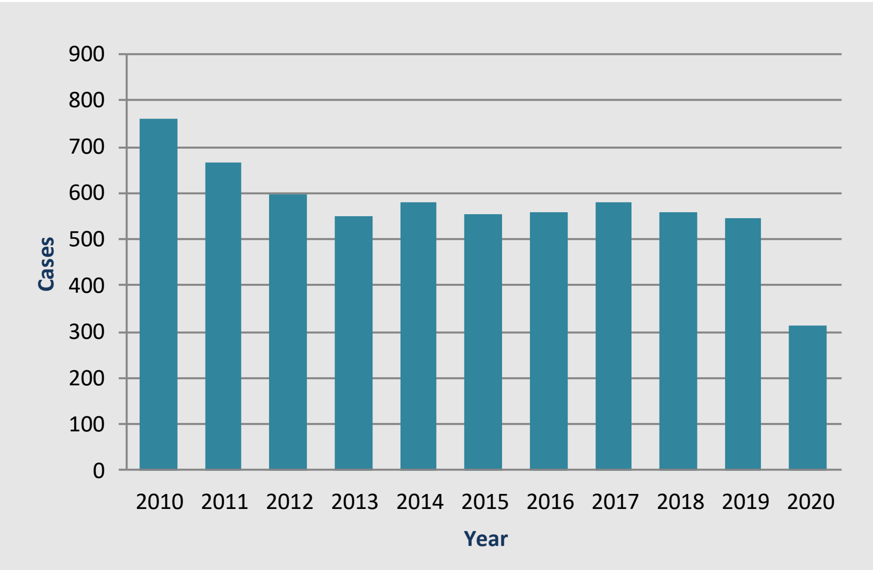


Figure 23: Giardiasis cases in the Auckland region (2010-2020)

Giardiasis typically has the highest number of cases in the summer holiday period and autumn, before tailing off over the second half of the year. In 2020 notifications were following this trend during January and February, but dropped off in March and April. Cases rebounded in spring coinciding with the lambing and calf-rearing season (Figure 24).

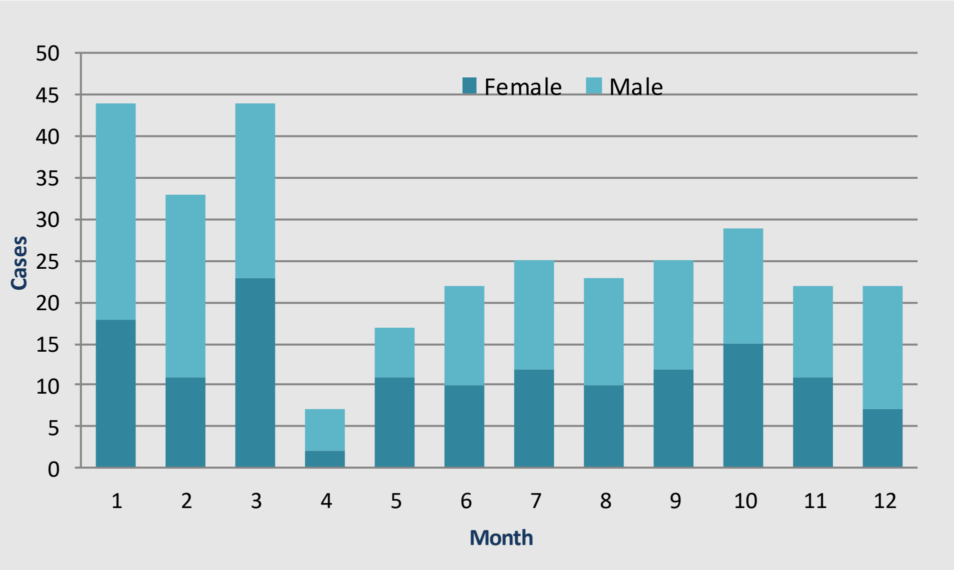


Figure 24: Monthly distribution by gender of giardiasis in the Auckland region (2020)

The ranking of the age specific incidence rate is unchanged with the most affected age group being one- to four-year-olds, followed by the 30- to 39-year-old age group. More male cases were reported than female cases, with a ratio of 1.2:1. This proportion is similar to previous years (Table 31).

Table 31: Age and gender distribution and age-specific incidence rates of giardiasis in the Auckland region (2020)

Age group	Female	Male	Total	Incidence rate per 100,000*
<1 year	3	1	4	18.6
1 to 4	15	29	44	51.1
5 to 9	10	10	20	17.4
10 to 14	3	5	8	7.1
15 to 19	3	5	8	7.2
20 to 29	16	30	46	16.5
30 to 39	29	44	73	26.9
40 to 49	29	14	43	19.0
50 to 59	9	21	30	14.0
60 to 69	18	7	25	15.9
70+	7	5	12	8.2
Total	142	171	313	18.0

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

The highest incidence by ethnic groups was seen in the European or Other ethnic group (Table 32). This is also similar to the trend of previous years.

Table 32: Ethnic group distribution of giardiasis in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	12	28	40	7.6
European or Other	117	124	241	30.8
Māori	9	9	18	8.9
Pacific Peoples	4	9	13	5.6
Unknown		2	2	-
Total	142	172	314	18.0

Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

3.3.6 Listeriosis

Listeriosis is a bacterial infection most commonly caused by *Listeria monocytogenes*. Listeriosis primarily causes infections of the central nervous system (meningitis, meningoencephalitis, brain abscess) and bacteraemia in those who are immunocompromised, pregnant, and at the extremes of age (newborns and the elderly). It may also cause gastroenteritis in healthy people who have ingested a large amount of the organism.

Listeria is ubiquitous in the environment and is primarily transmitted via the oral route from eating contaminated food. Listeria has been isolated from raw meat, dairy products, vegetables, fruit and seafood. Soft cheeses, unpasteurised milk and unpasteurised pâté are higher risk food items.

Twelve listeria cases were notified in the Auckland region in 2020, up from five in 2019 and well above the 10 year average of 7.2 cases per year. The 2020 incidence rate for the Auckland region was 0.7 cases per 100,000, similar to the rate for the rest of New Zealand. The twelve cases were spread evenly over the year. Five cases were in the 70-year-plus age group, and eight were aged 60 to 69 years old. Five were female and seven were male. Five cases were European or Other ethnicity, four were Asian and the remainder were Māori or Pacific. All cases were hospitalised and there were two deaths in cases aged over 70 years. Of the six cases that had samples serotyped, five were Type O4 and one was Type O1/2.

There were two additional cases of listeriosis in the perinatal period. Both of the mothers were aged 30 to 39 years old, and of Asian ethnicity. One mother had a spontaneous miscarriage at nine weeks and was found to be listeria-positive on blood culture. The second case presented in premature labour at 35 weeks with maternal blood culture positive for listeria post-delivery. Food sampling did not reveal a source but both cases had a history of consuming high risk foods. Both serotypes were O4.

3.3.7 Yersiniosis

Yersiniosis is an infectious disease caused by a bacterium of the genus *Yersinia*. Most yersiniosis infections among humans are caused by *Y. enterocolitica,* of which there are several pathogenic subtypes. Infection with *Y. enterocolitica* occurs most often in young children. The infection is thought to be contracted by consuming undercooked meat products, especially pork, unpasteurised milk, or water contaminated by the bacteria.

There were 406 cases of yersiniosis for the Auckland region in 2020. This is an incidence rate of 23.3 cases per 100,000 (compared with 26.0 cases per 100,000 for the rest of New Zealand), and the same as for 2019 when there were 405 cases.

Overall yersiniosis has been increasing since 2015 (Figure 25). A factor in the increase was a change in laboratory methods followed by a change to PCR testing in mid-2017. *Yersinia pseudotuberculosis* is not detected by the current PCR technology and diagnosis relies on clinical suspicion and stool culture.

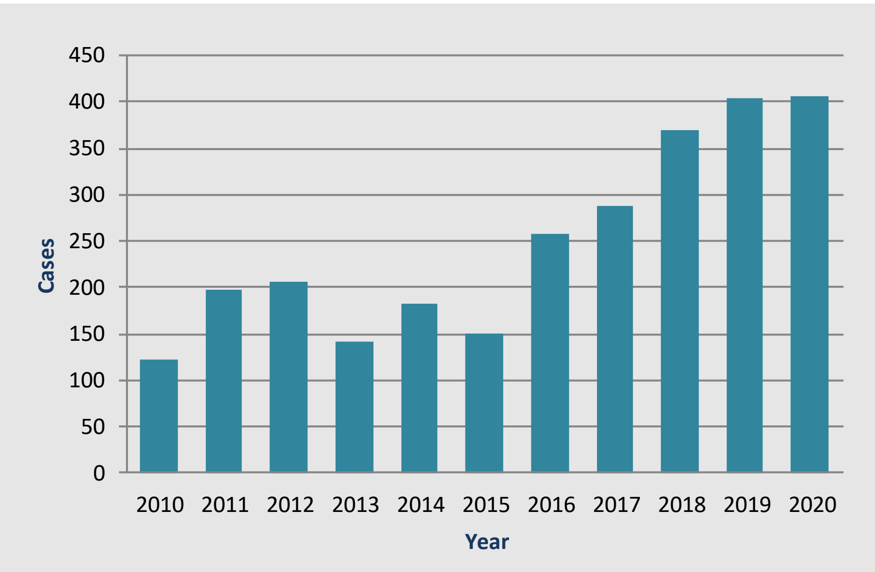


Figure 25: Yersiniosis cases in the Auckland region (2010-2020)

Yersiniosis was one of the few enteric diseases which saw incidence rates relatively unchanged by the COVID-19 pandemic. Case notifications dropped markedly during the first COVID lockdown in March and April but rebounded rapidly, triggering surveillance alerts early in the fourth quarter (Figure 26). Sixteen cases (4 per cent) required hospitalisation and there were no deaths.

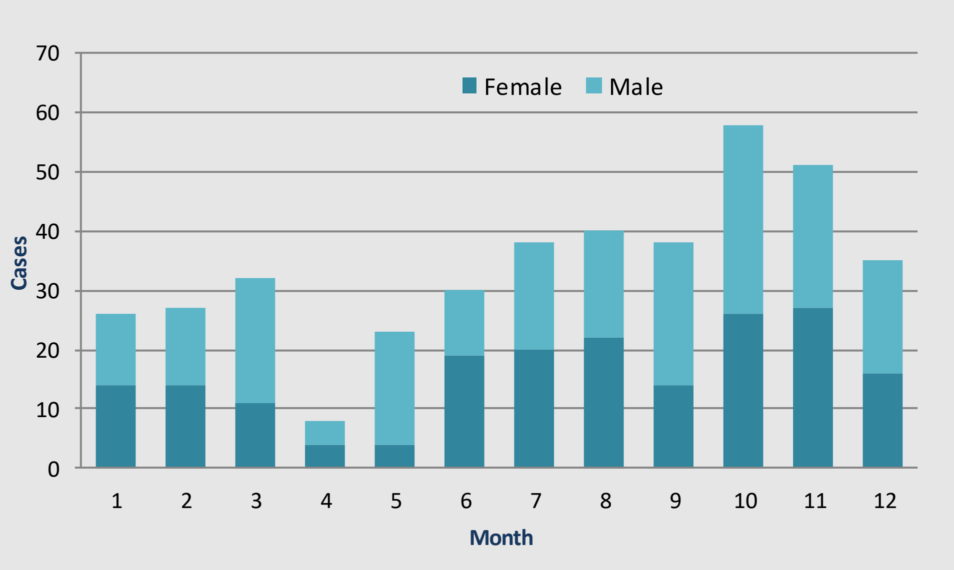


Figure 26: Monthly distribution of yersiniosis cases by gender in the Auckland region (2020)

As in previous years, children younger than five years old had the highest incidence rates. The male to female ratio was equal (Table 32).

Table 33: Age and gender distribution and age-specific incidence rates of yersiniosis in the Auckland region (2020)

Age group	Female	Male	Total	Incidence rate per 100,000*
<1 year	11	11	22	102.3
1 to 4	23	36	59	68.6
5 to 9	5	11	16	13.9
10 to 14	4	12	16	14.2
15 to 19	9	9	18	16.1
20 to 29	24	28	52	18.7
30 to 39	30	33	63	23.2
40 to 49	24	18	42	18.5
50 to 59	21	26	47	21.9
60 to 69	19	15	34	21.6
70+	21	16	37	25.3
Total	191	215	406	23.3

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

The Asian ethnic group had the highest incidence rate and, in cases where ethnicity is defined further, people of Chinese ethnicity accounted for 111 cases (27 per cent), with 29 per cent of cases occurring in those aged under five years old (Table 34). In all other ethnic groups, children younger than five years old were responsible for 10 to 15 per cent of cases. This finding is reproduced year after year, and merits further research, considering food diary analysis.

Table 34: Ethnic distribution and gender-specific incidence rates of yersiniosis in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	82	88	170	32.4
European or Other	80	100	180	23.0
Māori	11	10	21	10.4
Pacific Peoples	16	15	31	13.3
Unknown	2	2	4	-
Total	191	215	406	23.3

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

ESR microbiological typing of yersiniosis cases for the Auckland region by month is shown below (Figure 27) with yearly totals in Table 34. Of note is the seasonality of *Yersinia enterocolitica* biotype 1A. This increase occurs every year at the same time between September and November; the cause is not known. Otherwise, the predominant strains were *Yersinia enterocolitica* biotype 2/3 serotype O:9 (50 per cent), and *Yersinia enterocolitica* biotype 4 serotype O:3 (16 per cent) (Table 35).

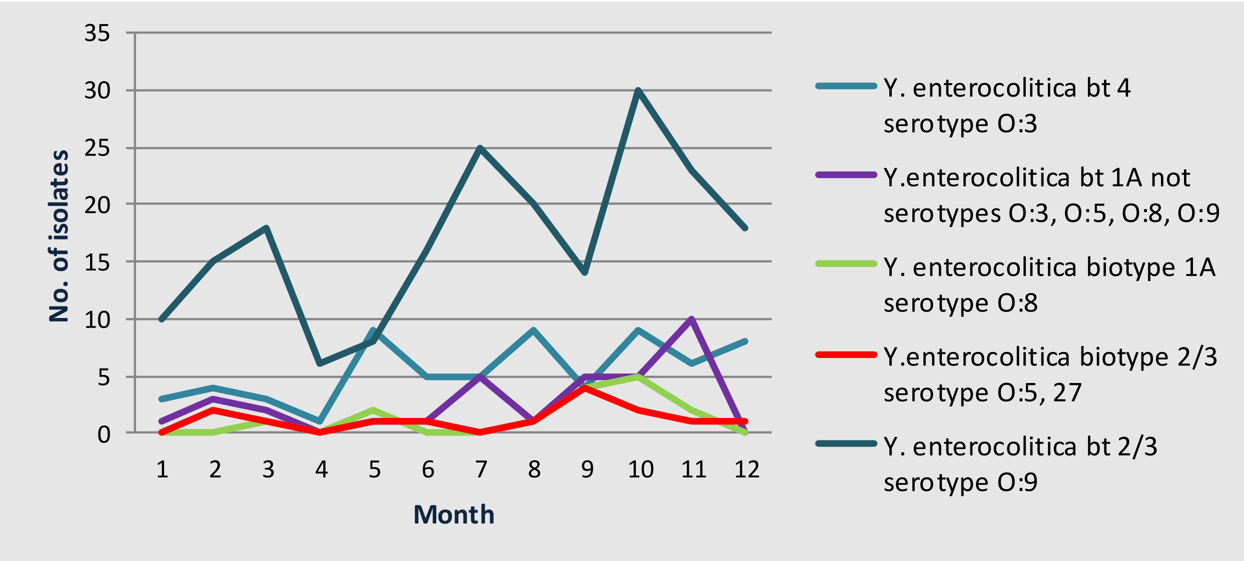


Figure 27: Microbiological typing of yersiniosis by month in the Auckland region (2020)

Table 35: Microbiological typing of yersiniosis in the Auckland region (2020)

Serotype	Cases	%
Y. enterocolitica biotype 2/3 serotype O:9	203	50.0
Y. enterocolitica biotype 4 serotype O:3	66	16.3
Y.enterocolitica biotype 1A not serotypes O:3, O:5, O:8, O:9	34	8.4
Y. enterocolitica biotype 1A serotype O:8	15	3.7
Y.enterocolitica biotype 2/3 serotype O:5, 27	14	3.4
Y. enterocolitica biotype 1A serotype O:5	9	2.2
Yersinia enterocolitica biotype 1A serotype ORough	2	0.5
No *Yersinia enterocolitica* or *Yersinia pseudotuberculosis* isolated	2	0.5
Y. enterocolitica Biotype 1A	1	0.2
Yersinia pseudotuberculosis	1	0.2
Not typed	59	14.5
Total	406	100

3.3.8 Gastroenteritis

Auckland Regional Public Health Service receives weekly data from privately contracted sentinel GPs in the Auckland region (representing approximately 10 per cent of Auckland's GP population). These practices code gastroenteritis based on a case definition of 'three or more episodes of diarrhoea in a 24-hour period with or without nausea, vomiting and/or abdominal pain'. On a weekly basis HealthStat extracts these events from practices via the Medtech 32 practice management software. This data is collected and plotted against a three-year moving average as cases (Figure 28) and rates by DHB (Figure 29).

Outbreaks of gastroenteritis occur frequently in the Auckland region (refer Section 8).

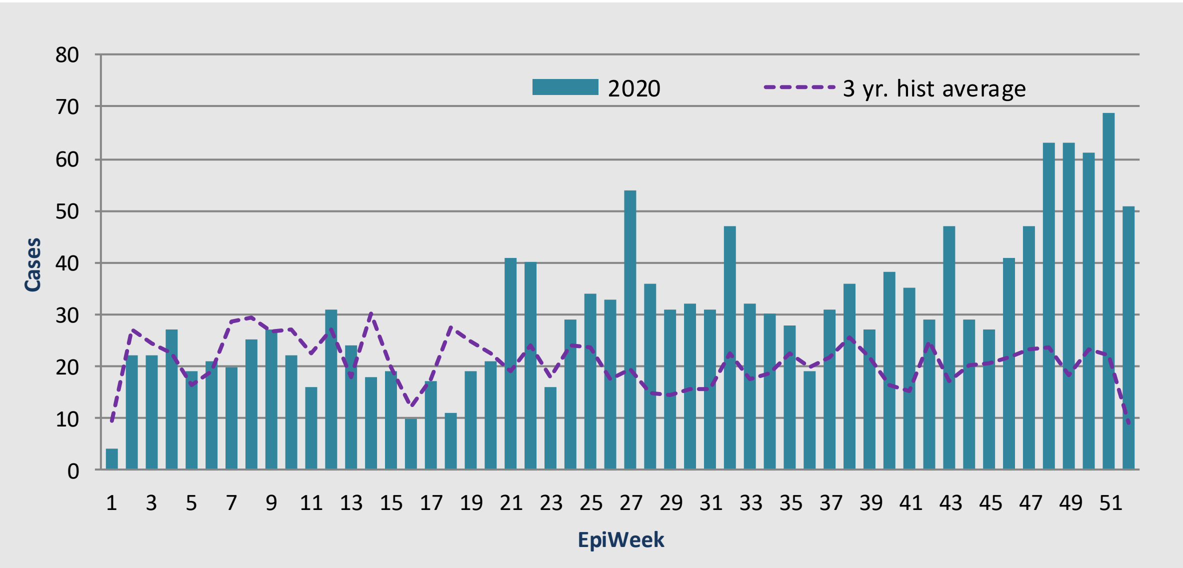


Figure 28: Gastroenteritis cases from sentinel GPs in the Auckland region (2020)

(Source HealthStat)

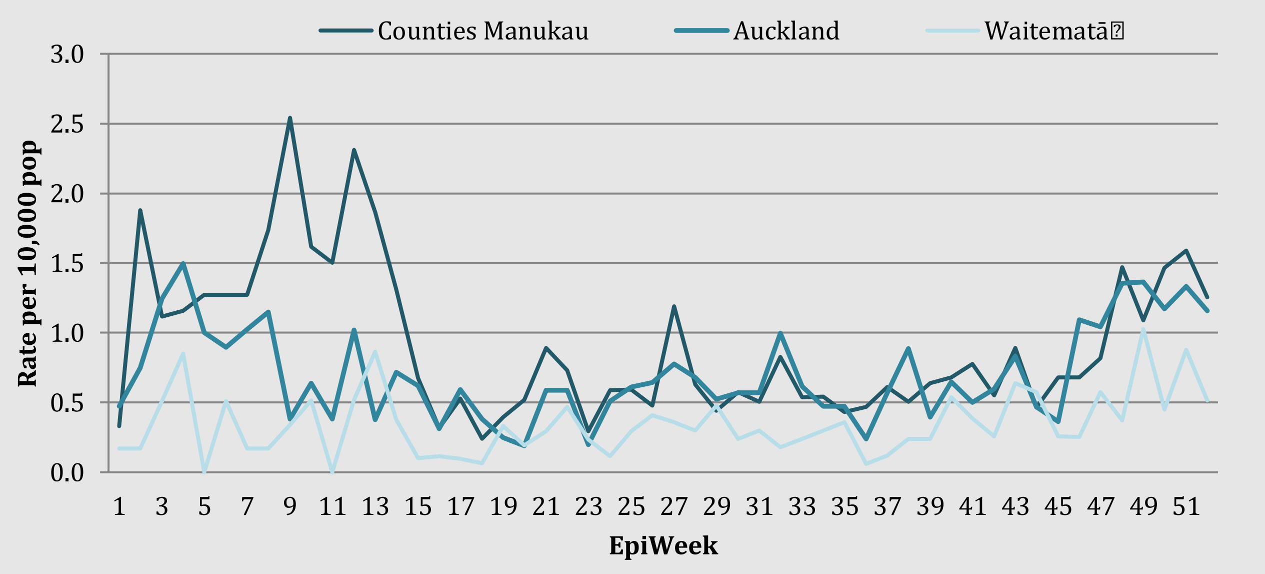


Figure 29: Gastroenteritis rates by week from sentinel GPs by DHB in the Auckland region (2020)

(Source HealthStat)

Despite COVID-19, gastroenteritis occurred in three waves over the year, peaking in the fourth quarter. The peak following the COVID-19 lockdowns was predominantly in the 15-plus age group. The fourth quarter peak was generated by a sharp rise in cases in under-14s. This corresponded with a large surge in ELS and primary school outbreak reports to ARPHS over this period (see Section 8). As referenced previously in this report, this may have been caused by changes to disinfectants and hand-washing practices.

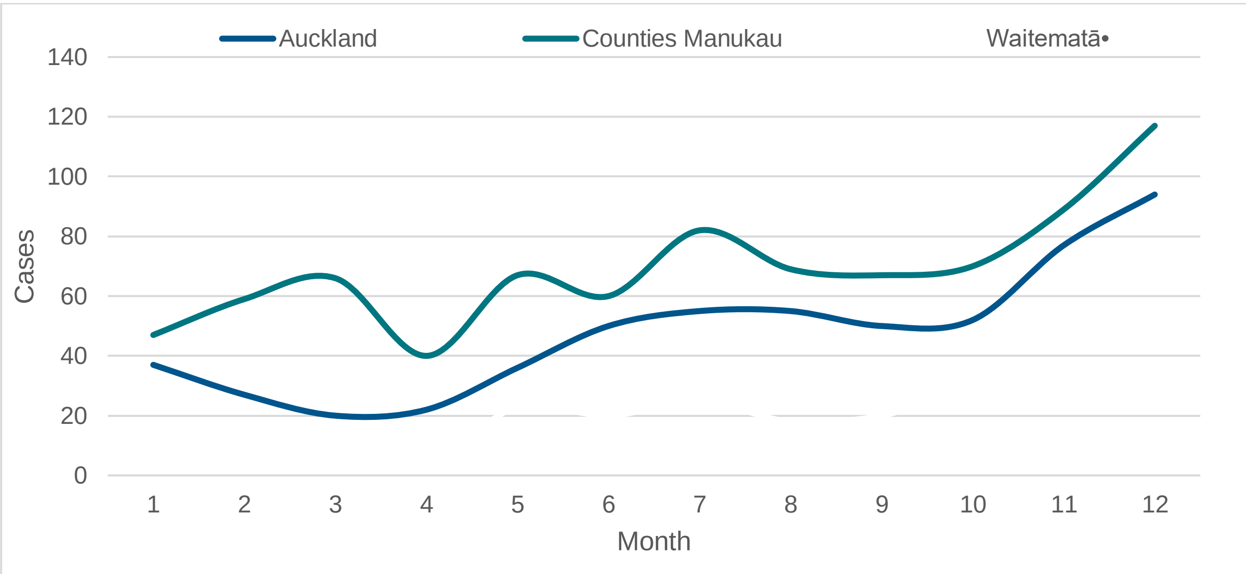


Figure 29: Gastroenteritis cases from sentinel GPs by month and age group in the Auckland region (2020)

Source: HealthStat

3.4 Viral hepatitis

Viral hepatitis is liver inflammation due to a viral infection. It may present in acute or chronic forms. The most common causes of viral hepatitis are the five unrelated hepatotropic viruses: hepatitis A, hepatitis B, hepatitis C, hepatitis D, and hepatitis E.

Overall, hepatitis A, B and C notifications in 2020 were at about a third of the normal levels of reporting.

Hepatitis A rates were highest in the Pacific Peoples ethnic group with half of the cases emanating from the Pacific region. Hepatitis B and C notifications were low-to-stable with rates highest in older age groups.

A total of 22 cases of probable and confirmed viral hepatitis were reported in 2020 (Table 36), compared with 57 in 2019 and 63 cases in 2018.

The drop in the number of hepatitis cases was largely a result of fewer cases of hepatitis A (12 compared with 37 in 2019).

All cases were serologically confirmed:

- twelve as hepatitis A
- four as hepatitis B
- one as hepatitis C
- five as hepatitis 'Not Otherwise Specified' (NOS).

The five NOS cases included three hepatitis E and two hepatitis D.

The distribution of acute viral hepatitis serotypes by year is shown in Figure 30. Hospitalisation was required for 60 per cent of cases. No deaths were reported from acute viral hepatitis.

Table 36: Classification of acute viral hepatitis cases in the Auckland region (2020)

Hepatitis Type	Cases	%
Hepatitis A	12	57
Hepatitis B	4	19
Hepatitis C	1	5
Hepatitis NOS		
Hepatitis D	2	9
Hepatitis E	3	14
Total	22	100

Hepatitis A = anti-HAV IgM positive, Hepatitis B = anti-HBc IgM positive,

Hepatitis C = anti-HCV IgM positive /HEPCRNA positive

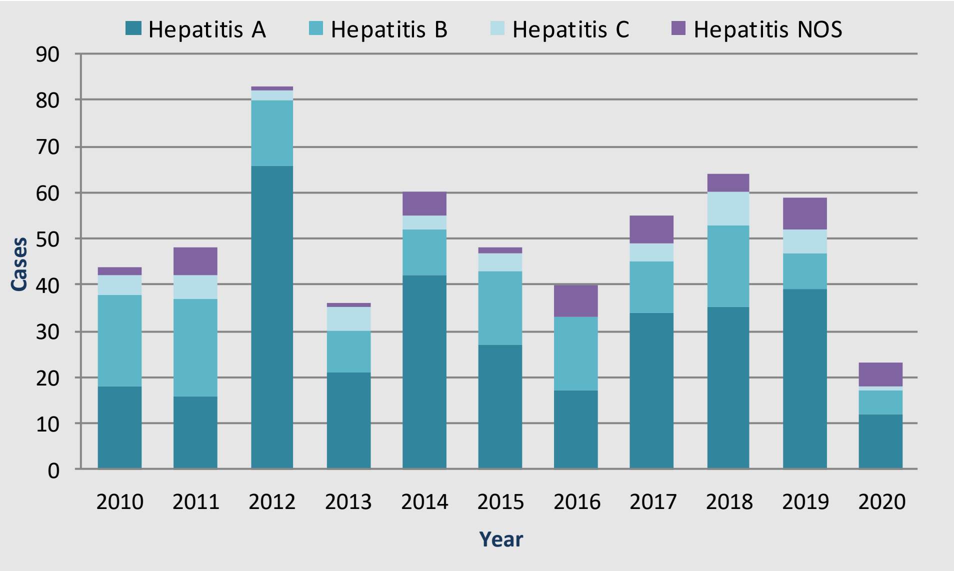


Figure 30: Viral hepatitis cases by type in the Auckland region 2010-2020

3.4.1 Hepatitis A

Hepatitis A or 'infectious jaundice' is caused by the hepatitis A virus (HAV), a picornavirus transmitted by the faecal-oral route. It is often associated with ingestion of contaminated food. It causes an acute form of hepatitis and does not have a chronic stage. The patient's immune system makes antibodies against HAV that confer immunity against future infection. People with hepatitis A are advised to rest, stay hydrated and avoid alcohol. A vaccine is available that will prevent HAV infection for up to 10 years. Hepatitis A can be spread through personal contact, consumption of raw berries or seafood, or drinking contaminated water.

Of the 12 hepatitis A cases notified eight were hospitalised. The incidence rate for the Auckland region was 0.7 cases per 100,000. This was around double the rate for the rest of New Zealand (0.3 per 100,000). The highest incidence rate was observed in the 20- to 29-year-old age group, but this finding should be interpreted cautiously as numbers are small (Table 37).

The overall male to female ratio was approximately equal. The ethnic-specific incidence rate of hepatitis A was highest in Pacific Peoples followed by Asian ethnic groups (Table 38).

Table 37: Age-gender distribution and age-specific incidence rates of acute hepatitis A in the Auckland region (2020)

Age group	Female	Male	Total	Incidence per 100,000*
0 to 4				-
5 to 9	1		1	0.9
10 to 14	1		1	0.9
15 to 19				-
20 to 29	1	4	5	1.8
30 to 39	1		1	0.4
40 to 49	2		2	0.9
50 to 59				-
60 to 69				-
70+	1	1	2	1.4
Total	7	5	12	0.7

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

Table 38: Ethnic group specific incidence rates of acute hepatitis A in the Auckland region (2020)

Ethnic group	Female	Male	Total	Incidence per 100,000*
Asian	2	2	4	0.8
European or Other	2	1	3	0.4
Māori				-
Pacific Peoples	3	2	5	2.1
Total	7	5	12	0.7

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

A range of ethnicities were identified, with the highest number of cases reported in Samoan (4) and Korean ethnicities, followed by other Asian ethnicities (Table 39).

Table 39: Ethnicity of acute hepatitis A cases in the Auckland region (2020)

Ethnicities	Female	Male	Total
Samoan	2	2	4
Other Asian		1	1
NZ European	1	1	2
Tongan	1		1
Middle Eastern	1		1
Indian		1	1
Korean	2		2
Total	7	5	12

Three quarters of cases (8) were acquired overseas. The source countries for these eight cases are shown in Table 40.

Table 40: Source countries for overseas-acquired acute hepatitis A in the Auckland region (2020)

Source country	Total
Samoa	4
India	1
Philippines	1
Vanuatu	1
Afghanistan	1
Total	8

There were no secondary cases. One Korean case had travelled to Korea, but this was outside the incubation period. The other was locally acquired but no source was found. ARPHS receives one or two notifications a year of hepatitis A cases who have travelled to Korea, have had visiting friends or family from Korea or are of Korean ethnicity. All share the same genotype (1A) but no epidemiological link between these cases has ever been found.

3.4.2 Hepatitis B

Hepatitis B is an infectious disease caused by the hepatitis B virus (HBV), which affects the liver. It can cause both acute and chronic infections. Almost 20 per cent of adult infections have no symptoms during the initial infection. Some develop a rapid onset of sickness with vomiting, yellow skin, fatigue, dark urine, and abdominal pain. It may take 30 to 180 days before symptoms begin. Often these symptoms last a few weeks, and rarely does the initial infection result in death.

In those who get infected around the time of birth, 90 per cent develop chronic hepatitis B. Thirty to 50 per cent of children infected between one- and five-years-old, and five per cent of infected adults, will develop chronic infection. Most of those with chronic disease have no symptoms. However, cirrhosis and liver cancer may eventually develop. These complications result in the death of 15 to 25 per cent of those with chronic disease.

Of the six acute hepatitis B cases notified in 2020, four cases were hospitalised. The incidence rate for the Auckland region was 0.2 cases per 100,000, which is similar to the rest of New Zealand (0.5 per 100,000) (Table 41). The highest age specific incidence rate was seen in the over 30 age groups as in previous years. The overall male to female ratio was 3:1. The ethnicity of the four cases is shown in Table 42.

Table 41: Age and gender distribution and age-specific incidence rates of acute hepatitis B in the Auckland region (2020)

Age group	Female	Male	Total	Incidence per 100,000*
0 to 9				-
10 to 19				-
20 to 29				-
30 to 39	1		1	0.4
40 to 49		1	1	0.4
50 to 59		1	1	0.5
60 to 69		1	1	0.6
Total	1	3	4	0.2

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

Table 42: Ethnic group specific incidence rates of acute hepatitis B in the Auckland region (2020)

Ethnicity Prioritised	Female	Male	Total	Incidence per 100,000*
Asian				-
European or Other		1	1	0.1
Māori	1	2	3	1.5
Pacific Peoples				-
Total	1	3	4	0.2

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Overseas travel was a risk factor in one case, one case was a sex worker with a history of injection drug use (IDU). For the remaining two cases no cause was found.

3.4.3 Hepatitis C

Hepatitis C is a blood-borne disease that causes inflammation of the liver, and can result in liver damage and liver cancer.

There are more than 50,000 people in New Zealand with the hepatitis C virus, although it is estimated only half are currently diagnosed.

People with the virus can remain asymptomatic (showing no symptoms) for decades.

There was one acute hepatitis C case notified in 2020 with multiple risk factors including overseas travel, sexual contact with a hepatitis C positive household contact, and recent tattoos.

4 Vaccine preventable and other airborne diseases

Key points

- There was a major outbreak of measles in 2019 with 1755 cases. Thirty-eight per cent of these cases were hospitalised but there were fortunately no deaths. The highest rates were seen in the under one year old age group, and the 15 to 29 year old age group. Pacific Peoples and Māori were markedly over-represented. By the first quarter of 2020 case numbers had dropped significantly. From the first COVID-19 lockdown there were no additional cases notified.
- Mumps cases continued to decline from the large outbreak of 2017 to single digits by April 2020. After this point there were no further probable or confirmed cases.
- There were 315 cases of pertussis reported in 2019, as part of a second wave of the 2017/2018 outbreaks. The first quarter of 2020 saw 11 to 16 cases per month. These dropped off after the first COVID-19 lockdown.
- Community influenza-related activity started the year at the low expected levels of five to 10 isolates per month at the Middlemore Hospital Laboratory (MMH), and then dropped to almost nothing through the rest of 2020, with only two isolates detected in MIFs in December.
- Meningococcal disease notifications were down by 80 per cent in 2020, with Serogroup B the predominant strain.
- Invasive pneumococcal disease notifications were down 32 per cent in 2020.

4.1 Measles

Measles, also known as morbilli, is a highly contagious infection caused by the measles virus.

Initial symptoms typically include fever (often greater than 40°C), cough, runny nose, and conjunctivitis. Two or three days after symptoms start, small white spots may form inside the mouth, known as Koplik's spots. A red, flat rash, which usually starts on the face and then spreads to the rest of the body, typically begins three to five days after the start of symptoms. Symptoms usually develop 10-to-12 days after exposure to an infected person, and last for seven-to-10 days.

Complications occur in about 30 per cent of cases and may include diarrhoea, encephalitis and pneumonia.

Worldwide, measles affects about 20 million people a year, primarily in the developing areas of Africa and Asia. During 2018 there was an increase in measles notifications across Europe, Asia, North America and the Philippines, later extending to all regions. By March 2020, New Zealand was seeing its first cases. By August and September there were peaking at more than 500 cases per month. Worldwide, more than 200,000 people died from measles in 2019 (CDC Estimate November 2020).

There were only seven cases of measles in 2020, compared with 1,755 cases during 2019 (Figure 31). The Auckland region incidence rate dropped from 100.9 cases per 100,000 in 2019 to 0.4 cases per 100,000 for 2020. The rest of New Zealand recorded an incidence rate of less than 0.1 per 100,000 for the year. Of the seven cases, two required hospitalisation and there were no deaths. All cases occurred in January 2020.

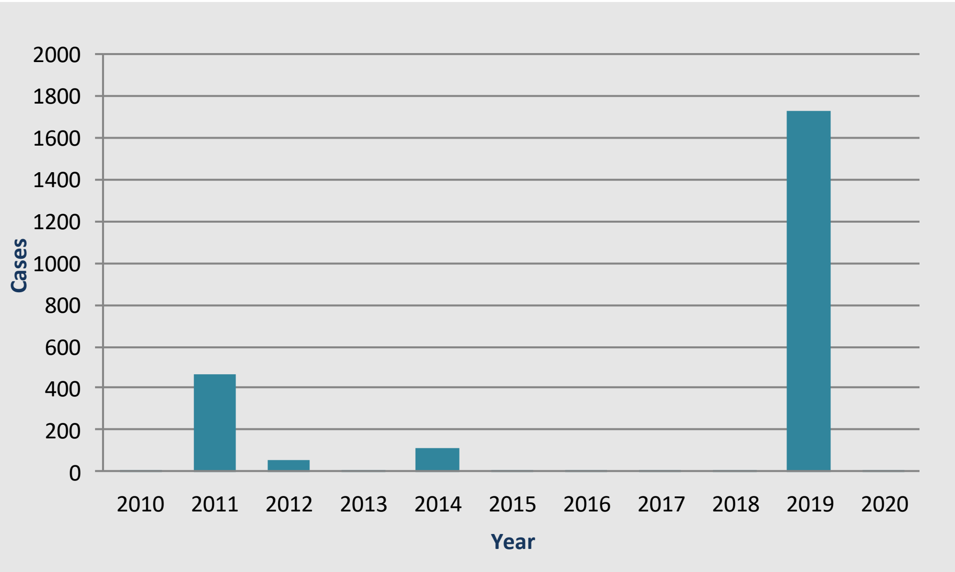


Figure 31: Measles cases in the Auckland region (2010 – 2020)

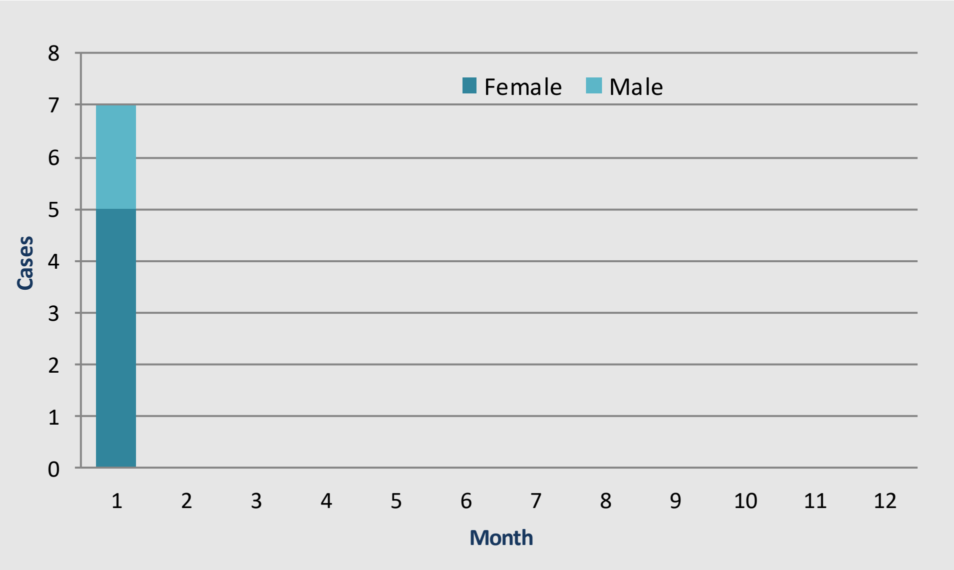


Figure 32: Monthly distribution of measles cases in the Auckland region (2020)

During the 2019 outbreak the highest rates were recorded in the under five-year-old age group, in particular those aged under one. This was followed by high rates in the 15- to 30-year-old age group, where there is a known ‘immunity gap’ relating to previous changes in the vaccine delivery schedule.

Table 43: Age and gender distribution and age-specific incidence rates of measles in the Auckland region (2020)

Age group	Female	Male	Total
<1 year	0	0	0
1 to 4	1	1	2
5 to 9	0	0	0
10 to 14	0	0	0
15 to 19	2	0	2
20 to 29	1	0	1
30 to 39	1	0	1
40 to 49	0	0	0
50 to 59	0	1	1
60 to 69	0	0	0
70+	0	0	0
Total	5	2	7

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand)

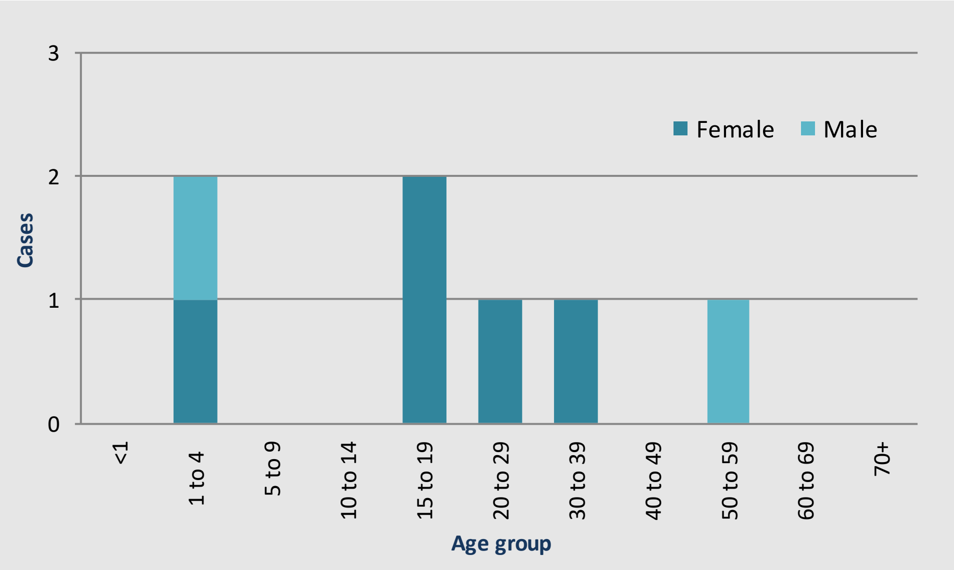


Figure 33: Measles case notifications by age and gender in the Auckland region (2020)

Ethnic specific disease rates were highest in Pacific Peoples in the 2019 outbreak at 332 cases per 100,000 population, and for Māori at 201 cases per 100,000. Even though numbers are very small this trend is still reflected in the seven cases for 2020 (Table 44). These groups have had declining immunisation rates over recent years[3]. From a geographic perspective, the Counties Manukau DHB population was most severely affected, with 67 per cent of cases occurring in this area (four of the seven cases for 2020) (Table 45).

Table 44: Ethnic group distribution and incidence rates of measles in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	1	-	1	0.2
European or Other	-	-	-	-
Māori	2	-	2	1.0
Middle Eastern / Latin American / African	-	-	-	-
Pacific Peoples	2	2	4	1.5
Total	5	2	7	0.4

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Table 45: Distribution of measles notifications in the Auckland region by DHB (2020)

DHB	Cases
Auckland	1
Counties Manukau	4
Waitematā	2
Total	7

[3] https://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-coverage/national-and-dhb-immunisation-data

Six of the cases were unimmunised. The immunisation status was unknown for the remaining case. (Table 46) Three cases were imported from overseas, two from Tonga and one from the Philippines (Table 47).

Table 46: Number of measles cases that had been fully immunised in Auckland region (2020)

Fully immunised	Total
No	6
Unknown	1
Yes	0
Total	7

Table 47: Source countries of overseas-acquired measles in Auckland region (2020)

Source Country	Cases
Philippines	1
Tonga	2
Total	3

4.2 Mumps

Mumps (epidemic parotitis) is a highly infectious, self-limiting viral disease caused by the mumps virus. Fever, painful swelling of the parotid glands, muscle pain, headache and feeling tired are common initial symptoms. Up to 48 hours later, painful swelling of the salivary glands – classically the parotid gland – usually occurs and is the most typical presentation seen in up to 95 per cent of cases. Complications include painful testicular swelling, which can lead to reduced fertility. Symptoms in adults are often more severe than in children. Mumps is highly contagious and is able to spread rapidly among people living in close quarters. The virus is transmitted by respiratory droplets, direct contact, or contaminated objects. Symptoms typically occur 14 to 18 days after exposure, and patients are infectious a few days before the onset of symptoms.

There were 68 cases of mumps in 2020, compared with 174 in 2019, 269 in 2018 and 1080 cases in 2017, which was the highest incidence for decades (Figure 34). The incidence rate for the Auckland region was 3.9 cases per 100,000, compared to 2.3 per 100,000 for the rest of New Zealand.

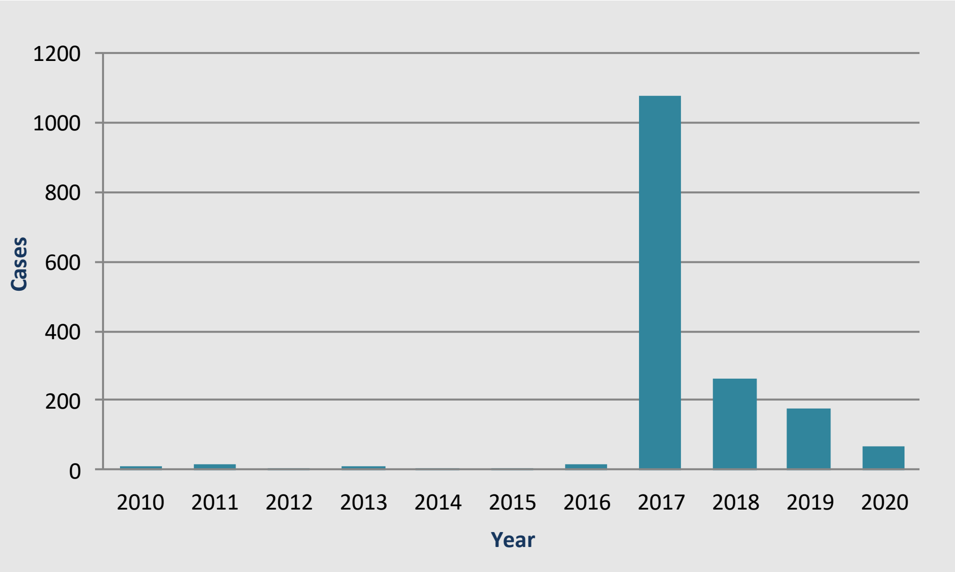


Figure 34: Mumps cases in the Auckland region (2010 – 2020)

Most cases occurred in the first quarter. The COVID-19 lockdown proved very effective at stopping ongoing transmission of mumps beyond April.

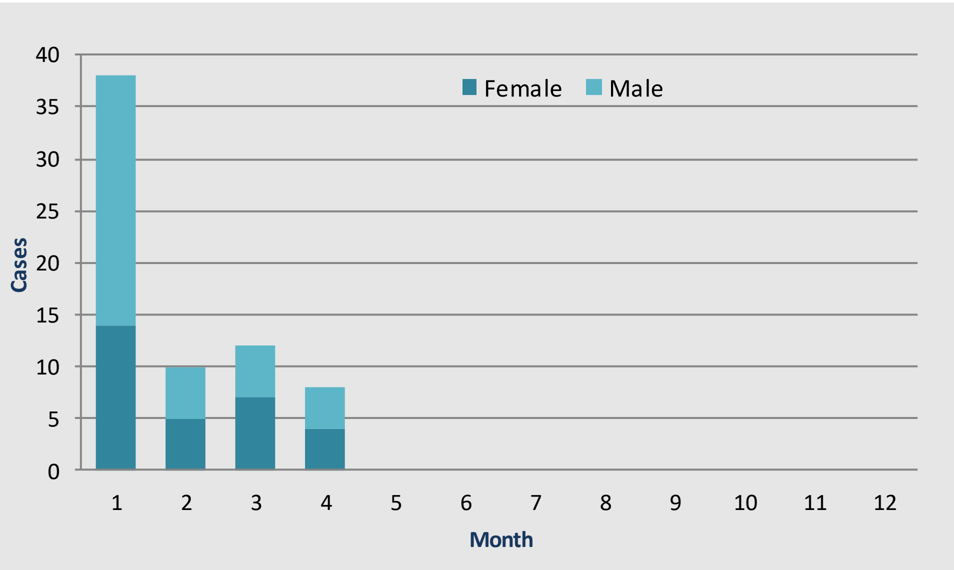


Figure 35: Monthly distribution of mumps cases in the Auckland region (2020)

The highest age-specific incidence rate was in the 20- to 29-year-old age group followed by the 15- to 19-year-old age group (Table 48). The highest ethnic group-specific incidence rate was seen in Pacific Peoples (8.6 per 100,000) (Table 49), representing 29 per cent of cases. Overseas-acquired infections accounted for only two cases (Table 50). Hospitalisation was required for seven cases (10 per cent) and there were no deaths. As with measles in previous years, the immunity gap in 15- to 30-year-olds was a key driver in the incidence of cases.

Table 48: Age and gender distribution and age-specific incidence rates of mumps in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1 year	0	1	1	4.6
1 to 4	0	2	2	2.3
5 to 9	0	1	1	0.9
10 to 14	1	3	4	3.6
15 to 19	3	3	6	5.4
20 to 29	18	21	39	14.0
30 to 39	3	4	7	2.6
40 to 49	2	1	3	1.3
50 to 59	2	1	3	1.4
60 to 69	1	0	1	0.6
70+	0	1	1	0.7
Total	30	38	68	3.9

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand)

Table 49: Ethnic group distribution and ethnic-specific incidence rates of mumps in the Auckland region (2020)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	6	8	14	2.7
European or Other	9	16	25	3.5
Māori	3	4	7	3.5
Middle Eastern/Latin American/African	1	1	2	5.1
Pacific Peoples	11	9	20	8.6
Total	30	38	68	3.9

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Table 50: Source country of overseas-acquired mumps cases in the Auckland region (2020)

Source Country	Cases
United Kingdom	2
Total	2

4.3 Rubella

Rubella is a common childhood infection that is seldom fatal and usually presents with minimal systemic upset, although transient arthropathy may occur in adults. Rubella is transmitted via airborne droplet emission from the upper respiratory tract of active human cases. Serious complications are very rare. Apart from the effects of transplacental infection on the developing foetus i.e., congenital rubella syndrome (CRS), rubella is a minor infection.

There were no cases of rubella case in 2020 (Figure 36).

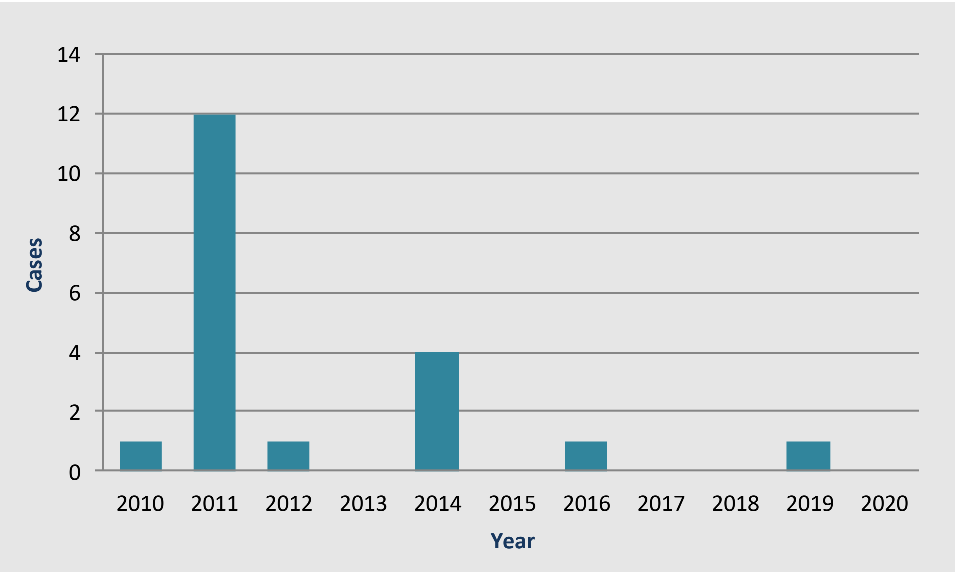


Figure 36: Rubella cases in the Auckland region (2010 – 2020)

4.4 Pertussis

Pertussis is caused by the bacteria *Bordetella pertussis*. It is an airborne disease which spreads easily through the coughs and sneezes of an infected person. People are infectious to others from the start of symptoms until about three weeks into the coughing fits. It is estimated that pertussis affects 16 million people worldwide each year. Most cases occur in the developing world and people of all ages may be affected. In 2013 it resulted in 61,000 deaths, down from 138,000 deaths in 1990. Nearly two per cent of infected children less than a year of age with pertussis will die.

The 50 cases reported for the Auckland region in 2020 represent an abruptly shortened tail of a second wave of the pertussis outbreak which occurred over 2017 and 2018 (Figure 37). This is an incidence rate of 2.9 cases per 100,000 for the Auckland region, less than for the rest of New Zealand (3.7 cases per 100,000). ARPHS’ strategy focuses on protecting infants less than one year old and involves extra case containment efforts at ELS and schools. This appears to have been successful at preventing spread to those most vulnerable. Hospitalisation was required for 12 cases (24 per cent). Hospitalisation rates are higher in infants less than one year of age, with four of the five (80 per cent) infants admitted. There were no deaths.

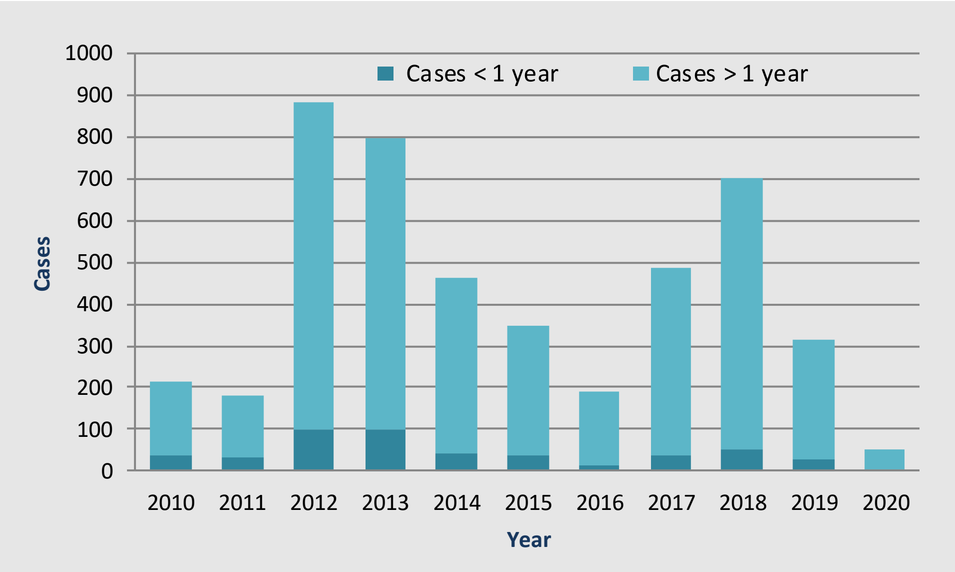


Figure 37: Pertussis cases in the Auckland region (2010 - 2020)

Cases decreased sharply at the end of the first quarter, during the COVID lockdown. They averaged one per month for the remainder of the year (Figure 38).

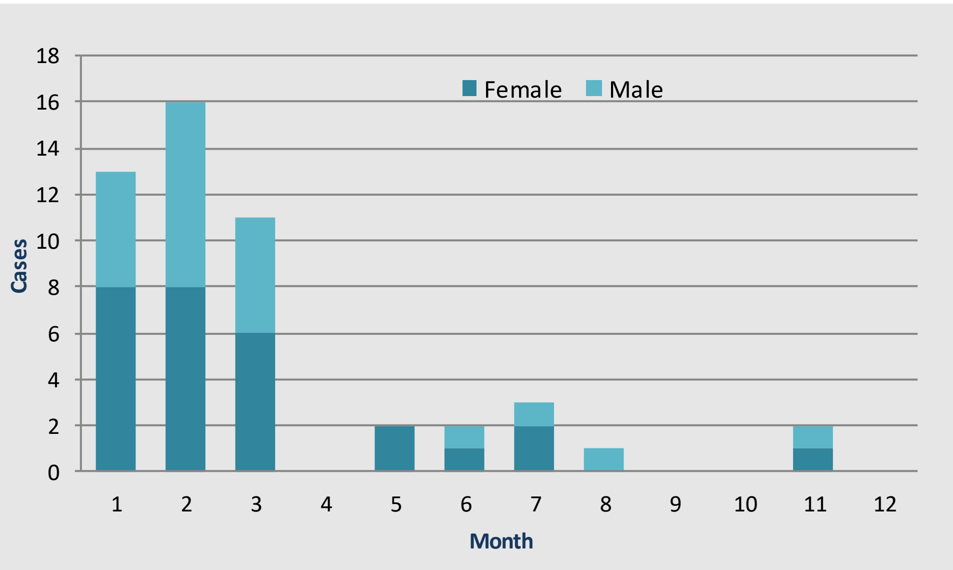


Figure 38: Monthly distribution of pertussis cases in the Auckland region (2020)

The highest age specific incidence rate was seen in children aged younger than one year old (23.1 per 100,000), followed by the one- to four-year-old age group, and then the 10- to 14-year-old age group. The yearly proportion of pertussis cases younger than one year old for the last decade is shown in Figure 39. This downward trend would suggest the focused strategy of protecting infants younger than one is working, despite more than 1,700 cases over the past five years.

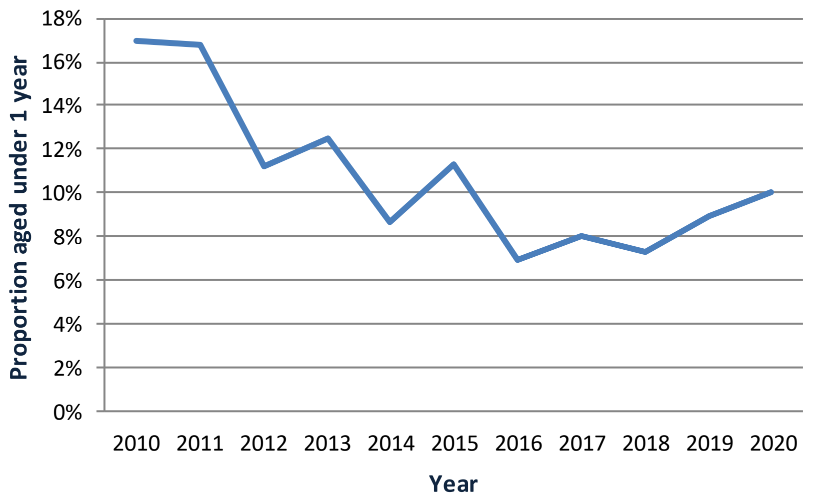


Figure 39: Proportion of pertussis cases in under-one-year-old infants in the Auckland region (2010 – 2020)

The overall female to male ratio was 1.3:1 (Table 51). Ethnic-specific rates were higher in Māori than other ethnic groups (Table 52). Of note is the consistently low incidence rate of pertussis in the Asian ethnic group. The reason for this is unknown, but the Asian ethnic group does have the highest childhood vaccination rates, in excess of 90 per cent at six months and five years (see Section 11: Immunisation).

Table 51: Age and gender distribution and age-specific incidence rates of pertussis cases in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1	4	1	5	23.2
1 to 4	3	4	7	8.1
5 to 9	3	1	4	3.5
10 to 14	1	4	5	4.4
15 to 19	1	1	2	1.8
20 to 29	3	-	3	1.1
30 to 39	2	3	5	1.8
40 to 49	4	2	6	2.6
50 to 59	4	2	6	2.8
60 to 69	2	1	3	1.9
70+	1	3	4	2.7
Total	28	22	50	2.9

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

Table 52: Ethnic distribution and ethnic specific incidence rates of pertussis cases in the Auckland region (2020)

Ethnicity	Female	Male	Total	Incidence rate / 100,000 population
Asian		2	2	0.4
European or Other	14	11	25	3.2
Maori	9	4	13	6.4
Pacific Peoples	4	5	9	3.9
Unknown	1		1	
Total	28	22	50	2.9

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

4.5 Influenza (seasonal flu)

Seasonal flu typically causes illness for just a few months out of the year. The flu season is different depending on where you are in the world. In New Zealand, it usually falls between April and September.

There are three types of flu viruses that cause seasonal influenza: A, B, and C.

4.5.1 Influenza A

Type A influenza (or Flu A) is usually responsible for the majority of seasonal flu cases. It is found in humans and in animals. Influenza A is spread from person to person by people who are already infected. Touching objects the infected person has touched (e.g. doorknobs, taps, phones) or even being in the same room as the person, especially if they are coughing or sneezing, is enough to become infected. There are many different varieties of influenza A that are classified into subtypes—H and N—and even further into different strains.

H and N subtypes of Influenza A are based on the particular proteins that are attached to the virus. There are 16 different types of hemagglutinin (H) proteins and nine different types of neuraminidase (N) proteins. This is how names such as "H1N1" or "H3N2" are acquired. However, the pandemic H1N1 influenza is different because it was created from a combination of human, swine, and bird flu viruses.

4.5.2 Influenza B

Influenza B is another type of flu that causes seasonal illness. It is found only in humans and is typically less severe than influenza A, but it can still be dangerous. It does not cause pandemics. There are also different strains of influenza B.

4.5.3 Influenza C

Influenza C, which affects only humans, is much milder than types A and B. It typically causes mild respiratory illnesses and is not known to have caused any seasonal flu epidemics. The symptoms of influenza C are similar to those of a cold.

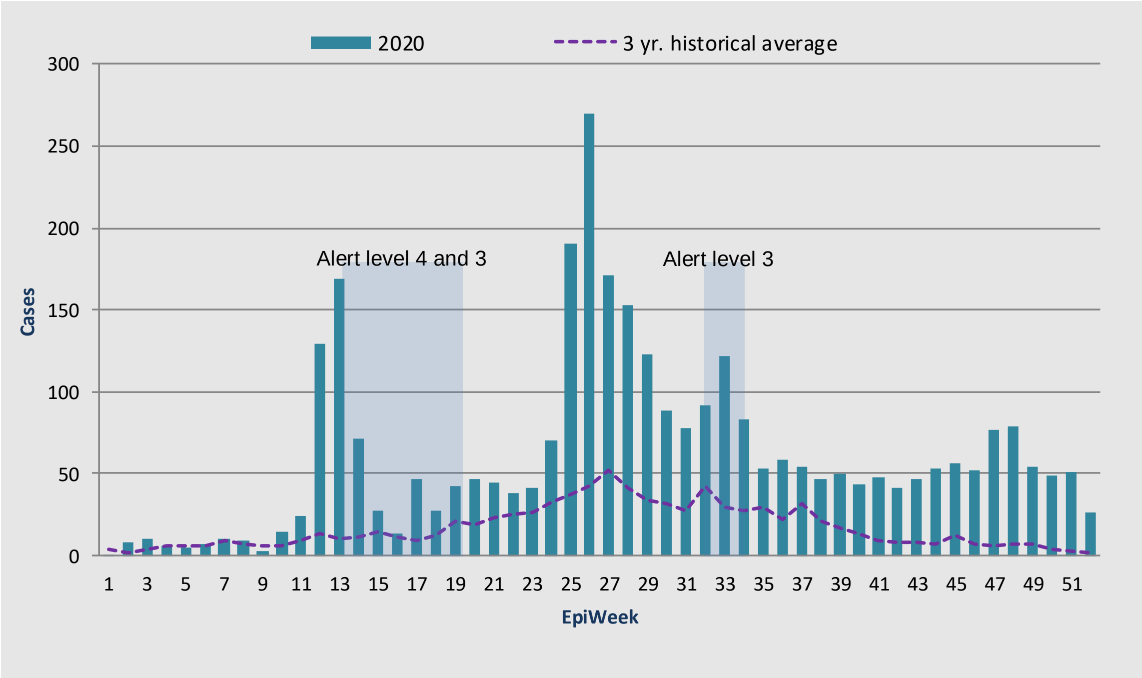
4.5.4 Flu pandemic

Any influenza A virus has the potential to become a flu pandemic, during which there are mass outbreaks of illness in humans around the world in a relatively short amount of time. In the past, some flu pandemics have caused very severe illness and killed millions of people, such as the 1918 flu pandemic. Others are less serious.

4.5.5 Influenza-like-illness (ILI) in the Auckland region

During the year, the incidence of influenza-like-illness (ILI) was monitored from HealthStat data provided by sentinel GPs situated across the Auckland region. These GPs care for approximately 10 per cent of the population. In 2020 ILI reporting was influenced by COVID lockdowns, increased testing and further sentinel GP recruitment. (Figure 40 and 41).

Large peaks were seen in weeks 12 to 13 and weeks 25 to 27. These were in response to government messaging for anyone with upper respiratory symptoms to get tested. Community Based Assessment Centres (CBACs) were set up but many people arranged testing through their general practitioners; these people were subsequently coded as ILI.



Note: COVID-19 resulted in an increase in the number of HealthStat practices recruited so the three-year historical average from Week 10 in absolute case numbers is not helpful and rates (as in Figure 40) are a better indication of ILI.

Figure 40: Influenza like illness rates at HealthStat sentinel GPs in the Auckland region (2020)

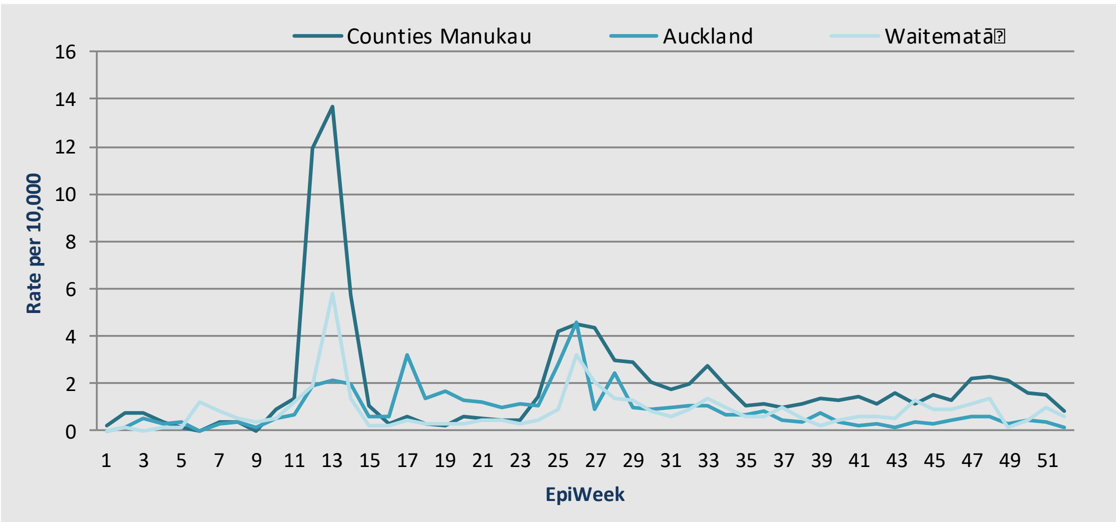


Figure 41: Influenza visit rates to HealthStat sentinel GPs in the Auckland region by DHB (2020)

The national general practice-based ILI surveillance undertaken by ESR changed in 2020 due to the COVID-19 response, limiting interpretability for ILI surveillance. Specimen collection started on 2 June 2020 and stopped on 27 September 2020. During this period there were 230 specimens collected from patients presenting to general practices with ILI symptoms, none of which were influenza positive. Of the tested swabs:

- 20 were enterovirus-positive
- 76 were rhinovirus-positive (one swab had both enterovirus and rhinovirus detected)
- one was human metapneumovirus-positive

- one was adenovirus-positive

Virology isolation reports were also received from Middlemore Hospital throughout the year (Figure 42). There were no influenza A or B isolates found from Week 14 (in March) until December when two influenza A(H3) were detected in a MIF. Typically, there is a large winter peak of respiratory syncytial virus (RSV), but this did not occur in 2020.

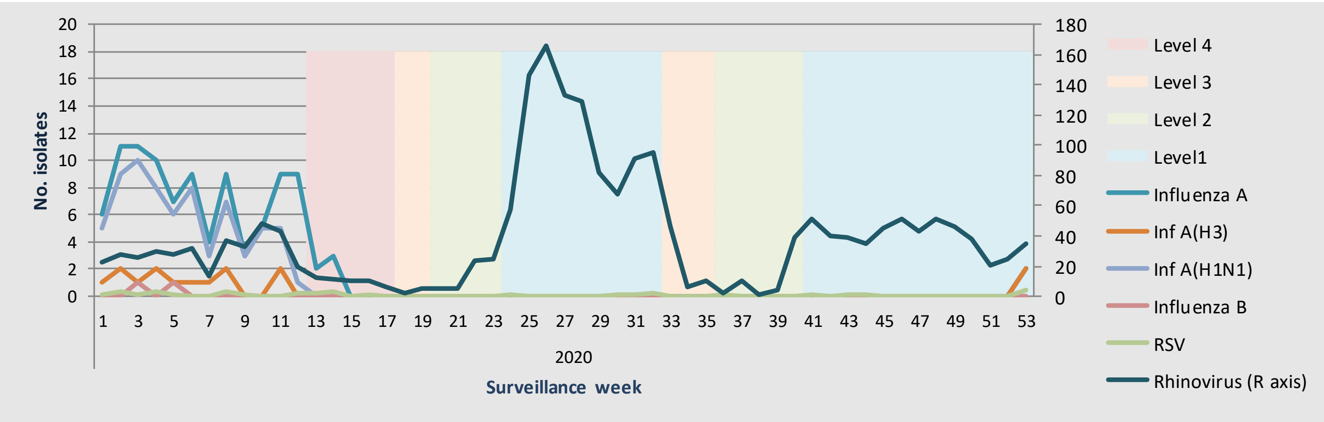


Figure 42: Influenza viruses, RSV and rhinoviruses detected by Middlemore Hospital laboratory by surveillance week and COVID-19 lockdown level (2020)

4.6 Other airborne viruses

Rhinovirus, parainfluenza 1 and adenoviruses were the most frequently detected non-influenza respiratory viruses circulating in 2020. COVID-19 lockdowns had a dramatic effect on the numbers of respiratory viruses detected as circulating (Figure 43).

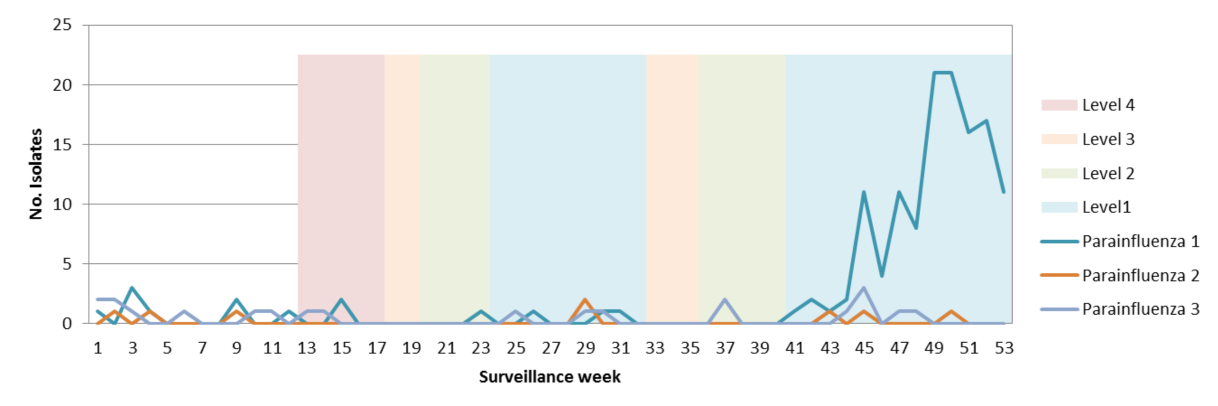


Figure 43a: Other virus isolates detected by Middlemore hospital for the Auckland region by surveillance week and COVID-19 lockdown level – Parainfluenza (2020)

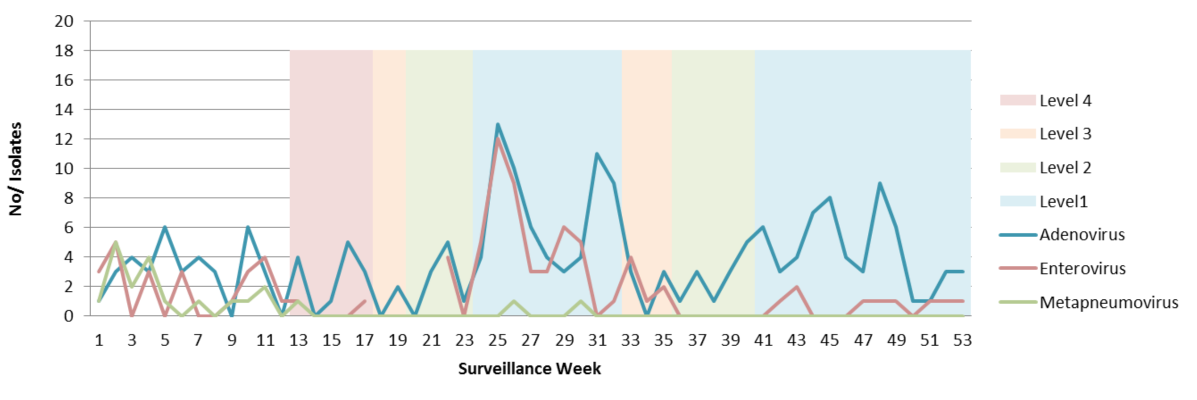


Figure 43b: Other virus isolates detected by Middlemore hospital for the Auckland region by surveillance week and COVID-19 lockdown level – Adenovirus, Enterovirus, Metapneumovirus (2020)

Source: New Zealand Influenza Intelligence Report – ESR

4.7 Meningococcal disease

Invasive meningococcal disease is an acute, potentially life-threatening illness caused by the bacterium *Neisseria meningitidis*, a gram-negative diplococcus. There are multiple different serogroups of *N. meningitidis*; the most clinically relevant serogroups are A, B, C, Y and W-135. Meningococci are transmitted in large respiratory droplets or secretions from the nasopharynx of colonised people. Most transmission occurs from people who do not themselves have meningococcal disease.

There were 12 reported cases of meningococcal disease in 2020, down 80 per cent from the 58 cases in 2019. 2020 saw the lowest level of notifications since 2014 (Figure 44). Since the end of the meningococcal epidemic in 2005 the number of cases per year has ranged from seven to 58. In 2020 the incidence in the Auckland region was 0.7 cases per 100,000 population. This was also the same rate for the rest of New Zealand.

All 12 reported cases were hospitalised and there were no deaths.

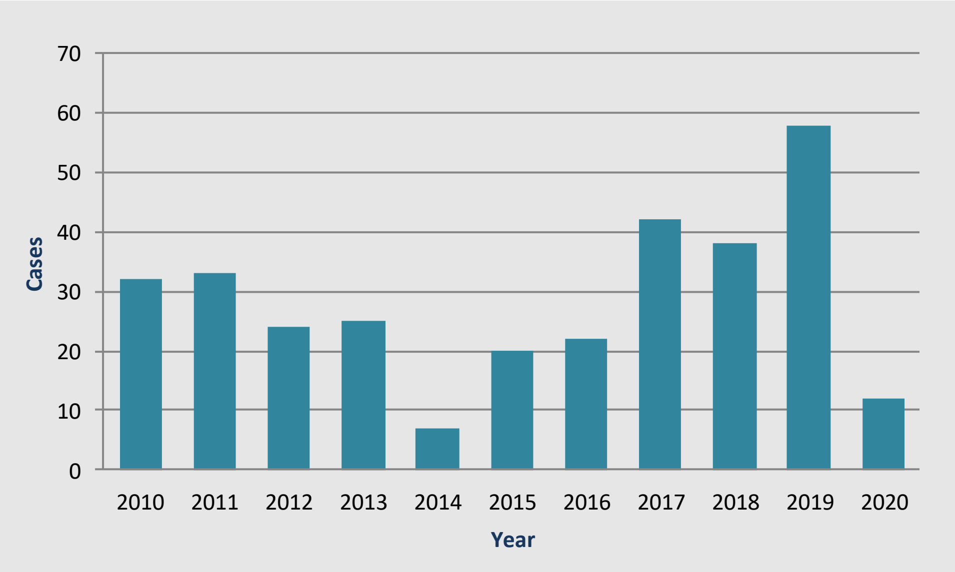


Figure 44: Meningococcal disease cases in the Auckland region (2010 – 2020)

Cases were spread throughout the year with five of the twelve cases occurring in the third quarter of 2020.

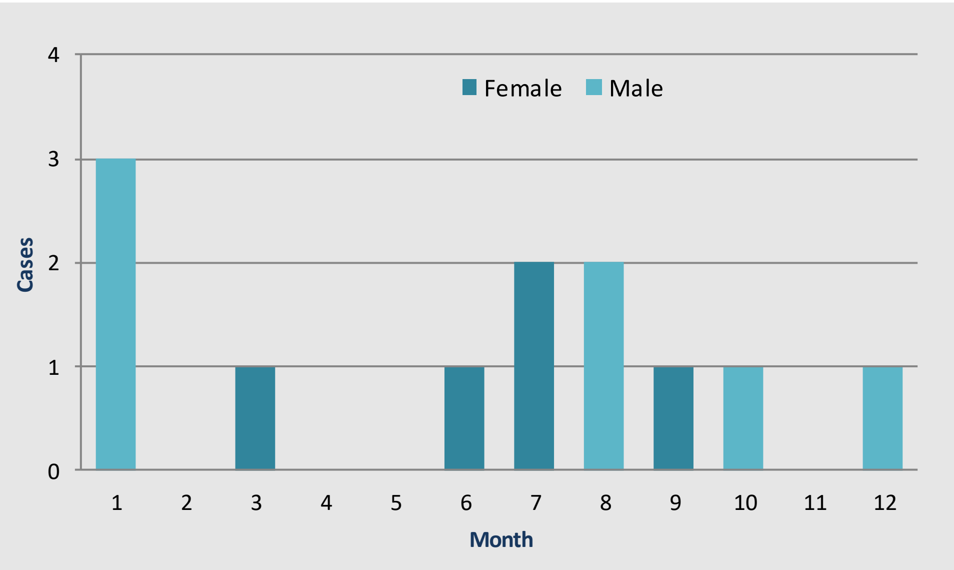


Figure 45: Meningococcal disease cases in the Auckland region by month (2020)

The highest age-specific incidence rate was in the under five-year-old age group. Half of the six cases in this age group were younger than 12 months old. The male to female ratio was 1.4:1 (Table 53).

Table 53: Age and gender distribution and age-specific incidence rates of probable and confirmed meningococcal disease in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1		3	3	13.4
1 to 4	2	1	3	3.4
5 to 9	1		1	0.9
15 to 19		1	1	0.9
50 to 59	2	1	3	1.5
70+		1	1	0.7
Total	5	7	12	0.7

* Rates are based on estimated mid-year population, 2020 (Source: Statistics New Zealand)

The highest ethnic group incidence rate was among Māori (Table 54).

Table 54: Ethnic group specific incidence rates of meningococcal disease in the Auckland region (2020.)

Ethnic group	Female	Male	Total	Rate per 100,000 pop*
European or Other	2	3	5	0.6
Māori	1	3	4	2.0
Pacific Peoples	2	1	3	1.3
Total	5	7	12	0.7

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Typically, two thirds of the cases occurred in decile 6 to 10, communities with the highest levels of deprivation. In 2020, cases were evenly split between higher and lower deciles.

The most common serogroup was *N. meningitidis* serogroup B, with seven cases (58 per cent) (Figure 46). Serogroup W had three cases (25 per cent) and group Y had one (8 per cent). There were no group C meningococcal cases in the Auckland region for 2020 but there was one case where the serotype was not known.

The major issue over the last three years has been the emergence of serotype W, with 14 cases (24 per cent) in 2019 and 11 cases (29 per cent) in 2018, compared with three cases in 2017. This increase was seen across New Zealand, with higher rates occurring in Northland, resulting in a mass vaccination campaign.

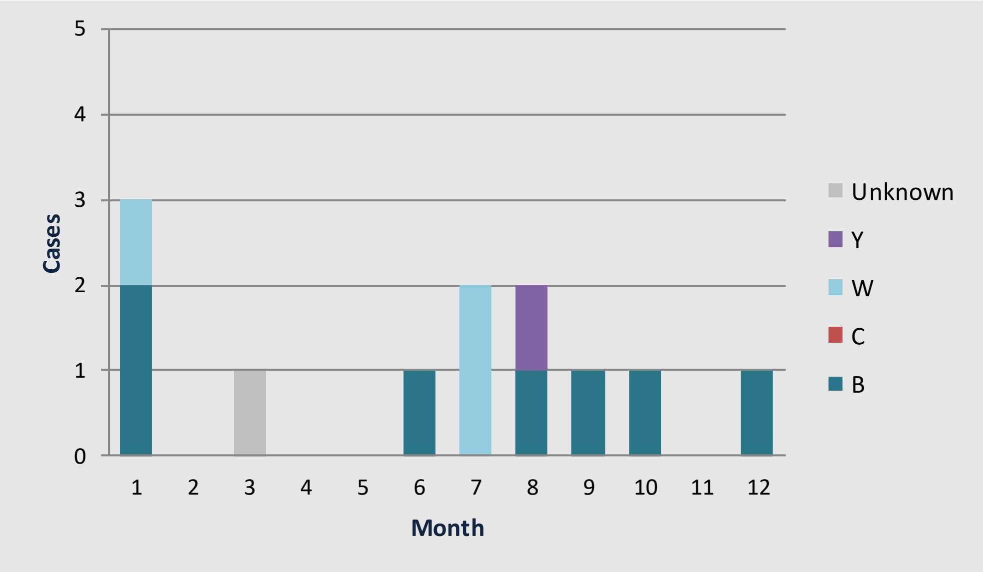


Figure 46: N. meningitidis serogroups isolated from meningococcal disease cases by month in the Auckland region (2020)

Specific typing of serogroup B cases showed the predominant PorA typing was P1.7-2,4, with four cases, compared with 2019 when the predominant PorA was P1.7-12,14, with eight cases. Two of the three serogroup W cases were of Por. Type P1.5,2 (Table 55).

Table 55: Specific Por A typing of N. meningitidis by meningococcal disease serotype in the Auckland region (2020)

	Serogroup				
PorA	B	W	Y	Unknown	Total
P1.19,15			1		1
P1.5,2		2			2
P1.7-12,14	1				1
P1.7-2,4	4				4
Not known	2	1		1	4
Total	7	3	1	1	12

Source: ESR

4.8 Invasive pneumococcal disease

Invasive pneumococcal disease (IPD) is caused by *Streptococcus pneumoniae*, or pneumococcus, a gram-positive *cocci* bacterium. *S. pneumoniae* resides asymptomatically in the nasopharynx of healthy carriers. The respiratory tract, sinuses, and nasal cavity are the parts of the host body that are usually infected. However, in susceptible individuals, such as elderly and immunocompromised people and children, the bacterium may become pathogenic, spread to other locations, and cause disease. *S. pneumoniae* is the main cause of community-acquired pneumonia and meningitis in children and the elderly, and of septicaemia in HIV-infected persons. The transmission methods include sneezing, coughing, and direct contact with an infected person. Invasive pneumococcal diseases include bronchitis, rhinitis, acute sinusitis, otitis media, conjunctivitis, meningitis, bacteraemia, sepsis, osteomyelitis, septic arthritis, endocarditis, peritonitis, pericarditis, cellulitis, and brain abscess.

Invasive pneumococcal disease (IPD) is defined as an infection of *S. pneumoniae* in a normally sterile site.

There were 107 IPD cases reported to ARPHS during 2020, a 32 per cent reduction from the 158 cases in 2019, and 180 in 2018. This represents an incidence rate for the Auckland region of 6.1 notifications per 100,000 population, slightly less than the rate for the rest of New Zealand (7.5 per 100,000). The yearly number of notifications is shown in Figure 47, and the distribution by month for 2020 in Figure 48, which shows fewer cases in April and May, most probably due to COVID-19 lockdowns then resurgence during the lower level lockdowns. Of the 107 IPD cases, 92 (86 per cent) were hospitalised and there were five pneumococcal disease-associated deaths.

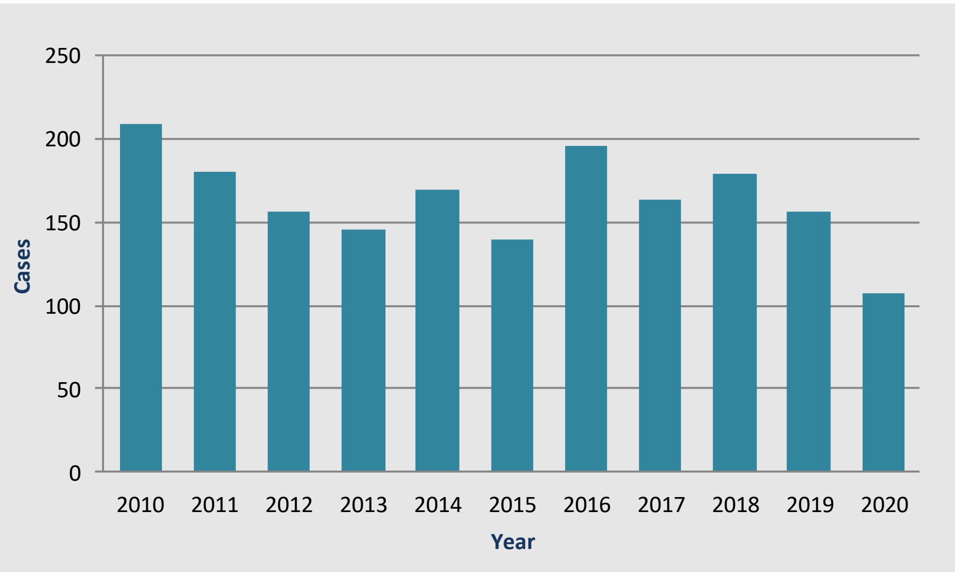


Figure 47: Invasive pneumococcal disease cases in the Auckland region (2010 – 2020)

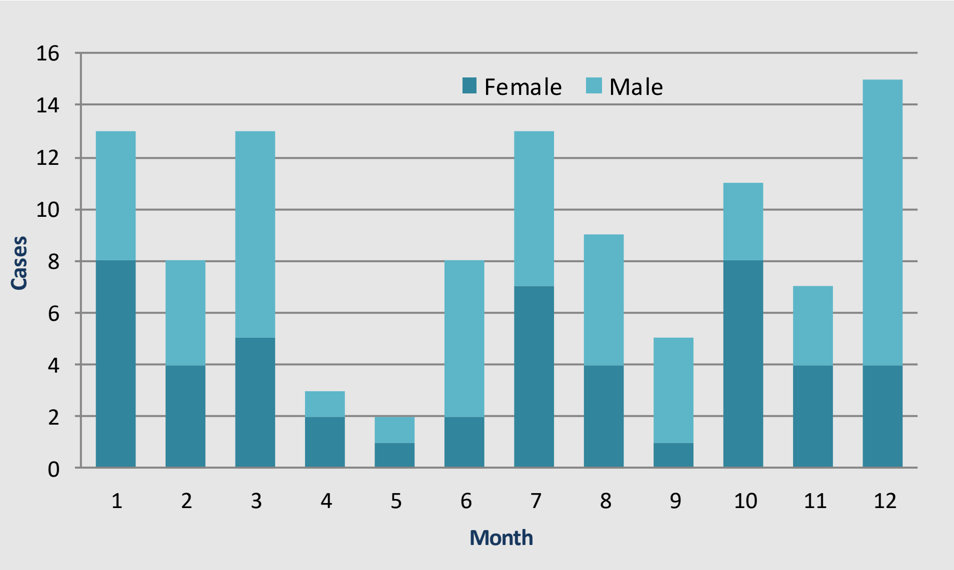


Figure 48: Monthly distribution of invasive pneumococcal disease cases in the Auckland region (2020)

In 2020 the highest incidence rate was seen in the elderly and the young with the highest rates in those aged 70-plus, followed by those in the 50-to-69 and then the under-five-year age groups. This is rather atypical as infants under one year usually have the highest incidence rate. The male to female ratio was nearly equal (see Table 56).

Table 56: Age and gender distribution and age-specific incidence rates of pneumococcal disease cases in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1	2		2	9.3
1 to 4	3	5	8	9.3
5 to 9	1	2	3	2.6
10 to 14	1		1	0.9
15 to 19	3		3	2.7
20 to 29	1	4	5	1.8
30 to 39	3	7	10	3.7
40 to 49	4	6	10	4.4
50 to 59	7	16	23	10.7
60 to 69	8	9	17	10.8
70+	17	8	25	17.1
Total	50	57	107	6.1

* Rates are based on estimated mid-year population 2020 (Source: Statistics New Zealand)

Ethnic-specific incidence rates were highest in Pacific Peoples and Māori, with rates of 18.9 and 12.4 cases per 100,000 respectively (Table 57). These were over four times the incidence rates seen in the European or Other or Asian ethnic groups.

Table 57: Ethnic-specific proportion and incidence rates of pneumococcal disease cases in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	6	7	13	2.5
European or Other	10	15	25	3.2
Māori	14	11	25	12.4
Pacific Peoples	20	24	44	18.9
Total	50	57	107	6.1

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Over 50 per cent of IPD cases occurred in those living in the most deprived areas (deciles 8, 9 and 10 as defined by NZDep13) (Figure 49).

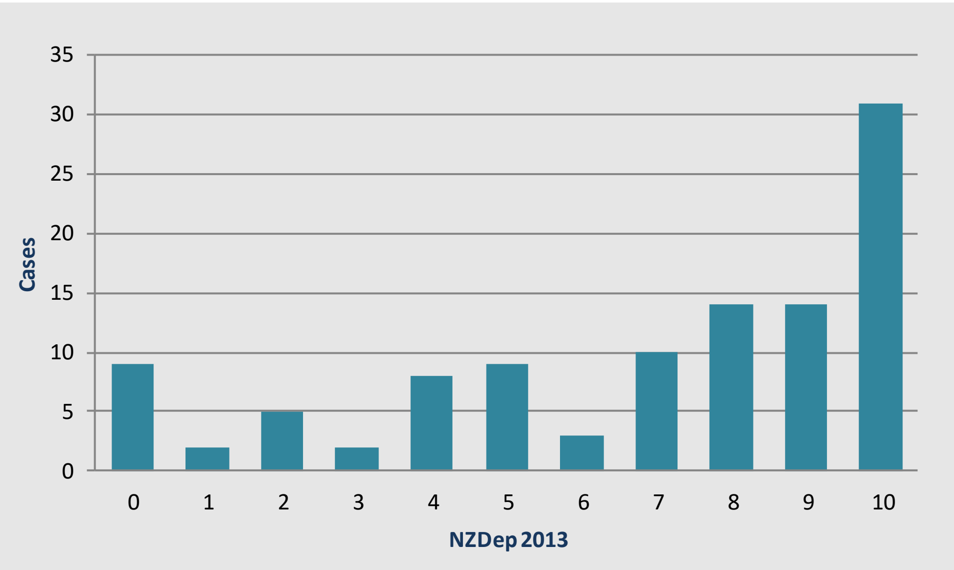


Figure 49: Invasive pneumococcal disease cases by NZ deprivation index in the Auckland region (2020)

Immunisation with PCV7 was introduced in June 2008. This was replaced by PCV10 in July 2011, and then PCV13 in July 2014. From July 2017, PCV10 was again used on the routine schedule. It will be interesting to see the changes with serotypes 19A and 3, as these are not covered by the PCV10 immunisation (Table 58). It's encouraging to see stable 2019 case numbers for 19A (17) and Type 3 (7).

The largest increase in specific serotype has been Type 12F and Type 8, which normally average about two to three cases per year. There were low numbers of Type 12F in 2016, but this has increased since to 25 in 2018, 16 for 2019 and 12 in 2020. Similarly, for Type 8, there were low numbers in 2014 increasing to 14 in 2019 and 2020. The other highlighted serotype, 22F, normally averages about 12 cases per year but this was less in 2020 at six. Average case numbers for Serotype 23B have been increasing in recent years, but this was not the case in 2020. There was in increase in 10A for 2018 (five) but this did not increase further in 2019 (three), and none were isolated for 2020.

Table 58: IPD serotypes isolated and the serotypes covered by the PCV10 and PCV13 vaccines in the Auckland region (2010 – 2020)

Serotype	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	PCV10	PCV13
1	37	15	2						1		1		
3	9	10	9	5	17	7	10	9	7	7	9		
4	15	17	13	7	6	2	8	6	2	2	1		
5							1						
6A	4	-	2	1		1		1	1				
6B	6	7	1	2	-	1	1	-	2	3	1		
6C	6	5	3	3	14	12	8	4	5	5	2		
6D							1						
7A		6		2									
7C					1	2	2	2	1	1			
7F	3	7	8	20	22	13	14	13	11	3	2		
8	2	3	8	3	4	3	11	14	12	14	14		
9 Non-typable	1		1	1						1			
9N	6	2	4	3	3	3	7	4	5	6	2		
9V	12	7	7	3	5	2	1	2	1	1			
10 Non-typable			2										
10A	3	6	2	1	1		2	1	5	3			
11A	7	7	3	3	4	1	4	6	3	3	4		
12F	1	2		3	1	1	2	7	25	16	12		
13	-	-	2	-	1	1	1			2	1		
14	17	6	5	5			2	2		1			
15 Non-typable			2	2	1								
15A					1	1	4	4	3	1			
15B		4	4	1	5	6	4	4	2	4	2		
15C					1	1	1	2	1	1	1		
16 Non-typable				2	4								
16F							6	3	3	5	3		
17 Non-typable	1												
17F	1	1	1	2		1	2	2	2	2			
18A		1						1					
18C	3	6	2	4	4	1	1						
18F									1		1		
19A	14	18	28	27	31	33	40	24	21	17	20		
19F	11	10	13	5	6	9	4	2	4	3	3		
20	3	2	2	2		1		1					
21		1					2	-	1	3			
22 Non-typable	1		1										
22A		1											

22F	9	15	10	15	16	6	15	7	12	13	6		
23A	3	2	2	2	4	10	4	8	9	5	3		
23B	1		3	2	2	2	5	3	7	6	4		
23F	14	8	3	2	1	2	2		1		1		
24 Non-typable			1				1						
31		1	1			1	1	2	3	2			
33 Non-typable				1		2	3	1	3	2	1		
33F	1		1	2	2	2	7	4	2				
34		2		1	2	1	4	1	4	2			
35 No factor sera	2	2											
35 Non-typable		5	2	2	5								
35B						4	1	1	1	1	3		
35F								2	1		1		
37		1							1		1		
38	2	1	1		1	1		5	2	1	2		
42								1					
Non-typable	2				1	1	2	2	3	3	1		

In 2020, additional IPD case analysis was undertaken by ARPHS. This found the predominant illness caused by IPD was pneumonia followed by bacteraemia without a focus. IPD caused meningitis in five per cent of cases.

Table 59: Site of invasive pneumococcal disease in the Auckland region (2020)

Disease site	Cases	%
Pneumonia	58	59
Bacteraemia of unknown source	21	21
Empyema	4	4
Meningitis	5	5
Other	10	10
Total	98	100

Of those children under five years old (for which vaccination data is available), seven out of 10 had been vaccinated.

4.9 Acute rheumatic fever

Rheumatic fever is an inflammatory disease that can involve the heart, joints, skin, and brain. The disease typically develops two to four weeks after a streptococcal throat infection. Signs and symptoms include fever, multiple painful joints, involuntary muscle movements, and occasionally a characteristic non-itchy rash known as erythema marginatum. The heart is involved in about half of cases. Damage to the heart valves, known as rheumatic heart disease, usually occurs after repeated attacks, but can sometimes occur after one. Worldwide, rheumatic fever occurs in about 325,000 children each year, and about 33.4 million people currently have rheumatic heart disease. Those who develop rheumatic fever are most often between the ages of five and 14 years old, with only 20 per cent of first-time attacks occurring in adults. The disease is most common in the developing world, and among indigenous peoples in the developed world.

There were 61 confirmed and probable, and seven suspected acute rheumatic fever (ARF) cases in 2020, down by 23 from 2019. 2020 saw the fewest cases since 2015 (Figure 50). Of the 61 confirmed and probable cases, 34 (63 per cent) resided in South Auckland. The incidence rate for ARF in the Auckland region was 3.5 cases per 100,000 population, compared with 2.3 cases per 100,000 for the rest of New Zealand.

ARPHS was concerned that the COVID-19 lockdowns might result in an increase in acute rheumatic fever but in fact the opposite occurred. The reason for this is not known but perhaps more attention to hand hygiene, the ability to more closely monitor children's illnesses and lower thresholds for seeking medical attention may have contributed to fewer cases.

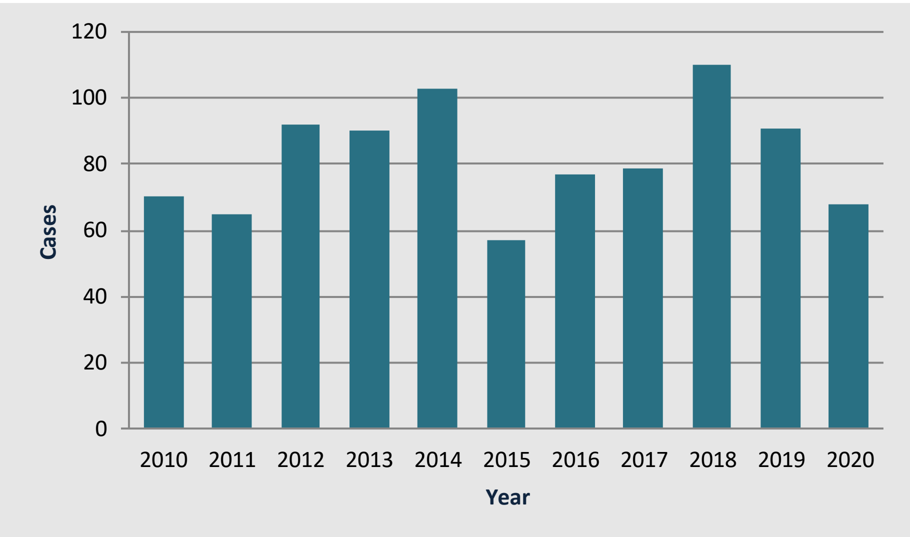


Figure 50: Acute rheumatic fever cases in the Auckland region (2010 – 2020)

Cases occurred steadily during the first quarter and then dropped off to low levels by mid-year, where they were sustained for the rest of the year (Figure 51).

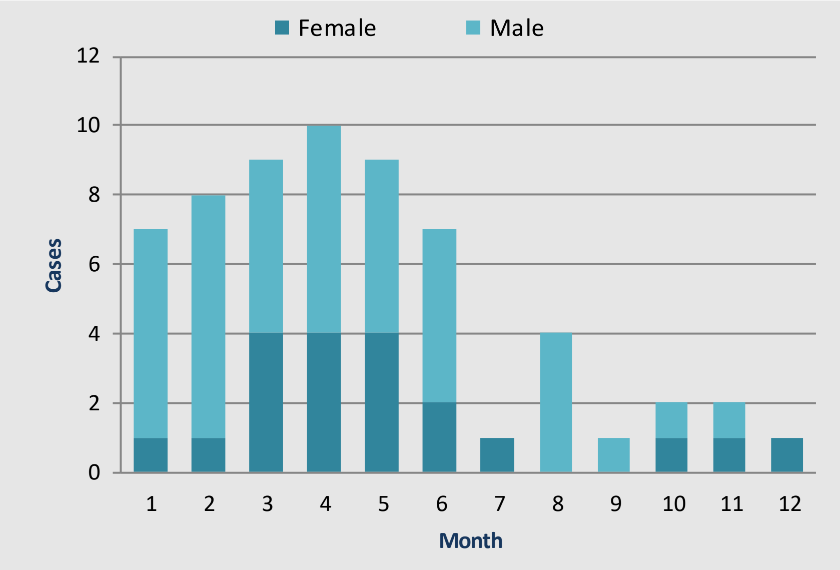


Figure 51: Acute rheumatic fever cases by month in the Auckland region (2020)

The onset of ARF typically occurs during childhood or adolescence, with most cases occurring in children aged 5 to 14 years old. The highest age specific incidence in 2020 was again in this age group, which represented 78 per cent of all new acute rheumatic fever cases (Table 60).

Table 60: Age and gender distribution and age-specific incidence rates of ARF in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
1 to 4		1	1	1.2
5 to 9	9	14	23	20.0
10 to 14	7	18	25	22.2
15 to 19	2	4	6	5.4
20 to 29	1	1	2	0.7
30 to 39		2	2	0.7
40 to 49	1	1	2	0.9
Total	20	41	61	3.5

* Rates are based on estimated mid-year population, 2020 (Source: Statistics New Zealand)

For the Auckland region, 27 per cent of cases were Māori, and 62 per cent were Pacific Peoples (Table 61).

Table 61: Ethnic group distribution and age-specific incidence rates of ARF in the Auckland region 2020

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	1	2	3	0.2
European or Other	3		3	0.1
Māori	6	11	17	8.2
Pacific Peoples	10	28	38	188.6
Total	20	41	61	3.5

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

A further breakdown of ethnic groups is shown in Table 62.

Table 62: Ethnicity distribution and gender of ARF cases in the Auckland region (2020)

Ethnicities	Female	Male	Total
Cook Islands Māori		4	4
Fijian (except Fiji Indian / Indo-Fijian)		1	1
Māori	6	11	17
NZ European	2		2
Samoan	4	10	14
Tongan	5	9	14
Tuvaluan		1	1
Filipino		2	2
African	1		1
Tokelauan	1		1
Samoan / Cook Islands Māori		2	2
Cook Islands Māori / Tongan / Indian		1	1
Indian	1		1
Total	20	41	61

ARF is rare in non-Māori and non-Pacific children. In 2019, Pacific children aged 5 to 19 years old had the highest number of ARF notifications in the Auckland region, followed by Māori children of the same age group. In 2019, case numbers in tamariki Māori were down by nearly 50 per cent from 2018, but these returned to 2016 - 2018 levels in 2020 with 14 cases. Pacific children had 37 per cent less acute rheumatic fever notified in 2020. Notifications dropped from 49 in 2019 to 31 in 2020 (Table 63).

Table 63: Confirmed, probable and suspected acute rheumatic fever cases by selected age and ethnic groups (2010 - 2020) *

Ethnic group	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
5 to 14 years											
Asian	1		2	2							3
European or Other			2	1	1			1	1	1	3
Māori	18	17	25	14	11	6	12	14	15	9	14
Pacific Peoples	33	37	33	48	49	39	35	34	47	49	31
Total	52	54	62	65	61	45	47	49	63	59	51
15 to 19 years											
Asian											
European or Other			3					1	1		
Māori	6	2	2	2	5		2	2	1	2	1
Pacific Peoples	4	1	7	9	13	3	11	10	17	6	7
Total	10	3	12	11	18	3	13	13	19	8	8
20 to 29 years											
Asian				1		1					
European or Other					1						
Māori	3	1	4	4	2	3	2	3	1	4	2
Pacific Peoples	4	4	12	8	17	3	9	8	21	16	2
Total	7	5	16	13	20	7	11	11	22	20	4

*Note these figures may differ to other ARF reporting from ARPHS as suspect cases are included.

In 2011 the Rheumatic Fever Prevention Programme was established to prevent and treat strep. throat infections, which can lead to rheumatic fever. The programme was expanded significantly from 2012 following the introduction of the then five-year rheumatic fever 'Better Public Services' target to reduce rheumatic fever by two-thirds, to 1.4 cases per 100,000 people. The programme is no longer nationally coordinated. However some aspects have been maintained (especially in the Counties Manukau DHB area).

Between 2013 and 2015 there was a 62 per cent reduction in the Auckland region in cases for Māori (16 cases to 6) and a 23 per cent reduction (57 to 44) for Pacific children aged 0 to 19 years old.

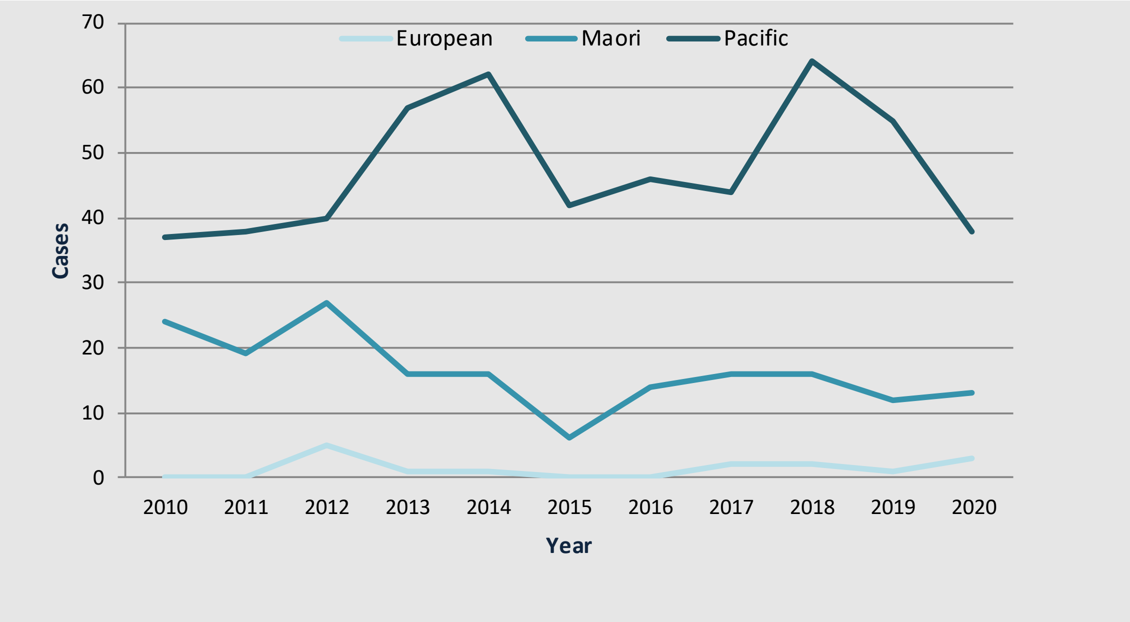


Figure 52: Acute rheumatic fever cases in 0-to-19–year-olds in the Auckland region (2010 – 2020)

Acute rheumatic fever is widely recognised as a disease of poverty, but the specific reasons for the increase since 2016 are not known (Figure 52). During 2020, 64 per cent of all ARF occurred in Auckland's most deprived areas (NZDep 8, 9, 10) (Figure 53). This compares with 74 per cent in 2019 and 84 per cent in 2018. The proportion for the five- to 14-year-old age group was 63 per cent, and has remained around this level since 2013 (when it was 85 per cent).

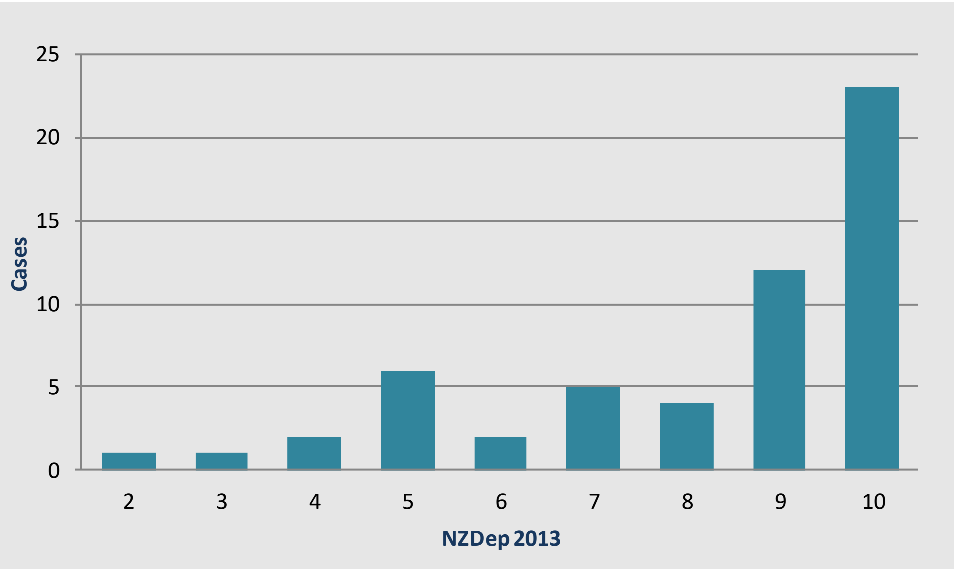


Figure 53: ARF cases by NZ deprivation index in the Auckland region (2020)

To prevent a recurrence of ARF, secondary prophylaxis is instigated. In New Zealand, this involves an intramuscular injection of antibiotic every 28 days for a minimum of 10 years, depending on the extent of carditis (heart inflammation).

The 2020 incidence rate for recurrent rheumatic fever in the Auckland region was 0.4 cases per 100,000 compared to 0.2 cases per 100,000 for the rest of New Zealand.

Within the Auckland region, there was a peak of 12 confirmed or probable recurrences in 2012 and 2014, dropping away to 4 cases in 2015 and, since then, gradually increasing back to 10 cases in 2018. In 2020 there were 7 notifications for recurrent ARF (Figure 54).

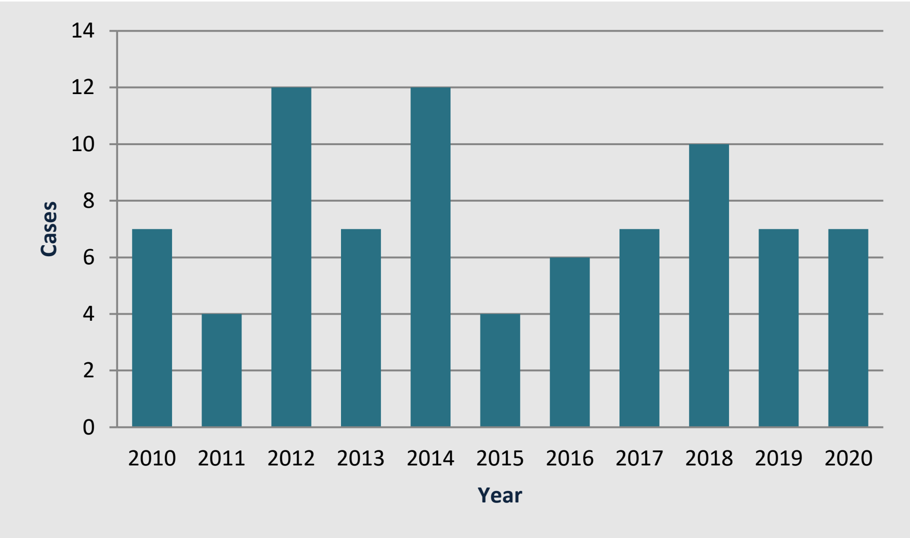


Figure 54: Numbers of recurrent rheumatic fever cases in the Auckland region (2010 – 2020)

One recurrence occurred in a child from the five- to nine-year-old age group. The other six cases were aged between 25 and 40 years (Tables 64 and 65). Five of the seven were from the Pacific Peoples ethnic group.

Table 64: Age and gender distribution of recurrent rheumatic fever cases in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
1 to 4				-
5 to 9	1		1	0.9
10 to 14				-
15 to 19				-
20 to 29	1	1	2	0.7
30 to 39	2	1	3	1.1
40 to 49	1		1	0.4
Total	5	2	7	0.4

Table 65: Ethnic group distribution of recurrent rheumatic fever cases in the Auckland region (2020)

Ethnicity prioritised	Female	Male	Total	Rate per 100,000*
Asian				-
European or Other				-
Māori	2		2	1.0
Pacific Peoples	3	2	5	2.1
Total	5	2	7	0.4

Five of the recurrent rheumatic fever cases were from the Counties Manukau DHB area and two were from Auckland. Four of the seven lived in areas of NZDep (2013) level 8,9 and 10.

4.10 Tuberculosis, latent tuberculosis and leprosy

Key points

- Tuberculosis notifications remained stable, with 164 cases in 2020. The highest rates were observed in the 20- to 29-year-old age group, and the 70 plus age group.
- The highest incidence was in the Asian ethnic group (predominantly amongst those of Indian, Chinese and Filipino ethnicity).
- There is a clear clustering of cases in the higher deprivation levels, with more than half of the cases occurring in NZDep levels 7, 8, 9, and 10.
- Drug resistance was found in seven new TB cases, six to isoniazid and one to ethambutol. The source countries for these cases were India (5) the Philippines (1) and Nepal (1).
- There was only one confirmed case of leprosy notified in 2020. This case presented with skin manifestations and was aged between 20 and 29 years. They had acquired their illness in the Pacific.

4.10.1 Tuberculosis

Tuberculosis (TB) is a bacterial infection, usually caused by *Mycobacterium tuberculosis,* but occasionally caused by *Mycobacterium bovis*. TB disease usually affects the lungs (pulmonary TB) but can also affect many other parts of the body, such as the lymph nodes, brain, kidneys, bowel, or bones (extrapulmonary TB). People with TB disease can have pulmonary or extrapulmonary TB, or both. TB disease is usually curable but requires six to 12 months of multi-drug therapy to achieve cure. Multi-drug resistant TB (MDR-TB) has lower cure rates than drug-sensitive TB and requires treatment for up to two years or more, with drugs that may have more side effects.

Following infection with the TB bacterium, 90 to 95 per cent of people contain and control the infection as latent TB infection (LTBI), with only five to 10 per cent of people developing primary TB. The risk of progression to active TB disease is much higher for young children and for adults with certain medical risk factors (for example, people with HIV/AIDS, cancer, kidney disease, diabetes, or who are taking chemotherapy or long term oral steroid treatment). People with LTBI are not infectious to others, and do not have any symptoms of TB disease. However, due to their small risk of developing TB disease in the future LTBI is often treated. The risk of developing active TB disease is higher within the first two years of becoming infected, and for people who are immunosuppressed.

TB is one of the top ten leading causes of death worldwide, and the leading cause from a single infectious agent, ranking above HIV/AIDS. In 2018, there were an estimated 1.2 million TB deaths among HIV-negative people (down from 1.7 million in 2000), and an additional 251,000 deaths among HIV-positive people. An estimated 10 million people fell ill with TB in 2018; stable compared to previous years. 89 per cent were adults; 57 per cent were male; 8.6 per cent were people living with HIV; 67 per cent of cases came from India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa.

There were 164 new TB diagnoses made and notified in the Auckland region in 2020, similar to 2019 (157), 2018 (155) and 2017 (148) (Figure 55). The 2020 incidence rate for the Auckland region was 9.4 cases per 100,000, which is double that of the rest of New Zealand (4.6 cases per 100,000). Of the 164 cases, 62 per cent received inpatient hospital care. One TB associated death was reported in 2020.

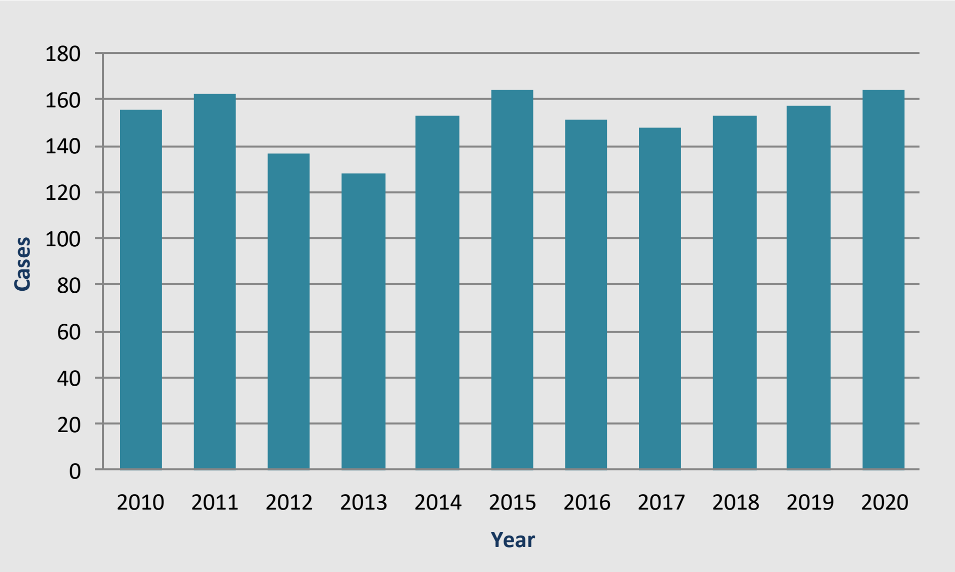


Figure 55: New tuberculosis cases in the Auckland region (2010 – 2020)

Due to the variable, and potentially very long, time between a person being exposed to TB and developing TB disease, it is hard to take any meaning from fluctuations of TB notifications between months or years, and the data is best looked at for trends over several or many years. Case notifications occurred throughout the year (Figure 56).

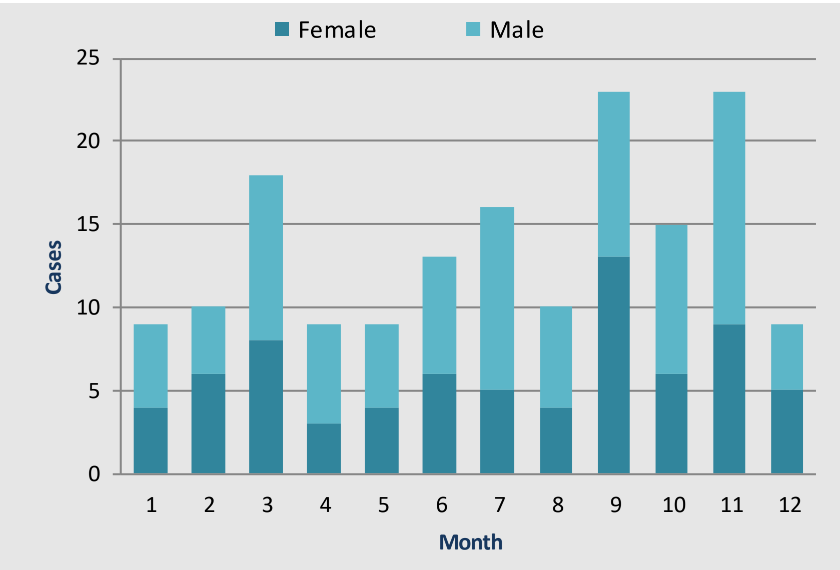


Figure 56: Monthly distribution of new tuberculosis cases in the Auckland region (2020)

Of the 164 new TB diagnoses, 76 (46 per cent) were pulmonary TB. Of these, 53 per cent (41) were smear-positive, compared with 49 per cent in 2019 and 47 per cent in 2018.

The highest age-specific incidence rate of new tuberculosis was in the 20- to 29-year-old age group (16.2 per 100,000), followed closely by the 70 plus age group (13.7 per 100,000). This is a change from the highest age group incidence rates in 2018, which were in the 70 plus and the 60- to 69-year-old age group (Table 66). In terms of gender, 55 per cent of cases were male and 45 per cent were female.

Table 66: Age-specific incidence and age-specific incidence rates of new tuberculosis cases in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1	1		1	4.6
1 to 4		2	2	2.3
5 to 9	1		1	0.9
10 to 14		1	1	0.9
15 to 19	2	7	9	8.1
20 to 29	18	27	45	16.2
30 to 39	13	19	32	11.8
40 to 49	8	10	18	7.9
50 to 59	11	7	18	8.4
60 to 69	8	9	17	10.8
70+	10	10	20	13.7
Total	72	92	164	9.4

* Rates based on 2020 estimated mid-year population (Source: Statistics New Zealand)

Among the five major ethnic groups, Asian people had the highest incidence rate with, 21.6 cases per 100,000 followed by Pacific Peoples at about half that rate (Table 67).

Table 67: Ethnic group-specific new tuberculosis cases and incidence rates in the Auckland region (2020)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	52	61	113	21.6
European or Other	5	11	16	2.0
Māori	1	5	6	3.0
Pacific Peoples	14	15	29	12.5
Total	73	92	164	9.4

* Rates are based on Ministry of Health Prioritised Pop Projection off 2018 base (Source: Statistics New Zealand)

Of the 164 new TB cases, 143 (86 per cent) were born outside of New Zealand. The probable source countries were:

- India (41 per cent)
- Philippines (12 per cent)
- China (10 per cent)
- South Africa (four per cent)
- Korea (three per cent)
- Fiji, Samoa, Cook Islands, Tonga, Tuvalu, Kiribati (all at two per cent each)

This remains essentially unchanged (Table 68). The average duration of time between arrival in New Zealand and onset date was 11.5 years. Thirty two (19 per cent) were diagnosed within the first two years of their arrival, and 21 (13 per cent) within one year. This is double the number of early diagnosed cases compared with 2019.

Table 68: Source countries for new tuberculosis cases born outside New Zealand in the Auckland region (2020)

Source Country	Proportion of cases born outside NZ (%)
India	41
Philippines	12
China	10
South Africa	4
Korea	3
Fiji	2
Samoa	2
Cook Islands	2
Tonga	2
Tuvalu	2
Kiribati	2
Nepal	2
Other countries (18)	15
Total	100

There was a known contact with a case for 23 per cent of new cases, and no known contact in 67 per cent of cases. The remainder of cases (10 per cent) were reported as “Unknown”.

Occupational groups are shown in Table 69. Unemployed people made up 19 per cent of cases in 2020, much the same as for 2019 but well up from 10 per cent in 2018. The service industry TB case numbers were up in 2020 (32), but no particular occupational area stood out. Healthcare workers accounted for ten cases, which is above the average for the previous four years (5.8). There was a drop in the proportion of student cases at 7 per cent compared with the 12 per cent of cases in 2019 (though this was not quite statistically significant). It may however reflect the reduced numbers of overseas students in 2020 due to COVID-19 restrictions. The numbers of new TB cases in the remaining occupational groups were relatively stable, with retired persons at 15 per cent.

Table 69: Occupational group for new tuberculosis cases in the Auckland region (2016 – 2020)

Occupational group	2016	2017	2018	2019	2020	2020 (%)
Unemployed or beneficiary	13	26	16	35	31	19%
Student	31	23	22	19	11	7%
Service industry	25	19	22	14	32	19%
Retired persons	21	20	29	23	24	15%
Administration roles	15	13	6	9	7	4%
Food handler	4	13	8	7	2	1%
Unknown	15	6	15	16	17	10%
Tradesperson/factory worker	8	9	12	9	12	7%
Visitor to NZ	3	7	2	3	3	2%
Healthcare worker	11	4	2	6	10	6%
Technician		4	6	2	8	5%
Children 0-to-15 years	2	1	2	1	4	2%
Self-employed		2	7		2	1%
Teacher	1		3	1	2	1%
Music, art & sports						0%
Prison inmate	0	0	0	1	0	0%
Total	151	148	155	157	165	100%

The NZ Deprivation Index distribution of new TB cases is shown below. There is a clear clustering of cases in the higher deprivation zones, with 42 per cent of the cases occurring in NZDep zones 8, 9, and 10 (Figure 57). This proportion has remained essentially unchanged since 2014.

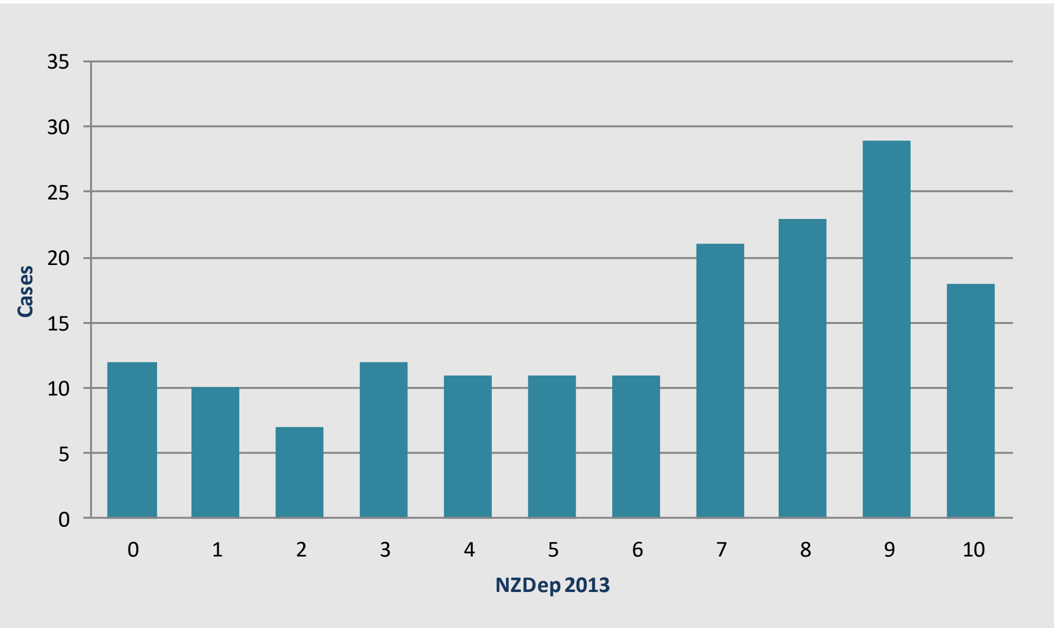


Figure 57: Distribution of new TB cases by NZDep in the Auckland region (2020)

Drug resistance was found in seven new TB cases, six to isoniazid and one to ethambutol.

For the drug resistant cases, the source countries were India (5) the Philippines (1) and Nepal (1).

4.10.2 Latent tuberculosis

A diagnosis of latent tuberculosis (LTB), also called latent tuberculosis infection (LTBI), means a person is infected with *Mycobacterium tuberculosis*, but does not have active tuberculosis disease. Active tuberculosis can be contagious while LTBI is not. The main risk is that approximately 10 per cent of cases (five per cent in the first two years after infection, and 0.1 per cent per year thereafter) will go on to develop active tuberculosis. This is more likely where the immune system is suppressed by medications, disease, or advancing age, or in very young children.

The identification and treatment of people with LTBI is an important part of controlling this disease, especially if the exposure has been recent. Various treatment regimens are uses to treat LTBI, which generally need to be taken for several months.

It is not mandatory for all cases of LTBI to be notified to the Medical Officer of Health. Cases are only notified with consent from the individual. Data presented here is therefore not representative of the true burden of LTBI in the community, or of the number of TB contacts followed up by ARPHS.

A total of 38 LTBI cases were processed in 2019, compared with 111 in 2019, 106 in 2018 and 136 cases in 2017 (Figure 58). Only a minority of LTBI cases are diagnosed so this does not represent a true incidence rate.

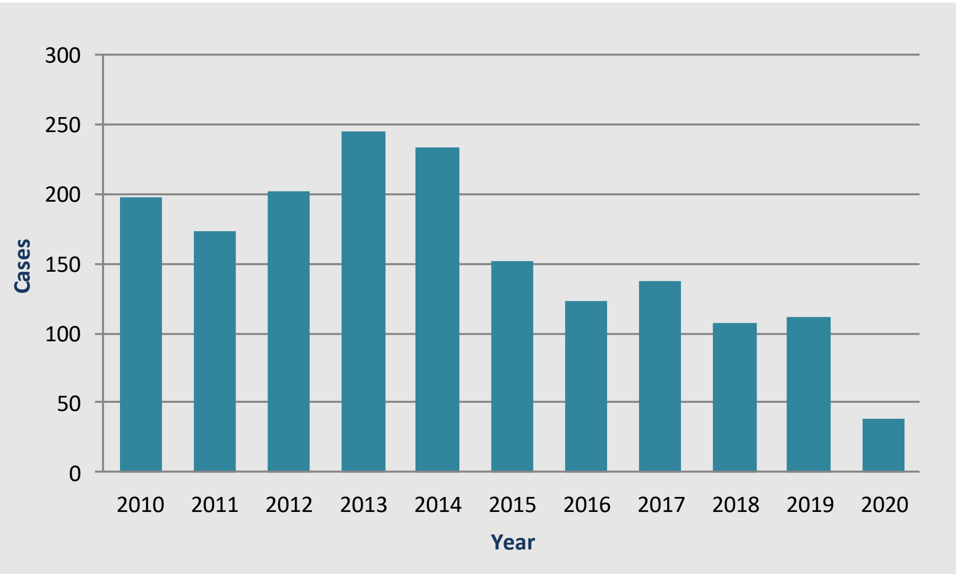


Figure 58: LTBI cases in the Auckland region (2010 – 2020)

After the first quarter of the year, fewer cases were identified through the subsequent months as a result of COVID-19 restrictions and competing work pressures (Figure 59).

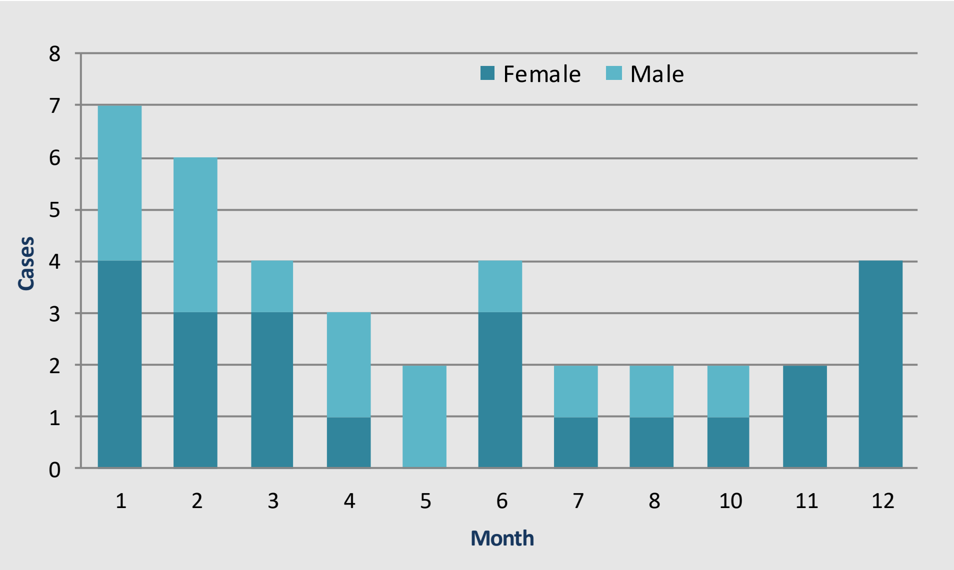


Figure 59: Monthly distribution of LTBI notifications in the Auckland region (2020)

The incidence rate was 2.2 cases per 100,000 population, with the highest age-specific incidence rate in the under one year old age group (36.9 per 100,000) and the one to four-year old age groups (11.5 per 100,000) (Table 70). The male to female ratio is similar at 1.5:1.

Table 70: Age-specific incidence and age-specific incidence rates of LTBI in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1	5	3	8	37.2
1 to 4	5	5	10	11.6
5 to 9	1	1	2	1.7
10 to 14	2		2	1.8
15 to 19	1		1	0.9
20 to 29	2	1	3	1.1
30 to 39	1		1	0.4
40 to 49	2	2	4	1.8
50 to 59	3	1	4	1.9
60 to 69	1	2	3	1.9
Total	23	15	38	2.2

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand)

Asian and Māori had the highest incidence rate (4.0 per 100,000), followed by Pacific Peoples (2.1 per 100,000) (Table 72).

Table 71: Ethnic group-specific latent tuberculosis cases and incidence rates in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	13	8	21	4.0
European or Other	2	1	3	0.4
Māori	5	3	8	4.0
Pacific Peoples	2	3	5	2.1
Unknown	1		1	
Total	23	15	38	2.2

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

There were five TB preventative treatment cases during 2020. These cases were aged between 23 and 54 years old (median age = 34). Three were of Asian ethnicity and two were from the Pacific region.

The last remaining subgroup of tuberculosis that is monitored by ARPHS is the relapse or reactivations of tuberculosis disease. In 2020 there were seven cases in this group, and this number has been relatively stable over the years. The age range was 44 to 78 years old and the median age was 73 years old. Of the seven cases, six were of Asian ethnicity and one was African. Three cases were discovered during immigration screening. None were smear positive.

4.10.3 Leprosy

Hansen's Disease (HD), also known as leprosy, is a rare but important notifiable infectious disease in New Zealand. In almost all cases of HD notified in New Zealand, the disease has been acquired in overseas countries where HD is still endemic, such as the Pacific Islands or India. HD is caused by *Mycobacterium leprae*, an acid-fast bacillus. The disease is curable with appropriate multidrug therapy (MDT). Hansen's Disease is not particularly infectious to others, but timely diagnosis and treatment is important to prevent the complications associated with untreated disease, and to prevent its transmission in New Zealand. Hansen's Disease has a long incubation period where the person has the bacteria in the body but no symptoms. This is why HD can sometimes occur years after the person arrives in New Zealand.

There were 208,619 new leprosy cases registered globally in 2018, according to official figures from 159 countries from the six WHO regions.

In Auckland, there are usually only one or two cases diagnosed and notified per year. In 2020 there was only one confirmed case, compared with two cases in 2019. This case was in the 20- to 29-year-old age group. They presented with skin manifestations and had acquired their illness in the Pacific.

5 Environmental related diseases

Key points

- Legionellosis notifications in 2020 were slightly down on 2019 with cases clustering in June and in spring. The predominate serotype in Autumn was *Legionella pneumophila,* which is associated with aerosolised water, and in spring, *Legionella longbeachae,* which is associated with contact with soil and compost.
- Lead absorption notifications in 2020 were well down on 2019, when identified cases were up due to an increase in routine occupational testing by Housing New Zealand. Of the non-occupational cases, the majority were associated with the removal of lead-based paints, shooting range hobbyists and Ayurvedic medicine use.
- There were two key outbreaks of foodborne intoxication for 2020. One occurred in November 2020 and was a scombroid-like illness associated with consuming of contaminated trevally. This affected 34 people in the Auckland region people and 91 people across the country. The other outbreak involved seven cases of *Vibrio parahaemolyticus* linked to the consumption of New Zealand-grown mussels from the Pelorus Sound mussel growing area.
- There were 21 hazardous substances cases notified during 2020; 15 incidents occurring in the home, four at work and one at school. Of the home incidents, all were due to accidental ingestion of household products, one of which was diffuser oil.

5.1 Legionellosis

Legionnaires' disease (also known as legionellosis) is a form of atypical pneumonia caused by any species of gram-negative aerobic bacteria belonging to the genus *Legionella*. There is a less severe form of the infection known as Pontiac fever, which resembles acute influenza. The main causative species are *L pneumophila* and *L. longbeachae*. *L longbeachae* is typically present in soil, whereas *L. pneumophila* is generally found in water. It thrives in temperatures between 25 and 45°C, with an optimum temperature of 35°C.

Legionnaires' disease is transmitted by inhalation of aerosolised water or soil contaminated with the bacteria. It is not transmitted from person-to-person. Sources where temperatures allow the bacteria to thrive include hot water tanks, cooling towers, and evaporative condensers of large air-conditioning systems, such as those commonly found in hotels and large office buildings.

A total of 36 legionellosis cases were reported in 2020, down slightly from 42 in 2019, 61 in 2018 and 82 in 2016 (Figure 60). The diagnosis of legionellosis was based on either a pan-*legionella* PCR, *legionella* species-specific PCR, *legionella* urinary antigen test (LUA), or a fourfold rise in ESR-confirmed indirect fluorescent antibody titre or specific ESR-confirmed antibody titres in the presence of a clinically compatible illness.

The incidence rate of legionellosis in the Auckland region was 2.1 cases per 100,000, compared to the rest of New Zealand at 4.0 cases per 100,000.

Of the 36 cases notified, the majority (89 per cent) received hospital treatment. Two deaths were reported in 2020, giving a case-fatality rate of 5.6 per cent. One of the two deaths was associated *with L. longbeachae /L. bozmanae.* and the other *L. pneumophila*. There were no legionellosis outbreaks in 2020.

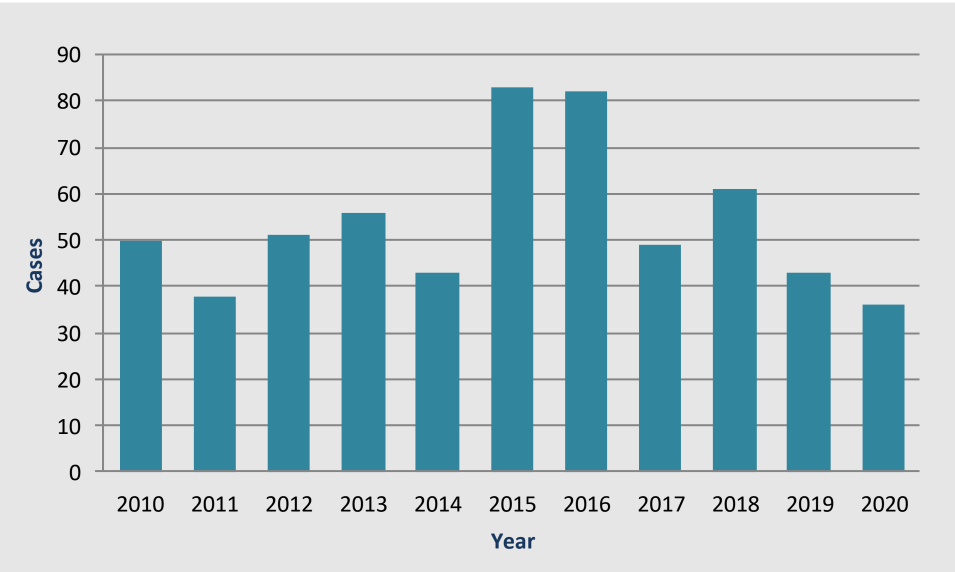


Figure 60: Legionellosis cases in the Auckland region (2010 – 2020)

There were two cases involving patients who contracted the disease while staying overseas. The rest of the cases occurred sporadically throughout the Auckland region during the year, apart from a spike in June. Case numbers then increased in the third quarter due to increased exposures to gardening soil and potting mix (Figure 61).

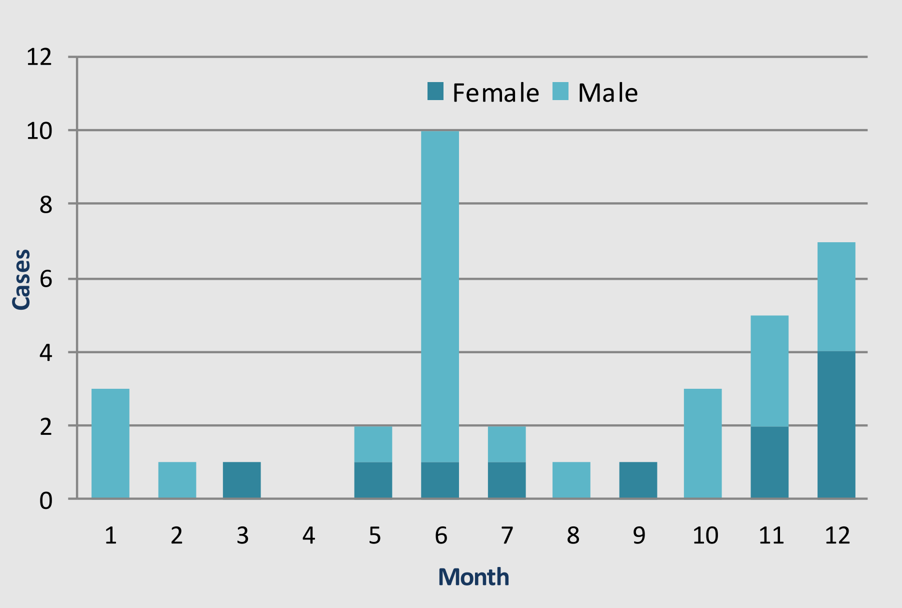


Figure 61: Monthly distribution of legionellosis cases in the Auckland region (2020)

The male to female ratio was 2.3:1 with the ages of the reported cases ranging from 41 to 90 years. The highest age specific incidence rate was among people aged 60 to 69 years old (Table 72).

Table 72: Age-specific incidence and age-specific incidence rates of legionellosis in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
40 to 49		2	2	0.9
50 to 59	4	6	10	4.7
60 to 69	4	11	15	9.5
70+	3	6	9	6.2
Total	11	25	36	2.1

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand).

Among the four major ethnic groups, Māori had the highest incidence rate (3.5 per 100,000), followed by European or Other (2.2 per 100,000), Pacific Peoples (1.7 per 100,000) and Asian (1.5 per 100,000) (Table 73).

Table 73: Ethnic group specific legionellosis cases and incidence rates in the Auckland region (2020)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	4	4	8	1.5
European or Other	4	13	17	2.2
Māori	2	5	7	3.5
Pacific Peoples	1	3	4	1.7
Total	11	25	36	2.1

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Of the 24 reported cases where immunosuppressive illness status was recorded, 8 had evidence of concurrent immunosuppressive illness.

Due to pressure on laboratory services not all legionellosis cases were serotyped at ESR in 2020, but a combination of ESR typing and local laboratory typing is shown in Table 74. The predominant serotype was *L. pneumophila* serogroup 1 (44 per cent), which is typically associated with aerosolised water. This was followed by *L. longbeachae* (28 per cent), typically associated with soil and compost products. There were six cases of *L. pneumophila* which were not able to be typed further but are likely to represent more *L. pneumophila* serogroup 1.

Table 74: Legionella serotypes in the Auckland region (2020)

Legionella serotype	Total	Proportion (%)
L.pneumophila sg 1	16	44
L. longbeachae	10	28
L.pneumophila	6	17
L. Jordanis	1	3
L. longbeachae/Bozmanae	1	3
L.pneumophila sg 14	1	3
Legionella spp	1	3
Total	36	100

The monthly distribution of *Legionella* serotypes is shown in Figure 62. The cause for the spike in *L. pneumophila* sg 1 cases in June is not known. Stage one water restrictions were implemented in Auckland from 16 May until 14 December 2020, when residents were able to use hand-held hoses fitted with trigger nozzles only. Whether this had an impact on legionella pneumophila cases is not known. There was otherwise an observed increase in *L. longbeachae* in spring and summer, which is often due to greater exposure to soil, gardens, composts and potting mixes. *L. pneumophila* sg 1 notifications are typically predominant during the first and second quarter of the year.

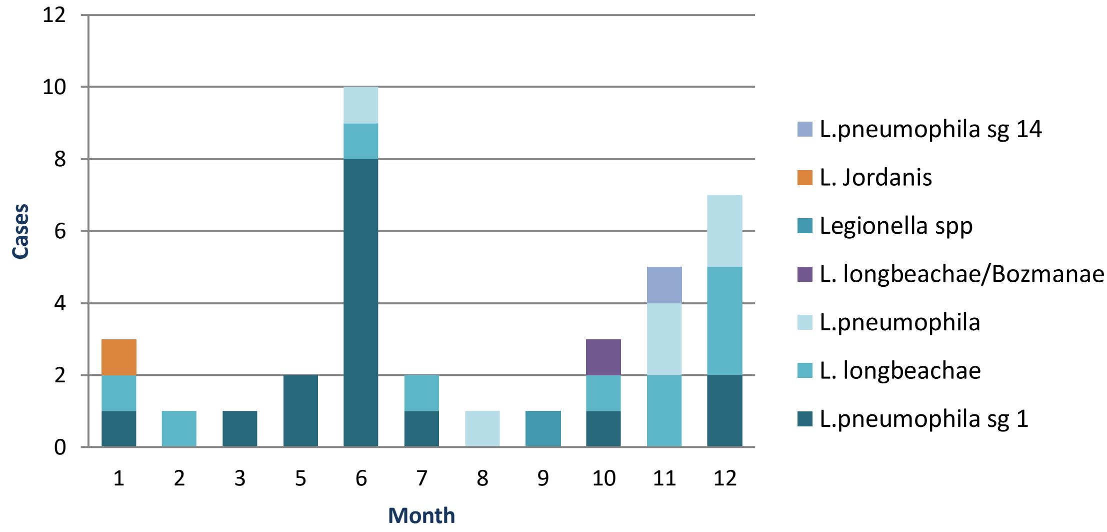


Figure 62: Monthly distribution of *Legionella* serotypes in the Auckland region (2020)

5.2 Lead absorption

Lead is one of the heavy metals that can cause illness in humans and other vertebrates. It interferes with the development of the nervous system, so is particularly dangerous for children, causing learning and behaviour disorders, which may be permanent. Exposure mechanisms to lead include contaminated air, water, soil, food, and consumer products. Occupational exposures such as painting and lead smelting are common causes of lead poisoning in adults. Certain hobbies, DIY projects involving house renovations, indoor shooting, and consumption of Ayurvedic medications are recurrent sources of lead absorption in New Zealand.

There were 29 lead cases in 2020, well down on the number of notifications for 2019 when there were 110 (Figure 63). Notifications were received throughout the year, with a spike due to third party occupational testing in December.

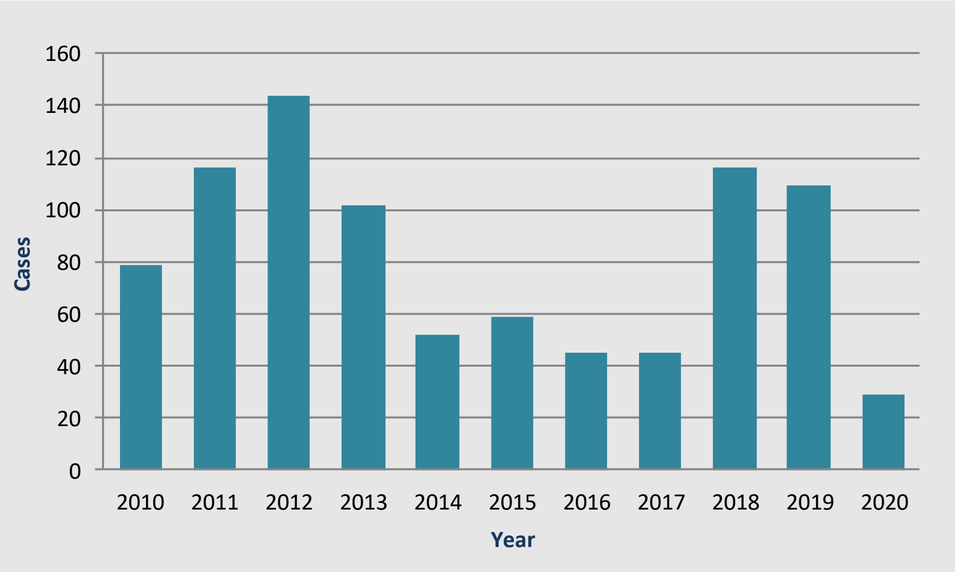


Figure 63: Lead absorption cases in the Auckland region (2010 – 2020)

The overall incidence rate was 1.7 cases per 100,000 population. The highest age-specific rate was among people aged 60 to 69 years, followed by the 50-to-59-year age group (Table 75). All but one case was male. Among the four major ethnic groups, Pacific Peoples had the highest incidence rate (2.3 per 100,000) (Table 76).

Table 75: Age-specific incidence rates of lead absorption in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
1 to 4	1		1	0.9
5 to 9			0	-
15 to 19			0	-
20 to 29		3	3	3.0
30 to 39		6	6	6.0
40 to 49		4	4	4.0
50 to 59		7	7	7.0
60 to 69		8	8	8.0
70+			0	0.0
Total	1	28	29	1.7

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand).

Table 76: Ethnic group-specific lead absorption cases and incidence rates in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian		1	1	0.2
European or Other	1	12	13	1.7
Māori		3	3	1.5
Pacific Peoples		6	6	2.3
Unknown		6	6	-
Total	1	28	29	1.7

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

There were 19 occupational exposure cases, all identified during routine screening. The average blood lead level overall was 0.85 μmol/l, which is lower than for 2019 (1.1 μmol/l) and 2018 (0.94μmol/l). The individual highest level was found in a foundry worker (2.35 μmol/l).

Overall, higher average blood levels were seen in foundry workers with average blood lead levels of 0.99 μmol/l (Table 77).

Table 77: Exposure sources in occupational lead absorption cases in the Auckland region (2020)

Source of exposure	Cases	Average blood lead level
Foundry Worker	8	0.99
Radiator repair	3	0.58
Pump sales/repairs	2	0.61
Routine testing (occupation not stated)	1	0.54
Painter/Decorator	1	0.65
Glazier	1	0.65
Fishing sinkers	1	1.05
Scrap metal worker	1	0.58
Auto mechanic	1	0.6
Total	19	0.85

Of the 10 non-occupational exposures, three were associated with the stripping and painting of houses previously painted with lead-based paints (Table 78). The highest blood lead level in a non-occupational exposure case was 5.1, seen in a child who had pica disorder in a lead contaminated home environment.

Table 78: Sources for non-occupational lead absorption cases and average blood lead levels in the Auckland region (2020)

Source of exposure	Cases	Average blood lead level
Paint removal	3	0.86
Shooter	2	0.51
Ayurvedic medications	2	0.53
Exposure to metals/lead NOS	1	0.85
Lead foreign body in foot	1	0.65
Pica in lead contaminated environment	1	5.1
Total	10	1.13

5.3 Foodborne intoxication

Key points

- Gastroenteritis due to foodborne toxins is capable of causing a rapid onset and often severe constellation of symptoms.
- There were 59 notifications for gastroenteritis due to foodborne intoxication during 2020, occurring throughout the year.
- The female to male ratio was 1.4:1. The highest incidence was seen in the 50 to 59 year old age group followed by 40 to 49 year olds. No particular ethnic group was overrepresented.
- The overall incidence rate was 3.4 per 100,000 population. Of the 59 cases, nine were hospitalised and there were no deaths.

5.3.1 Scombroid

Scombroid is a foodborne illness that typically results from eating spoiled fish. Symptoms may include flushed skin, headache, itchiness, blurred vision, abdominal cramps, and diarrhoea. Symptom onset is typically ten to 60 minutes after eating and can last for up to two days. Scombroid poisoning is more likely with certain fish species, such as tuna, mackerel, mahimahi, trevally, sardine, anchovy, herring, bluefish, amberjack, and marlin. These fish naturally have high levels of histidine, which is converted to histamine when bacterial growth occurs during improper storage.

The Auckland region reported 38 cases of scombroid for the 2020 year, the majority (34) occurring in November 2020 as part of a national outbreak that affected 91 people nationwide and was linked to the consumption of contaminated trevally.

5.3.2 Vibrio parahaemolyticus

Found in the sea and in estuaries, *Vibrio parahaemolyticus* is a gram-negative bacterium which, when ingested, causes gastrointestinal illness in humans. It is identified by LabTests Auckland using a new PCR test for Vibrio.

There were 14 cases of *V. parahaemolyticus* notified for the Auckland region in 2020. Seven cases occurred as part of a national outbreak that was linked to the consumption of New Zealand grown mussels from Pelorus Sound. The remaining cases occurred throughout the year and were associated with the consumption of fish or shellfish.

5.3.3 Ciguatera

Ciguatera fish poisoning (or ciguatera) is a marine foodborne illness contracted from eating fish that contain certain toxins. These toxins are produced by a dinoflagellate (small algae-like organism), which attaches itself to algae growing in warm ocean reef areas. Small plant-eating fish eat the toxic algae and in turn are eaten by larger predatory fish. Ciguatera fish poisoning occurs when humans consume fish that have accumulated a significant amount of the toxin.

There was one case of probable ciguatera fish poisoning in a young male adult who became unwell after consuming fish brought back to New Zealand from a fish market in Fiji.

5.3.4 Toxic shellfish poisoning

There are four main kinds of toxic shellfish poisoning. The chemicals that cause it are produced by certain species of toxic algae and released into the shellfish when they ingest the algae.

There were no cases of toxic shellfish poisoning notified in 2020, with the last Auckland region case notified in 2014.

5.4 Hazardous substances injuries

As defined in the Hazardous Substances and New Organisms Act 1996, a hazardous substance is officially defined as any substance with one or more of the following intrinsic properties:

- explosive
- flammable (catches fire)
- capacity to oxidise
- corrosive, or
- toxic to humans

The same Act requires hospitals and medical practitioners to notify hazardous substances injuries to the Medical Officer of Health.

Hazardous substances injury cases are derived from the large number of hazardous substances or chemical injuries that are treated at the region's hospital emergency departments (EDs). Prior to 2018 data was made available to ARPHS only by Auckland DHB but, from 2018, all the region's hospitals were able to contribute. Data is assessed and managed by ARPHS as required and the resultant clinical and epidemiological data is entered into the national Hazardous Substances Disease and Injury Reporting Tool (HSDIRT) database before being collated and analysed by Massey University's Centre for Public Health Research. There is no reporting of data from primary care GPs or after-hours clinics. A system exists for reporting at the primary care level but the indications for reporting are unclear and access to the reporting system from the practice management systems appears to remain a barrier to reporting.

Training may be key to this, but it will require a change in medical student functional inquiry training, including understanding and investigating the environment's impact on the patients' health, and specific inquiry into hazardous substances exposures.

Hazardous substances injury cases encompass a vast group of diagnoses, including:

- children swallowing cleaning products or cosmetics
- intentional overdoses with agrichemicals
- carbon monoxide poisoning
- illness caused by exposure to chemicals such as solvents or chlorine
- contact dermatitis from chemicals
- fireworks burns or eye injuries and
- huffing of substances

There were 21 hazardous substances cases notified during 2020, down from 29 in 2019 and 40 in 2018. The incidence rate was highest in the under five-year-old age group (Table 79).

Table 79: Hazardous substances injury cases by age group in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
<1	1		1	4.6
1 to 4	3	4	7	8.1
5 to 9	2		2	1.7
15 to 19				-
20 to 29		1	1	0.4
30 to 39		1	1	0.4
40 to 49				-
50 to 59	1	5	6	2.8
60 to 69		2	2	1.3
70+	1		1	0.7
Total	8	13	21	1.2

* Rates are based on 2020 estimated mid-year population (Source: Statistics New Zealand).

Although numbers were small, the incidence rate of hazardous substances injury across the various ethnic groups was similar (Table 80).

Table 80: Hazardous substances injury cases by age group in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	1		1	0.2
European or Other	4	9	13	1.7
Māori	1	1	2	1.0
Pacific Peoples	2	3	5	2.1
Total	8	13	21	1.2

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Of the 21 cases, 15 incidents occurred in the home, four at work and one at school.

Of the work-related cases, two were related to accidental ingestion of cement/cement booster, one case was from the inhalation of ozone and another from a whiff inhalation of cyanide.

Of the home incidents, all were due to accidental ingestion of household products, one of which was diffuser oil. All but one was reported as being assessed at hospital, and there were no deaths (Tables 81 and 82).

Table 81: Hazardous substances injury cases by type of injury in the Auckland region (2020)

Type of injury	Cases
Accidental chemical ingestions	19
Inhaled fumes	2
Conjunctival burns	-
Total	21

Table 82: Auckland region hazardous substances cases by setting (2020)

Place of exposure	Total
Home	15
Work	4
School	1
Other/unknown	1
Total	21

The hazardous agent involved is shown in Table 83. The emergence of diffuser oils as a hazard for young children has been of interest because of three cases reported in 2019. There was only one case reported for 2020. Overall, the most common substance causing harm was caustic soda or other caustic substances, followed by laundry detergent, petrol and cement/cement booster.

Table 83: Hazardous substances injuries by agent in the Auckland region (2020)

Hazardous substance	Total
Caustic soda	2
Other caustic substance	2
Laundry detergent	2
Petrol	2
Cement/cement booster	2
Teething gel	1
Cyanide	1
Diffuser fluid	1
Disinfectant	1
Hand sanitiser	1
Jewellery cleaner	1
Organic fertiliser	1
Ozone gas	1
Toilet disinfection block	1
Weed killer (glyphosate)	1
Unknown	1
Total	21

6 Rare diseases

The information for rare diseases has been deliberately generalised to avoid any individual case being able to be identified.

Key points

- *Haemophilus influenzae* Type B (HiB) is now considered a rare disease since the introduction of the highly effective HiB component in the Infanrix-hexa vaccine given at six weeks, three months and five months.
- Q fever notifications have increased since the introduction of new health testing requirements for shearers wanting to work in Australia. This has not resulted in an increase in detection of acute cases, but testing indicates evidence of past exposure in a small number.
- Rickettsial disease remains rare in New Zealand. Only one case was notified in the Auckland region in 2020, a case of murine typhus.
- Taeniasis notifications numbered in the low single digit numbers and are sometimes detected during refugee screening.

6.1 Brucellosis

Brucellosis is a highly contagious zoonosis caused by ingestion of unpasteurised milk or undercooked meat from infected animals, or from close contact with their secretions.

Brucella species are small, gram-negative, non-motile, non-spore-forming, rod-shaped (coccobacilli) bacteria. They function as facultative intracellular parasites and cause chronic disease that usually persists for life. Acute symptoms include profuse sweating and joint and muscle pain.

There was one confirmed Brucellosis case in a young adult visiting New Zealand from the Pacific who became unwell one week after their arrival.

6.2 Haemophilus influenzae B (HiB)

Invasive HiB disease is an acute, potentially life-threatening illness caused by the bacterium *Haemophilus influenzae*, a gram-negative coccobacillus. Non-encapsulated *H. influenzae* strains cause non-invasive disease, such as bronchitis and otitis media. However, six encapsulated strains of the bacteria (types a-f) cause invasive disease. Prior to the introduction of vaccination, type b (HiB) was the prevalent strain.

There was one case of confirmed HiB out of 28 *Haemophilus influenzae* notifications for 2020. This case presented as blood culture-positive septicaemia in a nine-year-old child. The child had reportedly received their first vaccinations overseas at 15 months old. The last notified case of HiB occurred in 2017.

6.3 Hydatid disease

Hydatid disease, also called echinococcosis, is a parasitic disease of tapeworms of the *Echinococcus* type. People get two main types of disease, cystic echinococcosis and alveolar echinococcosis. The disease often starts without symptoms, and this may last for a year. The symptoms and signs that occur depend on the cyst's location and size. The disease is spread when food or water that contains the parasite's eggs is consumed, or by close contact with an infected animal. The eggs are released in the stool of meat-eating animals infected by the parasite. Commonly infected animals include dogs, which become infected by eating the organs of an animal that contains the cysts, such as sheep or rodents.

There were no cases of hydatid disease notified in 2020. The most recent cases were in 2016 when there were three probable cases.

6.4 Q fever

Q fever is a disease caused by infection with *Coxiella burnetii*, a bacterium that affects humans and other animals. This organism is uncommon, but may be found in cattle, sheep, goats and other domestic mammals, including cats and dogs. The infection results from inhalation of a spore-like small cell variant, and from contact with the milk, urine, faeces, vaginal mucus, or semen of infected animals. Other modes of transmission to humans include tick bites, ingestion of unpasteurized milk or dairy products, and human-to-human transmission, but are rare. Humans are often very susceptible to the disease, and very few organisms may be required to cause infection.

There were no confirmed cases of Q fever in 2020 but six notifications were investigated and found not to be cases. These notifications arose out of Q fever screening for people seeking work in the shearing or meat processing industry in Australia.

6.5 Rickettsial disease

Rickettsial disease in humans (spotted fevers, typhus or scrub typhus) is caused by a number of related species of intracellular bacteria of the genus *Rickettsia*, which have blood-feeding arthropod vectors. Each species is associated with a different spectrum of clinical features, geographical distribution, insect vector (tick, louse, flea, mite or chigger), seasonal incidence and other epidemiological factors.

Murine typhus is caused by *Rickettsia typhi* and *R. felis*, which are transmitted to humans by fleas. It is clinically similar to, but milder than, epidemic typhus, causing chills, headache, fever, and rash. Murine typhus is a rickettsial disease. Animal reservoirs include wild rats, mice, and other rodents, and there are reservoirs of infection in the Southern Kaipara.

There was one case of confirmed murine typhus in 2020 following tick bites during travel to Indonesia.

6.6 Diphtheria

Diphtheria is a rare but serious disease caused by toxin-producing strains of *Corynebacterium*. The bacteria usually cause infection of the throat, but can also cause skin infections.

There were no confirmed cases of toxigenic *Corynebacterium diphtheria* notified in 2020. Thirteen notifications were received but all had negative toxigenic gene studies. The last confirmed case was one of cutaneous diphtheria in 2017.

6.7 Taeniasis

Taeniasis is a parasitic disease due to infection with tapeworms belonging to the genus *Taenia*. The two most important human pathogens in the genus are *Taenia solium* (the pork tapeworm) and *Taenia saginata* (the beef tapeworm). The third species—*Taenia asiatica*—is found only in East Asia. Taeniasis is generally asymptomatic, but heavy infection causes weight loss, dizziness, abdominal pain, diarrhoea, headaches, nausea, constipation, chronic indigestion, and loss of appetite. A type of taeniasis called cysticercosis is caused by accidental infection with the eggs of *T. solium* from contaminated food and water. A specific form of cysticercosis called neurocysticercosis is one of the most common infections of the central nervous system.

There were three confirmed cases of taeniasis in 2020, compared with five in 2019, four in 2018 and four in 2017. All three cases acquired their illness overseas; two from Africa and one from Vietnam.

7 Environmental health indicators

Environmental health indicators (EHIs) are measures that summarise the relationship between the environment and health. Their main functions are to:

- ***monitor changes in the environment and health***
- ***enable surveillance of the status or trends of public health events associated with environmental exposures***
- ***provide information to decision-makers in order to identify needs and actions both in the environment and in health***
- ***provide objective baseline information for developing targets***
- ***demonstrate spatial and temporal variations***
- ***monitor effectiveness of policy actions***
- ***promote specific policy issues***

Key points

- There were few weather extremes of rainfall in 2020 compared with 2018 and 2017. The Auckland Airport station reported average levels of rainfall for autumn, winter, and summer, but a drier spring.
- NIWA spring and autumn temperatures for 2020 were reported as cooler and winter was warmer and cloudier. Our emerging interest here is where there have been consecutive days of very warm temperatures and the impact this has on older adults' health.
- Population increase is likely to result in growing pressures on the environment and health-related services, and potential increased risks to health.
- In Auckland, air quality measures of PM10 and PM2.5 concentrations sometimes exceed air quality thresholds. Over the years, the average concentrations of PM10 have decreased, but PM2.5 concentrations have remained relatively stable.

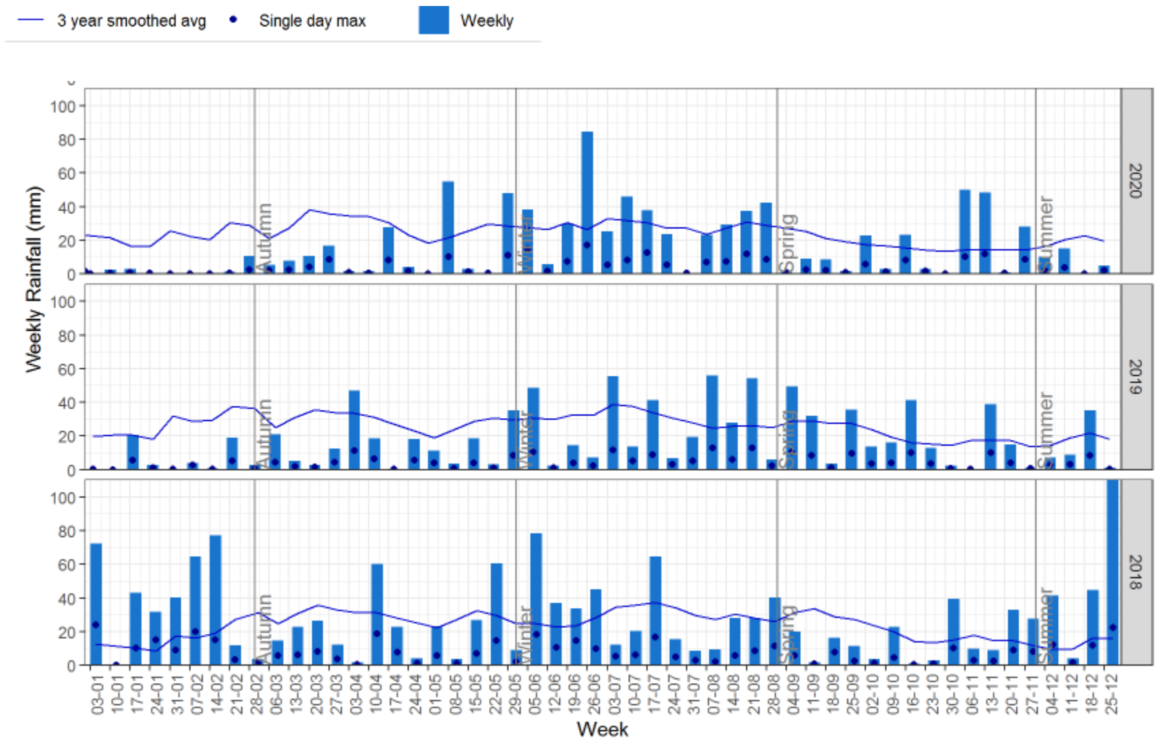
7.1 Environmental health indicators in New Zealand

- Environmental health indicators (EHIs) give us information and statistics on how the environment affects New Zealanders' health.
- EHIs are used as a tool to assess, quantify and monitor the health and vulnerability of our region, inform adaptations and policy development, and measure the effectiveness of climate change adaptation and mitigation activities. In addition, they provide baseline information for assessing and monitoring the temporal and spatial variability of climate change risks, and enable projection scenarios to be developed about how the current situation may evolve (e.g., epidemics, costs/benefits of interventions).
- Monitoring human disease surveillance data has the potential to act as an early warning system for ecosystem disruption and may be used to identify interventions for preserving ecological and human health. Such an approach allows interventions to be applied higher up the causal chain than would have been possible based on environmental monitoring or health surveillance alone. Implementing such interventions can improve ecological wellbeing which, in turn, will reduce the resultant burden of disease in humans.

7.1.1 Rainfall

The weather extremes of rainfall did not occur in 2020, compared with 2018 and 2017. The Auckland Airport station reported average levels of rainfall for autumn, winter and summer but a drier spring. For some years we have held hypotheses that persistently high rainfall and more surface water is linked to increases in enteric illnesses such as cryptosporidiosis and possibly VTEC. However, our observations over the past few years have not borne this out. We have noted, anecdotally, increased notifications of VTEC when heavy rainfall follows a period of drought, though more in-depth study is required.

New approaches to looking at this with respect to rainfall, rain volumes and run-off may help us come to a better understanding.



Source: NIWA

Figure 64: Auckland Airport rainfall by week (2018 – 2020)

7.1.2 Rain days

‘Heavy rain days’ are defined as those days in excess of the 95th percentile over the last five years.

The 11 heavy rain days for 2020 was similar to the ten in 2019, but well down on the 18 for 2018 and 24 in 2017. In no month did the number of heavy rain days exceed three.

Our interest in rain days is the detrimental impact this has on the Auckland region’s recreational water quality in the several days following the rainfall (Figure 65).

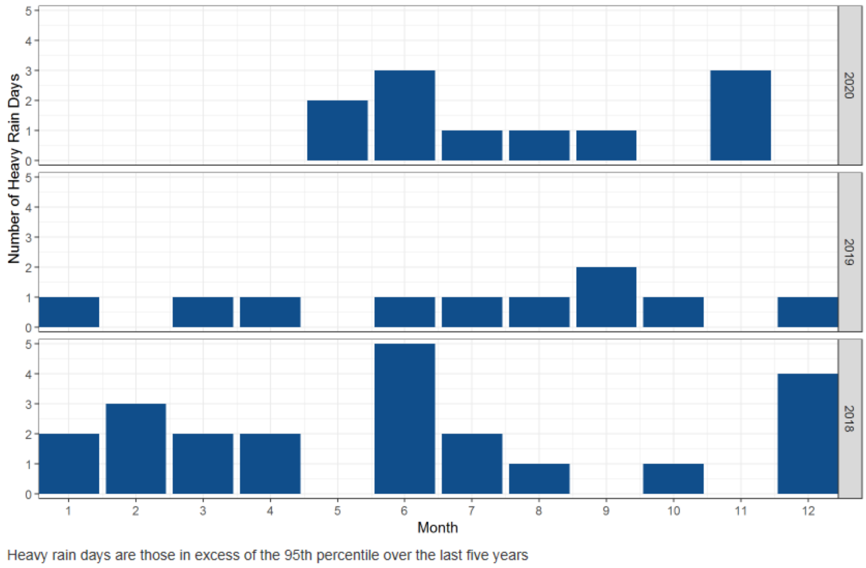


Figure 65: Auckland Airport rain days by month (2018 – 2020)

7.1.3 Temperature

One of the key climate measures is the average weekly temperature. Overall NIWA rated winter 2020 as warmer, and spring and autumn as average while the summer months were cooler (Figure 66). Our emerging interest here is where there have been consecutive days of very warm temperatures and the impact this has on older adults' health .

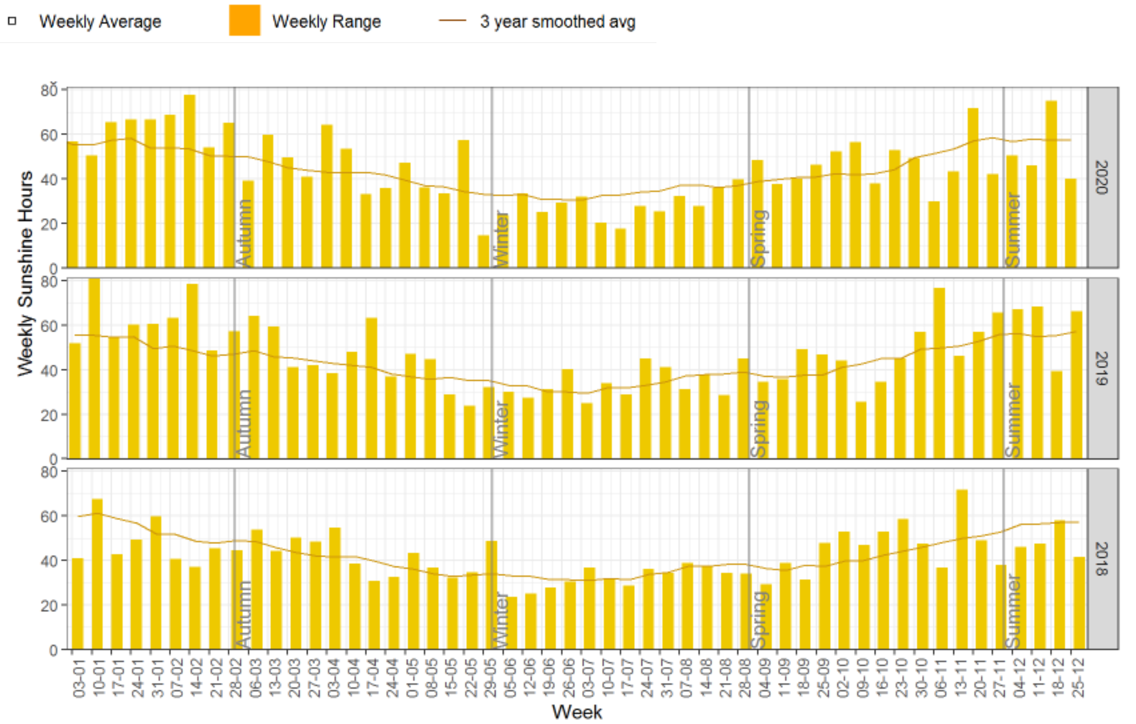


Figure 66: Auckland average weekly temperature range by week (2018 – 2020)

Source: NIWA

8 Outbreaks

Key points

- The number of outbreaks remained relatively low for the first part of 2020 and throughout the lockdowns, but surged in the last quarter due to a shift in the type of cleaning products used and hand hygiene behaviour in ELS and primary schools.
- Of the non-foodborne outbreaks, COVID-19 obviously had the biggest impact. There were 17 COVID-19 outbreaks due to SARS CoV2. Of these 17, there were 11 outbreaks where 209 linked cases were identified, but there were another six outbreaks where the true case numbers could not be established.
- Of the foodborne diseases the most common cause was norovirus in ELS and primary school settings. There were 56 identified norovirus outbreaks for 2020, in various settings, and many more where norovirus was suspected but unable to be confirmed. Two thirds of the confirmed norovirus outbreaks occurred in ELS and just over a quarter in long term care facilities.
- As mentioned in Section 5.4, there were 50 gastroenteritis notifications due to foodborne intoxication during 2020, with two key outbreaks identified. One occurred in November 2020 and was a scombroid-like illness associated with the consumption of contaminated trevally. This affected 34 people in the Auckland region and 91 people country wide. The source was attributable to a home delivery meal kit company. The other outbreak involved seven cases of *Vibrio parahaemolyticus* that were linked to the consumption of New Zealand-grown mussels from Pelorus Sound.
- In total, Auckland Regional Public Health Service identified or received 181 outbreak notifications in 2020, well up on the 134 in 2019. This increase was due to various outbreaks within the COVID-19 pandemic and to the unusual increase in gastroenteritis outbreaks in the latter part of the year, referred to in the first point above (Figure 67).
- It is important to note that these are reported outbreaks and there will have been many non-notified outbreaks.

There are typically more outbreaks reported in summer and early spring. In 2020, outbreaks were reported throughout the year with drop-offs associated with COVID-19 lockdowns and then a very large increase in the last quarter as schools and childcare institutions opened and were susceptible to new circulating noroviruses (Figure 68).

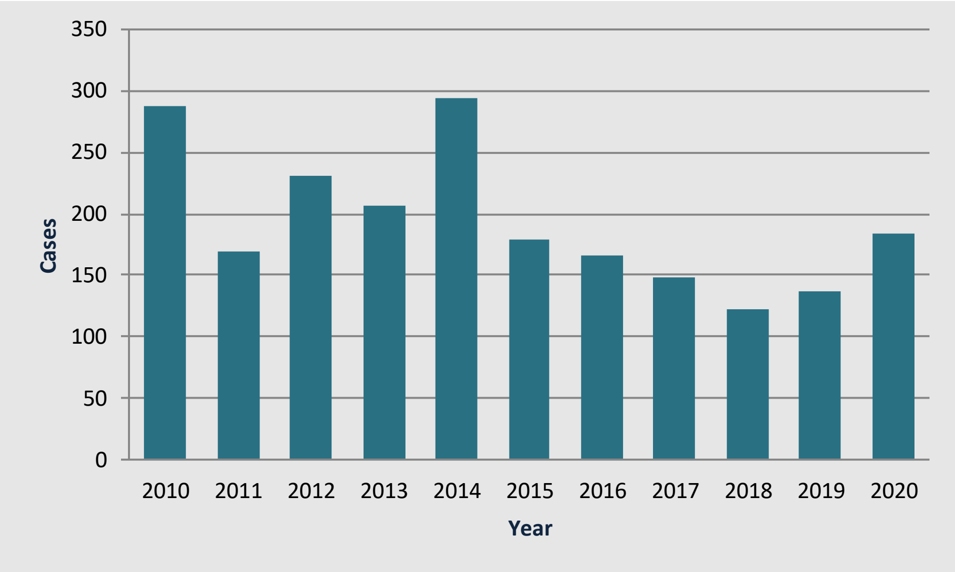


Figure 67: Outbreaks by year in the Auckland region (2010 – 2020)

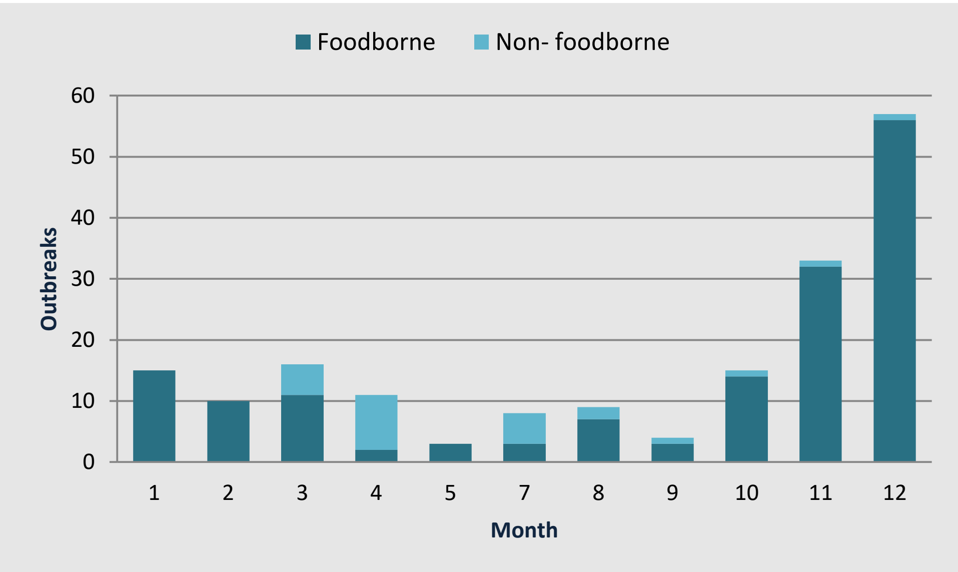


Figure 68: Outbreaks identified by ARPHS by month in the Auckland region (2020)

There were 13 different causative agents and these are shown in Table 84. In addition, there were 80 gastroenteritis cases of unknown cause (though the majority were presumed to be due to norovirus). Under normal circumstances these would have been investigated further to identify the causative agent, but this was not possible due to the large number of outbreaks and competing pressures caused by COVID-19. The remainder were from a small number of ILI outbreaks where the causative agent could not be investigated.

Table 84: Number of outbreaks identified by or reported to ARPHS (2015 – 2020)

Pathogen	2015	2016	2017	2018	2019	2020
Adenovirus			1		1	1
Astrovirus	1					
Bacillus				1		
Campylobacter	1		1	1	2	2
Ciguatera fish poisoning			1		1	
Clostridium	3			1	1	1
Cryptosporidium	12	19	17	1	4	
Giardia	27	18	11	2	1	2
Hepatitis A	1		3	1	1	
Histamine (scombroid) fish poisoning		1	1		2	1
Lead absorption	2	4	2	1	2	
Legionella	2					
Measles virus		1	1	1	3	
Mumps virus		1	3		1	
Mycobacterium tuberculosis	2	2	1		1	3
Neisseria meningitidis		1				
Norovirus	50	35	49	51	44	55
Pertussis			1	1		
Rotavirus				1	2	1
Rheumatic fever				1		
Rhinovirus						5
Salmonella	16	12	8	9	18	5
Sapovirus	1	7			1	2
Shigella	7	1	6	6	8	3
SARS-CoV-2						17
Staphylococcus	1					
Streptococcus (foodborne)					1	
Typhoid			1	2	1	
VTEC/STEC	11	9	7	12	8	4
Yersinia		1			2	
Unknown	40	54	36	34	32	80
Total	179	166	146	127	137	181

Of the 181 outbreaks, 156 were foodborne and the cause was found for 76 (49 per cent) of them.

8.1 Non-foodborne outbreaks

During COVID-19, extra surveillance of aged residential care facilities resulted in the reporting of Influenza Like Illness (ILI) within these facilities. This resulted in five outbreaks being reported, affecting a total of 50 residents. Once notified, all the affected cases had COVID-19 swabs followed by a respiratory panel in some circumstances. In most instances the respiratory panel indicated rhinovirus as the causative agent.

8.1.1 Mycobacterium tuberculosis

There were three reported outbreaks relating to tuberculosis, involving two, four and ten cases respectively. The transmission mode for all of these was household contacts.

8.1.2 COVID-19

There were 17 COVID-19 outbreaks due to SARS CoV2 in 2020. Of these 17, 11 were associated with 209 identified cases. There were another six outbreaks where the true numbers of cases could not be established (refer to Section 9 on COVID-19 for further information).

8.2 Foodborne outbreaks

Norovirus, salmonellosis, VTEC and shigellosis were responsible for the greatest number of outbreaks in 2020 (Table 85). In 2020 there were 80 outbreaks of gastroenteritis for which a cause could not be found or was not sought. We would expect the majority of these ‘unknown cause’ outbreaks to also be norovirus outbreaks as the majority occurred during December 2020 at a time when there was a regional increase in gastroenteritis outbreaks in ELS and primary schools.

Two outbreaks had an overseas origin. These were both small household outbreaks, one of salmonellosis in two people returning from Indonesia and one of VTEC affecting three people returning from Samoa.

Foodborne outbreaks are shown by size, disease, and the total number of cases in Tables 85 and 86.

Table 85: Foodborne outbreaks in the Auckland region by size and number of cases (2020)

Pathogen	Size of outbreak											Total
	2	3	4	5	6	7	8	9	10 to 19	20 to 49	50 to 100	
Adenovirus					1							1
Campylobacter			1						1			2
Clostridium									1			1
Giardia	2											2
Norovirus	1		2	1	1	4	1	2	22	20	2	56
Rotavirus										1		1
Salmonella	3				1				1			5
Sapovirus		1								1		2
Shigella	2				1							3
VTEC/STEC	1	1		1								3
Gastroenteritis - unknown cause	5	4	4	8	10	3	4	4	22	12	4	80
Total	14	6	7	10	14	7	5	6	47	34	6	156

Norovirus outbreaks caused illness in at least 1,110 people, well up from the 835 cases in 2019 and similar to the 1,339 cases in 2018 and 912 cases in 2017. Norovirus was responsible for the majority of outbreak-associated illness, and probably a good number of the 1,143 gastroenteritis cases where the pathogen was not confirmed.

Salmonella was found to be the source of four outbreaks (with 20 associated cases), well down on the 16 outbreaks with 145 cases in 2019.

Shigella was the identified source of ten cases across three outbreaks and there was only one small household typhoid outbreak involving two cases.

VTEC was responsible for three smaller outbreaks in 2020 involving ten people in total. One had its source overseas in Samoa affecting three people, the others were household outbreaks. Unfortunately, ESR was unable to provide serotyping for many of these cases.

Table 86: Foodborne outbreaks in the Auckland region by pathogen and number of cases (2020)

Pathogen	Total
Adenovirus	18
Campylobacter	14
Clostridium	14
Giardia	4
Norovirus	1110
Rotavirus	28
Salmonella	20
Sapovirus	33
Shigella	10
Typhoid	2
VTEC/STEC	10
Gastroenteritis - unknown cause	1143
Histamine (scombroid) fish poisoning	34
Vibrio parahaemolyticus	6
Total	2446

8.2.1 Adenovirus

This outbreak started in February 2020 at an ELS. In all, there were 18 cases notified from 70 individuals exposed over a 15-day period. Norovirus was also isolated from some stool specimens suggesting co-infection was likely. Cases presented with vomiting with or without diarrhoea, and several children relapsed, but it is not known whether this was a relapse of adenovirus or a new infection with co-circulating norovirus. The source was not found.

8.2.2 Campylobacteriosis

Campylobacteriosis outbreaks affected 14 individuals. One was a four-person outbreak in a long-term care facility, the other was from a school tramping trip affecting ten participants. This particular tramping trip has resulted in similar campylobacteriosis outbreaks in the past few years, thought to be due to the consumption of contaminated water during the outdoor pursuits.

8.2.3 Clostridium

This outbreak occurred following the consumption of a shared meal at a shooting club. It was typically toxin-like in its rapid onset (six to 12 hours). *Clostridium perfingens* was isolated from stool samples. Fourteen people were affected from the 30 people exposed and the source was deemed by MPI to be a chicken and leek pie contaminated with *Clostridium perfingens* (due to the lack of adequate temperature controls and storage overnight).

8.2.4 Norovirus

There were 56 identified norovirus outbreaks for 2020 across various settings. Two thirds (66 per cent) occurred in ELS, just over a quarter (27 per cent) occurred in long term care facilities, and the remainder occurred in eating establishments (4 per cent), at sports gatherings (2 per cent), and in households (2 per cent). The largest outbreak involved 77 people attending a conference dinner. There were 22 proven norovirus outbreaks numbering over 20 cases. Seventeen occurred in ELS, three were in long-term care facilities and the remaining two were linked to a restaurant/café and a catered event.

Gastroenteritis of unknown cause affected as many people (1,143). In the majority of situations norovirus was suspected but unable to be proven. In all, 80 outbreaks were identified and, of these, 55 per cent occurred in ELS and 34 per cent in long term care facilities. The largest outbreak was 87 cases in a primary school environment, and there were 15 other outbreaks with case numbers of more than 20 people. Thirteen of these were in ELS and a primary school, with the remaining two in a long-term care facility.

There was a dramatic increase in gastroenteritis in December 2020 (Figure 69).

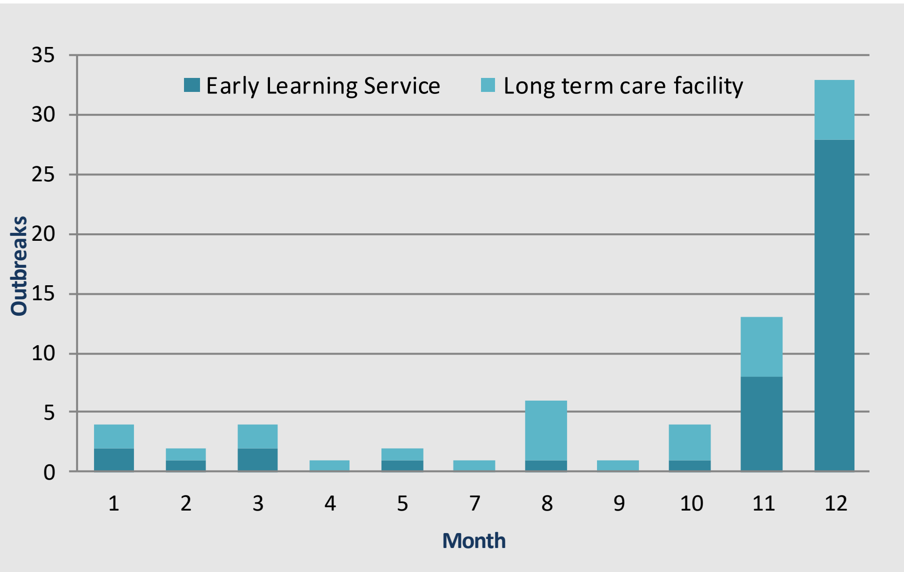


Figure 69: Norovirus and gastroenteritis-of-unknown-cause outbreaks in ELS and long-term care facilities by month, Auckland region (2020)

In response to this ARPHS implemented the following measures:

- Immediate site visits to the affected childcare centre
- Public health messaging via Ministry of Education, with a focus on:
    - Handwashing, in particular the importance of soap and water use rather than alcohol-based hand sanitiser
    - Hypochlorite use for cleaning and disinfection, including detailed advice on how to use hypochlorite products.

The outbreak source investigation revealed that during COVID-19 many institutions had begun using cleaning products that claimed to be (but weren't) superior to hypochlorite for negating COVID-19. In addition, in many centres, alcohol gels had replaced soap, water and paper towels for hand hygiene. Alcohol gels are not as effective against norovirus as the correct use of soap and water for handwashing and so a change in hand hygiene behaviour was required. Despite this, many services had persistent outbreaks and follow-up visits found that there were two main reasons for this:

- Inadequate concentration or miscalculation of hypochlorite concentrations
- Inadequate duration of hypochlorite application before rinsing off

The Christmas break helped ELS to carry out 'deep cleans' and implement correct measures and numbers of outbreaks fell quickly in the new year.

8.2.5 Rotavirus

A single outbreak affected 23 children and five staff, located across five areas of an ELS of 100 attendees and staff. This outbreak caused by rotavirus occurred in three waves over 25 days with staff members mostly affected in the third wave. Unfortunately, immunisation records of those unwell were unavailable. The overall attack rate was 28 of 100 attendees exposed (28 per cent). Overseas studies give attack rates of 69 per cent in unvaccinated children (Perez-Ortin et al, 2019).

8.2.6 Salmonella

There were four salmonellosis outbreaks in 2020. All were related to households and involved a small number of cases where incriminated food was prepared in the home, purchased elsewhere, and consumed at home, or consumed outside the home but confined just to the household member.

Two outbreaks incriminated the consumption of raw fish and shellfish and another undercooked chicken. One raw fish outbreaks identified S. *Typhimurium* ST19 as the causative agent and the other *S. Typhiumurium* ST2297. The undercooked chicken outbreak involving just two family members was *S. Typhimurium* ST19.

The fourth outbreak involved a farming family where there were multiple risk factors including pet dogs and chickens. It was believed there was secondary person to person spread and the serotype was *S. typhimurium* ST2297.

8.2.7 Sapovirus

There were two sapovirus outbreaks for the year; one small household outbreak with three associated cases and a larger outbreak of 30 cases in an ELS of 114 children and staff. The second larger outbreak was reported in early December 2020. It occurred in three waves over four weeks and involved 28 children and two staff members. The overall attack rate was 26 per cent.

8.2.8 Shigella

Three Shigella outbreaks were reported. Two were caused by *Shigella sonnei* and one was *Shigella flexneri* 1A. The *Shigella flexneri* outbreak involved only two household members and was thought to be transmitted through person-to-person transmission.

One *Shigella sonnei* outbreak was acquired overseas in Indonesia and involved two people, while the other involved six household members who had been swimming in a small portable swimming pool that may have been inadequately disinfected for the number of people using it.

8.2.9 Typhoid

This was a two-person outbreak in a family of six. The source was thought to be an aunt visiting from Samoa with food acquired overseas. Fortunately, only two family members became infected.

8.3 National foodborne outbreaks

8.3.1 Scombroid

As mentioned in Section 5.4 there were 59 notifications for gastroenteritis due to foodborne intoxication. Two key outbreaks were identified. One occurred in November 2020 and was a scombroid-like illness associated with the consumption of contaminated trevally, affecting 34 people in the Auckland region people and 91 people country wide. The source was attributable to a home delivery meal kit company.

8.3.2 Vibrio parahaemolyticus

The other outbreak involved seven cases of *Vibrio parahaemolyticus* that were linked to the consumption of New Zealand-grown mussels from the Pelorus Sound.

8.4 Foodborne outbreak settings

ELS experienced the greatest number of foodborne outbreaks in 2020, with 85 outbreaks involving 1523 children and staff. This is well up on the typical 20 to 25 outbreaks seen each year, which would on average have around 300 to 400 cases. The reason for this is discussed above in 8.2.4.

Long term care facilities had the next largest number of outbreaks (43) involving 471 residents. This is also slightly up on 2019 and 2018. Outbreaks in the home (13) were down on previous years and involved a smaller number of cases (44) (Tables 87 and Table 88).

Table 87: Foodborne outbreaks in the Auckland region by setting and number of cases (2020)

Setting	No. of outbreaks	Total no. of cases
Catered event	1	77
Community, church, sports gathering	1	14
ELS	85	1,523
Household	13	49
Long-term care facility	43	471
Other food outlet	1	5
Other institution	1	4
Overseas	2	5
Restaurant/cafe/bakery	4	64
School	2	98
School camp	1	10
Take away food outlet	1	2
Total	156	2,322

There were 14 outbreaks involving only two cases, six of which were in a household and three in an ELS. However, 2020 will be remembered not just for COVID-19, but for the large number of ELS and primary school norovirus outbreaks. These involved more than 1,600 children and staff due to well-intentioned changes in disinfection processes and hand hygiene behaviour (Table 88).

Table 88: Number of foodborne outbreaks by setting and size in the Auckland region (2020)

Setting	Size of outbreak										
	2	3	4	5	6	7	8	9	10 to 19	20 - 49	50 - 100	Total
Catered event											1	1
Childcare centre	3	1	2	3	7	4	3	6	25	28	3	85
Community, church, sports gathering									1			1
Household	6	2	1	1	2				1			13
Long-term care facility	2	2	4	5	4	3	2		16	5		43
Other food outlet				1								1
Other institution			1									1
Overseas	1	1										2
Restaurant/cafe/bakery	1				1				2	1		5
School									1		1	2
School camp									1			1
Takeaway food outlet	1											1
Total	14	6	8	10	14	7	5	6	47	34	5	156

In the household setting, the largest outbreak involved 10 cases. In the restaurant setting, the largest outbreak affected 25 people.

Catered events are typically responsible for a small number of the larger outbreaks, but this did not occur to the same extent in 2020 with only one event involving 76 cases. This was presumably due to the restrictions on large gatherings.

There were no hospital-based outbreaks.

There were five outbreaks involving 50 or more cases, and these were seen in the following settings:

- Three outbreaks in ELS involving 51, 58 and 60 cases respectively, caused by norovirus or norovirus-like illnesses.
- One primary school outbreak involving 87 cases.
- A catered event caused by norovirus (mentioned above)

Table 89 shows the spectrum of pathogens in various settings, with the widest spectrum in the ELS and the household. A pathogen was able to be determined in 51 per cent of outbreaks. This percentage is down on the 75 per cent in 2019 due to the large number of gastroenteritis outbreaks that occurred during December 2020. The priority was to undertake site visits and provide recommendations for disinfection and hygiene rather than stool sampling of cases in every outbreak.

Table 89: Number of foodborne outbreaks in each exposure setting, by pathogen, in the Auckland region (2020)

	Pathogen												
Setting	Adenovirus	Campylobacter	Clostridium	Giardia	Norovirus	Rotavirus	Salmonella	Sapovirus	Shigella	VTEC/STEC	Gastro. - unknown cause	Typhoid	Total
Catered event					1								1
Early Learning Services	1			1	37	1		1			44		85
Community, church, sports gathering			1										1
Household				1	1		4	1	2	2	1	1	13
Long term care facility		1			15						27		43
Other food outlet											1		1
Other institution											1		1
Overseas									1	1			2
Restaurant/cafe/bakery					2						3		5
Primary School											2		2
School Camp		1											1
Take away food outlet											1		1
Total	1	2	1	2	56	1	4	2	3	3	80	1	15 6

9 COVID-19

Key points

- The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).
- The virus was first identified in December 2019 in Wuhan, China. The World Health Organization (WHO) declared a Public Health Emergency of International Concern regarding COVID-19 on 30 January 2020, and later declared a pandemic on 11 March 2020.
- Symptoms of COVID-19 are mainly respiratory, although highly variable, ranging from none to life-threateningly severe. Transmission of COVID-19 occurs when people are exposed to virus-containing respiratory droplets exhaled by an infected person. Those droplets may be inhaled or may reach the mouth, nose, or eyes of a person through touching or direct deposition (i.e. being coughed on).
- The risk of infection is highest when people are in close proximity for a long time, but droplets can be inhaled over longer distances, particularly indoors in poorly-ventilated and crowded spaces. In those conditions small particles can remain suspended in the air for minutes to hours. Touching a contaminated surface or object may lead to infection although this does not contribute substantially to transmission. People remain contagious for up to 20 days, and can spread the virus even if they do not develop any symptoms.
- Recommended preventive measures include physical distancing, wearing face masks in public, ventilation and air-filtering, hand washing, covering coughs and sneezes, disinfecting surfaces, and monitoring and self-isolation for people exposed or symptomatic. Several vaccines have been developed and widely distributed since December 2020. Current treatments focus on addressing symptoms, but work is underway to develop medications that inhibit the virus. Authorities worldwide have responded by implementing travel restrictions, lockdowns/quarantines, workplace hazard controls, and business closures. Numerous jurisdictions have also worked to increase testing capacity and trace contacts of the infected.
- The pandemic has resulted in significant global social and economic disruption, including the largest global recession since the Great Depression. In 2020 and beyond it led to widespread supply shortages exacerbated by panic buying, agricultural disruption, and food shortages. However, there were also decreased emissions of pollutants and greenhouse gases. In 2020 numerous educational

institutions and public areas were partially or fully closed, and many events were cancelled or postponed. Misinformation has circulated through social media and mass media.

- The pandemic raised issues of racial and geographic discrimination, health equity, and the balance between public health imperatives and individual rights.

For the whole of New Zealand there were 2,176 detected cases of COVID-19 for the year. In the Auckland region there were 1,068 cases detected which was nearly half of the total (49 per cent). This includes cases in MIFs and cases in the community. The Auckland region incidence rate was 62 cases per 100,000, nearly double the rate for the rest of New Zealand (34 per 100,000). The hospitalisation rate was 6 per cent overall and there were six deaths in the Auckland region bringing the case fatality rate to 0.6 per cent.

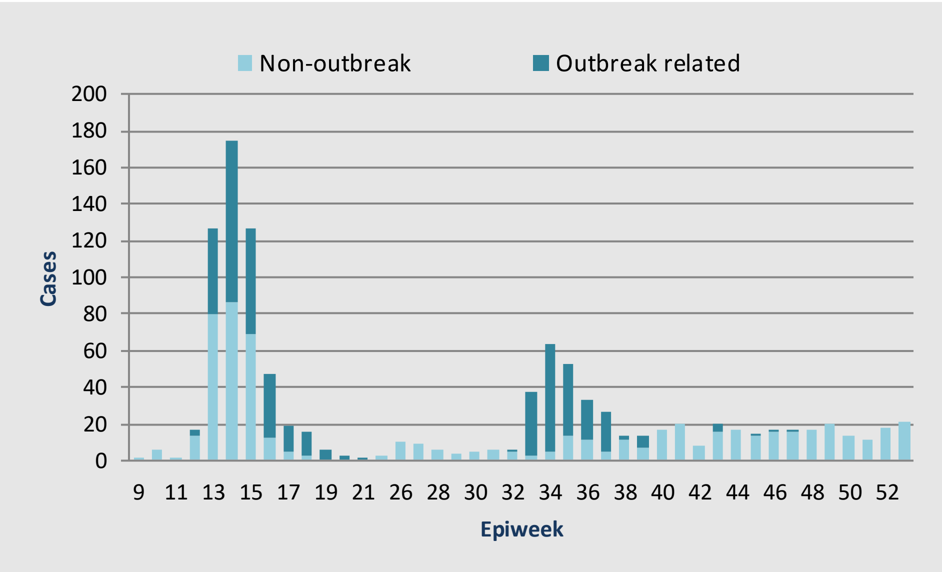


Figure 70: COVID-19 cases in the Auckland region (2020)

The first case of COVID-19 in New Zealand was reported on 26 February 2020 in a resident returning from Iran via Dubai and Indonesia. The rest of the year was characterised by two main peaks, with 17 outbreaks involving 25 clusters (Figure 71).

There were 40 outbreaks across New Zealand for the year and many of these included Auckland residents and linkages.

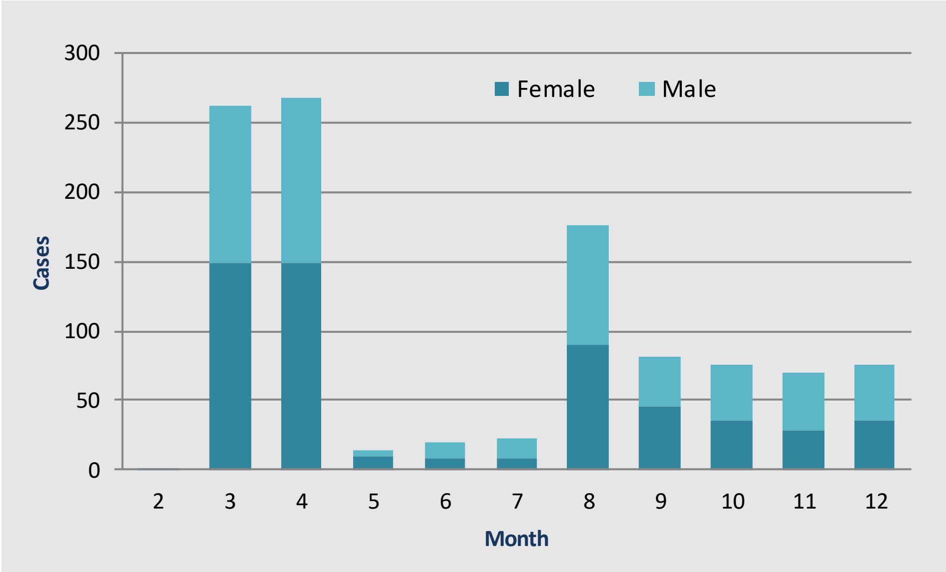


Figure 71: Monthly distribution of COVID-19 cases in the Auckland region (2020)

The highest age-specific rate was seen in the 20- to 29-year-old age group, followed by the 30- to 39-year-old age group. The 40- to 69-year-old age group was next at approximately two thirds the incidence rate of the 20- to 29-year-old group. The ratio of male to female cases was very similar across the age groups, at approximately 1:1 (Table 90 and Figure 72).

Table 90: Age and gender distribution and age-specific incidence rates of COVID-19 in the Auckland region (2020)

Age Group	Female	Male	Total	Rate per 100,000*
<1	2	5	7	32.3
1 to 4	10	15	25	28.9
5 to 9	13	15	28	24.2
10 to 14	38	24	62	54.9
15 to 19	41	18	59	53.9
20 to 29	141	116	257	93.5
30 to 39	106	97	203	74.0
40 to 49	72	78	150	66.0
50 to 59	72	59	131	61.4
60 to 69	44	57	101	64.1
70+	20	25	45	30.8
Total	559	509	1068	61.4

* Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand).

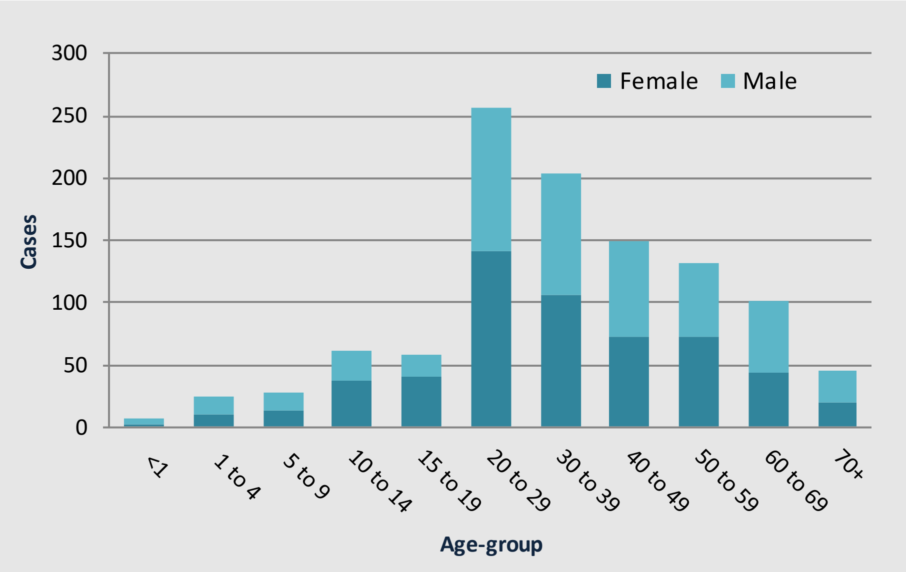


Figure 72: COVID-19 case notifications of cases by age and gender in the Auckland region (2020)

Ethnic-specific disease rates were highest in the Middle Eastern/Latin American/African ethnic group and were almost double the incidence rate of the next highest groups of Asian and Pacific Peoples (Table 91). From a geographic perspective, the Counties Manukau DHB population was most severely affected, with 67 per cent of cases occurring in this area. It is likely disease spread was facilitated by socioeconomic factors such as poverty, crowded housing, and working in border-facing roles.

Table 91: Ethnic group distribution and incidence rates of COVID-19 in the Auckland region (2020)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	158	137	295	61.0
European or Other	240	225	465	51.9
Māori	49	43	92	47.1
Middle Eastern / Latin American / African	25	29	54	137.6
Pacific Peoples	85	73	158	60.4
Unknown	2	2	4	-
Total	559	509	1,068	61.4

* Rates are based on 2020 projected mid-year population, ethnicity is Total Response (Source: Statistics New Zealand)

Of the 1068 cases, 65 (6.1 per cent) were hospitalised. The number and total percentage of cases hospitalised is shown in Table 92.

Those cases aged 70 plus were more likely to be hospitalised, with 36 per cent of this age group requiring admission. This was followed by the 50 to 59 and 60- to 69-year-old age groups, but at about a third the rate (11 per cent and nine per cent respectively). For those under the age of 50 only four per cent were admitted to hospital.

Table 92: Hospitalisation by age group and gender for COVID-19 in the Auckland region (2020)

Age group	Female	Male	Hospitalised	Total cases for age group	Hospitalised (%)
15 to 19	2		2	59	3
20 to 29	4	1	5	257	2
30 to 39	3	6	9	203	4
40 to 49	5	5	10	150	7
50 to 59	9	5	14	131	11
60 to 69	4	5	9	101	9
70+	9	7	16	45	36
Total	36	29	65	1,068	6

There were six deaths in the Auckland region giving an overall case fatality rate (CFR) of 0.6 per cent. Of the six deaths, five were in those aged 70-plus, giving a CFR of 11 per cent for that age group. The remaining death was a 50- to 59-year-old case, which gives a CFR of 0.8 per cent. Four of the deaths were females and two were male.

Overseas travel was the source of infection in 538 cases. The source countries are shown in Table 93.

Table 93: Last country departure of overseas-acquired COVID-19 in Auckland region (2020)

Source Country	Total
United Arab Emirates	99
Australia	90
United States of America	86
Malaysia	66
India	58
Qatar	37
Singapore	32
Hong Kong	16
Canada	12
United Kingdom	10
Indonesia	9
Chile	5
Philippines	3
Argentina	2
Taiwan	2
Saudi Arabia	1
Thailand	1
Scotland	1
England	1
Mexico	1
Ireland	1
China	1
Portugal	1
Japan	1
Afghanistan	1
South Korea	1
Total	538

The majority of the top six 'Last Countries' act as hubs for returning travellers and are not necessarily the source country, though there is further opportunity for exposure either during the stopover or in flight. Table 94 shows the source countries feeding these hubs for these travellers.

Table 94: Previous countries for overseas-acquired COVID-19 cases passing through international travel hubs, Auckland region (2020)

Travel hub	Previous country	Total
United Arab Emirates	United Kingdom	26
	England	11
	Pakistan	9
	India	9
	Afghanistan	5
	Ireland	4
	Ukraine	4
	Germany	4
	South Africa	3
	Ethiopia	3
	Russia	2
	Iran	2
	Belgium	2
	Bangladesh	2
	Netherlands	2
	Uzbekistan	1
	Kenya	1
	Switzerland	1
	Zimbabwe	1
	Jordan	1
United Arab Emirates Total		93
Australia	Qatar	49
	United States of America	11
	Uruguay	6
	Japan	4
	United Arab Emirates	4
	Singapore	2
	New Zealand	2
	Indonesia	1
	Fiji	1
Australia Total		80
Malaysia	United Arab Emirates	59
	United Kingdom	5
	India	1
	Turkey	1
Malaysia Total		66
United States of America	United States of America	33
	United Kingdom	4
	England	4
	New Zealand	2
	Mexico	1
	Virgin Islands, United States	1
	Turks and Caicos Islands	1
	Panama	1
United States of America Total		47

Qatar	United Kingdom	17
	England	6
	Spain	3
	Turkey	2
	Italy	1
	Sweden	1
	Germany	1
	France	1
	Ireland	1
	Iran	1
	Afghanistan	1
	Iraq	1
Qatar Total		36
Singapore	India	9
	England	5
	Netherlands	4
	United Kingdom	4
	Italy	3
	Viet Nam	2
	Thailand	1
	Indonesia	1
	France	1
	Hong Kong	1
	Spain	1
Singapore Total		32
Hong Kong	Philippines	9
	United Kingdom	2
	England	2
	China	1
	Canada	1
	Switzerland	1
Hong Kong Total		16

9.1 COVID-19 outbreaks

The COVID-19 pandemic has resulted in multiple outbreaks and multiple clusters within those outbreaks. The Auckland region experienced 17 outbreaks ranging in size from two to 178 with the average size being 26 cases. There were five outbreaks of more than 30 cases and this required a major surge in the public health response. These outbreaks are shown by month in Table 97.

The largest outbreak was the August community outbreak, comprising 178 cases and 17 clusters. Cluster sizes varied from one to 33 and included secondary cases in households, workplaces and church gatherings. Of the six larger clusters of 10 or more, four were from church settings, one was the initial workplace and the other was the households of this workplace.

The August community outbreak required an all of ARPHS response including intensive efforts in outbreak investigation and control. Clear epidemiological links back to the border were also not identified.

9.2 Whole Genome Sequencing

For the August community outbreak whole genome sequencing (WGS) performed by ESR revolutionised case and contact management and source investigation. In late July 2020, ESR conducted routine sequencing of all samples and, from these, important linkages, were identified. These informed important response decisions such as the use of lockdowns and the management of contact groups.

COVID-19 lineage

WGS performed on cases up to the end of August were in the majority B1 or B1.1.1 but by October, new variants were being detected and by mid-November, three B1.1.7. genomes ('UK Strain', now formally called the alpha strain) were identified in Russian fishermen and continued to be detected throughout December. In addition, the first B1.351 ('South African Strain', now formally called the beta strain) was detected in late December (Figure 73).

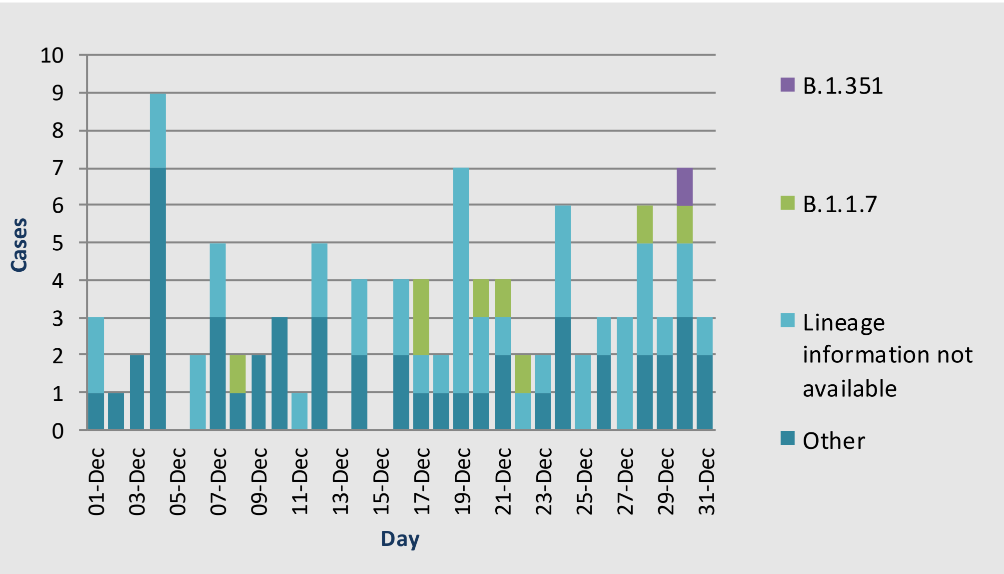


Figure 73: Emergence of new COVID lineages by sequence. New Zealand (2020)

Source: ESR

10 Sexually transmitted infections

ESR operates sexually transmitted disease laboratory surveillance for gonorrhoea, chlamydia and syphilis. All of the charts and tables in this section are derived from ESR data.

Key points

- Syphilis has trended downwards since early 2019. The largest drop in syphilis has been in the MSM community.
- There has been a gradual increase in gonorrhoea since 2014. Notifications during the first quarter of 2020 were up 14 per cent on the same period in 2019. Most vulnerable were young Māori and Pacific females. COVID lockdown during the second quarter resulted in a short sharp drop in notifications but this decrease was not sustained and a rebound was observed in the third quarter. Notifications then levelled off for the fourth quarter.
- There has also been a slow increase in chlamydia since 2014 but notifications in the first quarter of 2020 were down 7.6 per cent on the same period in 2019. There was a sharp drop in cases notified in the second quarter of 2020 but the third and fourth quarters saw notifications increasing again (though not to the levels seen for the same period in 2019).

Impact of COVID on sexually transmitted diseases

Towards the end of the first quarter of 2020 the first COVID-19 case was reported in New Zealand. This was followed by Level 4 and Level 3 lockdowns that significantly impacted the movements of people, and their access to testing and health seeking behaviour. It is also likely there was an impact on contact with others and sexual behaviour over this time.

There was a reduction in face-to-face consultations with increased telephone triaging to prioritise symptomatic patients and innovative use of technology to facilitate remote consultations, with procedures varying between DHBs and between services (sexual health clinics, general practices and Family Planning).

Due to the demand on laboratory resources for COVID-19 testing, chlamydia and gonorrhoea testing was restricted from late March in most DHBs. In many DHBs, at least for part of Q1 and Q2, no asymptomatic screening for chlamydia and gonorrhoea was available, and clinical indications for testing were restricted. People may also have been less likely to seek care during this time.

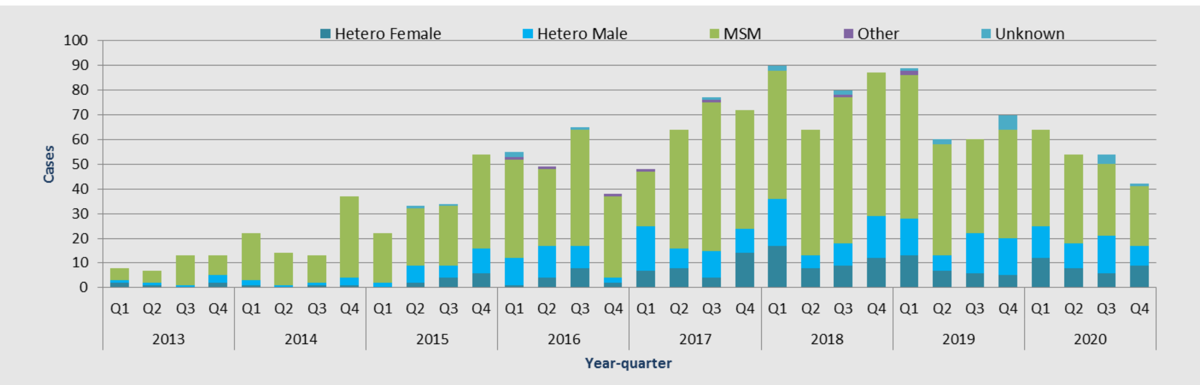
There was an observed decrease in chlamydia and gonorrhoea cases in Q1 and Q2 of 2020 and this is likely to be the result of this reduced testing. The actual number of new infections is also likely to have decreased as a result of COVID-19 restrictions and social interaction.

The drop in notifications was less pronounced with new syphilis cases, as syphilis serology testing continued throughout alert level changes, including the three-monthly screening for men who have sex with men (MSM) and are on HIV pre-exposure prophylaxis (PrEP) in some centres. ESR data utilises quarterly rolling 12-month case counts (for syphilis) or rates per 100,000 (for gonorrhoea and chlamydia) which provide better insights into slow-moving trends.

10.1.1 Syphilis

Syphilis is a sexually transmitted infection caused by the bacterium *Treponema pallidum*, subspecies *pallidum*. The signs and symptoms of syphilis vary depending in which of the four stages it presents (primary, secondary, latent and tertiary). Syphilis is most commonly spread through sexual activity but may also be transmitted from mother to baby during pregnancy or at birth, resulting in congenital syphilis. The incubation period for syphilis can range from 10 to 90 days so any changes may take some months to become apparent.

Auckland region syphilis notifications have been levelling off since the second quarter of 2019, and this trend continued throughout 2020 (Figure 74). The largest drop in notifications has been in the MSM community and this has also been observed nationally.



Source: ESR

Figure 74: Quarterly distribution of syphilis cases by sexual behaviour in the Auckland region (2013 – 2020)

There were 214 syphilis notifications in the Auckland region for 2020, a rate of 12.3 per 100,000 population compared with 8.6 per 100,000 for the rest of New Zealand.

Syphilis testing, including three-monthly screening for MSM on PrEP, continued online in Auckland DHBs throughout the year. However, it is uncertain whether there was consistent testing to access PrEP, so the observed changes are most likely due to changes in social interaction and willingness to seek help from clinics and medical professionals.

The number of syphilis notifications amongst women has remained fairly constant throughout 2019 and 2020. These cases are usually identified as part of routine antenatal and perinatal testing and this would suggest that testing has continued at similar levels throughout 2020. Proportionately, however, heterosexual case numbers are increasing due to a drop in absolute case numbers in the MSM population.

The age specific incidence was highest in the 30- to 39-year-old age group followed by the 20- to 29-year-old age group (Table 95).

Table 95: Age-gender distribution and age-specific incidence rates of syphilis in the Auckland region (2020)

Age group	Female	Male	Total	Rate per 100,000*
15-19	2	6	8	7.2
20-29	13	53	66	23.7
30-39	12	65	77	28.4
40-49	8	24	32	14.1
50+	2	28	30	5.8
Total	37	177	214	12.3

* Rates are based on 2020-estimated mid-year population from Statistics New Zealand

Source: ESR

The highest incidence was seen in the European or Other ethnic group, followed closely by Māori and Pacific Peoples. ESR reports there has been an approximately 50 per cent relative decrease in syphilis notifications among those of European or Other ethnicity (52 per cent decrease) and those of Māori (55 per cent decrease) ethnicity since 2019 Q1, and these decreases carried forward through the COVID-19 lockdowns (Table 96).

Ideally we should compare rates by gender or sexual behaviour, as the overall objective is to identify the different transmission dynamics between MSM and heterosexuals, plus any related equity issues. Time limitations have prevented this for 2020 but attempts will be made for such an analysis in 2021.

Table 96: Ethnic distribution and gender-specific incidence rates of syphilis in the Auckland region (2020)

Ethnicity	Female	Male	Total	Rate per 100,000*
Asian	2	25	27	5.2
European or Other	19	105	124	15.8
Māori	10	20	30	14.9
Pacific	5	26	31	13.3
Unknown	1	1	2	-
Total	37	177	214	12.3

* Rates are based on Ministry of Health Prioritised Population Projection off 2018 base from Statistics New Zealand

Source: ESR

10.1.2 Gonorrhoea

Gonorrhoea is a sexually transmitted infection (STI) caused by the bacterium *Neisseria gonorrhoeae.* It is spread through sexual contact with an infected person. This includes oral, anal and vaginal sex. It can also spread from a mother to a neonate during birth.

There were 3,877 notifications of gonorrhoea in the Auckland region in 2020, similar to the 3,913 reported in 2019. This is an incidence of 222 per 100,000 population compared with 115 per 100,000 for the rest of New Zealand.

Notifications have been steadily increasing since 2016 but the second quarter of 2020 showed a decrease in notifications associated with COVID-19 restrictions. This was followed by a rebound in the third quarter and a further decrease in the fourth quarter during the August COVID-19 outbreak (Figure 75). The data quality for sexual behaviour in gonorrhoea is inconsistent.

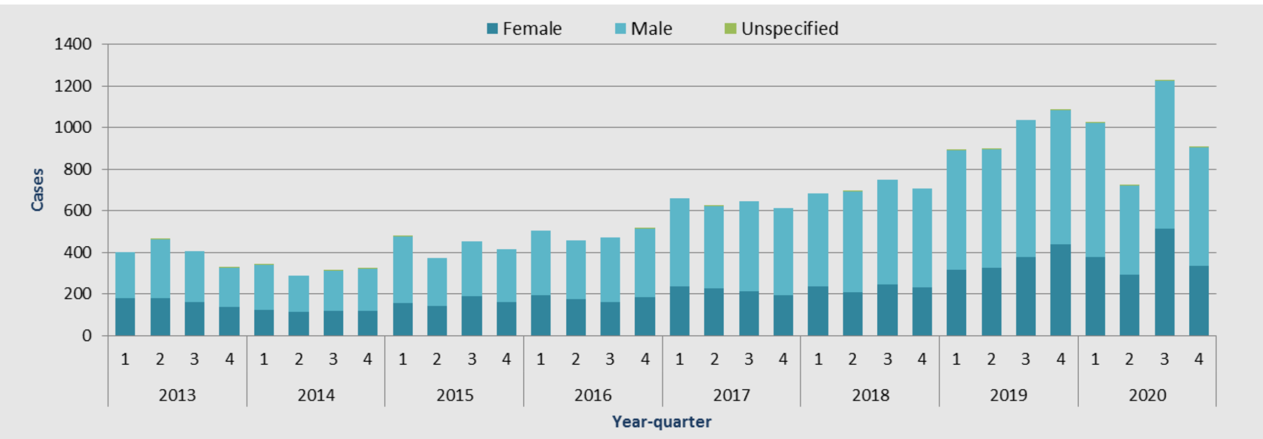


Figure 75: Quarterly distribution by gender of gonorrhoea cases in the Auckland region (2013-2020)

The age specific incidence was highest in the 20- to 29-year-old age group followed by the 30- to 39 then 15- to 19-year-old age groups. This is a slightly younger age distribution compared to syphilis. The ratio of females to males across the age groups was 0.6:1 though this is dramatically reversed for under 15- to 19-year-old females where the ration of females to males reported was 1.5:1 (Table 97).

Table 97: Age-gender distribution and age-specific incidence rates of gonorrhoea in the Auckland region (2020)

Age group	Female	Male	Unspecified	Total	Rate per 100,000*	F : M Ratio
0-14	31	7		38	12.1	4.4 : 1
15-19	302	196	1	499	446.7	1.5 : 1
20-29	736	1079	2	1817	653.3	0.7 : 1
30-39	329	658		987	363.9	0.5 : 1
40-49	91	254	2	347	153.1	0.4 : 1
50+	35	153		188	36.3	0.2 : 1
Unknown			1	1		
Total	1524	2347	6	3877	222.6	0.6:1

*Rates are based on 2020-estimated mid-year population from Statistics New Zealand.

Source: ESR

Ethnic specific rates were highest in Māori and Pacific ethnicities. Young Māori females aged 15 to 19 are the most vulnerable group, with female to male ratios at 3:1 compared with the overall ratio in that group of half that, 1.5:1 (Table 98).

Table 98: Ethnic distribution and gender-specific incidence rates of gonorrhoea in the Auckland region (2020)

Ethnicity	Female	Male	Unspecified	Total	Rate per 100,000*	F : M Ratio
Asian	78	387	1	466	88.9	0.2 : 1
European/Other	279	946	2	1227	156.8	0.3 : 1
Māori	654	454		1108	548.5	1.4 : 1
Pacific	505	539		1044	448.5	0.9 : 1
Unknown	8	21	3	32		
Total	1524	2347	6	3877	222.6	0.6 : 1

*Rates are based on Ministry of Health Prioritised Population Projection off 2018 base from Statistics New Zealand.

Source: ESR

10.1.3 Chlamydia

Chlamydia infection is a sexually transmitted infection caused by the bacterium *Chlamydia trachomatis*. Most people who are infected have no symptoms. Symptoms may occur only several weeks after infection; the incubation period between exposure and being able to infect others is thought to be around two to six weeks.

There were 9,373 notifications of chlamydia in the Auckland region in 2020, the lowest number of notifications since 2016 and 22 per cent down on the 11,402 reported in 2019. This is an incidence rate of 538 per 100,000 population for the Auckland region compared with 507 per 100,000 for the rest of New Zealand.

Notifications have been slowly increasing since 2013 but the second quarter of 2020 showed a dramatic drop in notifications associated with COVID-19 restrictions. This was followed by a rebound in the third quarter but not quite to the same level as seen prior to COVID-19 (Figure 76).

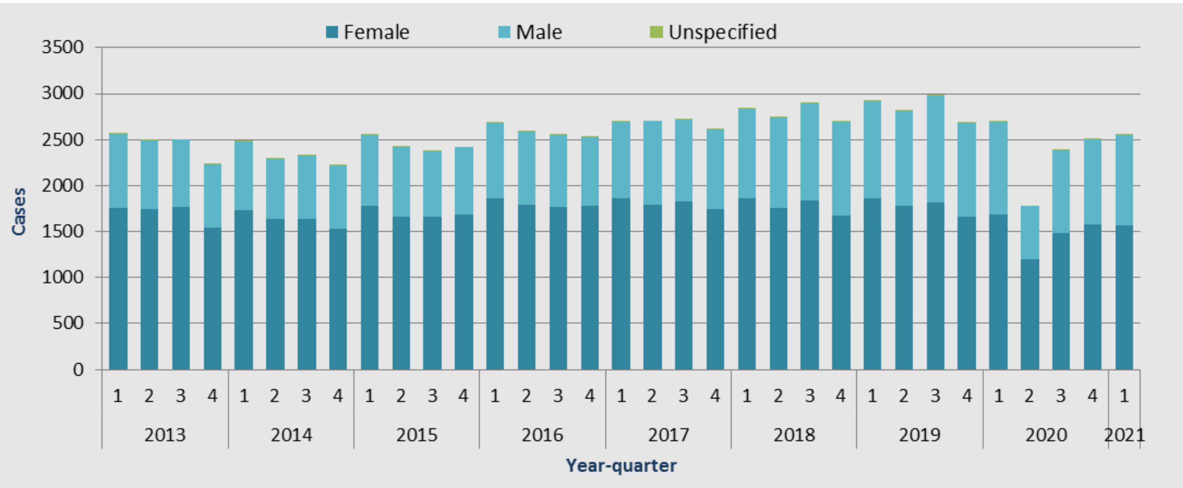


Figure 76: Quarterly distribution by gender of chlamydia cases in the Auckland region (2013 – 2020)

The age-specific incidence was highest in the 20- to 29-year-old age group where the ratio of female to male notifications was 2:1. This was followed by the 15- to 19-year-old age group, where the female to male ratio was 3.2:1. It's of interest that the 30 to 49 year age group have a female to male ratio approaching 1:1, with the 50 plus age group then exhibiting higher case numbers in males (Table 99).

Table 99: Age and gender distribution and age-specific incidence rates of chlamydia in the Auckland region (2020)

Age group	Female	Male	Unspecified	Total	Rate per 100,000*	F : M Ratio
0-14	60	17	1	78	23.3	3.5 : 1
15-19	1335	423		1758	1573.9	3.2 : 1
20-29	3387	1726	6	5119	1840.6	2.0 : 1
30-39	870	814	1	1685	621.2	1.1 : 1
40-49	218	261		479	211.3	0.8 : 1
50+	66	188		254	49.0	0.4 : 1
Total	5936	3429	8	9373	538.3	1.7 : 1

*Rates are based on 2020-estimated mid-year population (Source: Statistics New Zealand).

Source: ESR

The ethnicity-specific incidence is highest in Māori and Pacific Peoples where nearly three times more females are notified than males. In the 15 to 19 year age group for Māori females the ratio peaks at 3.7:1 (Table 100).

Table 100: Ethnic distribution and gender-specific incidence rates of chlamydia in the Auckland region (2020)

Ethnicity	Female	Male	Unspecified	Total	Rate per 100,000*	F : M Ratio
Asian	607	519	1	1127	215.0	1.2 : 1
European/Other	1368	1383	3	2754	352.0	1 : 1
Māori	1937	666	1	2604	1289.0	2.9 : 1
Pacific	1957	817		2774	1191.8	2.4 : 1
Unknown	67	44	3	114		1.5 : 1
Total	5936	3429	8	9373	538.3	1.7 : 1

*Rates are based on Ministry of Health Prioritised Population Projection off 2018 base (Source: Statistics New Zealand)

Source: ESR

10.1.4 AIDS

HIV/AIDS surveillance is undertaken by the AIDS Epidemiology Group, Department of Preventive and Social Medicine at the University of Otago's Dunedin School of Medicine. For 2020 reporting please refer to **www.otago.ac.nz/aidsepigroup.**

11 Immunisation programme

New Zealand's childhood immunisation programme (Table 105) offers vaccination against:

- tuberculosis (for high risk groups, when vaccine is available)
- rotavirus
- hepatitis B
- diphtheria
- pertussis
- tetanus
- poliomyelitis
- *Haemophilus influenzae B*
- Measles
- Mumps
- Rubella
- Varicella
- pneumococcal disease
- human papillomavirus
- influenza (high risk groups)
- zoster for the 65-year-old-plus age group

Changes were made to the schedule in October 2020 (Table 101). The immunisation data utilised in this chapter was provided by Ministry of Health.

Key points

- Compared to 2019, 2020 saw a small increase in the Auckland region's immunisation coverage. Compared to 2016, vaccines were less frequently 'on time' over 2017 and 2018 in Māori and Pacific ethnic groups. This trend reversed slightly in 2019, perhaps due to media coverage associated with the measles outbreak and immunisation, but this was not sustained into 2020 and timeliness may well have been affected by the impact of COVID-19.
- Between 2012 and 2015 immunisation coverage at two years old, by ethnic group, showed a gradual improvement. This was followed by a reduction, so that the Asian ethnic group was the only one to sit above the government target of 95 per

cent. In 2020 there was a slight increase in coverage across the ethnic groups, except for Māori.

- Immunisation timeliness at five years old showed continuous improvement between 2012 and 2017, both in Auckland and the rest of New Zealand. This was followed by a drop in coverage, which fortunately levelled out across all ethnicities in 2018. 2019 showed a promising improvement for Māori. In 2020 there was some improvement in immunisation timeliness seen in non-Māori ethnic groups, but for Māori there has been a small decline.
- Parents have the right to opt-off the National Immunisation Register (NIR). This means that any future immunisations their child receives will not be recorded on the NIR, although their child is still included in the number eligible for immunisation. Parents are also able to decline immunisation, and this is recorded on the child's individual record on the register. Again, the child is still included in the number eligible for immunisation.
- In 2020, the national opt-off percentage remained low at 0.5 per cent by two years of age. The decline rate ranged from 4.8 per cent to 5.7 per cent, and was lowest at age 12 months (4.4 per cent). This increased to five per cent by 18 months, and 5.7 per cent by five years of age. The decline rate was up fractionally on 2019, which was also up slightly on the 2017 and 2018 data. Immunisation coverage of 95 per cent or higher is required for effective control of most vaccine preventable diseases; national targets are set at this level.

Table 101: New Zealand Immunisation Schedule to September 2020

Age	Diseases covered and vaccines
Pregnancy	Tetanus/Diphtheria/Pertussis (BOOSTRIX™)
	Influenza - 1 Injection
6 weeks	Rotavirus oral (Rotarix®)
	Diphtheria/Tetanus/Pertussis/Polio/Hepatitis B/*Haemophilus influenzae* type b (INFANRIX® -hexa)
	Pneumococcal PCV10 (SYNFLORIX®)
3 months	Rotavirus oral (Rotarix®)
	Diphtheria/Tetanus/Pertussis/Polio/Hepatitis B/*Haemophilus influenzae* type b (INFANRIX® -hexa)
	Pneumococcal PCV10 (SYNFLORIX®)
5 months	Diphtheria/Tetanus/Pertussis/Polio/Hepatitis B/*Haemophilus influenzae* type b (INFANRIX® -hexa)
	Pneumococcal PCV10 (SYNFLORIX®)
15 months	*Haemophilus influenzae* type b (HIBERIX®)
	Measles/Mumps/Rubella (M-M-R PRIORIX®)
	Varicella (Varilrix®)
	Pneumococcal PCV10 (SYNFLORI ®)
4 years	Diphtheria/Tetanus/Pertussis/Polio (INFANRIX™-IPV)
	Measles/Mumps/Rubella (M-M-R PRIORIX®)
11 years	Tetanus/Diphtheria/Pertussis (BOOSTRIX™)
12 years	Human papillomavirus - 2 doses given over 6 months (GARDASIL 9®)
45 years	Diphtheria/Tetanus (ADT™ Booster)
65 years	Diphtheria/Tetanus (ADT™ Booster)
	Shingles vaccine (Zostavax®)
	Influenza - 1 Injection (annually)

From October 2020 the following changes were made to the Schedule (Table 102).

Table 102: New Zealand Immunisation Schedule from October 2020

Age	Diseases covered and vaccines
Pregnancy	Influenza
	1 Injection annually, at any stage of pregnancy (Afluria Quad)
	Tetanus/Diphtheria/Pertussis (whooping cough)
	1 injection, from 16 weeks of pregnancy (Boostrix® [PDF, 93 KB])
6 weeks	Rotavirus (start first dose before 15 weeks)
	1 oral vaccine (Rotarix® [PDF, 223 KB])
	Diphtheria/Tetanus/Pertussis/Polio/Hepatitis B/*Haemophilus influenzae* type b
	1 injection (Infanrix®-hexa [PDF, 138 KB])
	Pneumococcal
	1 injection (Synflorix® [PDF, 42 KB])
3 months	Rotavirus (second dose must be given before 25 weeks)
	1 oral vaccine (Rotarix® [PDF, 223 KB])
	Diphtheria/Tetanus/Pertussis/Polio/Hepatitis B/*Haemophilus influenzae* type b
	1 injection (Infanrix®-hexa [PDF, 138 KB])
5 months	Diphtheria/Tetanus/Pertussis/Polio/Hepatitis B/*Haemophilus influenzae* type b
	1 injection (Infanrix®-hexa [PDF, 138 KB])
	Pneumococcal
	1 injection (Synflorix® [PDF, 42 KB])
12 months	Measles/Mumps/Rubella
	1 injection (Priorix® [PDF, 51 KB])
	Pneumococcal
	1 injection (Synflorix® [PDF, 42 KB])
15 months	*Haemophilus influenzae* type b
	1 injection (Hiberix® [PDF, 132 KB])
	Measles/Mumps/Rubella
	1 injection (Priorix® [PDF, 51 KB])
	Varicella (Chickenpox)
	1 injection (Varivax® [PDF, 165 KB])
4 years	Diphtheria/Tetanus/Pertussis/Polio
	1 injection (Infanrix-IPV [PDF, 47 KB])
11 or 12 years	Tetanus/Diphtheria/Pertussis
	1 injection (Boostrix™ [PDF, 93 KB])
	Human Papillomavirus (HPV)
	2 injections (Gardasil® 9 [PDF, 119 KB]) given at least 6 months apart for those aged 14 and under
	3 injections given over 6 months for those aged 15 and older
45 years	Tetanus/Diphtheria/Pertussis
	1 injection (Boostrix™ [PDF, 93 KB])
65 years	Tetanus/Diphtheria/Pertussis
	1 injection (Boostrix™ [PDF, 93 KB])
	Zoster (shingles)
	1 injection (Zostavax® [PDF, 117 KB])
	Influenza
	1 Injection annually (Afluria Quad)

11.1 Immunisation coverage

Immunisation coverage is measured at 'milestone ages' using Ministry of Health data. The milestone ages are six months, eight months, 12 months (one year), 18 months, 24 months (two years), and five years of age.

Figure 77 shows the immunisation coverage for children who have completed their age-appropriate immunisations at the 24-month milestone age during the calendar year. The chart shows data for the last nine years for both the Auckland region and the rest of New Zealand. Compared to 2019, 2020 saw a small increase in the Auckland region's percentages whereas the rest of Aotearoa continued the slight decline observed since 2015.

Immunisation rates at the 24-month milestone age peaked in 2015 for the Auckland region and the rest of the country.

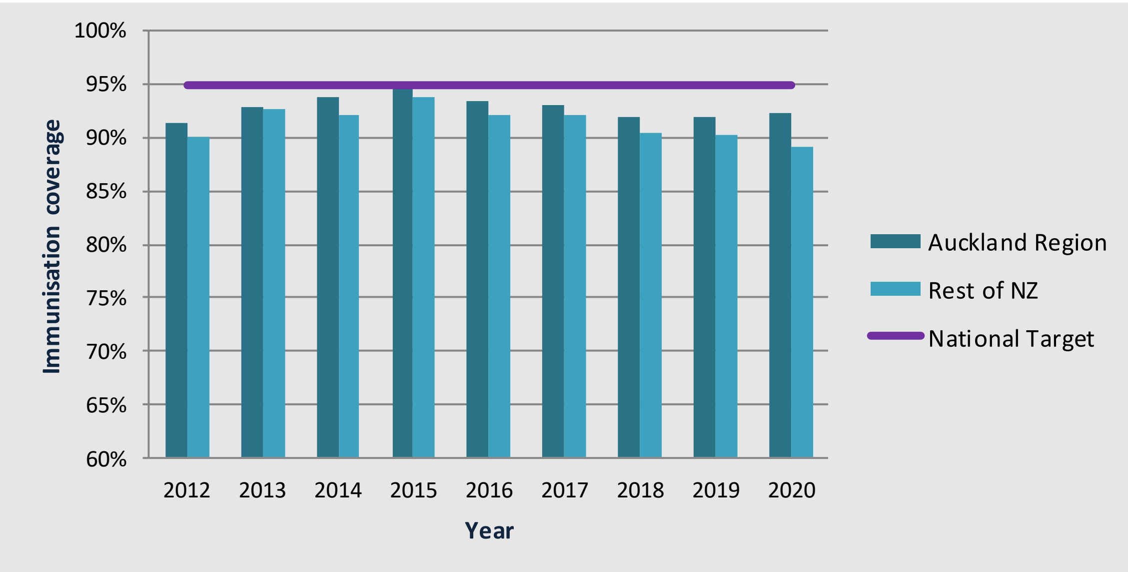


Figure 77: Percentage of Auckland region two-year-old children fully vaccinated by year compared with the rest of New Zealand (2012 – 2020)

Immunisation coverage for all milestone ages is shown in Figure 78 for the Auckland region compared with the rest of New Zealand, and for the Auckland metro DHBs in Figure 79. Since 2012 there has been sustained improvement in 12-month- and five-year-old coverage rates.

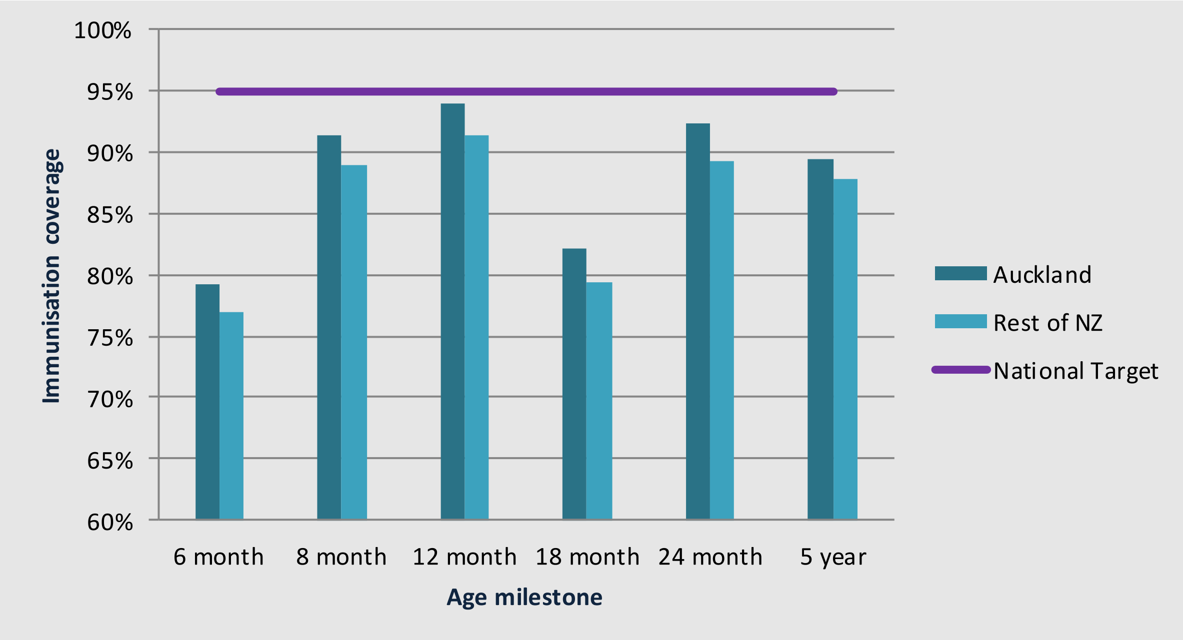


Figure 78: Percentage vaccination coverage for Auckland children at various age milestones compared with the rest of New Zealand (2020)

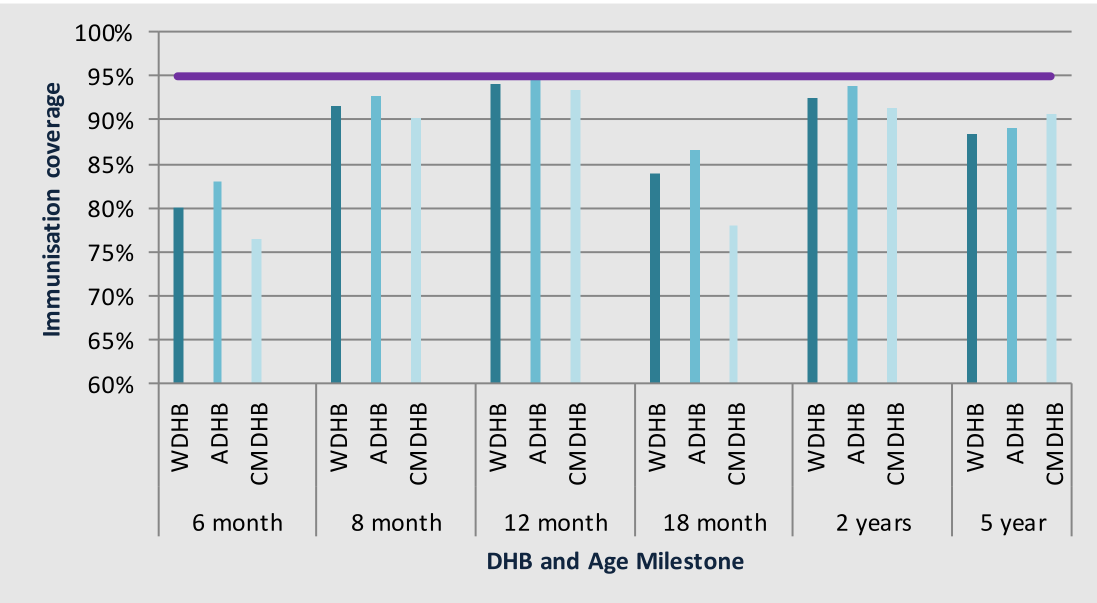


Figure 79: Percentage vaccination coverage for Auckland children at various age milestones by DHB (2020)

Immunisation coverage by ethnic group shows a gradual improvement in coverage at twenty-four months old between 2012 and 2015, but this was followed by a reduction in coverage in the Auckland region between 2015 and 2018 (Figure 80). Fortunately, this trend reversed for 2019 and 2020 in all ethnic groups and, while an improvement was seen in coverage rates for Māori for 2019, this was not sustained into 2020. The Asian ethnic group remains the only one to sit above the target of 95 per cent.

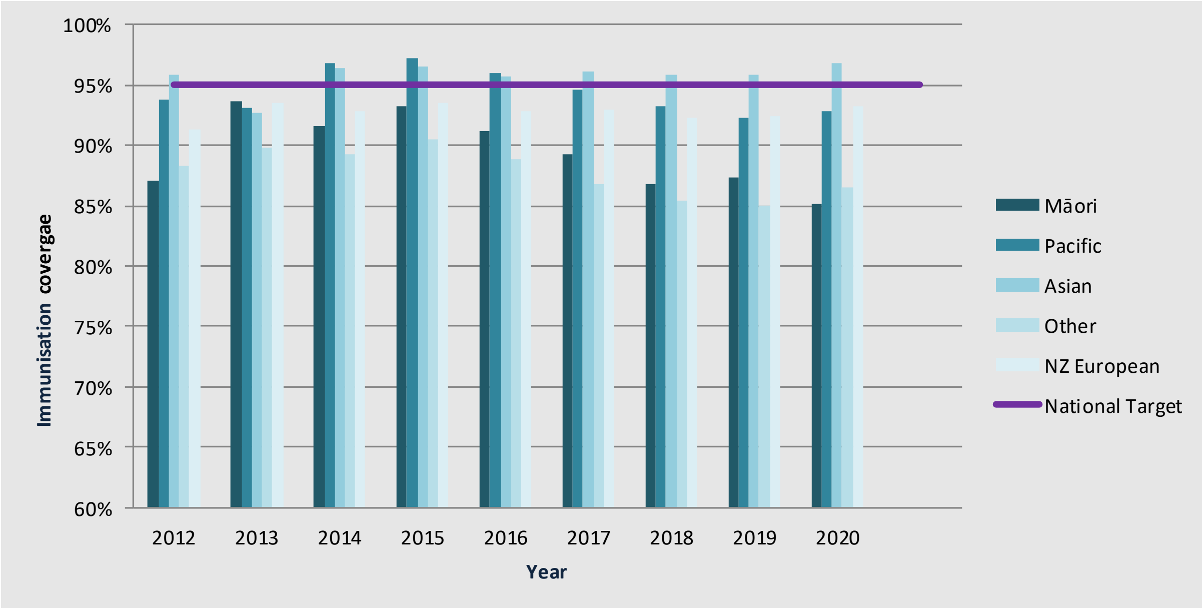


Figure 80: Percentage vaccination coverage at two-years-old by ethnic group in the Auckland region (2012-2020)

Receiving childhood immunisations on time is important to avoid vaccine preventable diseases in infancy and during the school years. In particular, pertussis control relies on mothers being vaccinated in pregnancy (this data is not yet captured in this analysis), babies being vaccinated on time at six weeks, three months and five months, and on older siblings being up to date with their immunisations during the school years. Infants with delayed immunisation at six weeks, three months or five months are at much greater risk of hospital admission for pertussis in their first year of life.

Immunisation timeliness at six months has been improving since 2012 (Figure 81), though it has slightly declined since 2017. Asian ethnicity is most associated with timeliness and Māori ethnicity is least associated with timeliness (Figure 82). Compared to 2016, timeliness worsened over 2017 and 2018 in Māori and Pacific ethnic groups. This trend reversed slightly in 2019, perhaps due to media coverage associated with that year's measles outbreak and immunisation, but this was not sustained into 2020 and timeliness may well have been affected by the impact of COVID-19.

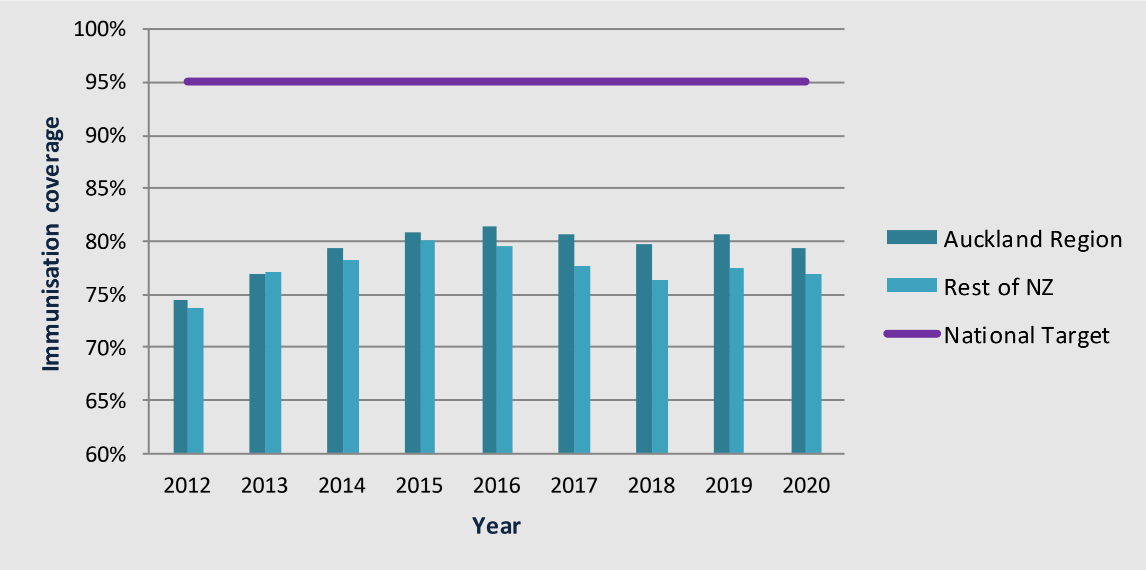


Figure 81: Percentage vaccination coverage at six months in the Auckland region and the rest of New Zealand (2012 – 2020)

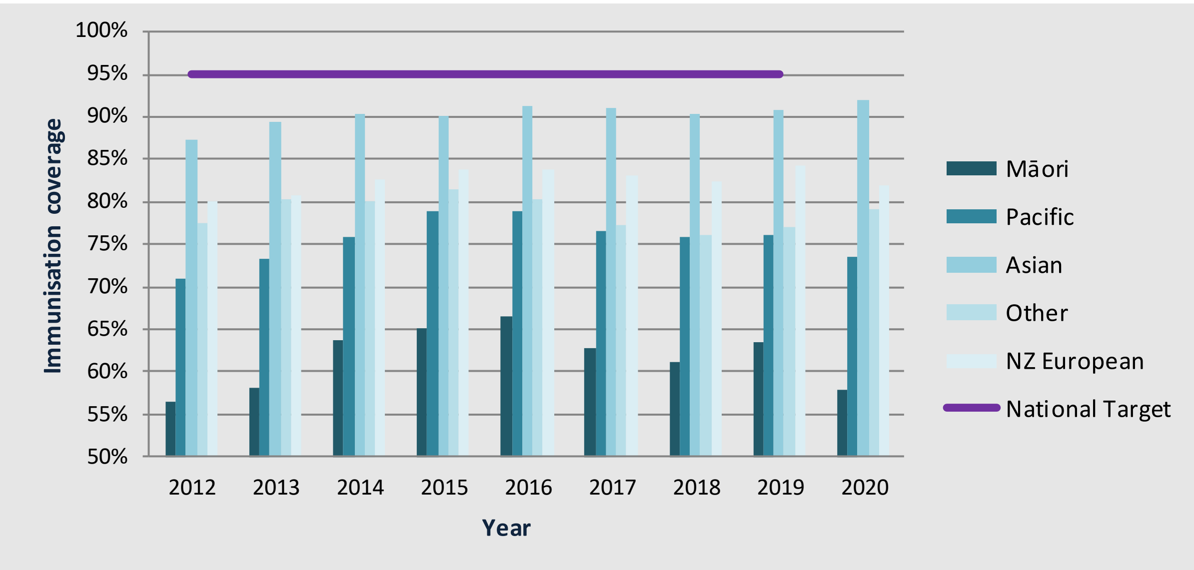


Figure 82: Percentage vaccination coverage at six months by ethnic group in the Auckland region (2012-2020)

Immunisation before starting school is important to ensure immunity against vaccine preventable diseases that are easily transmitted in school settings. Immunisation at four years old includes a pertussis booster and a second measles vaccine. Pertussis continues to circulate in the Auckland region with regular large outbreaks, and although there are no measles cases at present there is still measles circulation overseas and the possibility of importation. Throughout 2017 and 2018 a mumps epidemic circulated through the Auckland region.

Immunisation timeliness at five years old continued to show improvement between 2012 and 2017, both in Auckland and the rest of New Zealand. In 2018 there was a levelling out of timeliness in the five-year-old cohort across all ethnicities, especially Māori. However, there was a promising reversal of this trend for all ethnic groups in 2019, though this was not sustained into 2020 for Māori (Figure 83, Figure 84).

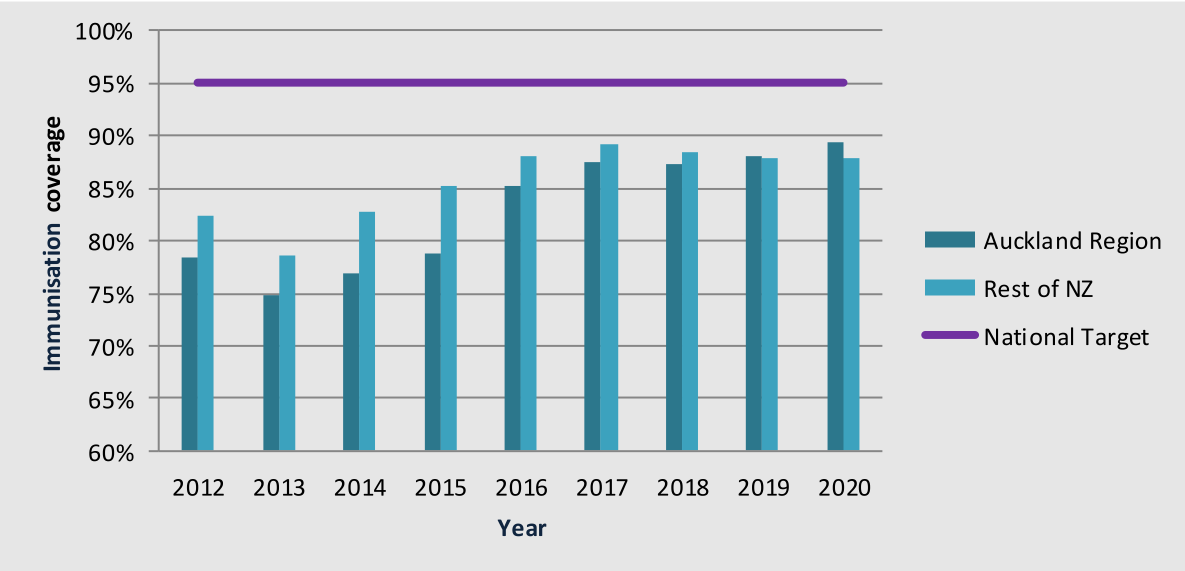


Figure 83: Percentage vaccination coverage at five-years-old in the Auckland region and the rest of New Zealand (2012 – 2020)

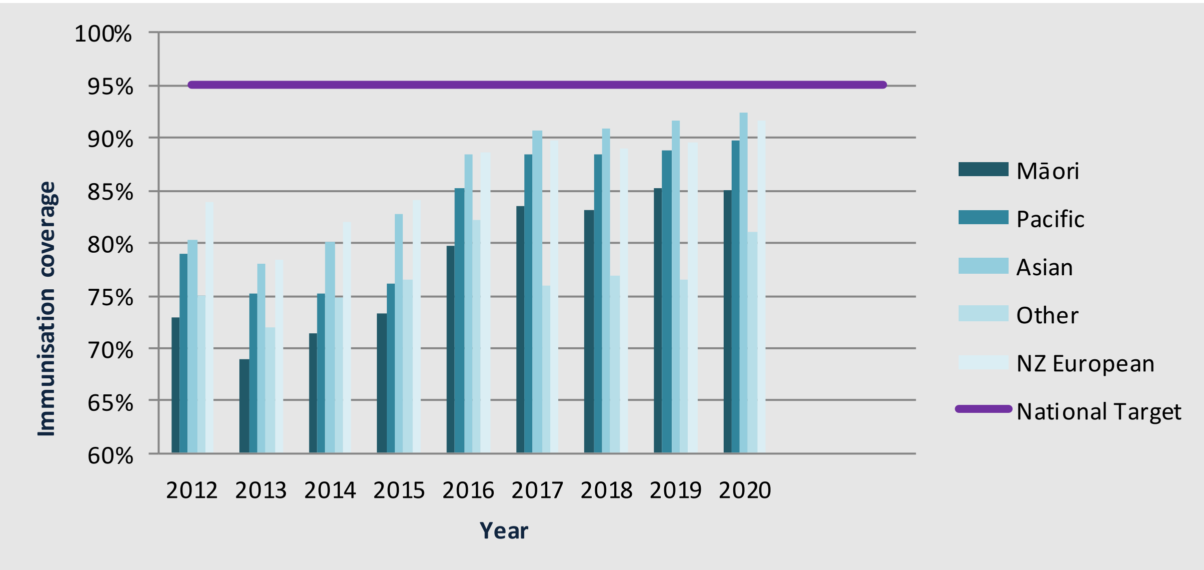


Figure 84: Percentage vaccination coverage at five-years-old by ethnic group in the Auckland region (2012 – 2020)

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Resources

Books

Bennett, J. E., Dolin, R., Blaser, M. J. (Eds.). (2015). *Principles and Practice of Infectious Disease*. 8th ed. https://doi.org/10.1016/C2012-1-00075-6

Hawker, J., Begg, N., Blair, I., Reintjes, R., Weinberg, J. (2005). *Communicable Disease Control Handbook.* 2nd ed. https://doi/10.1177/146904460600700108 01

Heymann, D. (2015). *Control of Communicable Diseases Manual*. 20th ed. American Public Health Association. ISBN 978-87553-018-5

Ministry of Health. (2017). *Immunisation Handbook.* https://www.moh.govt.nz/notebook/nbbooks.nsf/0/4EADF56C3D807998CC25814C0075D0D7/$file/immunisation-handbook-2017-may17-v2.pdf

Other data sources

Statistics New Zealand for 2019 estimated resident population numbers http://archive.stats.govt.nz/

ESR for Public Health Surveillance. https://surv.esr.cri.nz

ARPHS Fact Sheets. www.arphs.health.nz

ARPHS Normal and After hours Protocols (internal access only)

ARPHS Surveillance Strategy 2016-2018, 2018 to 2022 (Draft) (Internal access only)

Environmental Health Intelligence New Zealand, Massey University: Hazardous Substances Disease and Injury Reporting Tool https://www.ehinz.ac.nz/indicators/hazardous-substances/resources-for-health-professionals/

Ministry for Primary Industries for shellfish biotoxin alerts www.mpi.govt.nz/travel-and-recreation/fishing/shellfish-biotoxin-alerts/

EpiSurv Reports

Epidemiologial data is extracted from both EpiSurv and NDCMS as listed below

File names from EpiSurv custom reports

ARPHS Cases by year

ARPHS All EpiWeek Report

Enteric Disease with Addlab ESR Typing

ARPHS Arbovirus

ARPHS Hep B_C_NOS

ARPHS HiB

ARPHS Leprosy

ARPHS Listeriosis

ARPHS Malaria

ARPH Measles Mumps Rubella

ARPHS Outbreak Surveillance Report

ARPHS TB

Hepatitis A

Lead Absorption cases

Lead Notification Risk factors

Legionellosis

LTBI

Meningococcal Line Listing

Pertussis

Rheumatic fever

Rheumatic fever NZDep

VTEC AddLab

Yersiniosis Auckland

NDCMS Reports

Vector-borne diseases, Food-borne diseases, Hepatitis and Air-borne diseases data are extracted from NDCMS and processed in “R” with outputs to Excel (Ron King)

Risk factor data is extracted through Risk factor reports designed and created by Anne Morrison

Salmonellosis, Shigellosis, Cryptosporidiosis, Giardiasis, VTEC, Yersiniosis

Hepatitis A, B, C

Lead absorption

Environmental Health Reports

National Institute of Water and Atmospheric Research (NIWA)

Cliflo database
https://cliflo.niwa.co.nz/

NZ Stats

https://www.stats.govt.nz/information-releases/agricultural-production-statistics-june-2017-provisional

Ministry for the Environment

https://data.mfe.govt.nz/table/52469-land-use-land-cover-classes-1996-2001-2008-and-2012/

https://data.mfe.govt.nz/document/11124-air-domain-report-2014-about-the-indicators/

Immunisation coverage

Ministry of Health Immunisation data: **https://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-coverage/national-and-dhb-immunisation-data**

What we die of

Ministry of Health Mortality Data (courtesy of Ministry of Health)

Antimicrobial Resistance

ESR Antimicrobial Resistance Laboratory:

Enterobacterales with acquired carbapenemases, 2019

Vancomycin-resistant enterococci, 2018