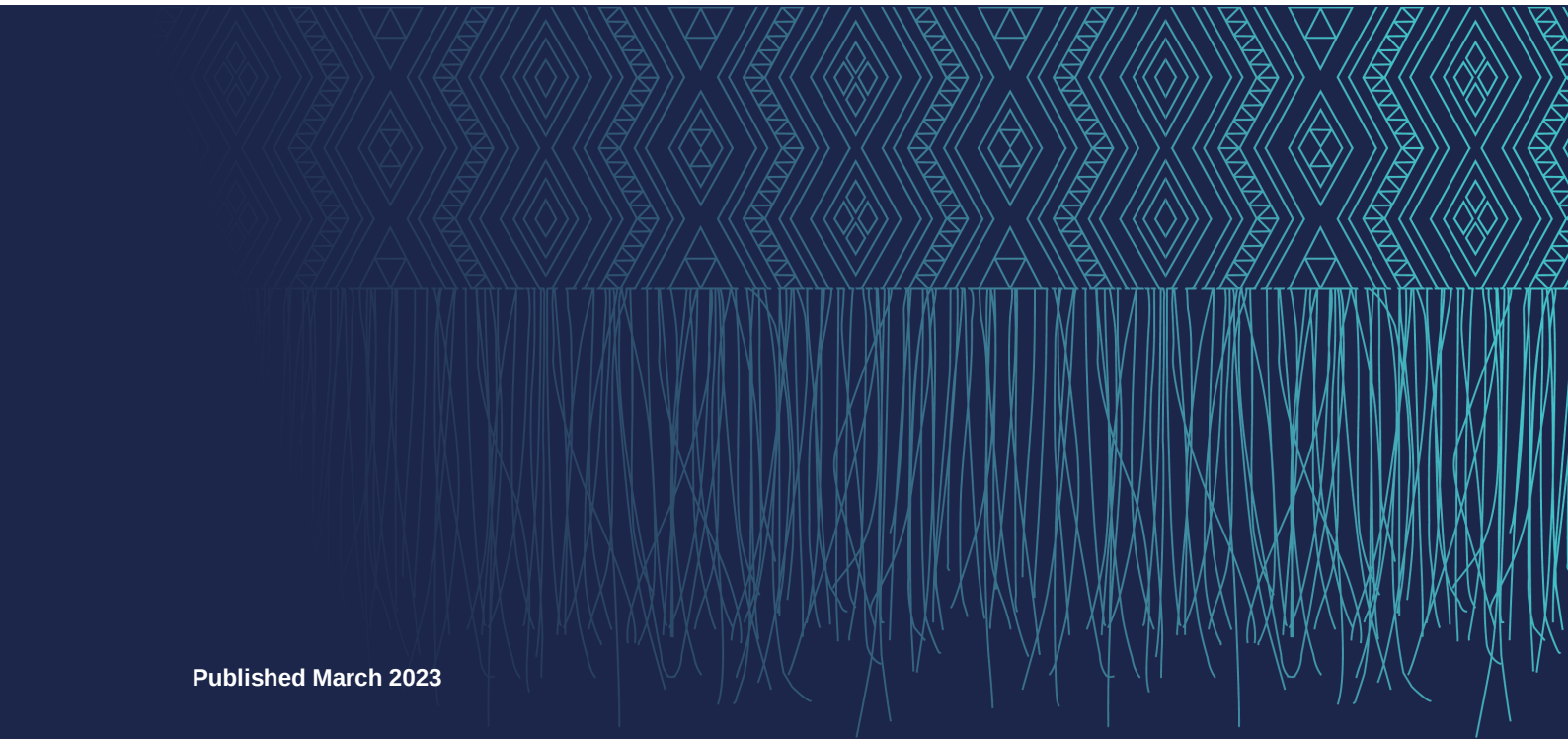
Te Whatu Ora
Health New Zealand

Auckland region – 2019 public health surveillance report



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Thank you to those health practitioners who provide notifications and reports to ARPHS which contribute to this report.

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

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 (Ministry of Health, 2012). These notifications are classified into "cases under investigation", "probable cases" and "confirmed cases". Those cases that don't 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 2019 estimated mid-year population statistics. Population statistics are sourced from Statistics New Zealand.

Ethnicity is prioritised 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

CPE Carbapenemase-producing Enterobacterales

CRS Congenital rubella syndrome

ED Emergency department

EHI Environmental health indicator/s

ELS Early Learning Service

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
MBL	Metallo-betalactamase
MDR	Multi-drug resistant
MDT	Multi-drug therapy
MELAA	Middle Eastern, Latin American, African
MI	Myocardial infarction
MIC	Minimum inhibitory concentrations
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
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 pupura
VRE	Vancomycin-resistant enterococci
VTEC	Verocytotoxin-producing *E. coli*
VZV	Varicella zoster virus
WGS	Whole genome sequencing
WHO	World Health Organization

Executive Summary

The 2019 Surveillance data in this report highlights potential threats to protecting, maintaining and improving public health.

The Auckland measles outbreak, which started in February 2019, was the largest outbreak of a vaccine preventable disease seen in a long time. A key driver of the measles outbreak in 2019 was its ability to spread quickly through non-immune communities where vaccination rates were lower.

Section 4, vaccine preventable diseases, provides extensive coverage of the measles outbreak. There were 155 reported cases. With multiple border incursions, and different measles strains in circulation simultaneously, the outbreak was vigorously managed for three months before community spread became established. Case numbers then rose quickly, reaching a peak in September and tailing off by the end of the year. Staff worked extremely hard within the possible resourcing constraints.

In response to the outbreak the Ministry of Health launched the ‘Become a Guardian of the Future’ campaign in 2020 to encourage people aged between 15 and 30 years old to get their MMR vaccinations. Improving MMR vaccination coverage across Auckland, especially south Auckland, will be vital to mitigating any future threat of measles.

Group B meningococcal disease remains the predominant meningococcal strain for those infants aged under one year, but 2019 has seen the continued emergence of the Group W and Y strains of Meningococcal disease. The 58 cases of confirmed meningococcal disease was the highest number of cases in Auckland in many years.

2019 was a busy year for staff managing outbreaks despite fewer total outbreaks. Section 8 of this report highlights the many, varied outbreaks managed including a mumps outbreak linked to vaping, an adenovirus outbreak in an Aged Care Facility and a Group A streptococcus foodborne outbreak at an open day event.

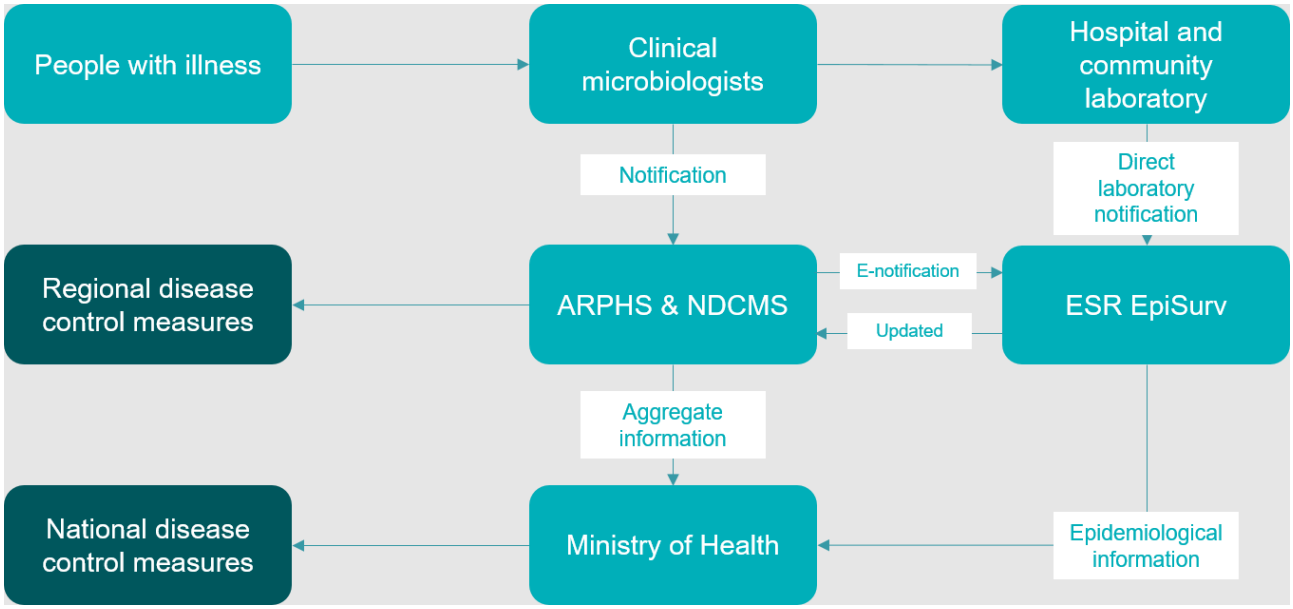
1 Summary

Throughout 2019 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 process of disease notification. The diseases that are notifiable to the Medical Officer of Health are listed in Appendix 1. 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 2019

The summary charts below (Figure 2) show the burden of notifiable diseases in the Auckland region for 2019. Foodborne infectious disease, driven by campylobacteriosis, was the leading infectious disease, followed by vaccine preventable diseases with 1,755 cases of measles. The incidence of measles was highest in Māori and Pacific, with rates six to ten times higher than for NZ Europeans. Although these groups have had declining immunisation rates over recent years, the outbreak was also driven by the under one-year-olds and a known immunisation gap in 15 to 29 year-olds. Two-thirds of all the Auckland

region measles cases occurred within the Counties Manukau DHB catchment, an area of Auckland where there are inequities in health and socio-economic status. The pertussis outbreak of 2018 tailed off in 2019 but notifications still remained well above the base line of one to two cases per week.

Other airborne communicable diseases followed. TB was the major contributor along with rheumatic fever, meningococcal disease and invasive pneumococcal disease. All of these diseases have demonstrated some constancy over the years, particularly in people of Māori and Pacific ethnicity and those affected by poverty and higher levels of deprivation. Lead absorption topped the environmentally associated diseases. There was also an increase in foodborne intoxication illnesses notifications caused by Vibrio parahaemolyticus in seafood, largely due to better laboratory detection.

The enteric diseases are divided into high and low risk enterics. VTEC/STEC remained the most common of the high-risk enteric diseases, followed by shigellosis. The key risk factors for VTEC included contact with farm animals, pets or faecal material, including manure. For shigellosis half of the cases were associated with overseas travel to India or the Pacific. Locally acquired cases had assorted risk factors, including a small number of cases of Shigella sonnei Biotype g, associated with men who have sex with men (MSM).

Low risk enteric notifications were led by campylobacteriosis. During the year 856 cases were interviewed as part of a national source attribution study (SACNZS). Through interviews and Whole Genome Sequencing (WGS) the models assigned 84 per cent of cases to a poultry source.

Yersiniosis reached record numbers, at least partly due to more sensitive laboratory methods. The cause of yersiniosis in New Zealand is not known. Internal outbreak investigations have incriminated bagged lettuce, bean sprouts, spring onions and tofu but further work is required to assess other risk factors and explain the demographics (people of Chinese ethnicity were predominantly affected).

There is a small group of serious diseases which fortunately occur in small numbers. Meningococcal disease is the most serious of these. Although there has been the emergence of serogroup W and Y in recent years, serogroup B was still responsible for half of the meningococcal cases and three of the four deaths. Likewise, legionellosis notifications were down for 2019 but the predominant serotype remained *Legionella pneumophila.* This serotype, which is generally associated with aerosolized water, was identified in two of the three legionellosis deaths.

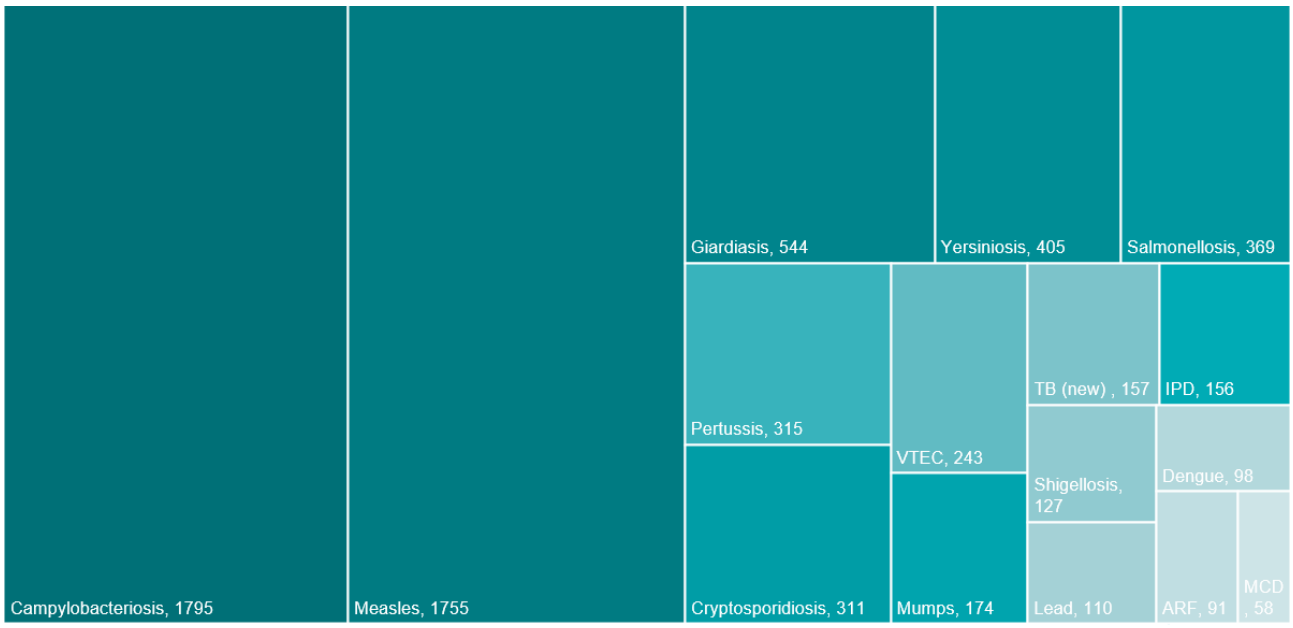


Figure 2: Summary of Notifiable Diseases in the Auckland region (2019)

NB: Diseases with very small case numbers are not represented in this figure

In 2019 137 outbreaks were reported. Seven of these were non-foodborne and included the measles outbreak and small outbreaks of mumps and tuberculosis (TB). The mumps outbreak was memorable in that the cause appears to have been a shared vaping device. The TB outbreak involved nine cases. All of these were diagnosed in 2019 and all were linked to an extended family, over multiple households, and with a range of co-morbidities present.

Of the remaining 130 foodborne outbreaks, a cause was found for 75 per cent of them. Norovirus was responsible for the majority of outbreak-associated illness, and probably caused a good number of the gastroenteritis cases where norovirus was suspected but could not be confirmed. Salmonella was found to be the source for 16 outbreaks and Shigella was the source for five. VTEC occurred in smaller outbreaks but of concern was that the three outbreaks were caused by O157:H7. Three of the four haemolytic uraemic syndrome (HUS) complications were associated with this serotype.

Morbidity, mortality and case fatality of notifiable diseases, Auckland region 2019

The incidence, mortality, morbidity and case-fatality rates of notifiable diseases reported in 2019 are shown in Table 1.

Table 1: Morbidity, mortality and case fatality rates of notifiable diseases in the Auckland region (2019)

	Cases	Morbidity rate*		Hospitalisation		Mortality		
Disease	Auckland Region Total	Auckland Region	Rest of NZ	Auckland Region	(%)	Died	Mortality rate*	Case fatality rate
Brucellosis	0	0.0	0.1	0	-	-	-	-
Campylobacteriosis	1795	104.6	139.0	28	2%	-	-	-
Chikungunya fever	4	0.2	0.2	1	25%	-	-	-
Cryptosporidiosis	311	18.1	22.8	1	-	-	-	-
Dengue fever	98	5.7	4.0	30	30.6%	-	-	-
Giardiasis	544	31.7	38.0	1	0%	-	-	-
Haemophilus influenzae type b	0	0.0	0.1	1	-	-	-	-
Hepatitis A	39	2.3	0.6	25	64%	-	-	-
Hepatitis B	8	0.5	0.6	5	63%	-	-	-
Hepatitis C	5	0.3	0.6	2	40%	-	-	-
Hepatitis NOS	7	0.4	0.1	0	-	-	-	-
Invasive pneumococcal disease	158	9.2	10.7	153	97%	2	0.1	1.3%
Latent tuberculosis infection	111	6.5	3.6	0	-	-	-	-
Legionellosis	42	2.4	3.8	41	98%	1	0.1	2.4%
Leprosy	2	0.1	0.1	0	-	-	-	-
Leptospirosis	11	0.6	2.6	8	73%	-	-	-
Listeriosis	5	0.3	0.6	5	100%	-	-	-
Listeriosis - perinatal	3	0.2	0.1	3	100%	1	-	-
Malaria	13	0.8	0.4	10	77%	-	-	-
Measles	1756	102.4	14.4	673	38%	-	-	-
Meningococcal disease	58	3.4	2.6	58	100%	4	0.2	6.9%
Mumps	174	10.1	2.8	21	12%	-	-	-
Murine Typhus	0	0.0	0.1	0	-	-	-	-

Paratyphoid fever	13	0.8	0.2	11	85%	-	-	-
Pertussis	315	18.4	28.1	63	20%	-	-	-
Rheumatic fever - initial attack	91	5.3	2.1	91	100%	-	-	-
Rheumatic fever - recurrent attack	10	0.6	0.2	10	100%	-	-	-
Rickettsial disease	1	0.1	0.0	1	100%	-	-	
Ross River virus infection	2	0.1	0.1	0	-	-	-	-
Rubella	1	0.1	0.0	0	-	-	-	-
Salmonellosis	369	21.5	25.8	111	30%	-	-	-
Shigellosis	127	7.4	2.8	47	37%	-	-	-
Taeniasis	5	0.3	0.0	0	-	-	-	-
Tuberculosis disease - new case	157	9.2	4.7	95	61%	1	0.1	0.6%
Tuberculosis disease - relapse	7	0.4	4.7	5	71%	1	0.1	14%
Tuberculosis infection - preventative tx.	4	0.2	0.0	0	-	-	-	-
Typhoid fever	30	1.7	0.8	27	90%	-	-	-
VTEC/STEC infection	243	14.2	27.0	64	26%	-	-	-
Yersiniosis	405	23.6	24.6	15	4%	-	-	-
Zika virus	1	0.1	0.2	0	-	-	-	-

Source: EpiSurve

*Rates per 100,000 population

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

- Dengue notifications were down from 2018 and the majority of infections were imported from Fiji.
- The predominant serotype was DEN1.
- There were few or no other arboviruses infections due to Chikungunya, Ross River Virus or Zika.
- Malaria importations were the lowest for 10 years.
- There were no Aedes aegypti interceptions in 2019, 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 short for 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, respectively, may also occur. Zika virus can also be transmitted sexually and can cause neurological impairment in the developing foetus.

For arboviruses, the vectors are commonly mosquitoes, ticks, sandflies and other arthropods that consume the blood of vertebrates for nutritious or developmental purposes. New Zealand does not currently have a suitable environment for sustaining populations of a competent vector for arboviral disease transmission but, 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, (with haemorrhagic features, previously referred to as haemorrhagic fever) characterised by

bleeding, low levels of blood platelets and blood plasma leakage, or into dengue shock syndrome. More severe illness and dengue with haemorrhage features are 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.

There were 98 cases of dengue fever reported for the Auckland region in 2019, down from 187 in 2018 and back to 2017 and 2016 levels (of 95 and 85 cases respectively). Dengue has increased gradually over the past seven years. A 2014 increase coincided with an outbreak of DEN3 in the Pacific but 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. More severe illness with concurrent dengue of differing serotypes is a well-documented feature of dengue fever.

The incidence rate for the Auckland region was 5.8 cases per 100,000, compared with four cases per 100,000 for the rest of New Zealand.

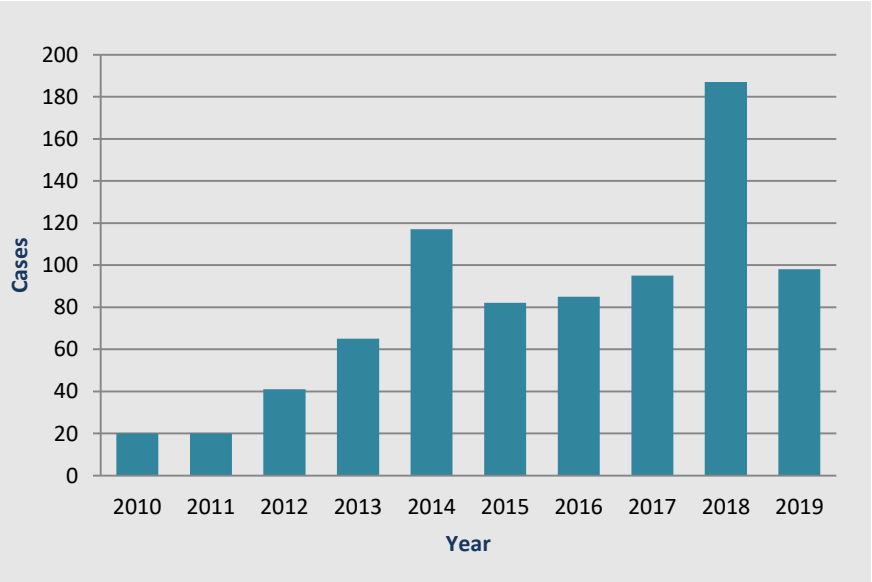


Figure 3: Dengue fever cases in the Auckland region 2010 - 2019

Hospitalisation (when recorded) occurred in 46 per cent of cases. This represents a reduction in the occurrence of more severe disease. The 2019 hospitalisation figures for previous years were:

- 66 per cent in 2018
- 64 per cent in 2017
- 41 per cent in 2016
- 51 per cent in 2015

There were no deaths.

Dengue cases are characteristically higher in the first quarter of the year when many local residents take holidays or visit friends and relatives in the Pacific. In 2019 this changed, and there was a steady increase in cases through the third and fourth quarters reflecting the new emergence of outbreaks of predominantly DEN1 in the Pacific region (Figure 4).

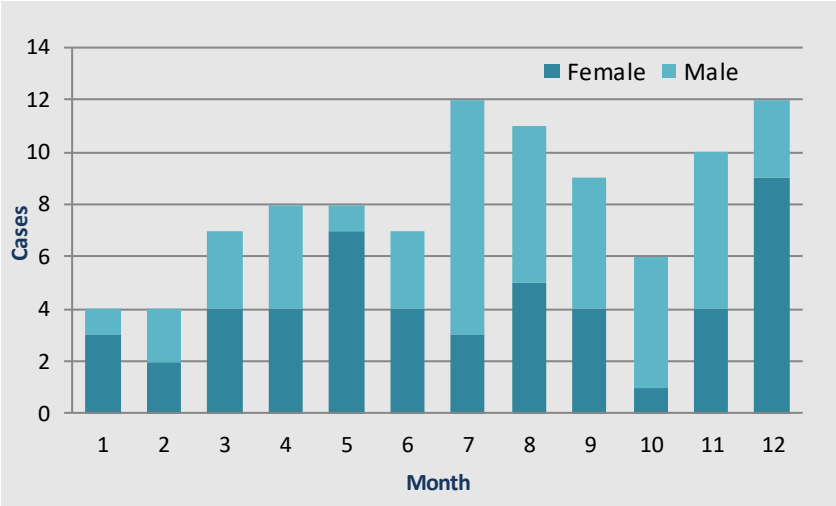


Figure 4: Dengue fever cases by month and sex in the Auckland region (2019)

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 30-39 age group (9.2/100,000) followed by the 40-49 year age group (8.1/100 000) (Table 2).

Table 2: Age and gender distribution and age-specific incidence rates of dengue fever in the Auckland region (2019)

Age group	Female	Male	Total	Rate per 100,000*
1 to 4	1	0	1	1.2
5 to 9	1	1	2	1.8
10 to 14	1	2	3	2.8
15 to 19	2	1	3	2.7
20 to 29	8	9	17	6.2
30 to 39	12	12	24	9.2
40 to 49	10	8	18	8.1
50 to 59	8	8	16	7.6
60 to 69	6	5	11	7.2
70+	1	2	3	2.2
Total	50	48	98	5.8

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

Pacific peoples usually account for the majority of cases but in 2019 the highest incidence rate was in people identifying as Asian, with 7.5 per 100,000 (Table 3). A more detailed ethnicity breakdown is shown in Table 5.

Table 3: Ethnic and gender distribution and ethnic specific incidence rates of dengue fever in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Grand Total	Rate per 100,000*
Asian	16	21	37	7.5
European or Other	27	21	48	6.1
Māori	1	4	5	2.5
Pacific peoples	6	2	8	3.5
Total	**50**	**48**	**98**	**5.8**

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

Table 4: Detailed ethnicity distribution of dengue fever in the Auckland region (2019)

Ethnicity	Total
Samoan	1
Tongan	1
European	48
Indian	24
Fiji, Indo-Fijian	7
Southeast Asian	2
Pacific Other	4
Chinese	3
Latin American	1
Māori	1
Middle Eastern	3
Tokelauan	3
Total	**98**

Table 5: Source countries of dengue fever notification in the Auckland region (2019)

Source Country	Total
Fiji	43
India	15
Indonesia	9
Philippines	6
Thailand	5
Cook Islands	3
French Polynesia	3
Vietnam	3
Samoa	2
Australia	2
New Caledonia	1
Pakistan	1
Total	**98**

Serotyping was available for half of the cases. The predominant circulating strain for 2019 was DEN 1 compared to 2018 when it was DEN2. There were also small numbers of DEN3 (7) and DEN4 (1) identified. The source countries for these serotypes are shown in Table 6.

Table 6: Dengue fever serotypes by source country in the Auckland region (2019)

Serotype	Country	Total
DEN1	Cook Islands	1
	Fiji	13
	India	2
	Malaysia	1
	Samoa	1
	Thailand	2
	Vietnam	1
DEN1 Total		21
DEN2	Fiji	5
	French Polynesia	2
	India	1
	Indonesia	4
	Malaysia	1
	Pakistan	1
	Thailand	2
DEN2 Total		16
DEN3	India	3
	Malaysia	1
	Philippines	3
DEN3 Total		7
DEN4	Indonesia	1
DEN4 Total		1

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 one 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.

Four cases of Chikungunya were reported in 2019. The incidence rate of Chikungunya for the Auckland region was 0.2 cases per 100,000; the same as for the rest of New Zealand. Cases were aged between 30 and 60.

Source countries for the confirmed cases were India (2), Thailand (1) and Fiji (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 two cases notified for the year down from five in 2017. Typically, there are only one or two cases notified in the Auckland region each year. Both cases had a recent travel history to Australia and did not require hospitalisation.

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 was only one zika case notified 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 microorganism) 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 13 cases notified in 2019, similar to the last four years (Figure 5). The incidence rate of malaria for the Auckland region was 0.8 cases per 100,000, compared with 0.4 cases per 100,000 for the rest of New Zealand.

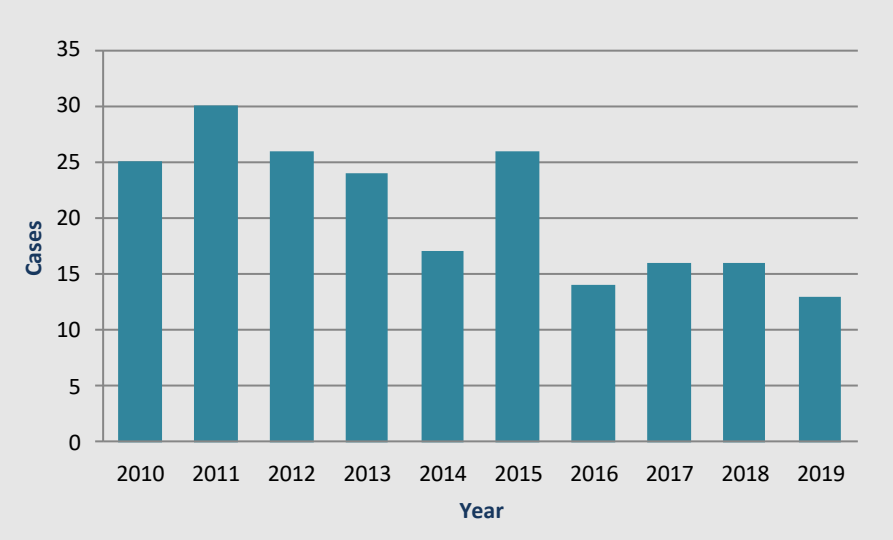


Figure 5: Malaria cases by year in the Auckland region 2010 - 2019

All cases were overseas acquired. Six cases had *P. falciparum* and two *had P. vivax. T*he remainder were not typed. Ten of the cases were hospitalised, and there were no deaths.

Cases were reported throughout the year.

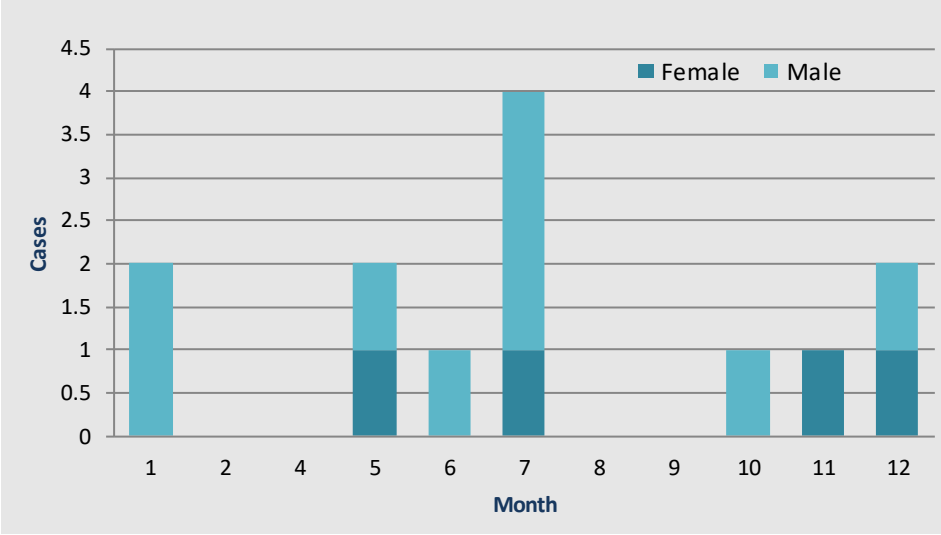


Figure 6: Malaria cases by month and sex in the Auckland region (2019)

The age-specific incidence rate was highest in the 20-29 year age group, and the male to female ratio was 2.3:1 (Table 7).

Table 8: Age and gender distribution and age-specific incidence rates of reported malaria cases in the Auckland region (2019)

Age-group	Female	Male	Total	Incidence per 100,000*
1 to 4	1		1	1.2
15 to 19		1	1	0.9
20 to 29	1	3	4	0.9
30 to 39		2	2	1.4
40 to 49	2	1	3	0.8
10 to 14		1	1	1.3
70+		1	1	0.7
Total	**4**	**9**	**13**	**0.8**

*Rates are based on 2019 estimated mid-year population (Source: Statistics New Zealand)

Asian, Middle Eastern, Latin and African (MELAA) ethnicity represented 69 per cent of cases (Table 8). Five of the 13 cases acquired their illness in Africa, three in India (Table 9).

Table 8: Ethnic and gender distribution and ethnic-specific incidence rates of malaria in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Total	Incidence per 100,000*
Asian	4	3	7	1.4
European or Other		5	5	0.6
Māori				
Pacific peoples		1	1	0.4
Total	**4**	**9**	**13**	**0.8**

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

Table 9: Overseas acquired malaria cases by country of origin in the Auckland region (2019)

Source Country	Total
India	3
Afghanistan	2
Indonesia	2
Sierra Leone	1
Papua New Guinea	1
Nigeria	1
Uganda	1
Ethiopia	1
Kenya	1
Total	**13**

2.3 Mosquito interceptions

Both Aedes albopictus and Aedes aegypti are mosquito vectors for dengue and are also important vectors for Chikungunya and Zika virus. These mosquitoes have not been able to establish populations in New Zealand 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.

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

Routine surveillance by Ports of Auckland (POAL) detected 92 interceptions at the border in 2019, of which 47 were mosquito interceptions. Of the 47, all involved *Culex quinquefasciatus.* Frequently *Culex pervigilans* and other *Culex* species were detected in the same interception.

Auckland International Airport (AIAL) reported three incursions, none of which involved exotic species and one which was a non-mosquito species.

Other transitional facilities detected 15 further incursions of which two were exotics species: A*edes stimulans* and *Culex hutchinsoni*. Of the endemic species, two were *Culex quinquefasciatus*, three were Culex species.

Details of specimens identified and their source country are shown in Table 10.

Table 10: Specimen identification of ARPHS mosquito interceptions/incursions in the Auckland region (2019)

Species	POAL	AIAL	Trans. facilities	Country of origin
Aedes aegypti*				
Aedes notoscriptus	1			NZ
Aedes stimulans*			1	France (Imported car)
Culex hutchinsoni*			1	Cargo of pet food
Culex pervigilans	17			NZ
Culex quinquefasciatus	44	1	2	India, China, Ecuador, NZ
Culex sp.	14	1	2	NZ
Pending			1	
Mosquito interceptions	47	3	7	

*Denotes an exotic species

Source: ARPHS Biosecurity Logging Database 2019

2.4 Leptospirosis

Leptospirosis is an infection caused by corkscrew-shaped bacteria called *Leptospira*. Some cases are asymptomatic, while others will have symptoms ranging from mild (such as headaches, muscle pains, 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. Rodents are the most common animals that spread the disease. 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 11 cases of leptospirosis notified in 2019, compared with 13 in 2018 (Figure 7). Notifications have been increasing since 2014. This may be due to increased volume or sensitivity of laboratory testing. There were no adult male cases and two adult female cases. Eight of the 11 required hospitalisation but there were no deaths. Cases occurred throughout the year, with three cases occurring in September.

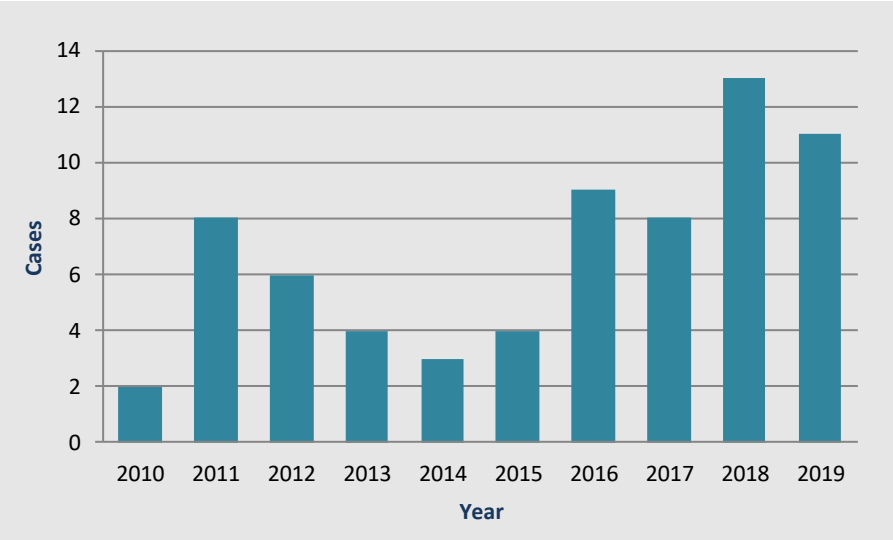


Figure 7: Leptospirosis cases by year in the Auckland region 2010-2019

Of the eleven cases, six were farmers (five dairy, one sheep), two had exposure to rats and rat droppings, two were overseas acquired (Samoa, Thailand) and one case was uncontactable.

3 Foodborne diseases

Key points

- Typhoid and paratyphoid notifications were quite typical in 2019. The predominant source country was India followed by Samoa.
- Shigellosis notifications were average with rates higher in Pacific ethnic groups.
- VTEC was up slightly but, more importantly, the numbers of serotype O157 were increased - especially in the first quarter of 2019.
- Salmonellosis notifications increased and there were five small to moderate foodborne outbreaks due to salmonellosis.
- Campylobacteriosis, cryptosporidiosis and giardiasis notifications were down.
- Yersiniosis notifications were up in 2019 and this is part of a sustained increase since 2017. People of Chinese ethnicity and children under the age of five are over-represented.

3.1 Enteric fevers

Enteric fever (typhoid and paratyphoid fever) is caused by *Salmonella enterica* serotypes Typhi or Paratyphi which are transmitted via the faecal-oral route. 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.

There were 43 cases of enteric fevers reported in 2019. This is similar to 2018, but well reduced from the 70 cases in 2017, and more in line with the 10 year average. Of the 43 cases, 30 (70 per cent) were typhoid fever and 13 (30 per cent) were paratyphoid fever (Table 12).

Table 11: Classification of enteric fever cases in the Auckland region 2009 - 2019

Year	Paratyphoid fever	Typhoid fever	Total
2009	12	26	38
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

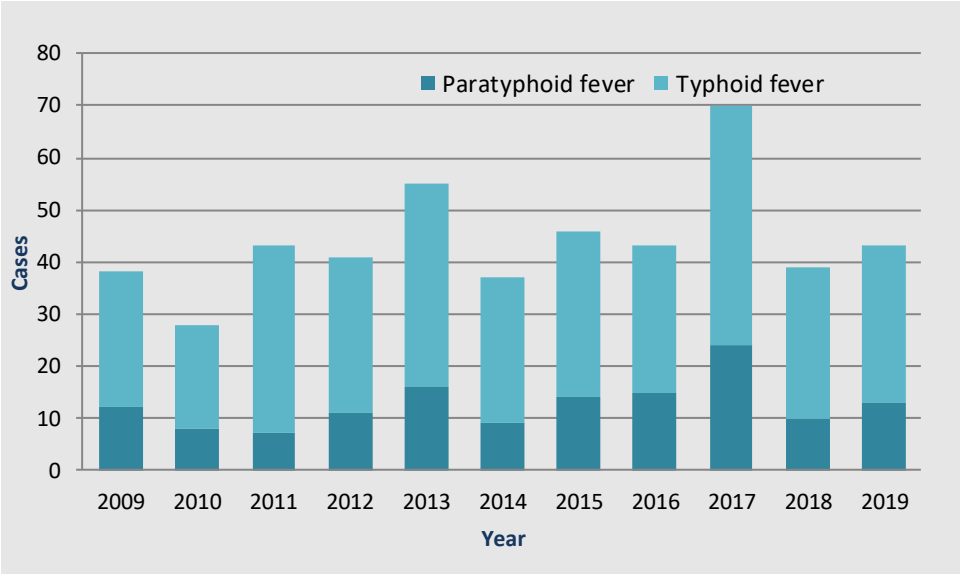


Figure 8: Classification of enteric fever cases in the Auckland region 2009-2019

3.1.1 Typhoid fever

Typhoid fever — also known simply as typhoid — is a common worldwide bacterial disease transmitted by the ingestion of food or water contaminated with the faeces of an infected person that contain the bacterium *Salmonella typhi*. 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 1.8 cases per 100,000; approximately twice the rate for the rest of New Zealand (0.8/100,000).

There were 30 typhoid cases reported throughout the year. The peak occurred in the summer months and was associated with travel to and from the Pacific (Figure 8). The majority of cases required hospitalisation (90 per cent). There were no deaths.

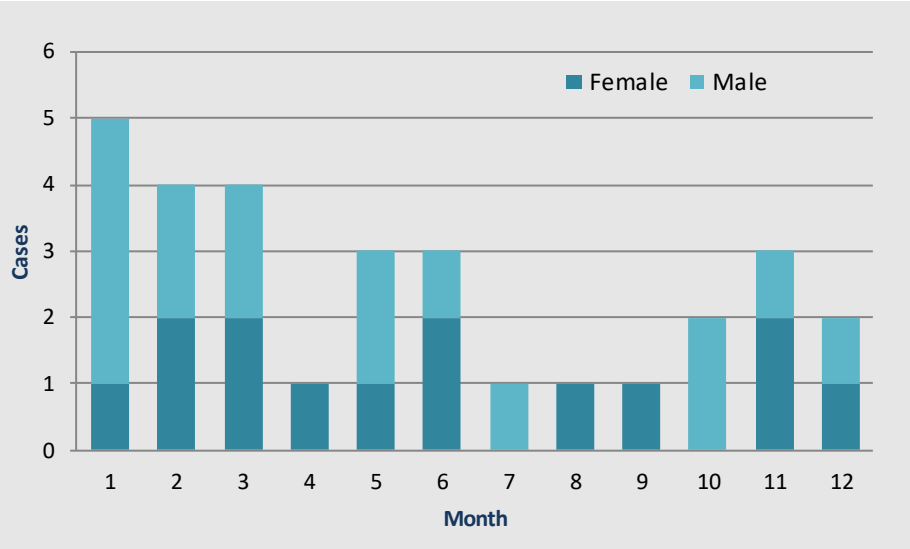


Figure 9: Monthly distribution of typhoid cases by gender in the Auckland region (2019)

Age-specific incidence rates were highest in young children; this compares 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 virtually equal. All cases were of Asian or Pacific ethnicity (Table 13*)*. The three locally acquired cases were from the Samoan community. The majority of overseas acquired cases were of Samoan or Indian ethnicity.

Table 12: Age and gender distribution and age-specific incidence rates of typhoid in the Auckland region (2019)

Age-group	Female	Male	Total	Incidence-rate per 100,000*
<1 year				-
1 to 4	1	2	3	3.5
5 to 9	1	1	2	1.8
10 to 14		2	2	1.8
15 to 19		2	2	1.8
20 to 29	3	4	7	2.5
30 to 39	2	2	4	1.5
40 to 49	2	1	3	1.3
50 to 59	4	2	6	2.9
60 to 69	1		1	0.7
70+				-
Total	**14**	**16**	**30**	**1.8**

*Rates are based on 2019-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 (2019)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	7	11	18	3.6
European or Other				-
Māori				-
Pacific peoples	6	5	11	4.8
Unknown	1		1	-
Total	**14**	**16**	**30**	**1.8**

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

There were nine locally acquired cases, of which five were amongst the Pacific community and three were of Asian ethnicity. The remainder of cases (21) were overseas acquired (Table 14).

Table 14: Country of origin for overseas acquired typhoid fever cases in the Auckland region (2019)

Source Country	Total
India	12
Samoa	5
Papua New Guinea	1
Fiji	1
Australia	1
Hong Kong	1
Total	**21**

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: *S.* Paratyphi A, *S*. Paratyphi B and *S.* Paratyphi C. Like *S. Typhi,* they are transmitted by means of contaminated water or food. Paratyphoid fever bears similarities with typhoid fever and the two are referred to by the common name enteric fever, but the clinical course of paratyphoid fever is more benign. *S.* 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.

The incidence rate of paratyphoid fever for the Auckland region was 0.7 cases per 100,000 in 2019, compared to the rest of New Zealand (0.2/100,000). 13 cases of paratyphoid fever were notified in 2019; marginally up from the 10 cases in 2018. Cases were notified throughout the year, with the highest number reported in February (4). The male to female ratio was 1.6:1 with most of the female cases occurring in the 20-to-29 and 30-to-39-year age group. Male cases were more evenly spread between all the age groups between one year and 39-years-old. Eleven of the 13 cases were hospitalised. There were no deaths.

The predominant ethnic groups were Asian (8) and NZ European (4). All but four of the cases were acquired overseas. Countries of origin included India (5), Indonesia (2), Nepal (1) and Chile (1). Of the typed cases, eight were identified as Paratyphi A and four were Paratyphi B.

3.2 High Risk Enterics

3.2.1 Shigellosis

Shigellosis is also known as bacillary dysentery. It is a foodborne illness caused by infection by bacteria of the genus *Shigella*. 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 2019, the incidence rate for the Auckland region was 7.5 cases per 100,000, more than double the incidence rate for the rest of New Zealand (2.8/100,000).

In 2019 there were 127 cases of shigellosis notified, almost exactly the same as for 2018 but down from the 150 cases notified in 2017 (Figure 10). Cases were reported throughout the year though notifications were down in the winter months, as is typical. The peak months were January and February, driven by the local population visiting friends and relatives overseas (Figure 11). Hospitalisation was reported in 37 per cent of cases; there were no deaths.

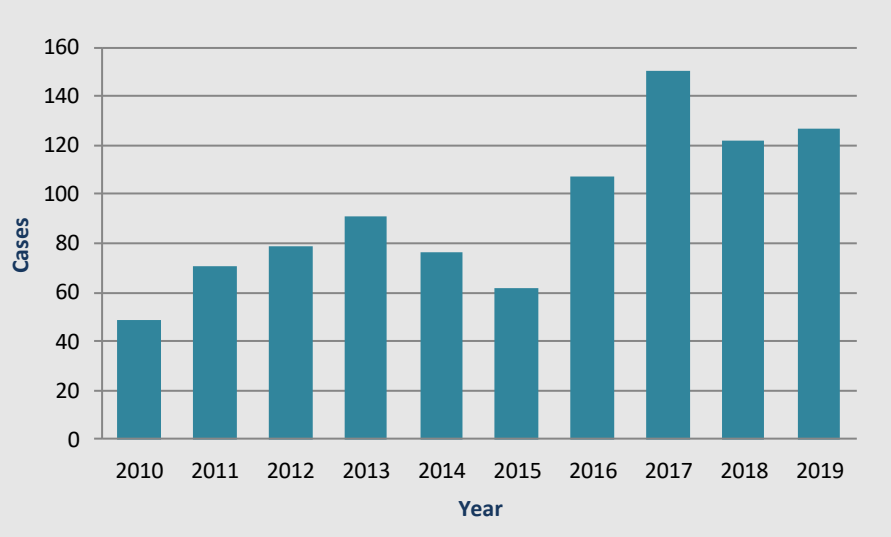


Figure 10: Shigellosis cases in the Auckland region 2010 - 2019

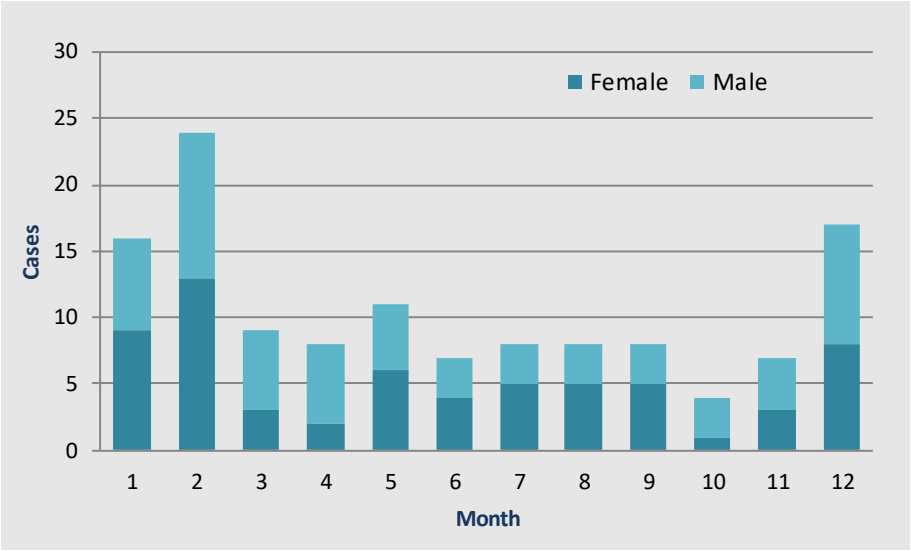


Figure 11: Monthly distribution by gender of shigellosis cases in the Auckland region (2019)

The age and gender distribution and age-specific incidence rates show a wide distribution, with the highest incidence in children aged younger than five-years-old. The male to female ratio is equal (Table 15).

Table 15: Age and gender distribution and age-specific incidence rates of shigellosis in the Auckland region (2019)

Age-group	Female	Male	Total	Incidence-rate per 100,000*
<1 year				-
1 to 4	5	6	11	12.8
5 to 9	5	4	9	7.9
10 to 14	1	3	4	3.7
15 to 19	1	1	2	1.8
20 to 29	14	14	28	10.1
30 to 39	9	11	20	7.7
40 to 49	6	9	15	6.7
50 to 59	14	7	21	10.0
60 to 69	6	6	12	7.9
70+	3	2	5	3.6
Total	**64**	**63**	**127**	**7.5**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand).

The highest incidence was seen in Pacific peoples, with 18.8 cases per 100,000 (Table 16). Tongan and Samoan ethnic groups (36) made up 28 per cent of all cases (Table 18).

Table 16: Ethnic-group distribution and gender-specific incidence rates of shigellosis in the Auckland region (2019)

Ethnic group	Female	Male	Grand Total	Rate per 100,000*
Asian	12	10	22	4.5
European or Other	24	26	50	6.4
Māori	5	7	12	6.0
Pacific peoples	23	20	43	18.8
Total	**64**	**63**	**127**	**7.5**

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

Table 17: Ethnicity distribution of shigellosis cases in the Auckland region (2019)

Ethnicities	Female	Male	Total
NZ European	17	20	37
Tongan	9	10	19
Samoan	8	8	16
Indian	9	6	15
Other European	6	6	12
Other Pacific People	4	3	7
NZ European / Māori	4	2	6
Māori	1	5	6
Chinese	1	2	3
Asian	2	1	3
Middle Eastern	1		1
Southeast Asian		1	1
African	1		1
Total	**63**	**64**	**127**

50 per cent of cases acquired their disease overseas with India (14), Tonga (8) and Samoa (7), predominating as source countries (Table 18). This compares with 66 per cent of cases acquiring their disease overseas in 2018, indicating a higher proportion of locally acquired cases in 2019.

Table 18: Country of origin for shigellosis cases in the Auckland region (2019)

Source Country	Total	%
India	14	22%
Tonga	8	13%
Samoa	7	11%
Philippines	3	5%
Australia	3	5%
Fiji	3	5%
Mexico	3	5%
Papua New Guinea	2	3%
United Kingdom	2	3%
USA	2	3%
Spain	1	2%
Colombia	1	2%
Indonesia	1	2%
Argentina	1	2%
Singapore	1	2%
Ethiopia	1	2%
Thailand	1	2%
Peru	1	2%
Madagascar	1	2%
Cambodia	1	2%
Vietnam	1	2%
Chile	1	2%
Middle East	1	2%
Pakistan	1	2%
Not stated	2	3%
Total	**63**	**100%**

Two serotypes were identified throughout the year; *Shigella flexneri* (49 per cent) and *Shigella sonnei* (51 per cent). No *Shigella boydii* were isolated for 2019 whereas three were identified in 2018. All *Shigella* isolates were from stool specimens (see Table 19).

Table 19: Shigella isolates in the Auckland region, 2018 – 2019

Serotype	2018	2019
***Shigella sonnei* Biotype g**	31	45
***Shigella sonnei* Biotype a**	19	19
***Shigella flexneri* 1b**	31	11
***Shigella flexneri* 2a**	7	11
***Shigella flexneri* 6 Boyd 88**	6	11
***Shigella flexneri* 1c**	5	6
***Shigella flexneri* 3b**	1	5
***Shigella flexneri* 1a**	2	4
***Shigella flexneri* 4b**		4
***Shigella flexneri* 2b**	1	2
***Shigella flexneri* Yv**	1	2
***Shigella flexneri* 4av**		2
Shigella flexneri	2	1
***Shigella flexneri* 3a**	2	1
***Shigella flexneri* X**		1
***Shigella sonnei* Biotype f**	1	1
***Shigella* Species positive**		1
Untyped	2	
***Shigella flexneri* Y**	2	
***Shigella boydii* 1**	1	
***Shigella boydii* 10**	1	
***Shigella boydii* 2**	1	
***Shigella dysenteriae* 3**	1	
***Shigella flexneri* 3b**	1	
***Shigella sonnei* isolated**	1	
EHEC	3	
Total	**122**	**127**

Shigella sonnei Biotype g and *Shigella sonnei* Biotype a were the most common serotypes, *displacing Shigella flexneri* Type 1b, *Shigella flexneri* 2a*, and Shigella flexneri* 6 Boyd 88 as the most common serotypes in 2019.

Of the 45 *Shigella sonnei* Biotype g cases identified, 20 were acquired overseas from 14 different countries with no particular country predominating. For the 25 locally acquired cases, various risk factors were identified. Five of the six MSM cases notified with shigellosis had the Biotype g serotype. Of the 11 *Shigella flexneri* 6 Boyd 88*,* six reported overseas travel, the majority (4) of which were associated with travel to Samoa. Likewise, of the 11 *Shigella flexneri* 1b cases, five reported overseas travel, including three from Tonga. *Shigella flexneri* 2a was identified in 11 cases, five were acquired from overseas travel but originating from five different countries.

India recorded 14 cases associated with overseas travel but across nine different serotypes, the most common being *Shigella flexneri* 4B (3).

Of the locally acquired cases, risk factors included consumption of raw fish (1), recreational swimming at a beach outside Auckland (1), and recreational swimming in a public swimming pool (2).

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 are 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 kidneys, to the extent that 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.

In mid-2015, Labtests Auckland introduced testing using the Entericbio® Gastro Panel assay. This PCR-based platform has the advantage of automated testing of multiple pathogens including viruses, bacteria and parasites in one assay. This results in a faster turnaround time and therefore improves timeliness for diagnosis, patient management and public health response. Labtests held a short trial in March 2015, which demonstrated good sensitivity and specificity and, in June 2015, PCR based testing in the Auckland region went live.

Verotoxin PCR positive samples processed by Labtests were sent to the Enteric Reference Laboratory at the Institute for Environmental and Scientific Research (ESR), a Crown Research Institute for further typing and analysis.

Prior to the introduction of PCR-based testing, 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.

In 2017 the incidence rate for the Auckland region was 14.2 cases per 100,000, with a total of 243 probable and confirmed cases for the year, up from 213 cases in 2018 and 177 cases.

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 22.1 cases per 100,000 in 2018 and 27.0 cases per 100,000 in 2019.

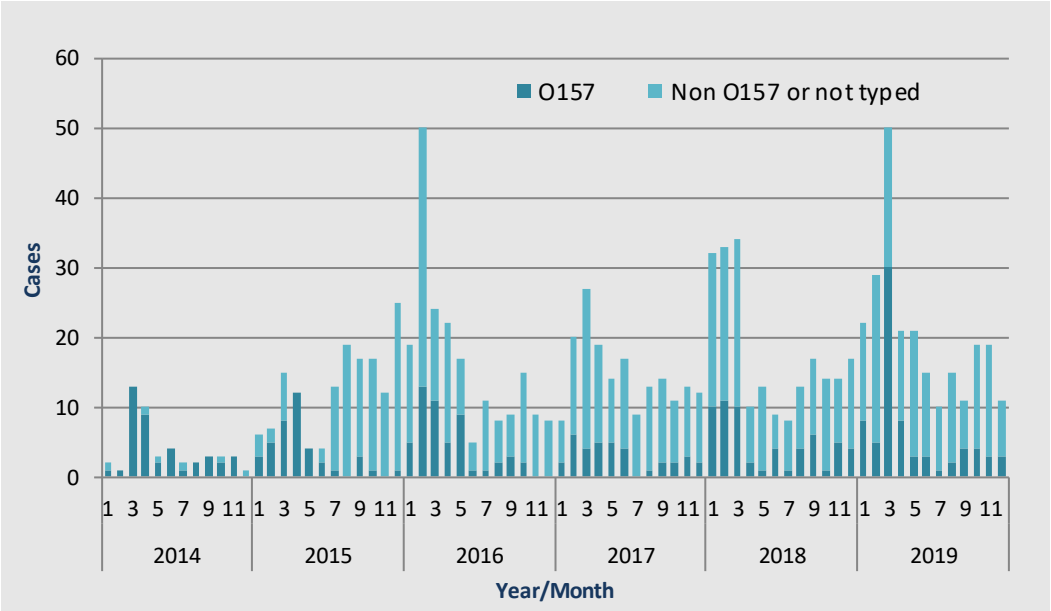


Figure 12: VTEC serotypes O157 and non-O157 by year and month for the Auckland region 2014-2019

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 12 and Table 20). This proportion of *E. coli* O157 cases has remained largely unchanged since, apart from an observed eight per cent increase in 2018 compared with 2017 (however this increase was not statistically significant). 2019 saw similar proportions to 2018. This suggests the new testing methodology is detecting more non-O157 cases.

Table 20: Proportion of O157 to non-O157 cases prior to the June 2015 introduction of PCR testing - and after - in the Auckland region 2014 – 2019

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

ARPHS' risk-based approach is based on two key aspects:

1. Severity of the illness
2. Public health risk

The case definition for VTEC is: "A clinically-compatible illness plus laboratory isolation of specific organisms or toxin." The Ministry of Health's Communicable Disease Control

Manual is in the process of clarifying what constitutes 'a clinically compatible illness'. It is apparent from our investigations that there is a wide spectrum of presenting symptoms. We also know that there are specific high-risk groups for HUS and public health risk. Accordingly, from 2016, symptoms from all notifications received by ARPHS were graded into three levels. During 2018 it was determined that this could be simplified further into just two categories (Table 21). This was implemented for the final quarter.

Table 21: Grading of symptoms of VTEC illness

Clinical Illness	Status	Assignment
Acute onset (<2 weeks) diarrhoeal illness (with or without blood or mucus in stool) OR Any case with documented HUS or TTP	Under Investigation	Assign to Disease Investigation
Chronic diarrhoea (>2 weeks) or no diarrhoea*	Not a case	Assign to Medical Officer
**If marginal e.g. acute diarrhoea three weeks ago in a young child, farm worker or travel, then assign for interview* Clinical exclusion criteria (despite having definitive laboratory evidence): Asymptomatic cases Cases with only mild bowel symptoms (e.g. occasional loose stools) or presentation with abdominal pain alone		

All cases were assigned to the Senior Medical Officer (SMO) for initial assessment, which included symptom grading, and an attempt to establish whether the case was high risk i.e. worked as a food handler, Early Learning Service (ELS) teacher, attended an ELS, or worked in healthcare.

After initial assessment, the following actions were taken:

- All acute onset diarrhoeal illness (< 2 weeks) or any case with HUS or TTP was referred to disease investigators (DI) for interview
- The remaining cases with chronic diarrhoea (> 2 weeks) or no diarrhoea were classified as 'not a case', and assigned to a Medical Officer pending typing
- Culture positive cases with symptoms > 2 weeks were reviewed in light of the serotyping results, especially for O157, O26, O128 cases, to consider a possible link to other cases (even though they are classified as "not a case" for surveillance purposes as they do not meet the national clinical case definition)

A total of 243 cases of VTEC were reported, up from 214 in 2018 and 177 in 2017 (Figure 13).

Cases occurred throughout the year, with a large number of notifications during the first quarter. Typically, there is an expected increase at this time of year thought to be associated with new rain after longer periods of dry weather. (Dobrowsky, P et al, 2014). In this first quarter increase, the more severe O157 serotype predominated. Although case interviews identified multiple risk factors, a common cause was unable to be identified. Hospitalisation occurred in 64 cases (26 per cent). There were four reported cases of HUS; three were associated with the O157 strain, the remaining case was identified as having the O38:H26 strain. There were fortunately no deaths.

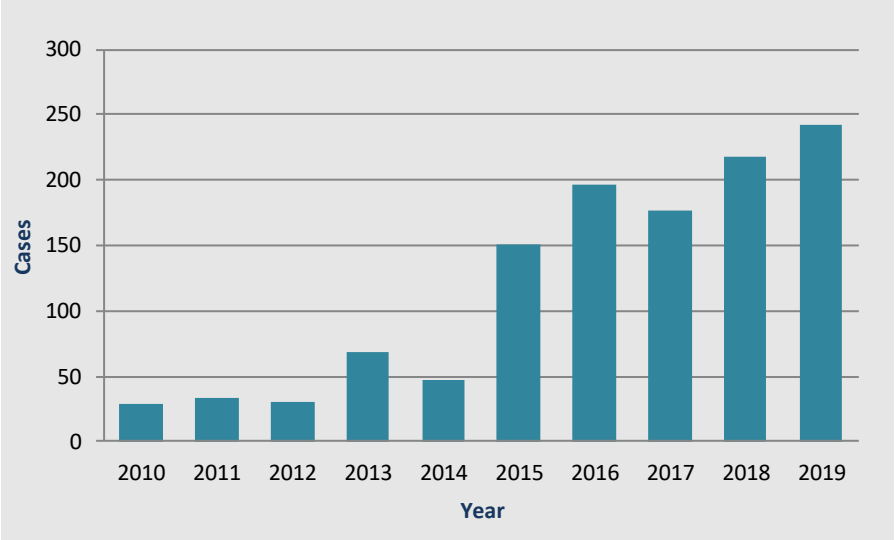


Figure 13: VTEC cases in the Auckland region 2010-2019

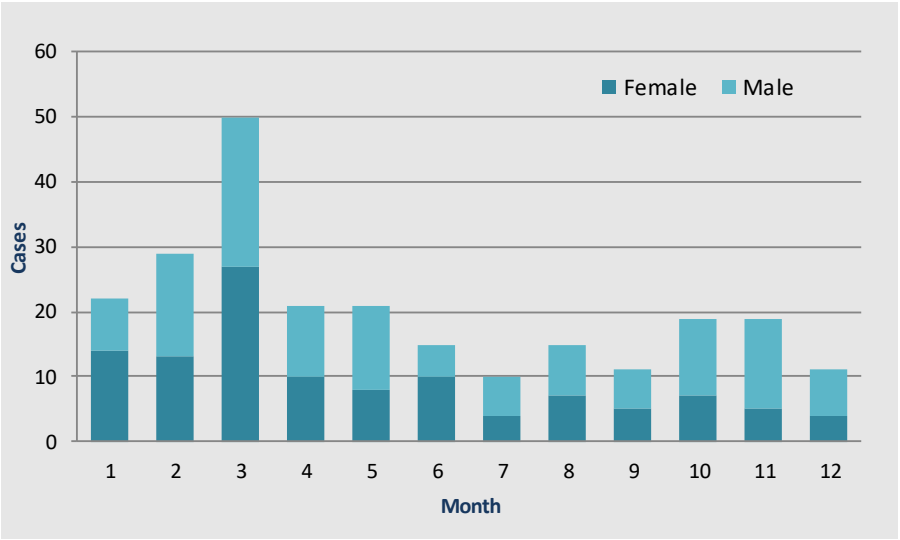


Figure 14: Monthly distribution of VTEC cases in the Auckland region by gender (2019)

The highest incidence rates were seen in the younger-than-five-year-old age groups. The male to female ratio was clearly in favour of male babies younger than one year and in previous years, this has also been observed in the one-to-four-year-old age group. Also, in previous years there has been a predominance of female cases in the 20-to-39-year-old age group (Table 22*)*, but this is seen to a lesser degree in 2019.

Table 22: Age and gender distribution and age-specific incidence rates of VTEC in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000 pop*
<1 year	1	10	11	51.1
1 to 4	20	21	41	47.6
5 to 9	3	10	13	11.4
10 to 14	3	9	12	11.0
15 to 19	8	6	14	12.6
20 to 29	15	12	27	9.8
30 to 39	14	11	25	9.6
40 to 49	10	12	22	9.8
50 to 59	15	11	26	12.4
60 to 69	12	17	29	19.1
70+	13	10	23	16.5
Total	**114**	**129**	**243**	**14.3**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand).

The highest incidence rate was seen in the European ethnicities representing 70 per cent of all cases notified (Table 23).

Table 23: Ethnic distribution and gender-specific incidence rates of VTEC in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000 pop.
Asian	12	20	32	6.5
European or Other	83	85	168	21.5
Maori	9	12	21	10.6
Pacific peoples	10	10	20	8.8
Unknown	0	2	2	-
Total	**114**	**129**	**243**	**14.3**

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

The risk factors for VTEC are listed below. 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 24). These risk factors have not changed substantially since 2016, although an increase was seen in overseas acquired cases in 2018. For 2019 there was a smaller proportion of cases associated with faecal contact, another confirmed case, or person with a similar illness, than in previous years.

Table 24: Risk factors associated with VTEC in the Auckland region 2016 - 2019

Risk factors	Cases	% Present 2016	% Present 2017	% Present 2018	% Present 2019
Overseas acquired	33	9%	18%	24%	12%
Untreated water supply	42	17%	11%	17%	15%
Contact with farm animals	32	14%	17%	16%	12%
Contact with domestic pets	88	43%	42%	47%	37%
Contact with faeces or manure	15	24%	20%	22%	13%
Contact with confirmed case or person with similar illness	18	13%	11%	14%	9%
Recreational water contact	6	1%	1%	0.6%	2%
Consumption of home kill meat	12	5%	4%	4%	5%

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 2019 incidence rate for the Auckland region was 21.7 cases per 100,000, lower than the incidence rate for the rest of New Zealand (25.8/100,000). A total of 369 cases of salmonellosis were reported, well up from the 286 cases in 2018, 297 cases in 2017 and 291 cases in 2016 (Figure 15).

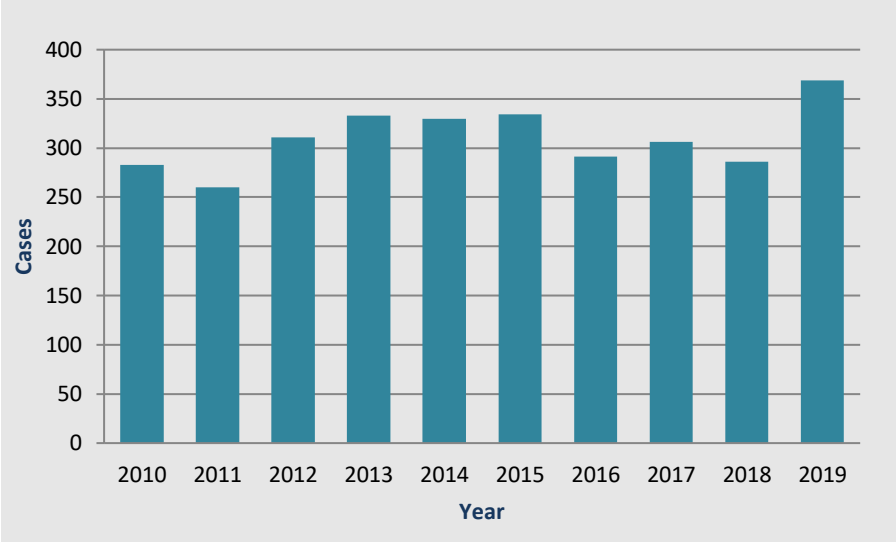


Figure 15: Salmonellosis cases in the Auckland region 2010-2019

January and February were the peak months, with the fewest notifications over the winter months (Figure 16).

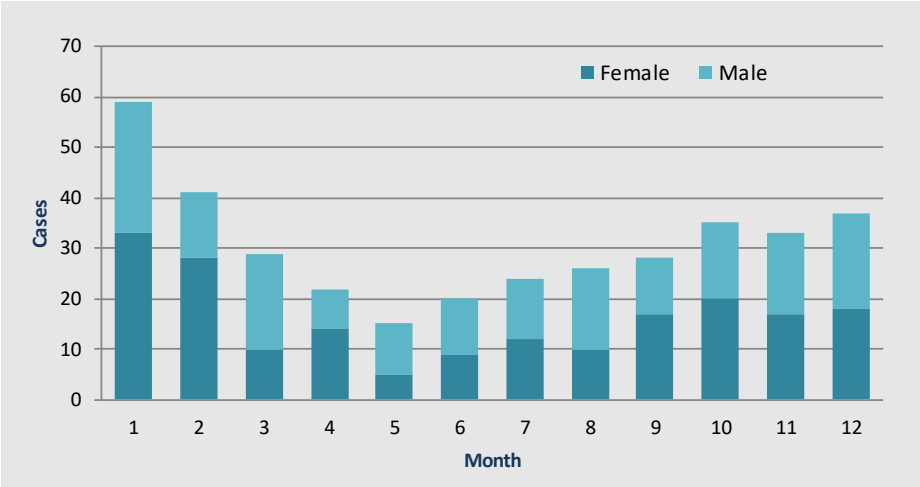


Figure 16: Monthly distribution by gender of salmonellosis cases in the Auckland region 2019

The incidence rate was highest in children younger than five-years-old (Table 25), and especially for those under a year old. Among the major ethnic groups, the incidence rates were highest among Pacific peoples, followed by 'Other' (which includes the European ethnic group) and Asian ethnic groups (Table 26). Just over a quarter (28 per cent) of salmonellosis cases were hospitalised in 2018. There were no deaths.

Table 25: Age-gender distribution and age-specific incidence rates of salmonellosis in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1 year	16	10	26	120.7
1 to 4	23	26	49	56.9
5 to 9	8	11	19	16.6
10 to 14	2	6	8	7.4
15 to 19	7	5	12	10.8
20 to 29	29	21	50	18.1
30 to 39	21	21	42	16.2
40 to 49	20	15	35	15.7
50 to 59	29	19	48	22.8
60 to 69	20	26	46	30.3
70+	18	16	34	24.5
Total	**193**	**176**	**369**	**21.7**

*Rates are based on 2019 estimated mid-year population (Source: Statistics New Zealand)

Table 26: Ethnic distribution and gender-specific incidence rates of salmonellosis in the Auckland region 2019

Ethnic group	Female	Male	Grand Total	Rate per 100,000*
Asian	39	37	76	15.4
European or Other	121	89	210	26.9
Maori	13	10	23	11.6
Pacific peoples	19	36	55	24.1
Total	**193**	**176**	**369**	**21.7**

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

Salmonella serotype analysis of 359 out of the 369 samples showed the highest salmonellosis notifications were caused by the outbreak strain *Salmonella Typhimurium* phage type 108/170, which occurred during the first quarter linked to the consumption of alfalfa bean sprouts.

The Auckland region had 27 of the 70 cases reported nationally. *Salmonella enterica* subsp. enterica (I) ser. 4,5,12:i: - occurred sporadically throughout the year but no common source was found.

The other outbreak strains observed during August were due to *Salmonella Enteritidis* phage type 8. The common event was a gathering of nine people for a birthday celebration where they consumed the cake. All became unwell and another family member who consumed cake the day after also became a case.

Finally, a small outbreak during August and September of *Salmonella Enteritidis* phage type 21 involving six people was associated with eating food from the same central city cafe.

Most of the other serotypes were spread sporadically throughout the year, with lower numbers reported in the winter months (Table 27).

Table 27: Selected serotypes identified for salmonellosis in the Auckland region (2019)

Salmonella Serotype	Cases
***Salmonella Typhimurium* phage type 108/170**	27
***Salmonella enterica* subsp. *enterica* (I) ser. 4,5,12 i: -**	26
Salmonella Enteritidis	18
Salmonella Typhimurium	15
Presumptive Salmonella Typhimurium	15
Salmonella Stanley	13
Salmonella Paratyphi B var Java	11
Salmonella Weltevreden	10
***Salmonella Typhimurium* phage type 56 variant**	10
***Salmonella Enteritidis* phage type 8**	10
***Salmonella Enteritidis* phage type 28**	10
***Salmonella Typhimurium* phage type RDNC**	9
Salmonella Brandenburg	8
Salmonella Bovismorbificans	7
***Salmonella Typhimurium* phage type 101**	6
***Salmonella Enteritidis* phage type 21**	6
Salmonella Agona	6
Salmonella Infantis	6
Salmonella Heidelberg	5
***Salmonella Enteritidis* phage type 26**	5
Salmonella Thompson	5
***Salmonella Enteritidis* phage type 11**	5
Salmonella Newport	5

Overseas travel accounted for 36 per cent of cases (133). The top source countries were Indonesia (31), Samoa (11), Australia (8), Fiji (8) and Vietnam (8). Other risk factors are shown in Table 28. A quarter of cases reported direct contact with pets. One in ten had contact with manure or compost, and recreational swimming was reported in seven per cent of cases. One case in six implicated a restaurant or food premises. Of the foods consumed, chicken and other meat products were those most frequently eaten by cases with salmonellosis, with an increase seen in consumption of cold sliced meat products. However, in no food samples was the presence of *salmonella* bacteria confirmed.

Table 28: Risk factors for salmonellosis in the Auckland region 2016 and 2017*

Risk factor	2017	2018	2019
Case overseas during the incubation period	41%	35%	36%
Case travelled within NZ during the incubation period*	7%	6%	6%
Contact with a confirmed case/another unwell person *	17%	3%	6%
Environmental risk factors			
Direct contact with pets	29%	20%	25%
Implicated restaurant or premises	16%	17%	14%
Contact with manure or compost	5%	1%	10%
Recreational swimming pool and other	14%	8%	7%
Untreated water from tank, bore or stream	7%	5%	3%
Visit farm	10%	4%	3%
Consumed food at large gathering	5%	9%	13%
Contact with animal faeces	7%	3%	7%
Contact with sick animals	1%	0%	1%
Foods *			
Chicken	37%	33%	27%
Other meats and poultry products	29%	21%	25%
Takeaway foods	17%	17%	14%
Tofu / soy products	5%	2%	3%
Cold sliced meat (ham, saveloys, salami, frankfurters, other)	5%	15%	23%
Raw eggs	2%	2%	4%
Sesame seed products	2%	2%	6%
Untreated raw milk		0.3%	1%

*Excludes those cases who acquired their illness overseas

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 105.5 cases per 100,000, significantly less than the incidence rate for the rest of New Zealand (139.0/100,000, p=<0. 001).

A total of 1,795 cases were reported, down 13 per cent on the 2,065 cases in 2018 (Figure 17). Campylobacter shows a typical seasonal distribution, with lower levels seen during winter, increasing during spring, and peaking in early summer (Figure 18).

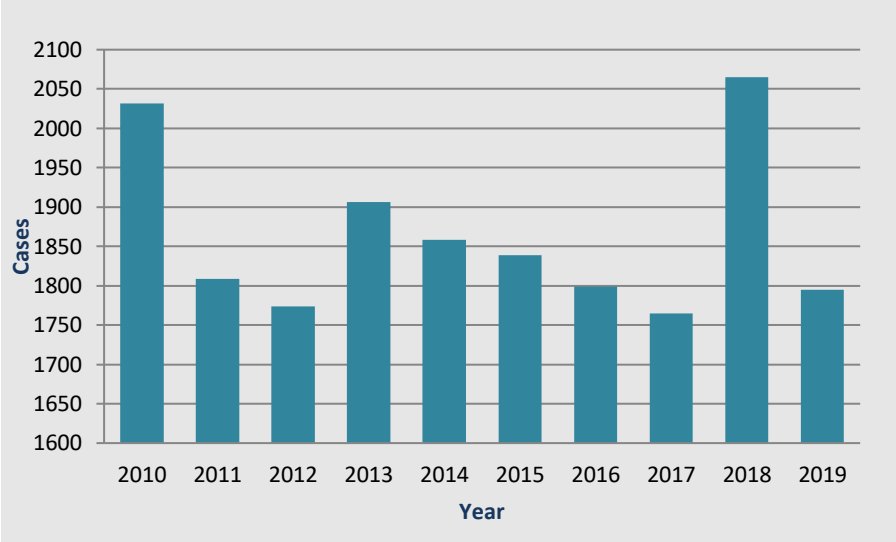


Figure 17: Campylobacteriosis cases in the Auckland region 2010 - 2019

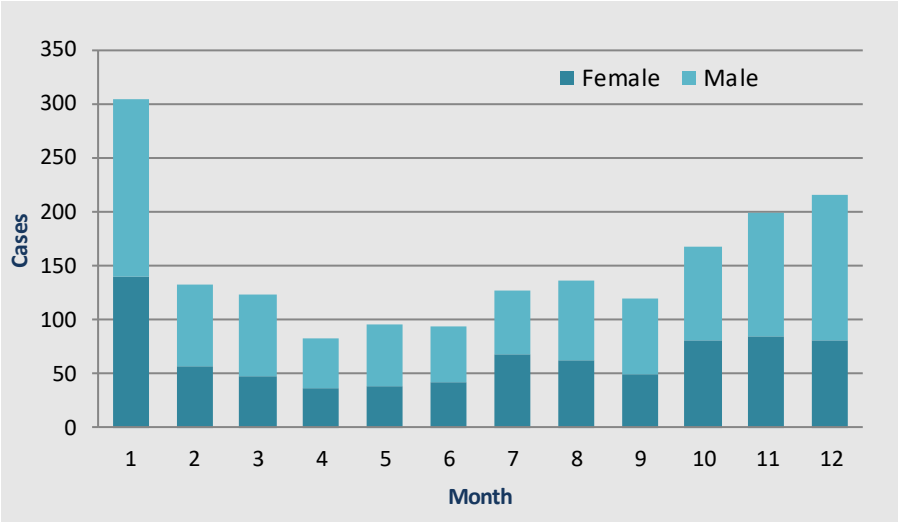


Figure 18: Monthly distribution of campylobacteriosis by gender in the Auckland region (2019)

The incidence rate was highest in the elderly, especially the over 70s, followed by the less-than-five-year age group (Table 29). Males are slightly more likely to be affected, with a male to female ratio of 1.3:1.

Table 29: Age and gender distribution and age-specific incidence rates of campylobacteriosis in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1 year	12	15	27	125.4
1 to 4	57	81	138	160.2
5 to 9	28	52	80	70.1
10 to 14	30	52	82	75.4
15 to 19	34	51	85	76.6
20 to 29	121	142	263	95.3
30 to 39	99	106	205	79.0
40 to 49	90	101	191	85.5
50 to 59	102	133	235	111.7
60 to 69	102	137	239	157.4
70+	108	142	250	179.8
Total	**783**	**1012**	**1795**	**105.5**

* Rates are based on estimated mid-year population, 2019 (Source: Statistics New Zealand)

Waitemata DHB had the largest number of reported campylobacteriosis cases (793), and Counties Manukau the least (487). This may represent health-seeking behaviour rather than true geographical predisposition. The highest incidence rate was seen in the European or Other ethnic group (145.0/100,000), which was more than double the rate for Māori, and more than three times that for Pacific peoples. The Asian rate, though still well below the European/Other rate, is approximately the same as Māori and higher than that of Pacific peoples, at 38.9 cases per 100,000 (Table 30).

Table 30: Ethnic distribution and gender-specific incidence rates of campylobacteriosis in the Auckland region (2019)

Ethnicity -prioritised	Female	Male	Total	Rate per 100,000*
Asian	104	118	222	45.0
European or Other	488	645	1133	145.0
Māori	40	46	86	43.3
Pacific peoples	40	49	89	38.9
Unknown	111	154	265	-
Grand Total	**783**	**1012**	**1795**	**105.5**

*Rates are based on Ministry of Health Prioritised Pop 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 (waste product) of an infected person, including asymptomatic cases.

There were no cases of cholera in 2019.

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 living with HIV/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 18.3 cases per 100,000; slightly less than the incidence rate for the rest of New Zealand (22.8/100,000).

A total of 311 cases of cryptosporidiosis were reported, well down on the 573 cases notified in 2018 and back to 2017 levels of 333 cases. The introduction of PCR laboratory testing in 2015 doubled the detection rate of cryptosporidiosis, but this alone does not explain the increase observed in 2018 and the subsequent return to 2016 and 2017 levels in 2019.

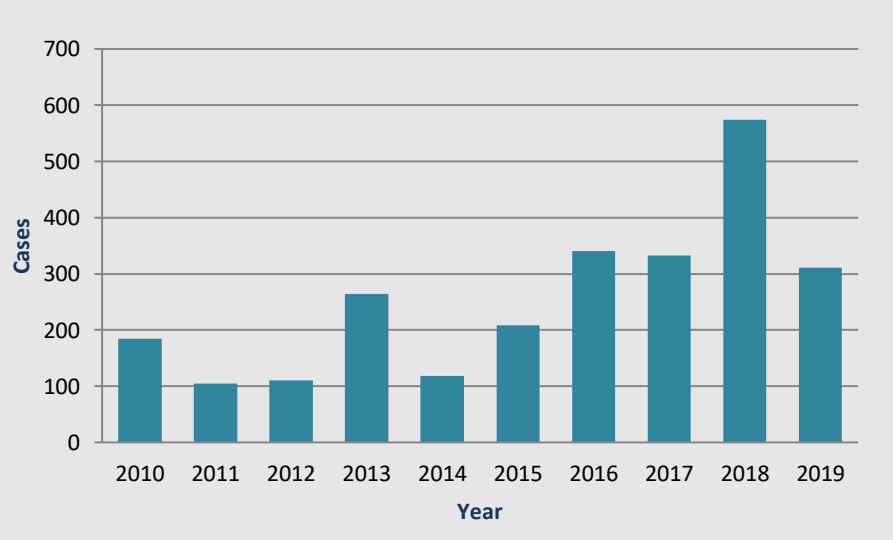


Figure 19: Cryptosporidiosis cases in the Auckland region 2010-2019

Cryptosporidiosis shows a typical seasonal distribution, with peak levels in late summer and early autumn, then lower levels during winter. Typically, there is an increase in spring during the lambing and calving seasons (starting in August) when there is closer contact

with farm animals, and this was quite obvious in 2019. Hospitalisation data is incomplete and only one case is recorded as requiring hospitalisation. There were no deaths.

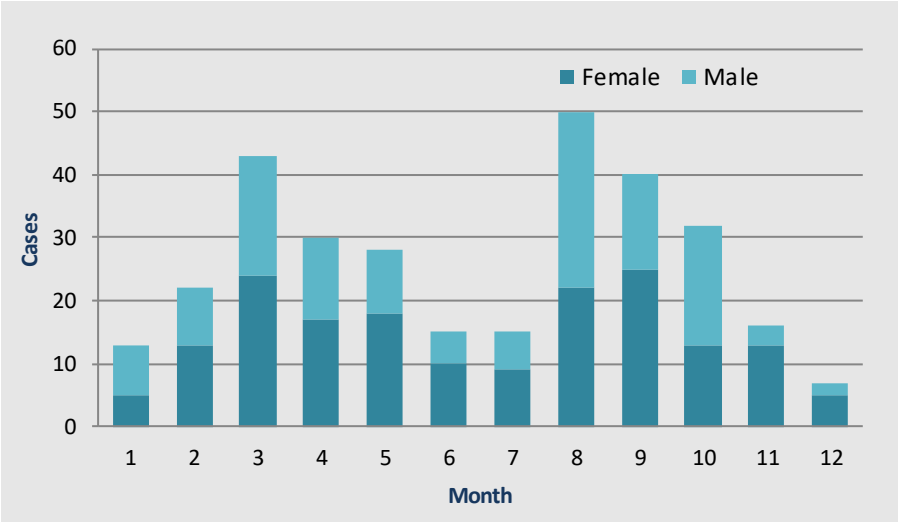


Figure 20: Monthly distribution of cryptosporidiosis cases by gender in the Auckland region (2019)

The age-specific incidence rate was highest in children aged one-to-four years, followed by those in the five–to-nine-year age group and under-one-year-olds (Table 32). The female to male ratio was 1.3:1 overall, but in the 30-to-39 year age group, the ratio was 2.6:1.

Table 31: Age and gender distribution and age-specific incidence rates of cryptosporidiosis in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1 year	3	2	5	23.2
1 to 4	33	34	67	77.8
5 to 9	9	21	30	26.3
10 to 14	12	10	22	20.2
15 to 19	9	4	13	11.7
20 to 29	23	23	46	16.7
30 to 39	39	15	54	20.8
40 to 49	18	13	31	13.9
50 to 59	13	9	22	10.5
60 to 69	9	3	12	7.9
70+	6	3	9	6.5
Total	**174**	**137**	**311**	**18.3**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

The incidence rate was highest for the European/Other ethnic group, with 27 cases per 100,000, at least double the incidence of any of the other ethnic groups (Table 32).

Table 32: Ethnic distribution and gender-specific incidence rates of cryptosporidiosis in the Auckland region (2019)

Ethnicity - prioritised	Female	Male	Total	Rate per 100,000*
Asian	31	15	46	9.3
European or Other	115	96	211	27.0
Māori	14	12	26	13.1
Pacific peoples	10	8	18	7.9
Unknown	4	6	10	-
Total	**174**	**137**	**311**	**18.3**

* 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 routinely collects risk factor data.

There was contact with an unwell person in 15 per cent of cases. Of the environmental risk factors, 58 per cent of cases had direct contact with pets. Recreational swimming in public pools was a risk factor for half of the cases. A higher proportion than normal had contact with animal or human faeces, and contact with manure or compost was a risk factor for 20 per cent of cases. Consumption of untreated water was a risk factor for 15 per cent of cases (Table 33).

Table 33: Risk factors for cryptosporidiosis in the Auckland region 2016-2018

Risk factor	2016	2017	2018
Case overseas during the incubation period	11%	11%	3%
Case travelled within NZ during the incubation period	13%	10%	31%
Contact with an unwell person	11%	19%	15%
Environmental risk factors *			
Direct contact with pets	48%	38%	58%
Recreational swimming pool and other	20%	18%	53%
Visit to farm, petting zoo etc.	16%	13%	5%
Contact with animal faeces	14%	7%	21%
Contact with manure or compost	13%	16%	20%
Untreated water	11%	9%	15%
Contact with human faeces	10%	4%	20%
Contact with sick animals	5%	4%	3%

2017 data is from 1/1/2017 to September 30 2017

2018 data from 20/2/2018 to 11/4/2018 (n=110)

*Excludes those cases who acquired their illness overseas

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. In 2014, there were an estimated 280 million people worldwide with symptomatic giardiasis.

The incidence rate for the Auckland region was 32.0 cases per 100,000, slightly less than for the rest of New Zealand (32.1/100,000).

A total of 544 cases of giardiasis were reported in 2019, similar to the 560 cases in 2018, 582 in 2017 and 560 in 2016 (Figure 21). Hospitalisation data are incomplete and only four hospitalisations were recorded. There were no deaths.

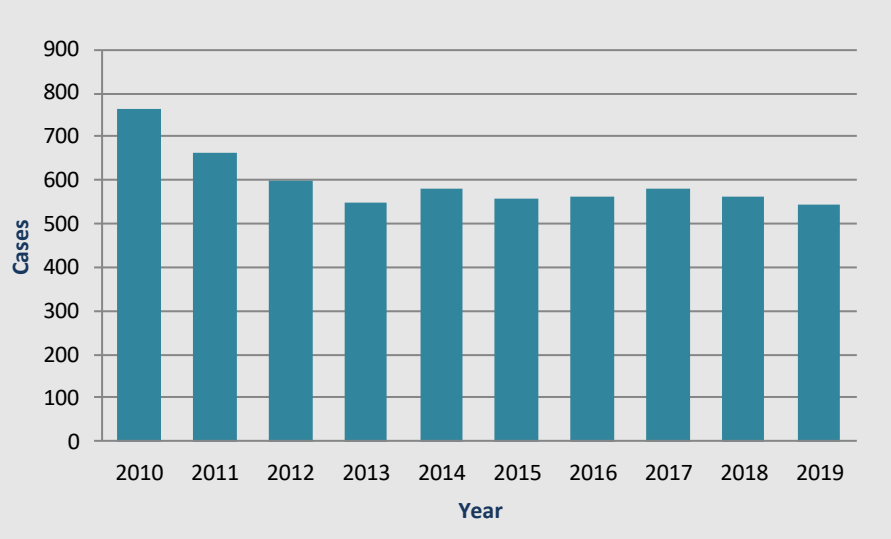


Figure 21: Giardiasis cases in the Auckland region 2010-2019

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 2019 there were additional peaks occurring throughout the year, the spring peaks possibly coinciding with the lambing and calving rearing season (Figure 22).

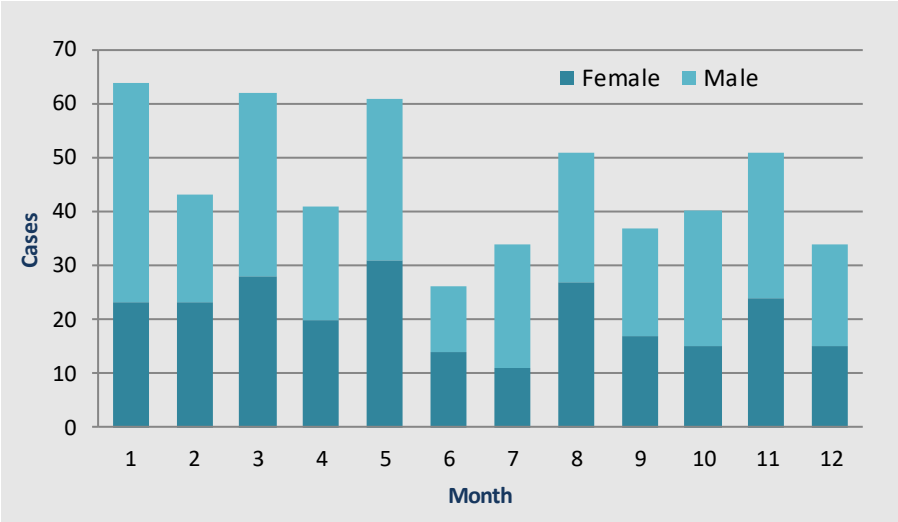


Figure 22: Monthly distribution by gender of giardiasis in the Auckland region (2019)

The age-specific incidence rate was highest in the one-to-four–year-old age group. This was followed by the 30-39-year-old age group, older adults, and then the under-one-year-old age group. More males were reported than females, with a male to female ratio of 1.2:1 (Table 34).

Table 34: Age and gender distribution and age-specific incidence rates of giardiasis in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1 year	2	7	9	41.8
1 to 4	35	58	93	107.9
5 to 9	18	19	37	32.4
10 to 14	6	10	16	14.7
15 to 19	5	9	14	12.6
20 to 29	28	50	78	28.3
30 to 39	55	50	105	40.4
40 to 49	27	39	66	29.5
50 to 59	24	24	48	22.8
60 to 69	36	21	57	37.5
70+	12	9	21	15.1
Total	**248**	**296**	**544**	**32.0**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

The highest incidence by ethnic group was seen in European or Other, followed by MELAA (though numbers are small) (Table 35).

Table 35: Ethnic group distribution of giardiasis in the Auckland region (2019)

Ethnicity - prioritised	Female	Male	Grand Total	Rate per 100,000*
Asian	29	51	80	16.2
European or Other	171	201	372	47.6
Māori	18	20	38	19.1
Pacific peoples	15	9	24	10.5
Unknown	15	15	30	-
Total	**248**	**296**	**544**	**32.0**

* Rates are based on Ministry of Health Prioritised Pop 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.

Five listeria cases were notified in the Auckland region in 2019, down from eight in 2018, and just below the 10-year average of 7.2 cases per year. The 2019 incidence rate for the Auckland region was 0.3 cases per 100,000, approximately half the rate occurring for the rest of New Zealand. Four of the five cases were in the 70-year-plus age group, and three were female and two male. Three cases were European or Other, two were Māori, and one was of Pacific ethnicity. There were no deaths.

There were three additional cases of listeriosis in the perinatal period. Two of the mothers were aged 20-to-29-years-old, and one mother was in 30-to-39-year-old age group. One case was of European/Other ethnicity, one was Māori and one was of Pacific ethnicity. One set of twins was born at 25 weeks, with one twin surviving. A second mother who was particularly careful with her diet during pregnancy but who had been travelling in Spain where there was a current outbreak became unwell with listeriosis after an intra-uterine death at 22 weeks gestation. The third case had an emergency Lower Segment Caesarean Section (LSCS) at 33 weeks for chorio-amnionitis. The baby was transferred to another region and survived. High risk foods consumed included various cheeses, quiche and custard pies. Five cases were O4 serotype, and one case O1/2. The others were not typed.

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 405 cases of yersiniosis for the Auckland region. This is an incidence rate of 23.6 cases per 100,000 (compared with 23.8 cases per 100,000 for the rest of New Zealand) and is a sustained increase from the 289 notifications in 2017. It also continues an upward trend seen since 2015 (Figure 22). A factor in the increase was a change in laboratory methods. At the beginning of 2016, Labtests Auckland doubled the incubation period for stool culture from 24 to 48 hours based on evidence that this increased the yield of *Yersinia enterocolitica* and *Yersinia pseudotuberculosis*. Then, in mid-2017, Labtests introduced PCR testing.

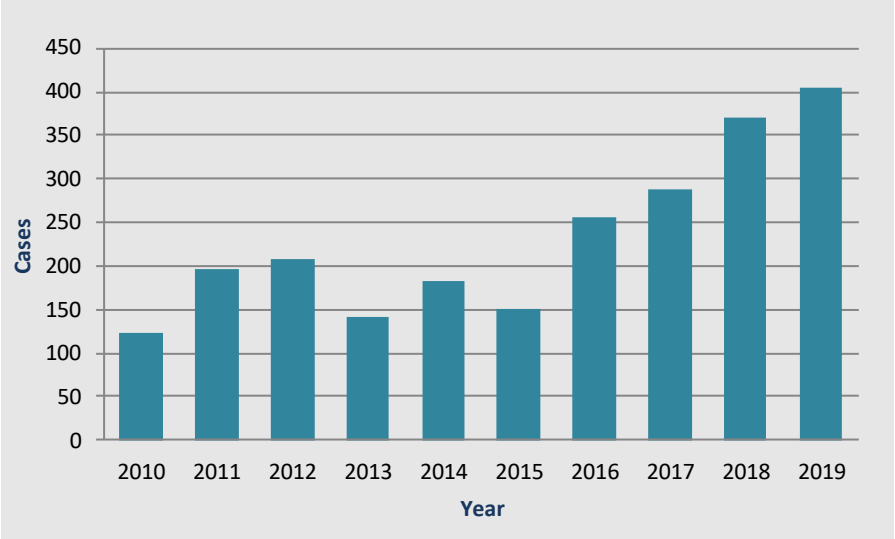


Figure 23: Yersiniosis cases in the Auckland region 2010-2019

Yersiniosis occurs throughout the year, typically with spring peaks. In 2018 and 2019, *Yersinia* also demonstrated an unusual yo-yo-like effect where notifications were up one week and down the next. Fifteen cases (4 per cent) required hospitalisation and there were no deaths.

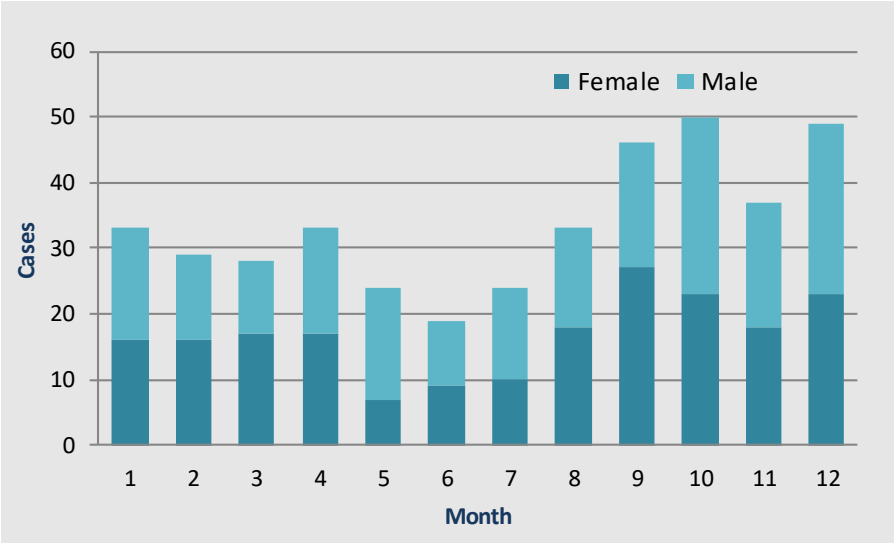


Figure 24: Monthly distribution of yersiniosis cases by gender in the Auckland region (2019)

Children younger than five-years-old led the age-specific incidence rates (Table 36). The Male to female ratio was equal.

Table 36: Age and gender distribution and age-specific incidence rates of yersiniosis in the Auckland region (2019)

Age-group	Female	Male	Total	Incidence-rate per 100,000*
<1 year	7	12	19	88.2
1 to 4	29	34	63	73.1
5 to 9	9	15	24	21.0
10 to 14	5	12	17	15.6
15 to 19	7	7	14	12.6
20 to 29	24	24	48	17.4
30 to 39	35	28	63	24.3
40 to 49	21	22	43	19.2
50 to 59	20	11	31	14.7
60 to 69	23	19	42	27.7
70+	21	20	41	29.5
Total	**201**	**204**	**405**	**23.8**

*Rates are based on 2019-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 114 cases (28 per cent) (Table 37). Of the cases of Chinese ethnicity, 39 per cent were younger than five-years-old. In all other ethnic groups, children younger than five years were responsible for 13 per cent of cases. This finding is reproduced year after year, suggesting that the five-year-and-under age group would be a good one to target with food diary analysis.

Table 37: Ethnic distribution and gender-specific incidence rates of yersiniosis in the Auckland region 2019

Ethnicity - prioritised	Female	Male	Total	Rate per 100,000*
Asian	87	90	177	35.9
European or Other	87	93	180	23.00
Māori	8	8	16	8.1
Pacific peoples	15	10	25	10.9
Unknown	4	3	7	-
Total	**201**	**204**	**405**	**23.8**

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

ESR microbiological typing of yersiniosis cases for the Auckland region by month is shown below (Figure 25) with yearly totals in Table 38. 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 (43 per cent), and *Yersinia enterocolitica* biotype 4 serotype O:3 (18 per cent) (Table 39).

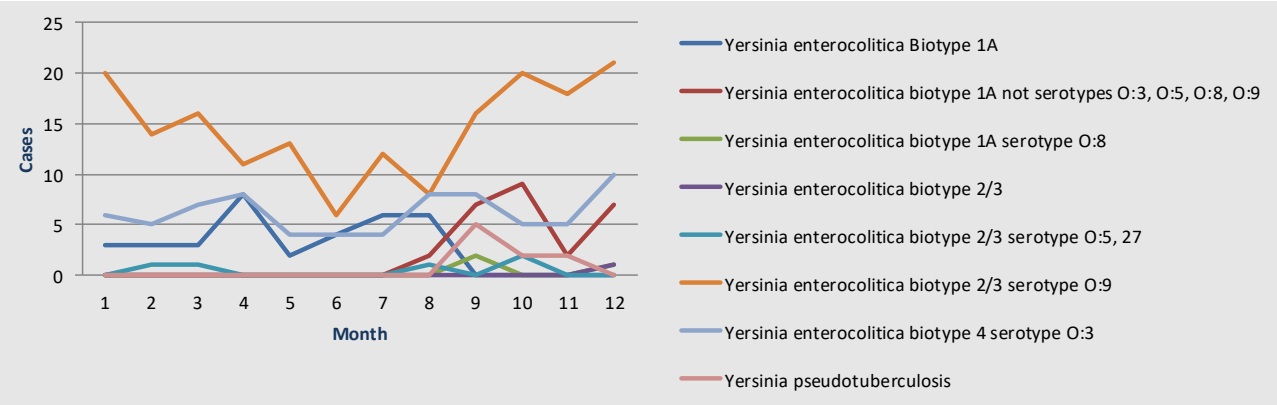


Figure 25: Microbiological typing of yersiniosis by month in the Auckland region 2019

Table 38: Microbiological typing of yersiniosis in the Auckland region 2019

Serotype	Total	%
Yersinia enterocolitica biotype 2/3 serotype O:9	175	43
Yersinia enterocolitica biotype 4 serotype O:3	74	18
Not isolated	66	16
Yersinia enterocolitica Biotype 1A	35	9
Yersinia enterocolitica biotype 1A not serotypes O:3, O:5, O:8, O:9	27	7
Yersinia pseudotuberculosis	9	2
Yersinia enterocolitica biotype 1A serotype O:5	8	2
Yersinia enterocolitica biotype 2/3 serotype O:5, 27	5	1.2
Yersinia enterocolitica biotype 1A serotype O:8	3	0.7
No Yersinia enterocolitica or Yersinia pseudotuberculosis isolated	2	0.5
Yersinia enterocolitica biotype 2/3	1	0.2
Total	**405**	**100**

3.3.8 Gastroenteritis

Auckland Regional Public Health Service received 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 26) and rates by DHB (Figure 27).

Outbreaks of gastroenteritis occur frequently in the Auckland region. Please see Section 8 for further information.

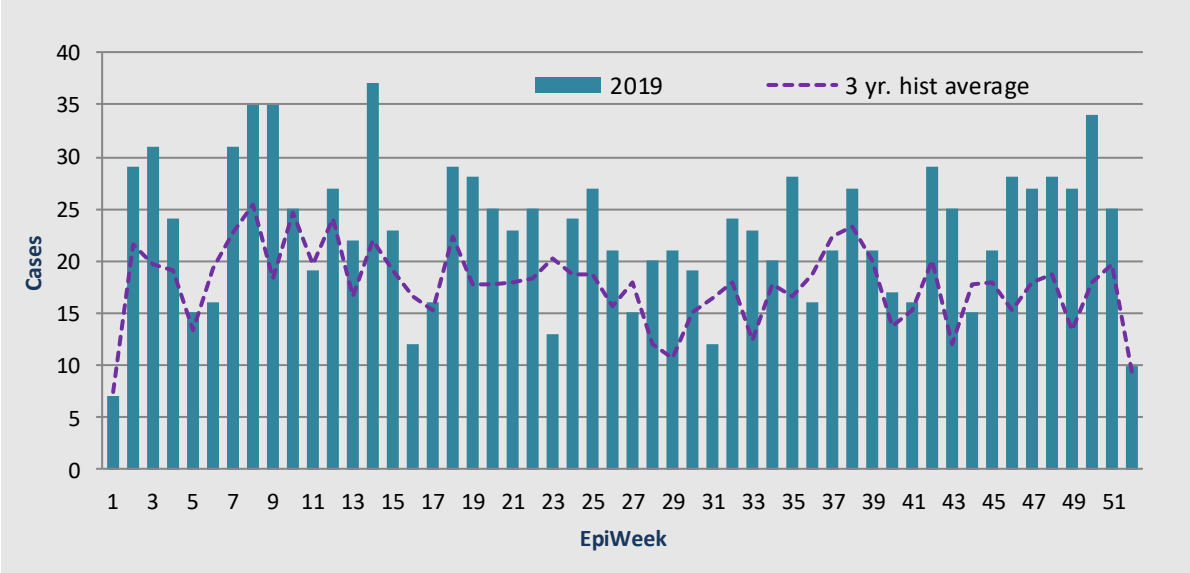


Figure 26: Gastroenteritis cases from sentinel GPs in the Auckland region (2019)

(Source HealthStat)

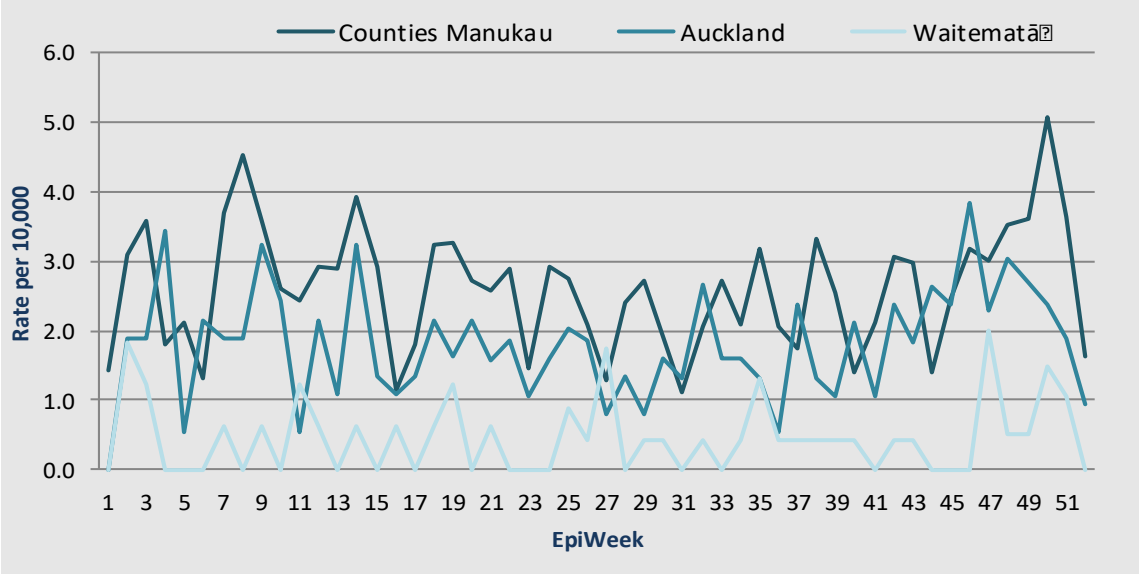


Figure 27: Gastroenteritis rates from sentinel GPs by DHB in the Auckland region (2019)

(Source HealthStat)

The weekly data is rather "noisy" but monthly plotting identifies four waves of gastroenteritis over the year - presumably relating to new strains moving through the community. Total 2019 cases by month (Figure 28), and by DHB and month (Figure 29), are shown below.

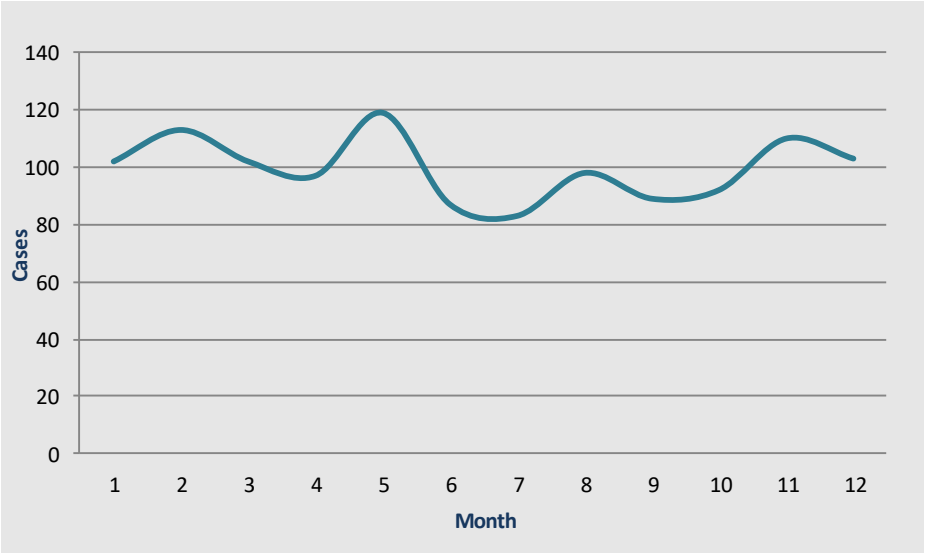


Figure 28: Gastroenteritis cases from sentinel GPs by month in the Auckland region (2019)

Source: HealthStat

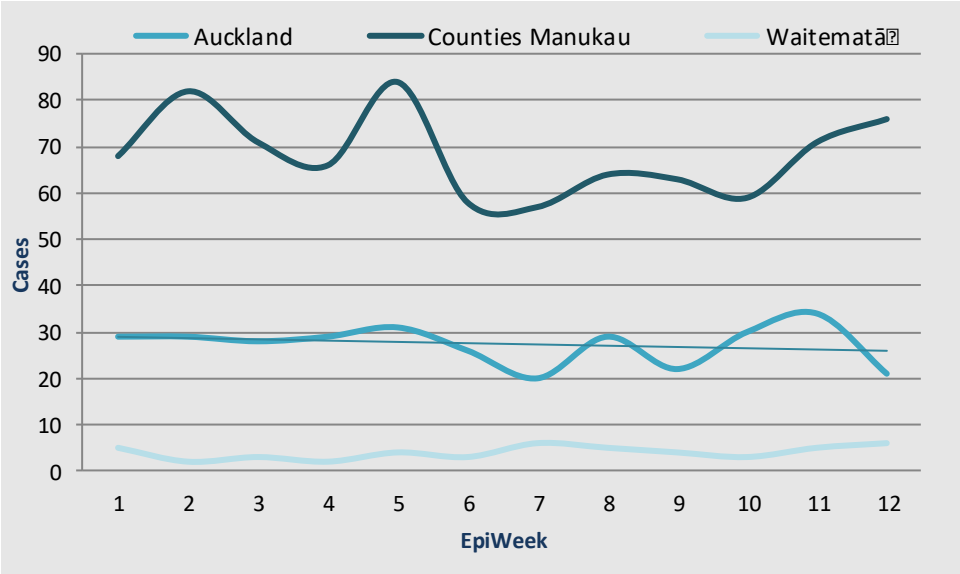


Figure 29: Gastroenteritis cases by DHB from sentinel GPs in the Auckland region (2019)

Source: HealthStat

Nearly a third of the gastroenteritis cases reported were in children younger than five years old. The 15-to-44-year-old age group also represented a third of cases. These proportions are very similar to 2017 (Table 41).

Table 39: Age group and proportion of cases reported by sentinel GP in the Auckland region (2019)

Age group	Cases	%
0 to 4	863	29
5 to 14	351	12
15 to 44	1067	36
45 to 64	493	17
65+	187	6
Total	**995**	**100%**

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.

Key points

- Hepatitis A, B, C notifications were stable.
- Hepatitis A rates were highest for the Pacific ethnic group, with the majority of cases originating from the Pacific region.
- Hepatitis B and C notifications were stable with highest rates seen in older age groups.
- There were two hepatitis E cases imported from India and Pakistan, and five hepatitis delta aged between 30 and 58-years-old (four with Pacific origins).

A total of 57 cases of probable and confirmed viral hepatitis were reported in 2019, compared with 63 cases in 2018 (Table 40, Figure 30). All cases were serologically confirmed: 37 as hepatitis A, eight as hepatitis B, five as hepatitis C and seven as hepatitis 'Not Otherwise Specified' (NOS). These NOS notifications included two cases of hepatitis E and five cases of hepatitis D. The distribution of acute viral hepatitis serotypes by year is shown in Figure 30. Hospitalisation was required for 50 per cent of cases. No deaths were reported from acute viral hepatitis.

Table 40: Classification of acute viral hepatitis cases in the Auckland region (2019)

Hepatitis Type	Total	%
Hepatitis A	37	65.0
Hepatitis B	8	14.0
Hepatitis C	5	8.8
Hepatitis NOS	7	12.2
Hepatitis D (5)		
Hepatitis E (2)		
Total	**57**	**100.0**

Hepatitis A = anti-HAV IgM positive,

Hepatitis B = anti-HBc IgM positive,

Hepatitis C = anti-HCV IgM positive /HEPCRNA positive

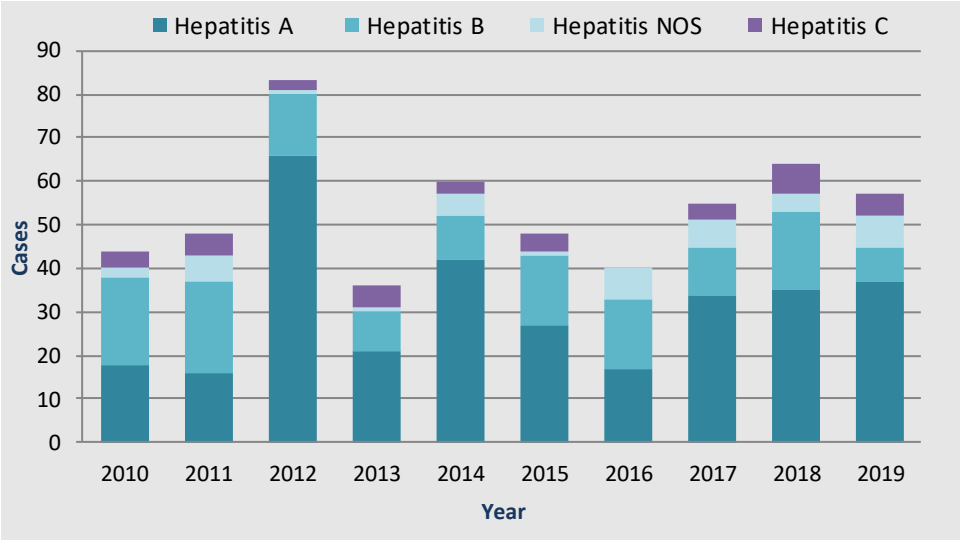


Figure 30: Viral hepatitis cases by type in the Auckland region 2010 - 2019

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 and 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 37 hepatitis A cases notified, 24 cases were hospitalised. The incidence rate for the Auckland region was 2.2 cases per 100,000, more than three times the rate for the rest of New Zealand (0.6 per 100,000). The highest incidence rate was observed in the 15-to-19-year age group, followed by the under-fives, and then five-to-nine and 10-to-14-year old age groups (Table 41). 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 42).

Table 41: Age-gender distribution and age-specific incidence rates of acute hepatitis A in the Auckland region (2019)

Age-group	Female	Male	Total	Incidence per 100,000*
1 to 4	2	2	4	4.6
5 to 9		4	4	3.5
10 to 14	2	2	4	3.7
15 to 19	5	1	6	5.4
20 to 29	3	5	8	2.9
30 to 39	3	4	7	2.7
40 to 49	2	1	3	1.3
50 to 59		1	1	0.5
Total	**17**	**20**	**37**	**2.2**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

Table 42: Ethnic group specific incidence rates of acute hepatitis A in the Auckland region (2019)

Ethnicity Prioritised	Female	Male	Total	Incidence per 100,000*
Asian	6	10	16	3.2
European or Other	4	2	6	0.8
Māori		1	1	0.5
Pacific peoples	7	7	14	6.1
Total	**17**	**20**	**37**	**2.2**

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

A range of ethnicities were identified, with the highest number of cases reported in the Tongan and Indian ethnic groups, followed by other Asian ethnicities (Table 43).

Table 43: Ethnicity of acute hepatitis A in the Auckland region (2019)

Ethnicities	Female	Male	Total
Tongan	3	6	9
Indian	4	4	8
Other Asian	2	2	4
NZ European	2	2	4
Samoan	1	1	2
Fijian (except Fiji Indian / Indo-Fijian)	2		2
European	2		2
Pakistani		1	1
Other Pacific peoples	1		1
Korean		1	1
Iraqi		1	1
Fijian Indian / Indo-Fijian		1	1
Chinese		1	1
Total	**17**	**20**	**37**

Just over two thirds of cases (68 per cent) were acquired overseas. The source countries for these 25 cases are shown in Table 44.

Table 44: Source country for overseas acquired acute hepatitis A in the Auckland region 2019

Source country	Total
Samoa	4
India	4
Tonga	3
Fiji	3
Indonesia	3
United States of America	2
Zimbabwe	1
Hong Kong (SAR)	1
Korea (DPR)	1
Pakistan	1
Afghanistan	1
Kiribati	1
Total	**25**

Of the 37 cases, seven were reported as being household contacts of a confirmed case i.e. they were secondary cases.

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. It is not a foodborne illness but is blood borne and included here for the sake of convenience. 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, feeling tired, 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, 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 eight acute hepatitis B cases notified in 2019, five cases were hospitalised. The incidence rate for the Auckland region was 0.5 cases per 100,000, which is the same as for the rest of New Zealand (0.6 per 100,000) (Table 45). The highest age specific incidence rate was seen in older age groups, as in previous years. The overall male to female ratio was 3:1. The ethnicity of the eight cases is shown in Table 46.

Table 45: Age and gender distribution and age-specific incidence rates of acute hepatitis B in the Auckland region (2019)

Age-group	Female	Male	Total	Incidence per 100,000*
20 to 29		1	1	0.4
30 to 39	1	1	2	0.8
40 to 49		1	1	0.4
50 to 59		2	2	1.0
70+	1	1	2	1.4
Total	**2**	**6**	**8**	**0.5**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

Table 46: Ethnic group specific incidence rates of acute hepatitis B in the Auckland region (2019)

Ethnicity Prioritised	Female	Male	Total	Incidence per 100,000*
Asian	1	1	2	0.4
European or Other	1	2	3	0.4
Māori		2	2	1.0
Pacific peoples		1	1	0.4
Total	**2**	**6**	**8**	**0.5**

*Rates are based on 2019 projected mid-year population, ethnicity is Total Response (Source: Statistics New Zealand)

Overseas travel was a risk factor in two cases; one case had received blood associated with an operation while overseas and one had a hepatitis B-positive household contact. No cases appeared to be associated with casual sexual contact, body piercing, tattooing or intravenous drug use (IVDU).

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. It is spread mainly through contact with the blood of an infected person.

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 for decades.

Glecaprevir/Pibrentasvir (Maviret), a combination of two antiviral medications, was funded in New Zealand from 1st February 2019. Effective against all strains of chronic hepatitis C infection, it is thought this will lead to a significant reduction in Hepatitis C in New Zealand. There were five hepatitis C cases notified in 2019, of which four were male, and one was female. All were of European ethnicity. Hepatitis C is not a foodborne illness but is blood borne and included here for the sake of convenience. Two cases had a history of IVDU and one had a history of overseas travel. No cases were knowingly exposed to blood or blood products, household contacts or casual sexual partners, tattooing or body piercing.

3.4.4 Hepatitis - Not Otherwise Specified (NOS)

Hepatitis NOS includes hepatitis D, hepatitis E, and cases of hepatitis where the type has not been determined.

Delta hepatitis (hepatitis D, HDV) may occur as an acute co-infection with hepatitis B or as a super-infection in people with chronic hepatitis B infection. HDV-HBV co-infection is considered the most severe form of chronic viral hepatitis due to more rapid progression towards hepatocellular carcinoma and liver-related death (World Health Organisation, 2022). Vaccination against hepatitis B provides protection against HDV infection.

Hepatitis E (HEV) is an enteric infection with a similar course to hepatitis A. The virus is shed in the stools of infected persons and enters the human body through the intestine. It is transmitted mainly through contaminated drinking water. The infection is usually self-limiting and resolves within two to six weeks. Occasionally a serious disease known as fulminant hepatitis (acute liver failure) develops, which can be fatal.

Seven cases of hepatitis NOS were notified to ARPHS in 2019. Two were cases of hepatitis E imported from India and Pakistan. The five delta cases were aged between 30 and 58 years and four had Pacific origins.

4 Vaccine preventable diseases

Key points

- There was a major measles outbreak in 2019 comprising 1755 cases. Of these cases, 38 per cent were hospitalised. There were fortunately no deaths.
- The highest rates were seen in the under-one–year-old and 15–to-29-year–old age groups, with Pacific and Māori markedly overrepresented
- Mumps cases continued to decline from the large outbreak of 2017, though the Pacific ethnic group remained overrepresented when it came to the burden of this disease.
- There were 315 cases of pertussis reported in 2019 , the majority in the first quarter as part of a second wave of the outbreak which occurred during 2017 and 2018. Rates were highest in the Pacific ethnic group
- Community influenza-related activity started and peaked earlier in 2019 than in recent seasons but remained at a low level overall. Influenza A (H3N2) and influenza B/Victoria strains co-circulated for the season
- Meningococcal disease notifications increased in 2019, with 63 per cent of cases occurring in communities with the highest level of deprivation. Pacific and Māori children were over-represented. Serogroup B was the predominant strain; the W and Y strains made up 35 per cent of cases.
- Invasive pneumococcal disease notifications were stable in 2019 but rates for Māori and Pacific children and the elderly remained high. Serotypes 12F and Type 8 increased in 2019. These serotypes are not directly covered by the current PCV vaccine.

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 the start of symptoms, 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 2019 New Zealand saw its first cases and by August and September cases were peaking at more than 500 per month. Worldwide, more than 140,000 people died from measles in 2018 (WHO estimate, 5 December2019).

Cases of measles in the Auckland region from 2010 to 2019 are shown in Figure 31. There were 1,755 cases in 2019 compared with five in 2018 and three in 2017. The Auckland region incidence rate was 103.1 cases per 100,000, nine times the rate for the rest of New Zealand (14.4 per 100,000). The hospitalisation rate was high at 38 per cent overall, but fortunately there were no deaths.

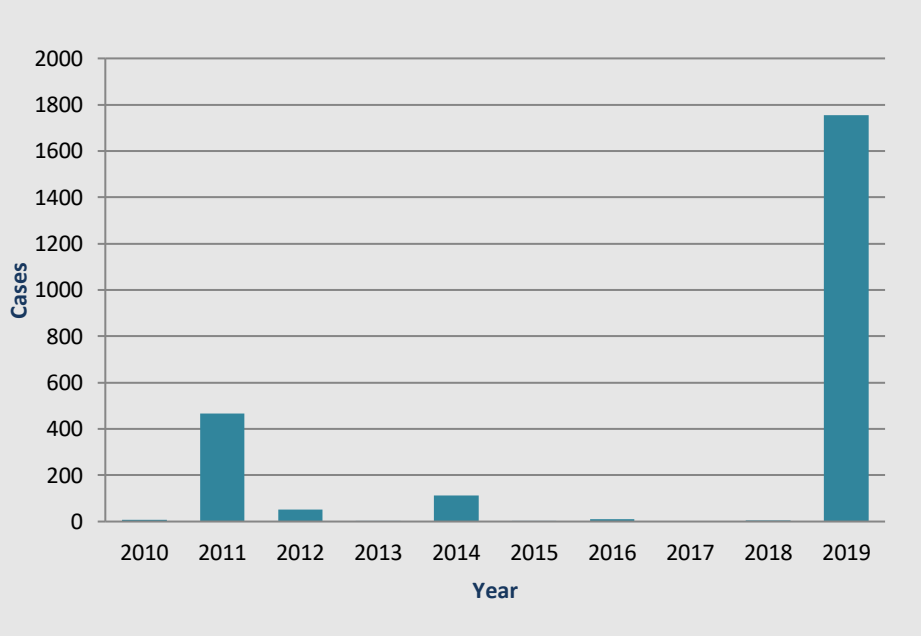


Figure 31: Measles cases in the Auckland region 2010 – 2019

The outbreak started in February 2019 and was vigorously managed for three months before community spread became established. Case numbers then rose quickly, reaching a peak in September and tailing off by the end of the year.

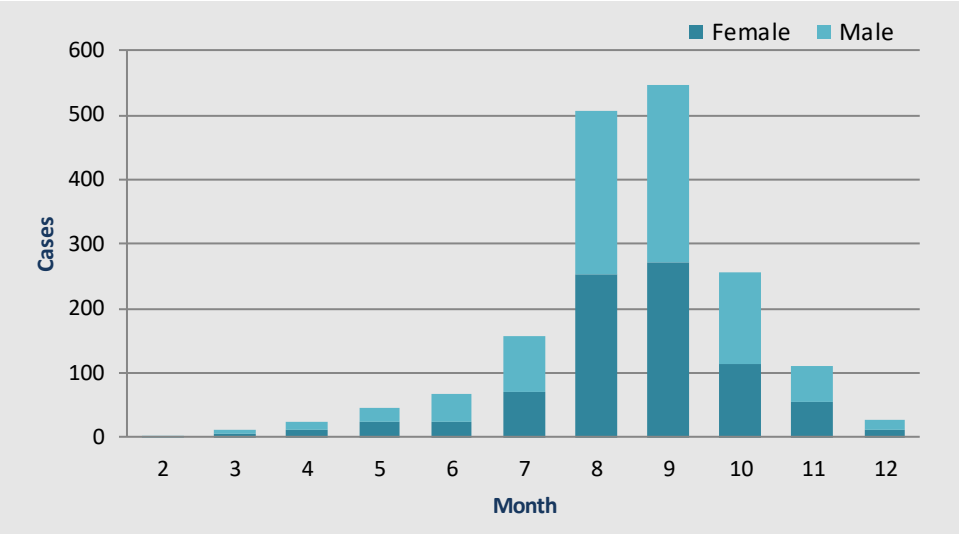


Figure 32: Monthly distribution of measles cases in the Auckland region 2019

The highest age-specific rate was seen in under-five-year-old children, in particular under-ones, and 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. The ratio of male to female cases was very similar at 1.1:1 (Table 47 and Figure 33).

Table 47: Age and gender distribution and age-specific incidence rates of measles in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1 year	117	127	244	1132.9
1 to 4	130	125	255	296.0
5 to 9	24	26	50	43.8
10 to 14	54	50	104	95.6
15 to 19	115	127	242	218.1
20 to 29	266	319	585	211.9
30 to 39	88	78	166	63.9
40 to 49	36	51	87	38.9
50 to 59	9	10	19	9.0
60 to 69	1	2	3	2.0
70+				-
Total	**840**	**915**	**1755**	**103.1**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

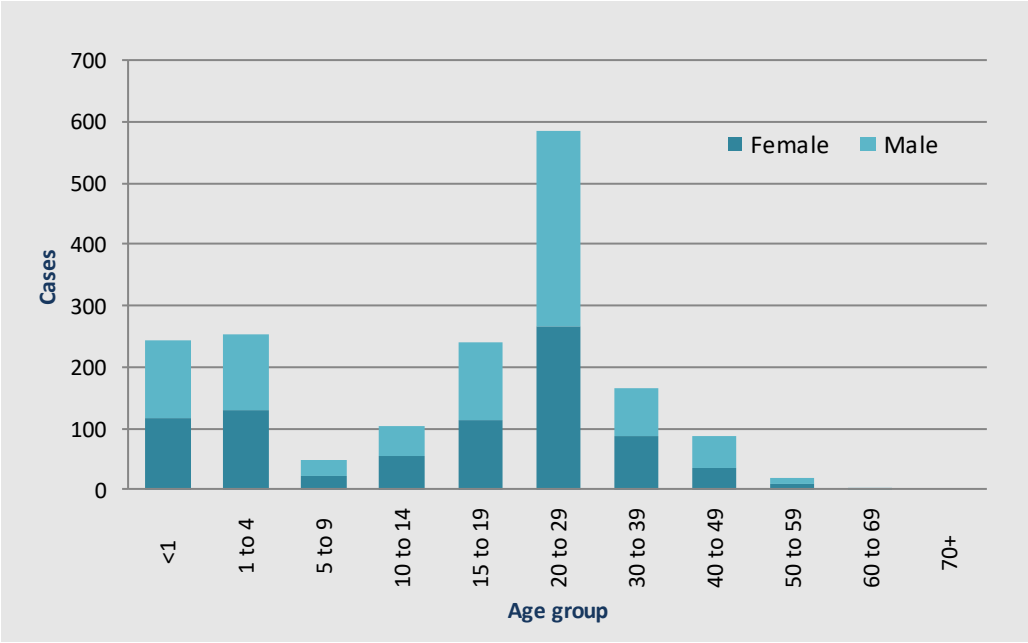


Figure 33: Measles case notifications of cases by age and gender in the Auckland region (2019)

Ethnic specific disease rates were highest in Pacific peoples at 379 cases per 100,000 population and for Māori at 198 cases per 100,000 (Table 48). These groups have had declining immunisation rates over recent years (see Section 10). From a geographic perspective, the Counties Manukau DHB population was most severely affected, with 67 per cent of cases occurring in this area (Table 49). It is likely that in addition to immunity issues, disease spread was facilitated by socio economic factors such as crowded housing.

Table 49: Ethnic group distribution and incidence rates of measles in the Auckland region (2019)

Ethnicity -prioritised	Female	Male	Total	Rate per 100,000*
Asian	60	87	147	29.8
European or Other	149	189	338	39.9
Māori	200	194	394	198.4
Pacific peoples	428	440	868	379.8
Unknown	3	5	8	-
Total	**840**	**915**	**1755**	**103.1**

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

Table 50: Distribution of Measles Notification in the Auckland region by DHB (2019)

DHB	Cases	%
Auckland	275	16
Counties Manukau	1174	67
Waitematā	306	17
Total	**1755**	**100**

Of the 1755 cases, 672 (38 per cent) were hospitalised. The percentage was highest for those aged under one year (64 per cent) and young children aged one-to-four years (51 per cent).

Only 17 per cent of cases had had two documented MMR vaccine. The remaining 83 per cent were not immunised, not fully immunised or their immunisation status was unknown.

Table 50: Number and percentage of measles cases that had been fully immunised in Auckland region (2019)

Fully immunised	Total	%
No	1273	73%
Unknown	191	11%
Yes	291	17%
Total	**1755**	**100%**

Although the spread through non-immune communities was a driving force behind the outbreak in the Auckland region, overseas acquired and imported cases did have some impact as well.

These cases came from various source countries, with Indonesia, Philippines, China, and Thailand contributing significantly at the start of the outbreak while the early “stamp it out” strategy was implemented. By August more than 700 cases of measles had been recorded in Auckland, with more than 400 of them in the more deprived suburbs of south Auckland. There was a high risk of spread to the Pacific islands from Auckland, and particular concern for countries with lower vaccination rates such as Samoa, Tonga and the Cook Islands. On 16 October, the Samoan Ministry of Health declared a measles outbreak, the first Pacific Island country to do so in the global resurgence of measles. By 22 January, 2020 there had been 5,707 measles cases reported and 83 measles-related deaths in Samoa (Craig et al., 2020).

Table 51: Source countries of overseas acquired measles in Auckland region (2019)

Source Country	Case
Samoa	27
Australia	13
Indonesia	5
United States of America	5
Unknown	3
Cook Islands	2
Philippines	2
Tonga	2
Fiji	1
Thailand	1
China	1
Total	**62**

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 174 cases of mumps in 2019, compared with 269 in 2018 and 1,080 cases in 2017, which was the highest incidence for decades (Figure 34). The incidence rate for the Auckland region was 10.2 cases per 100,000, three times the rate for the rest of New Zealand (2.8/100,000).

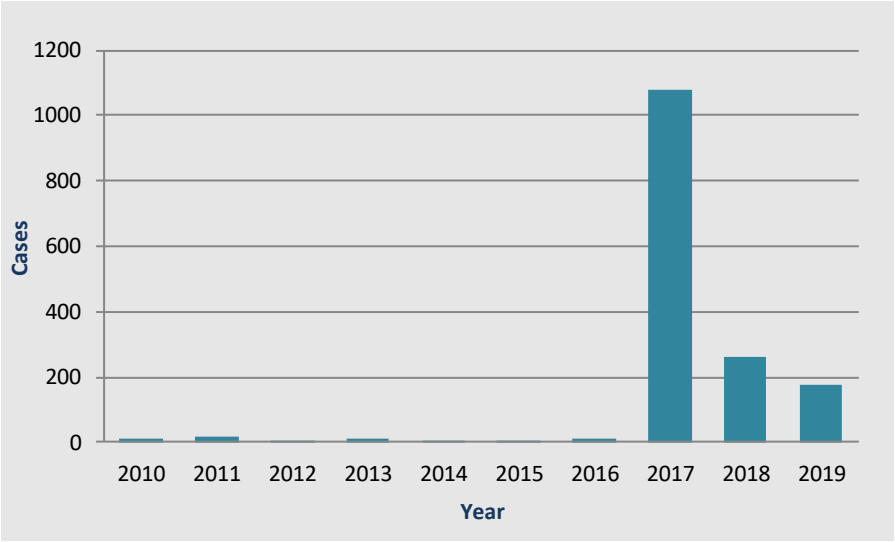


Figure 34: Mumps cases in the Auckland region 2010 – 2019

Cases were notified throughout the year but, from mid-winter 2019, there was a steady increase in the number of notifications - peaking in November and December.

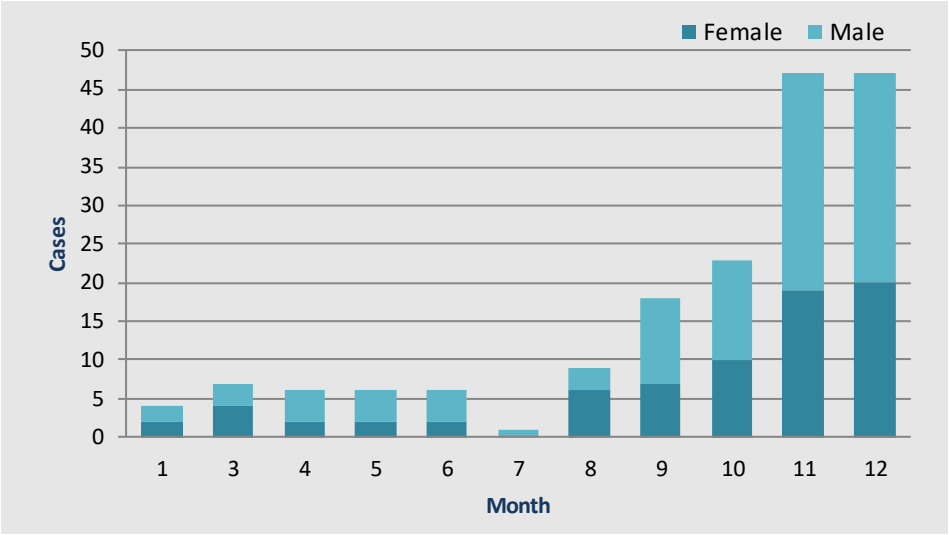


Figure 35: Monthly distribution of mumps cases in the Auckland region (2019)

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 52). The highest ethnic group-specific incidence rate was seen in Pacific peoples (17.9 per 100,000) (Table 53), representing 23 per cent of cases. Overseas acquired infections accounted for only 14 cases (Table 54). Hospitalisation was required for 21 cases (12 per cent), and there were no deaths. Similar to the measles outbreak, the immunity gap in 15-to-30-year-olds was a key driver in this increase.

Table 52: Age and gender distribution and age-specific incidence rates of mumps in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1 year				-
1 to 4	6	5	11	12.8
5 to 9	1	4	5	4.4
10 to 14	4	2	6	5.5
15 to 19	11	13	24	21.6
20 to 29	41	55	96	34.8
30 to 39	7	15	22	8.5
40 to 49	2	4	6	2.7
50 to 59	1	1	2	1.0
60 to 69	1	1	2	1.3
70+				-
Total	**74**	**100**	**174**	**10.2**

*Rates are based on 2019 estimated mid-year population (Source: Statistics New Zealand)

Table 53: Ethnic group distribution and ethnic-specific incidence rates of mumps in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	16	24	40	8.1
European or Other	30	49	79	10.1
Māori	7	5	12	6.1
Pacific peoples	20	21	41	17.9
Unknown	1	1	2	-
Total	**74**	**100**	**174**	**10.2**

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

Table 54: Source country of overseas acquired mumps cases in the Auckland region (2019)

Source Country	Cases
Australia	3
China	1
France	1
India	3
Ireland	1
Philippines	1
Samoa	2
Thailand	1
Germany	1
Total	**14**

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 was one rubella case for 2019 (Figure 36). This case was a female in the 30-to-39–year-old age group and was an assumed imported infection from China. No secondary cases were identified.

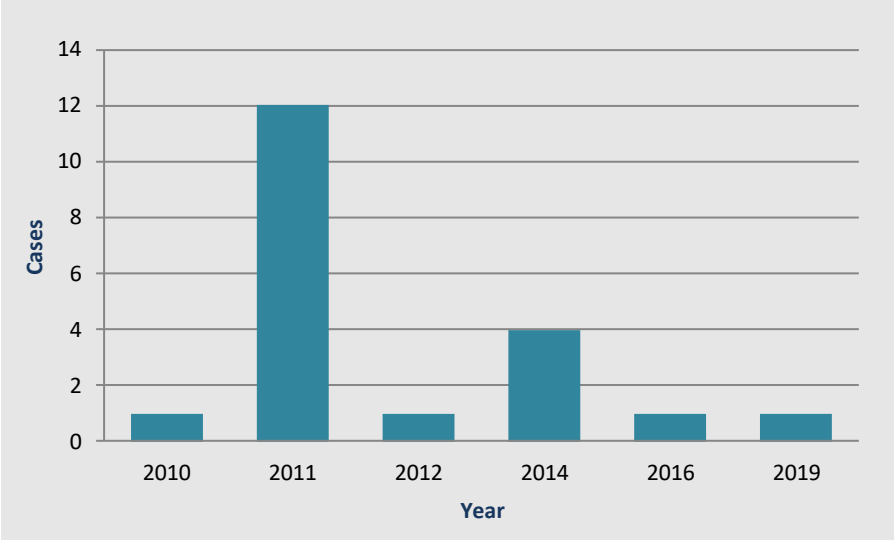


Figure 36: Rubella cases in the Auckland region 2010 – 2019

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 will die.

The 315 cases reported for the Auckland region in 2019 followed a second wave of the pertussis outbreak which occurred over 2017 and 2018 (Figure 37). This is an incidence rate of 18.5 cases per 100,000 for the Auckland region, but this was nearly half the rate for the rest of New Zealand (28.1 per 100,000). The ARPHS strategy focused on protecting infants less than one year of age and involved extra case containment efforts at early learning services and schools. This appears to have been somewhat successful at preventing spread to those most vulnerable. Hospitalisation was required for 63 cases (20 per cent) but this increased to 57 per cent for those infants less than one-year-old. There were no deaths.

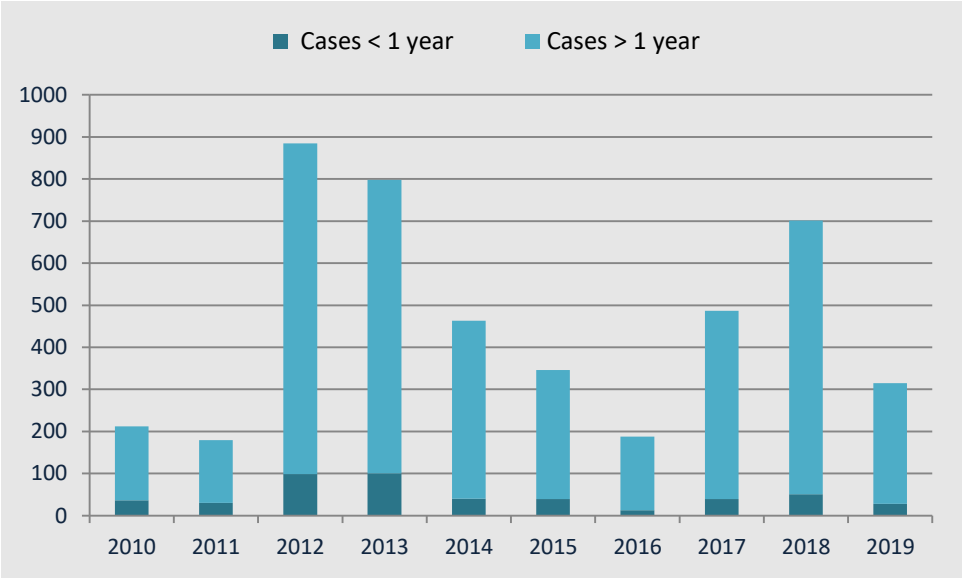


Figure 37: Pertussis cases by those under and over one year of age in the Auckland region 2010 - 2019

Cases decreased sharply over the first quarter to an average of 15 cases per month for the remainder of the year (Figure 35).

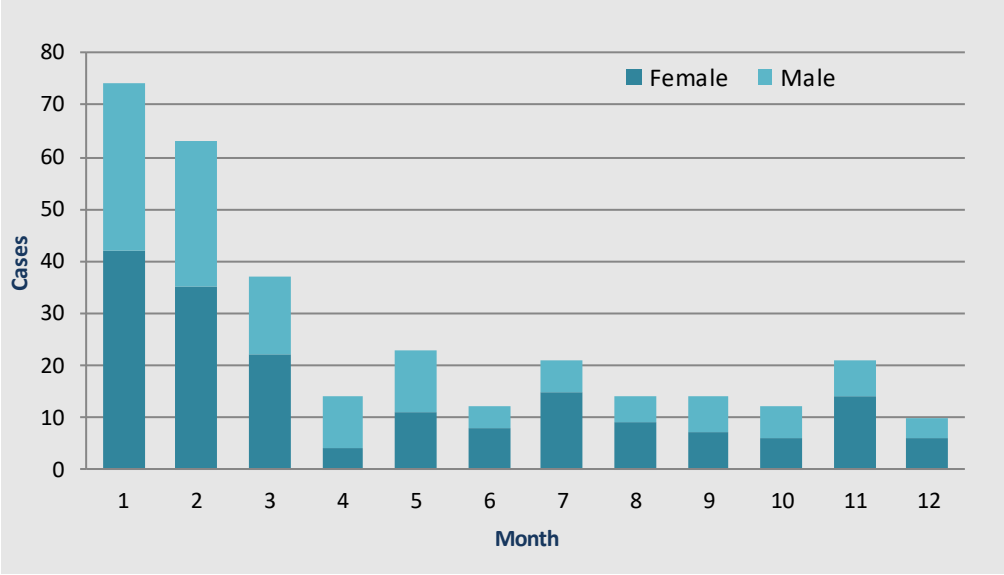


Figure 38: Monthly distribution of pertussis cases in the Auckland region (2019)

The highest age-specific incidence rate was seen in children younger than a year old 130.0 per 100,000), followed by the one to four-year-old and then 10-14-year-old age groups. The yearly proportion of pertussis cases aged less 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 a year old is working, despite nearly 1,400 cases over the past three years.

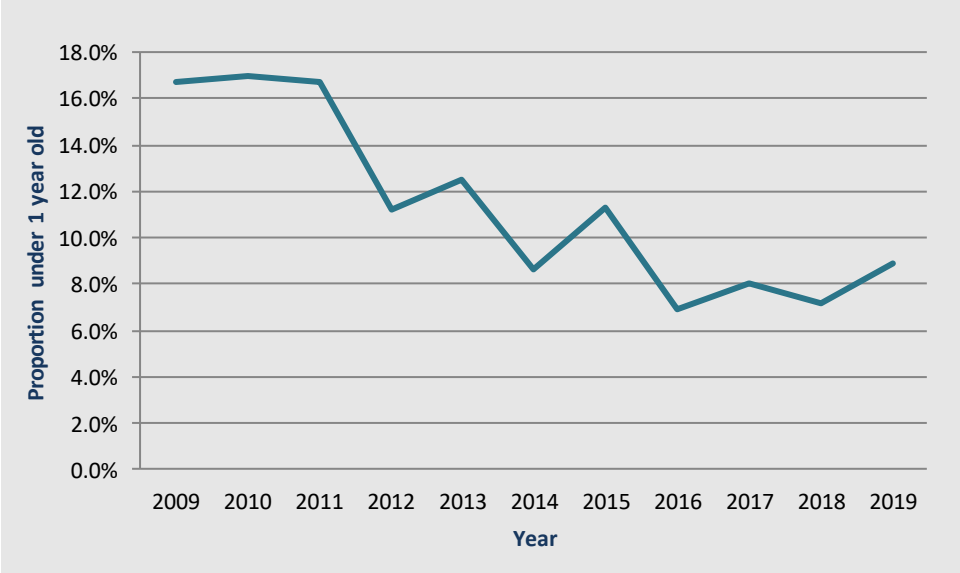


Figure 39: Proportion of pertussis cases in under-one-year-old infants in the Auckland region 2009 - 2019

The overall female to male ratio was 1.3:1, but it is notable that this ratio increases to 2:1 for the 20-to-29 and 30-to-39-year-old age groups (Table 55). Ethnic-specific rates were equal across Māori, Pacific peoples and European and Other ethnic groups. (Table 56). Of note is the 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 10**).

Table 55: Age and gender distribution and age-specific incidence rates of pertussis cases in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1	13	15	28	130.0
1 to 4	15	19	34	39.5
5 to 9	15	7	22	19.3
10 to 14	14	13	27	24.8
15 to 19	6	8	14	12.6
20 to 29	17	8	25	9.1
30 to 39	17	9	26	10.0
40 to 49	21	19	40	17.9
50 to 59	18	17	35	16.6
60 to 69	22	11	33	21.7
70+	21	10	31	22.3
Total	**179**	**136**	**315**	**18.5**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

Table 56: Ethnic distribution and ethnic specific incidence rates of pertussis cases in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	13	8	21	4.3
European or Other	108	81	189	24.2
Māori	23	25	48	24.2
Pacific peoples	32	22	54	23.6
Unknown	3		3	-
Total	**179**	**136**	**315**	**18.4**

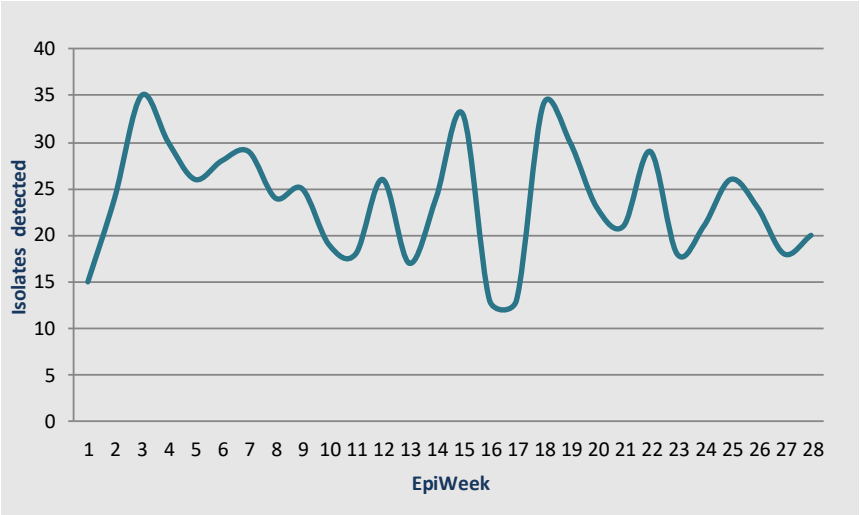
* Rates are based on Ministry of Health Prioritised Pop Projection off 2018 base (Source: Statistics New Zealand)

4.5 Chickenpox

Chickenpox, also known as varicella, is a highly contagious disease caused by the initial infection with varicella zoster virus (VZV). The disease results in a characteristic skin rash that forms small blisters, is itchy, and eventually scabs over. It usually starts on the face, chest, and back, and then spreads to the rest of the body. The disease is often more severe in adults than children. Symptoms begin 10 to 21 days after exposure to the virus. Chickenpox is an airborne disease that spreads easily via the coughs and sneezes of an infected person. It may be spread from one to two days before the rash appears, until all lesions have crusted over.

Chickenpox is not a notifiable disease in New Zealand.

Chickenpox activity was stable in 2019, with perhaps a slight downward trend over the first half of the year based on the number of isolates submitted to ESR (Figure 40). Chicken pox virology data was not available from mid-July 2019.



Source: ESR Influenza weekly, Virology Weekly report

Figure 40: Number of chickenpox isolates submitted to ESR from Auckland laboratories in the Auckland region (January - July 2019)

4.6 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.

Influenza A ("Flu 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 (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.

Influenza A's H and N subtypes 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.

Influenza B ("Flu 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.

Influenza C ("Flu C")

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

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.

4.6.1 Influenza in the Auckland region

During the year, the incidence of influenza was monitored through weekly attendances for acute respiratory infections (ARI) at HealthStat sentinel GPs situated across the Auckland region, representing approximately 10 per cent of the population. Influenza visit surveillance data showed that visits remained low until week 20, when there were lower numbers reported than normal, and even once the season got underway, it did not meet the three year curve until Week 36, after which it dropped off rapidly (Figure 41 and 42).

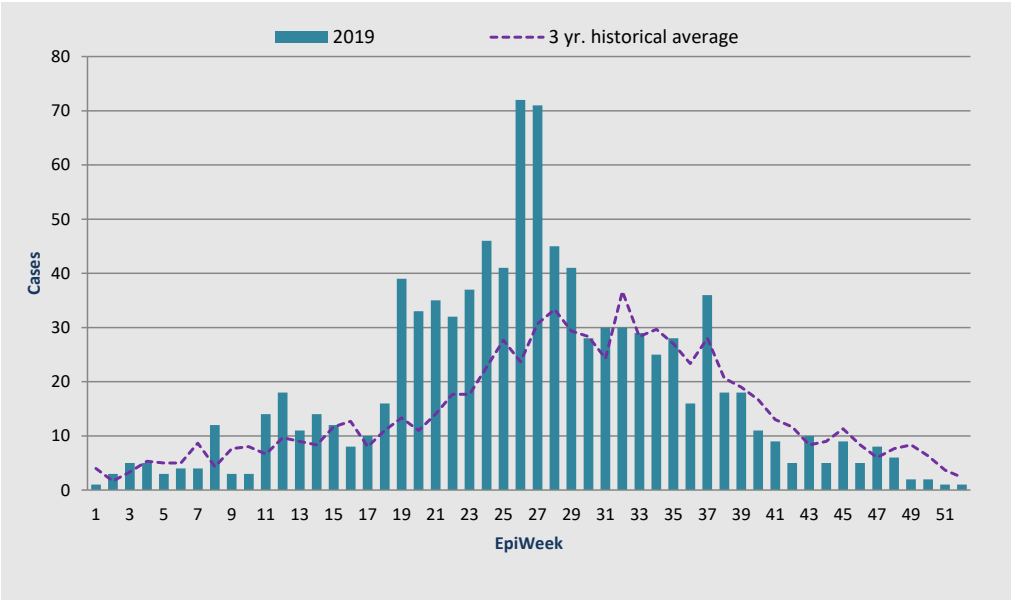


Figure 41: Influenza visits to HealthStat sentinel GPs in the Auckland region compared with three year average (2019)

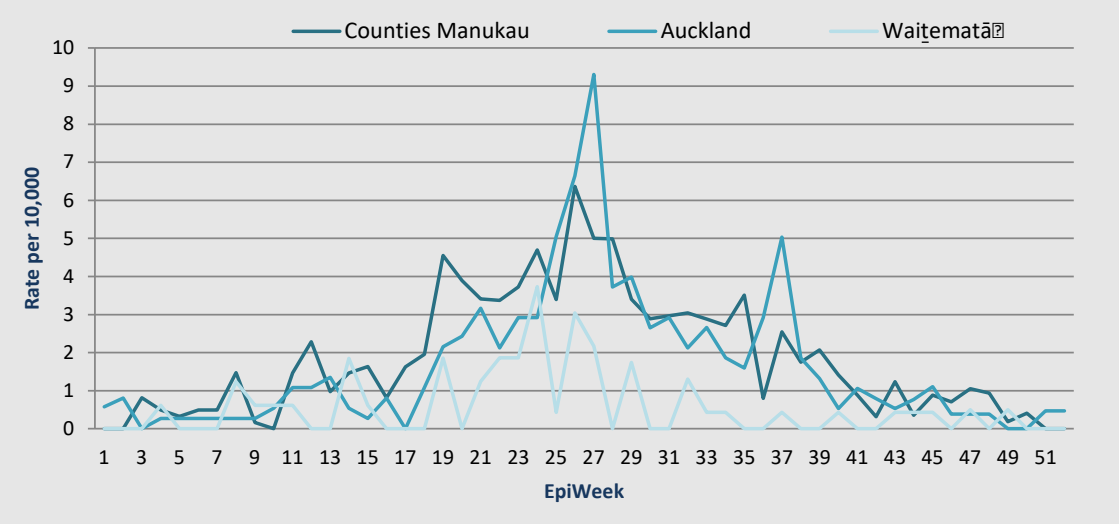


Figure 42: Influenza visit rates to HealthStat sentinel GPs in the Auckland region compared with three year average (grey dotted line) by DHB (2019)

Virology isolation reports were received from ESR throughout the flu season (Figure 43). Influenza A (H3N2) and influenza B/Victoria co-circulated in New Zealand during the 2019 influenza season. Influenza A viruses were more frequently detected in hospitalised patients and influenza B/Victoria was more frequently detected in the community.

Community influenza-related activity started and peaked earlier in 2019 than in recent seasons but remained at a low-level overall.

The severity of illness as measured by the ratio of influenza-associated intensive care unit (ICU) admissions to influenza-associated hospitalisations was low, which is similar to other influenza A (H3N2) predominant years.

The 2019 publicly funded influenza vaccines available in New Zealand were a good match for the circulating strains. There was a genetic mutation in the influenza B/Victoria virus circulating during the season. However, this change had no discernible impact on vaccine effectiveness.

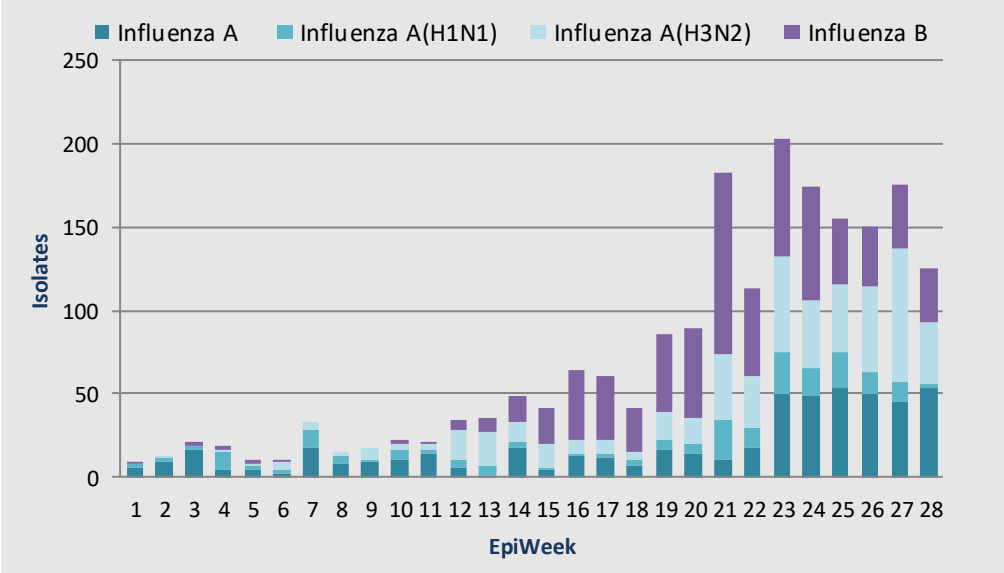


Figure 43: Influenza virus typing Auckland region to Week 28 (2019)

Note: Auckland region specific data was unavailable after week 28

Source (New Zealand Influenza Intelligence Report – ESR).

4.7 Other airborne viruses

Rhinovirus and Respiratory Syncytial Virus (RSV) were the most frequently detected non-influenza respiratory viruses circulating in 2019. Monitoring these non-influenza respiratory viruses not only provides a more accurate understanding of when influenza is *not* responsible for GP ILI visits or SARI hospitalisation trends, but also helps to identify clusters of these viruses. This could help inform decisions on the potential use of new vaccines and treatments in New Zealand as these become available.

Adenovirus and enterovirus isolation occurred throughout the year, with higher levels of adenovirus observed in the second half of the year (Figure 44).

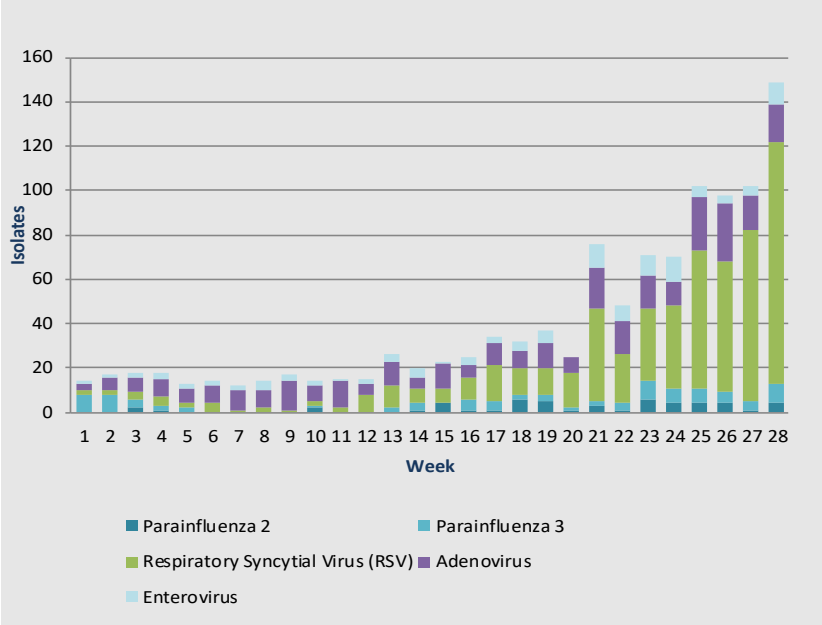


Figure 44: Other virus isolates submitted to ESR for the Auckland region by week (2019)

Source (New Zealand Influenza Intelligence Report – ESR)

4.8 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 persons. Most transmission occurs from people who do not themselves have meningococcal disease.

There were 58 reported cases of meningococcal disease in 2019, up 20 from 2018 and 16 from 2017 (Figure 45). Since the end of the meningococcal epidemic in 2005 the number of cases per year has ranged from seven to 47. The incidence in the Auckland region was 3.4 cases per 100,000 population compared with the rest of New Zealand at 2.6 per 100,000 population.

All cases were hospitalised. There were four deaths, one in the under-one-year-old age group, and one in each of the 50s, 60s and 70+ age decades. Three of the deaths were attributed to serogroup B (3/28 serogroup B cases, case fatality rate 11 per cent), and one sample was unable to be grouped, but POR typing was PorA type P1.5,2.

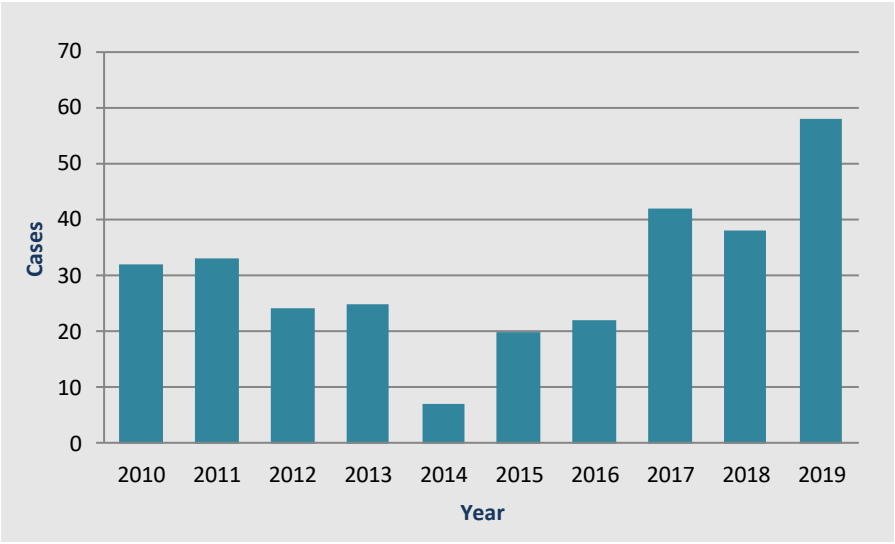


Figure 45: Meningococcal disease cases in the Auckland region 2010 – 2019

The highest age-specific incidence rate was in the under-five-year-old age group. Fourteen of the 23 cases (60 per cent) in this age group were younger than 12 months old. The male to female ratio was 1.5:1 (Table 57).

Table 57: Age and gender distribution and age-specific incidence rates of probable and confirmed meningococcal disease in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1	3	11	14	65.0
1 to 4	4	5	9	10.4
5 to 9		7	7	6.1
10 to 14		2	2	1.8
15 to 19	1	3	4	3.6
20 to 29	5	2	7	2.5
40 to 49	2	1	3	1.3
50 to 59	2	2	4	1.9
60 to 69	1	1	2	1.3
70+	5	1	6	4.3
Total	**23**	**35**	**58**	**3.4**

*Rates are based on estimated mid-year population, 2019 (Source: NZ Stats New Zealand)

The highest ethnic group incidence rate was among Pacific peoples and Māori; three and four times the rate of the European/Other ethnic group (Table 58).

Table 58: Ethnic group specific incidence rates of meningococcal disease in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	2	1	3	0.6
European or Other	8	11	19	2.4
Māori	6	8	14	7.1
Pacific peoples	7	15	22	9.6
Total	**23**	**35**	**58**	**3.4**

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

Nearly two thirds of the cases (63 per cent) occurred in Decile 6 to 10 communities with the highest deprivation levels of (Figure 46).

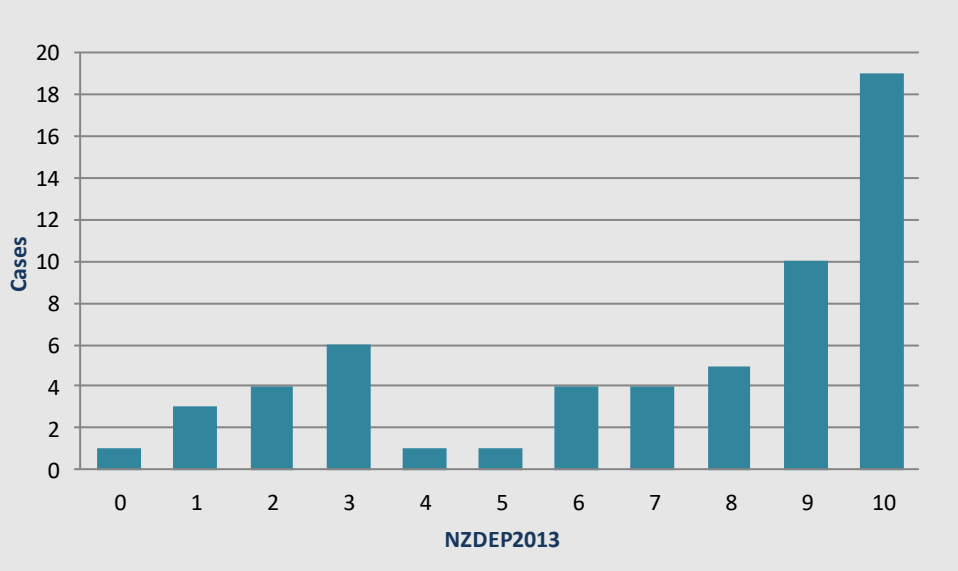


Figure 46: Meningococcal disease cases by NZ deprivation index in the Auckland region (2019)

The most common serogroup was *N. meningitidis* serogroup B, with 28 cases (48 per cent) (Figure 47). Group W had 14 cases (24 per cent) and group Y had eight (14 per cent). Group E had one case and there were no group C meningococcal cases in the Auckland region for 2019. The major issue for 2018 and continuing into 2019 was 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, which resulted in a mass vaccination campaign.

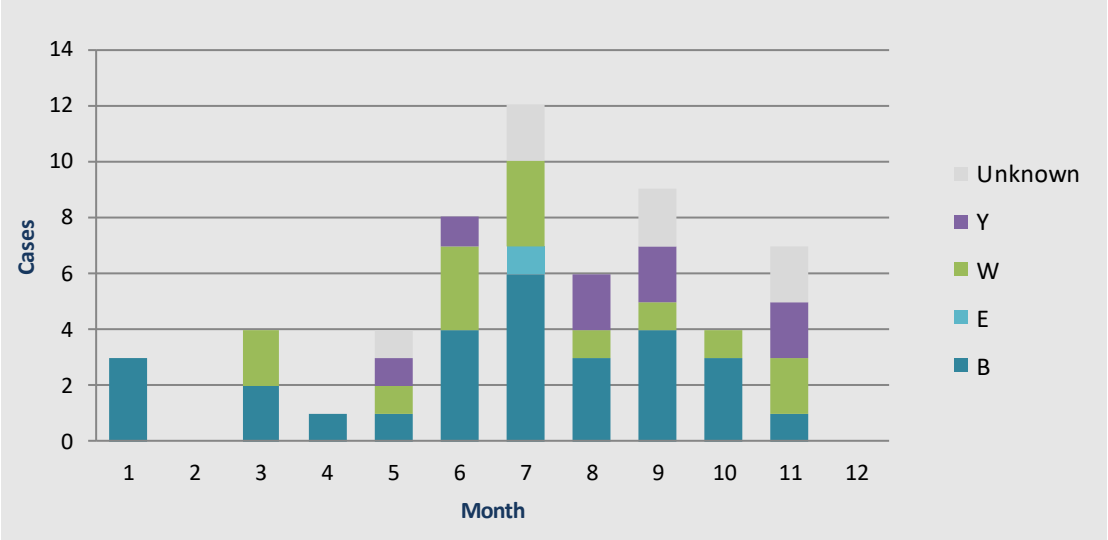


Figure 47: N. meningitidis serogroups isolated from meningococcal disease cases by month in the Auckland region (2019)

Group B remains the predominant strain for those infants aged under one-year-old. Of the 14 serogroup W cases, seven were aged under nine-years-old, with three under 12 months. The remaining seven were spread across the age groups.

Specific typing of serogroup B cases showed the predominant PorA typing was P1.7-12,14\, with eight cases (34 per cent). Ten of the 11 serogroup W cases were of Por. Type P1.5,2 (Table 59).

Table 59: Specific Por A typing of N. meningitidis by meningococcal disease serotype in the Auckland region (2019)

PorA	B	Not groupable	W	Y	Total
P1.5,2		1	10		11
P1.5-1,10-1\	2	1	1	5	9
P1.7-12,14\	8				8
P1.7-2,4	4				4
P1.5-1,10-4\				2	2
P1.18-1,3\	2				2
P1.22,14.	2				2
P1.18-1,34\	1				1
P1.7-2,13-1\	1				1
P1.5-2,10-1				1	1
P1.7-69,14\	1				1
P1.22,9\	1				1
P1.7-13,14	1				1
Total	23	2	11	8	44

4.9 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 methods of transmission 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 is defined as an infection of *S. pneumoniae* in a normally sterile site. There was a total of 156 IPD cases reported to ARPHS during 2019, down from 180 in 2018 and similar to the 165 notified in 2017. This represents an incidence rate for the Auckland region of 9.2 notifications per 100,000 population, similar to the rate for the rest of New Zealand (10.7 per 100,000 population). The yearly number of notifications is shown in Figure 48, and the distribution by month for 2019 in Figure 49, which shows an increasing trend over the winter months. Of the 156 IPD cases, 153 (97 per cent) were hospitalised. There were two deaths, representing 1.3 per cent of all IPD cases.

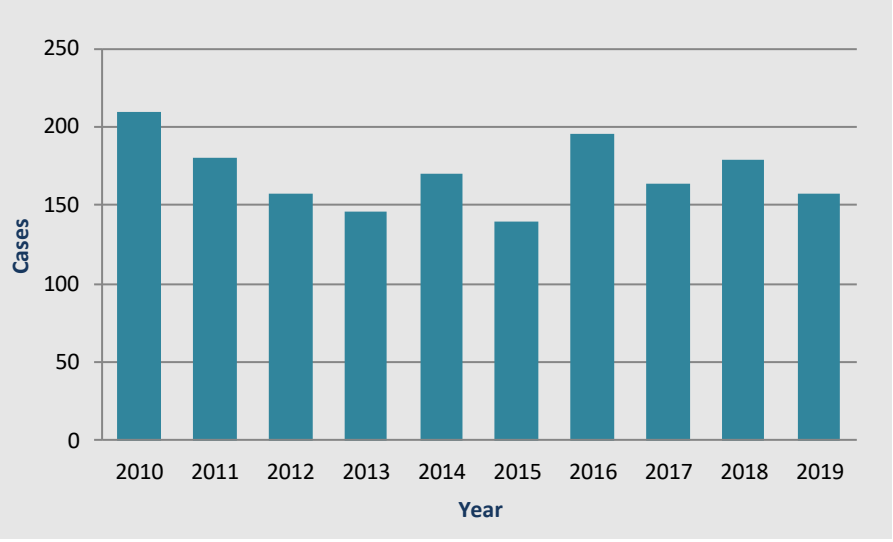


Figure 48: Invasive pneumococcal disease cases in the Auckland region 2010 – 2019

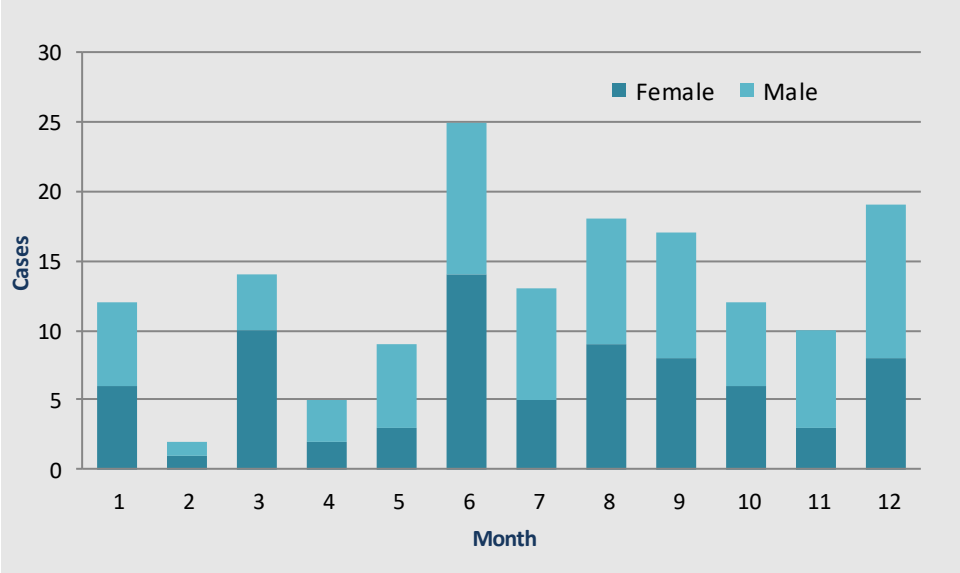


Figure 49: Monthly distribution of invasive pneumococcal disease cases in the Auckland region (2019)

The highest incidence rate was seen in the young and the elderly with the highest rates in those under one-year-old, followed by those in the 70+ age group. The male to female ratio was nearly equal (see Table 60).

Table 60: Age and gender distribution and age-specific incidence rates of pneumococcal disease cases in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1	3	5	8	37.1
1 to 4	7	6	13	15.1
5 to 9	1	2	3	2.6
10 to 14	2	2	4	3.7
15 to 19		1	1	0.9
20 to 29	2	5	7	2.5
30 to 39	8	7	15	5.8
40 to 49	8	11	19	8.5
50 to 59	13	12	25	11.9
60 to 69	15	15	30	19.8
70+	16	15	31	22.3
Total	**75**	**81**	**156**	**9.2**

*Rates are based on estimated mid-year population 2019 (Source: NZ Stats New Zealand)

Ethnic-specific incidence rates were highest in Pacific peoples and Māori, with rates of 24.9 and 17.6 cases per 100,000 respectively (Table 61). These were four times the incidence rates seen in the European and Other ethnic groups.

Table 61: Ethnic-specific proportion and incidence rates of pneumococcal disease cases in the Auckland region (2019)

Ethnicity-prioritised	Female	Male	Total	Rate per 100,000*
Asian	6	9	15	3.0
European or Other	22	24	46	5.9
Māori	21	14	35	17.6
Pacific peoples	24	33	57	24.9
Unknown	2	1	3	-
Total	**75**	**81**	**156**	**9.2**

*Rates are based on Ministry of Health Prioritised Pop 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 50).

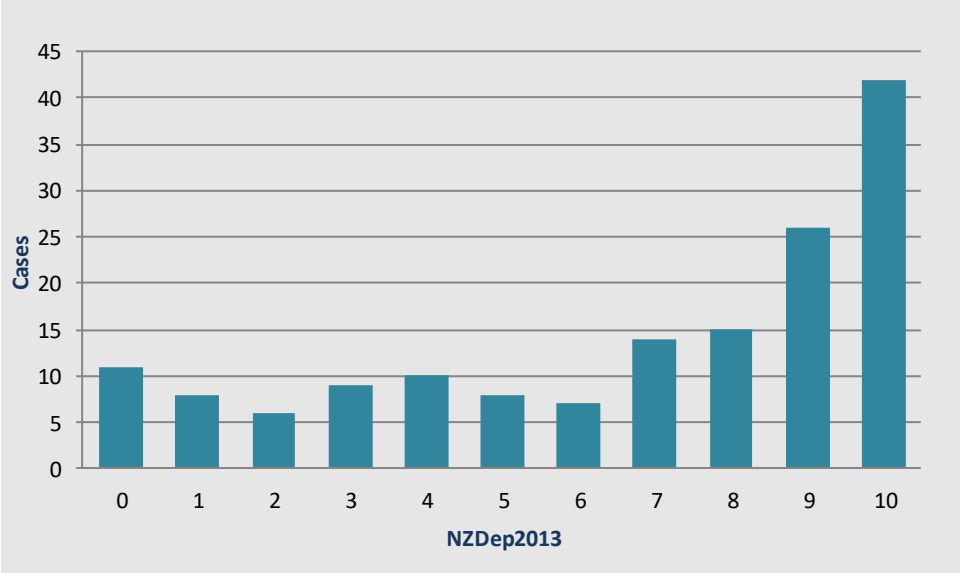


Figure 50: Invasive pneumococcal disease cases by NZ deprivation index in the Auckland region (2019)

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 62). It is encouraging to see stable 2019 case numbers for 19A (17) and Type 3 (7).

The most spectacular 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 both in 2016, but this increased to 25 for Type 12F in 2018 and 16 for 2019, and 14 cases for Type 8 in 2019. The other highlighted serotype, 22F, normally averages about 12 cases per year, and serotype 23B normally averages about two cases per year, but there were seven cases in 2018 and six in 2019. We noted the increase in 10A for 2018 (5) but this did not increase further in 2019 (3).

Table 62: Serotypes of IPD isolated, alongside the serotypes covered by the PCV10 and PCV13 vaccines in the Auckland region 2010 – 2019

Serotype	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	PCV10	PCV13
1	37	15	2	-	-	-	-	-	1	0		
3	9	10	9	5	17	7	10	9	7	7		
4	15	17	13	7	6	2	8	6	2	2		
5	-	-	-	-	-	-	1	-	-			
6A	4	-	2	1	-	1	-	1	1			
6B	6	7	1	2	-	1	1	-	2	3		
6C	6	5	3	3	14	12	8	4	5	5		
6D	-	-	-	-	-	-	1	-	-			
7A	-	6	-	2	-	-	-	-	-			
7C	-	-	-	-	1	2	2	2	1	1		
7F	3	7	8	20	22	13	14	13	11	3		
8	2	3	8	3	4	3	11	14	12	14		
9 Non-typable	1	-	1	1	-	-	-	-	-	1		
9N	6	2	4	3	3	3	7	4	5	6		
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		
12F	1	2	-	3	1	1	2	7	25	16		
13	-	-	2	-	1	1	1	-	-	2		
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		
15C	-	-	-	-	1	1	1	2	1	1		
16 Non-typable	-	-	-	2	4	-	-	-	-			
16F	-	-	-	-	-	-	6	3	3	5		
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			
19A	14	18	28	27	31	33	40	24	21	17		
19F	11	10	13	5	6	9	4	2	4	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		

23A	3	2	2	2	4	10	4	8	9	5
23B	1	-	3	2	2	2	5	3	7	6
23F	14	8	3	2	1	2	2	-	1	
24 Non-typable	-	-	1	-	-	-	1	-	-	
31	-	1	1	-	-	1	1	2	3	2
33 Non-typable	-	-	-	1	-	2	3	1	3	2
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
35F	-	-	-	-	-	-	-	2	1	
37	-	1	-	-	-	-	-	-	1	
38	2	1	1	-	1	1	-	5	2	1
42	-	-	-	-	-	-	-	1	-	
Non-typable	2	-	-	-	1	1	2	2	3	3

4.10 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, 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 91 confirmed, probable, and suspected acute rheumatic fever (ARF) cases, down 19 from 2018, but still up 12 from 2017 (Figure 51). Of the 91 cases, 57 (63 per cent) resided in South Auckland. The incidence rate for ARF in the Auckland region was 5.3 cases per 100,000 population, compared with 2.1 cases per 100,000 for the rest of New Zealand.

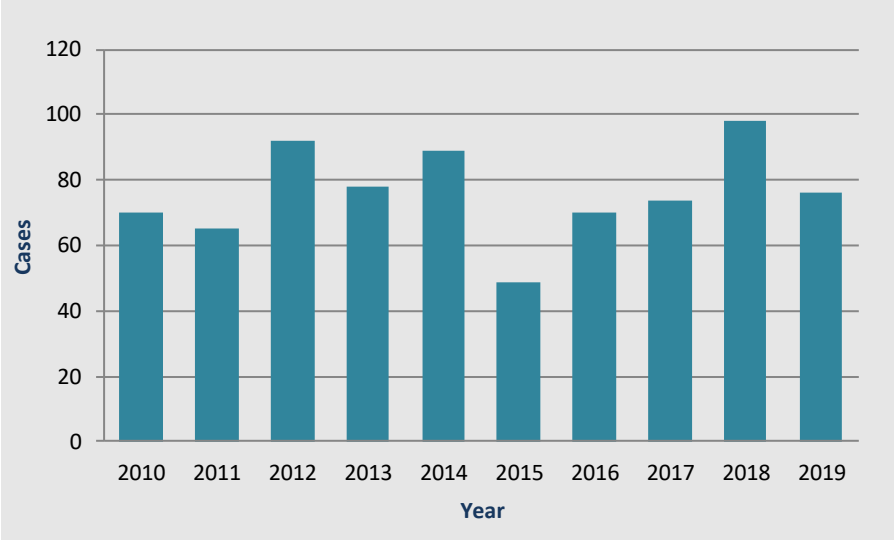


Figure 51: Acute rheumatic fever cases in the Auckland region 2010 – 2019

Cases occurred throughout the year, peaking in May (Figure 52).

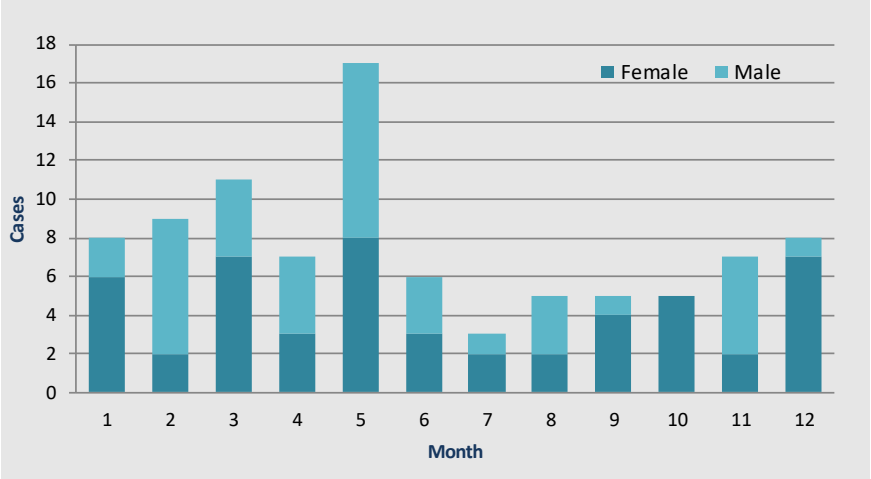


Figure 52: Acute rheumatic fever cases by month in the Auckland region (2019)

The onset of ARF typically occurs during childhood or adolescence, with the majority of cases in 5-to-14-year-old children. The highest age-specific incidence in 2019 was again in the five-to-14-year-old age group, which represented 64 per cent of all new acute rheumatic fever cases (Table 63). A new finding for 2018 and 2019 has been the increased incidence rate in the 15-to-19-year-old age group.

Table 63: Age and gender distribution and age-specific incidence rates of ARF in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
1 to 4	1		1	1.2
5 to 9	12	7	19	16.6
10 to 14	18	22	40	36.8
15 to 19	3	5	8	7.2
20 to 29	16	4	20	7.2
30 to 39	1	2	3	1.2
40 to 49				
Total	**51**	**40**	**91**	**5.3**

*Rates are based on estimated mid-year population, 2019 (Source: NZ Stats New Zealand)

For the Auckland region 16 per cent of cases were Māori, and 82 per cent were from the Pacific people's ethnic group (Table 64).

Table 64: Ethnic group distribution and age-specific incidence rates of ARF in the Auckland region (2019)

Ethnicity -prioritised	Female	Male	Total	Rate per 100,000*
Asian				-
European or Other		1	1	0.1
Māori	7	9	16	8.1
Pacific peoples	44	30	74	32.4
Total	**51**	**40**	**91**	**5.3**

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

A further breakdown of ethnic groups is shown in Table 65.

Table 65: Ethnicity distribution and gender of ARF cases in the Auckland region (2019)

Ethnicities	Female	Male	Total
Cook Islands	5	4	9
Kiribati / Gilbertese	2		2
Māori	6	8	14
Māori/Samoan	1	1	2
Niuean	1	1	2
NZ European		1	1
NZ European /Other	2		2
Pacific peoples [other]	1		1
Samoan	24	18	42
Tongan	9	6	15
Tuvalu Islander / Ellice Islander		1	1
Total	**51**	**40**	**91**

Acute Rheumatic Fever 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 aged 5-to-19 years although, in 2019, case numbers in tamariki Māori were down by nearly 50 per cent from 2018 (nine cases down from 15 in 2018) (Table 66).

Table 66: Acute rheumatic fever cases by selected age and ethnic groups 2009 - 2019

Ethnic group	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
5 to 14 years											
Asian	-	1	-	2	2	-	-	-	-	-	-
European or Other	1	-	-	2	1	1	-	-	1	1	1
Māori	13	18	17	25	14	11	6	12	14	15	9
Pacific peoples	29	33	37	33	48	49	39	35	34	47	49
Total (5 to 14 years)	43	52	54	62	65	61	45	47	49	63	59
15 to 19 years											
European or Other	-	-	-	3	-	-	-	-	1	1	-
Māori	2	6	2	2	2	5	-	2	2	1	2
Pacific peoples	3	4	1	7	9	13	3	11	10	17	6
Total (15 to 19yrs)	5	10	3	12	11	18	3	13	13	19	8
20 to 29 years											
Asian	-	-	-	-	1	-	1	-	-	-	-
European or Other	-	-	-	-	-	1	-	-	-	-	-
Māori	4	3	1	4	4	2	3	2	3	1	4
Pacific peoples	3	4	4	12	8	17	3	9	8	21	16
Total (20 to 29 years)	7	7	5	16	13	20	7	11	11	22	20

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 (now rescinded) 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 cases for Māori (16 cases to six) and a 23 per cent reduction (57 to 44) for Pacific children aged 0-to-19-years-old living in the Auckland region. Acute Rheumatic Fever is widely recognised as a disease of poverty, but the specific reasons for the increase since 2016 are not known (Figure 53).

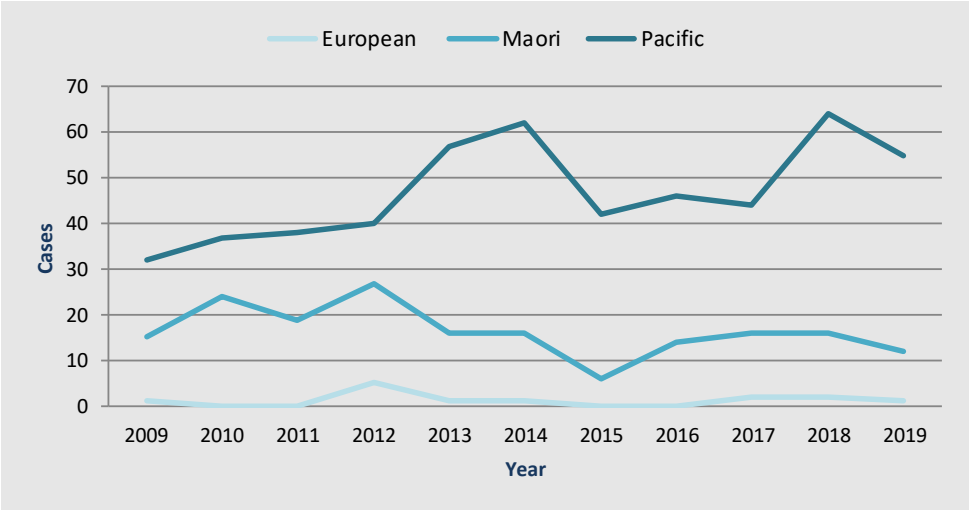


Figure 53: Acute rheumatic fever cases in 0-to-19-year-olds in the Auckland region 2009 - 2019

During 2019, 74 per cent of all ARF occurred in Auckland's most deprived areas (NZDEP 8, 9, 10) (Figure 54). This compares with 84 per cent in 2018. The proportion for the five-to-14–year-old age group is 64 per cent, and has remained around this level since 2013, when it was 85 per cent.

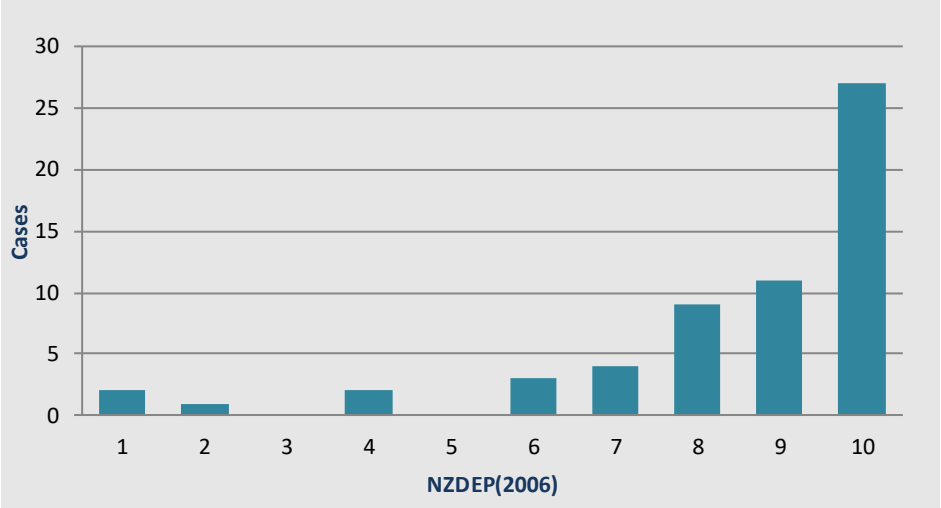


Figure 54: ARF cases by NZ deprivation index in the Auckland region (2019)

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).

These recurrences represent a failure of this follow up. The 2019 incidence rate for recurrent rheumatic fever in the Auckland region was 0.6 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 17 recurrences in 2014, dropping away to five cases in 2015 and, since then, gradually increasing back to 10 cases in 2019 (Figure 55).

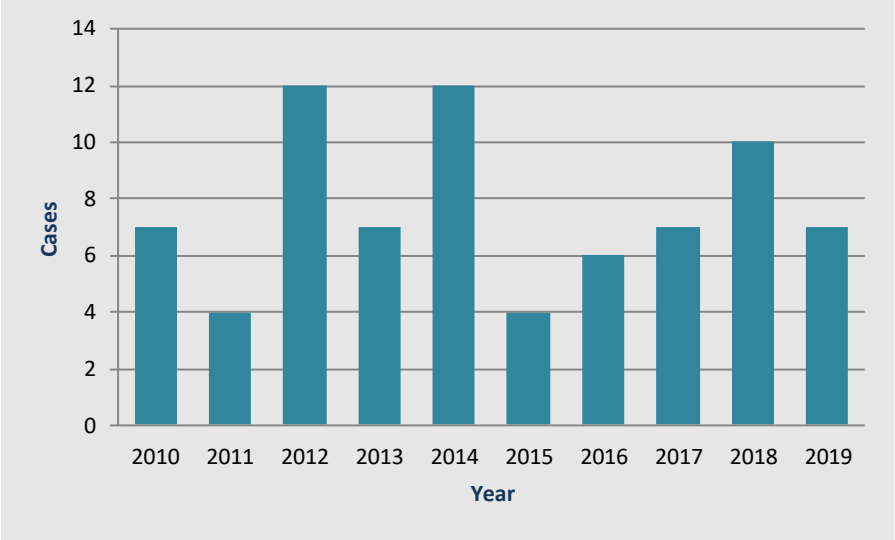


Figure 55: Numbers of recurrent rheumatic fever cases in the Auckland region 2010 - 2019

Note: includes suspected cases

The majority of cases were in the 20-to-29-year-old age group; seven of the 10 occurred amongst Pacific peoples (Tables 67 and 68).

Table 67: Age and gender distribution of recurrent rheumatic fever cases in the Auckland region (2019)

Age group	Female	Male	Total	Rate per 100,000*
1 to 4				-
5 to 9				-
10 to 14				-
15 to 19				-
20 to 29	3	5	8	2.9
30 to 39	1	0	1	0.4
40 to 49		1	1	0.4
Total	**4**	**6**	**10**	**0.6**

*Rates are based on estimated mid-year population, 2019 (Source: NZ Stats New Zealand).

Table 68: Ethnic group distribution of recurrent rheumatic fever cases in the Auckland region (2019)

Ethnicity -prioritised	Female	Male	Total	Rate per 100,000*
Asian	1		1	0.2
European or Other		1	1	0.1
Māori		1	1	0.5
Pacific peoples	3	4	7	3.1
Total	**4**	**6**	**10**	**0.6**

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

Seven of the recurrent rheumatic fever cases were from the Counties Manukau DHB area, two from Auckland, and one from Waitematā. Six of the 10 cases lived in areas of NZDEP (2013) level 9 and 10.

4.11 Tuberculosis, Latent Tuberculosis and Leprosy

Key points

- Tuberculosis notifications remain stable at 157 cases for the year. The highest rates were observed in the 20-to-29 and over-70-years age groups, with the highest incidence seen in the Asian ethnic group, predominantly from India, China and Philippines.
- 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 to isoniazid was found in only one new TB case (compared to eight in 2018). The multidrug resistant case source country was the Philippines.
- There were two confirmed cases of leprosy notified in 2019. Both cases presented with skin and peripheral nervous system manifestations and were aged between 15 and 29 years old. They had acquired their illness in the Pacific.

4.11.1 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. However, this applies only to healthy HIV-negative adults; the risk of progression to active TB disease is much higher for young children, for adults with certain medical risk factors, and especially for people who are living with HIV/AIDS. 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 (for example, people living with HIV/AIDS, cancer, kidney disease, diabetes, or who are taking chemotherapy or long term oral steroid treatment), or young children.

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 people living with HIV/AIDS. An estimated 10 million people fell ill with TB in 2018; stable compared to previous years. Of these 89 per cent were adults, 57 per cent were male, 8.6 per cent were people living with HIV, and 67 per cent were in eight countries: India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh and South Africa (World Health Organization, 2019)

There were 157 new TB diagnoses made and notified in the Auckland region in 2019. This was very similar to 2018 (155) and 2017 (148), but down from 164 in 2015 (Figure 56). The 2019 incidence rate for the Auckland region was 9.2 cases per 100,000, which is approximately double that of the rest of New Zealand, with a rate of 4.7 cases per 100,000. Of the 157 cases, 61 per cent received inpatient hospital care. Seven TB-associated deaths were reported in 2019 with four cases having multiple comorbidities, a case-fatality rate of 4.5 per cent.

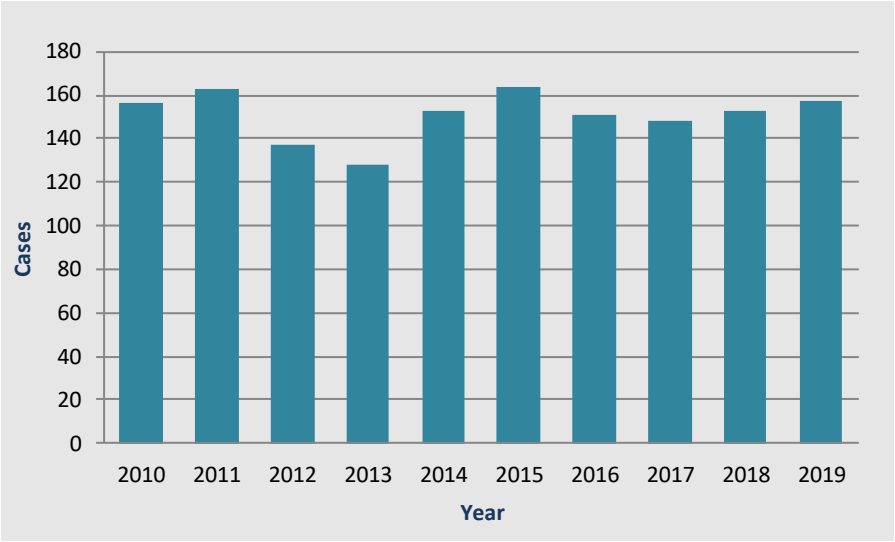


Figure 56: New tuberculosis cases in the Auckland region 2010 - 2019

Due to the variable and potentially very long time between a person being exposed to TB and actually 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. Despite this, cases occurred throughout the year, and the peak months were September and October, with 36 new cases in total over those two months (Figure 57).

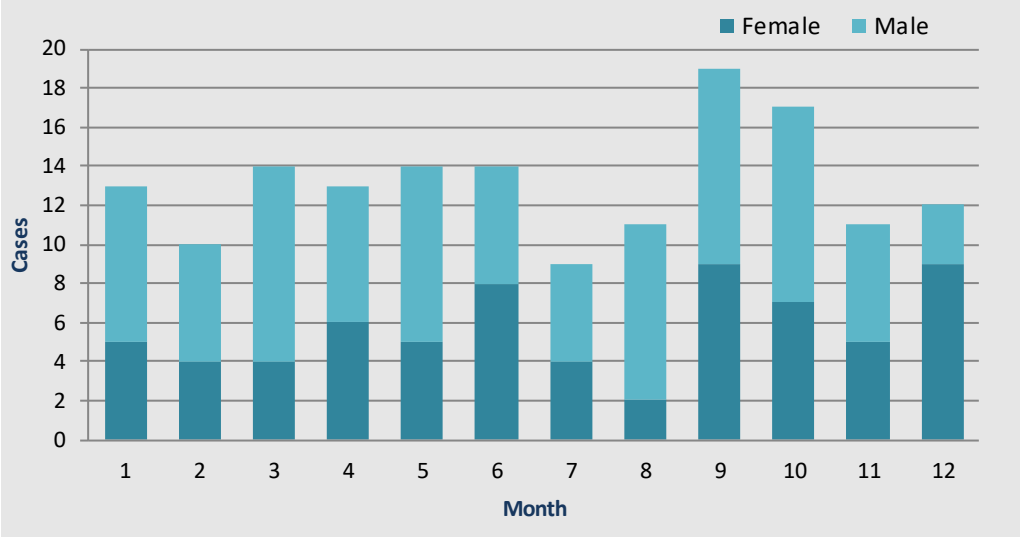


Figure 57: Monthly distribution of new tuberculosis cases in the Auckland region (2019)

Of the 157 new TB diagnoses, 99 (63 per cent) were pulmonary TB. Of these, 49 per cent were smear-positive, compared with 47 per cent smear-positive cases in 2018.

The highest age-specific incidence rate of new tuberculosis was in the 20-to-29-year-old age group (14.9 per 100,000), followed closely by the 70-plus age group (14.4 per 100,000). This is a change from the highest age-group incidence rates in 2018 being in the

70-plus and the 60-to-69-year-old age group (Table 69). 57 per cent of cases were male and 43 per cent were female.

Table 69: Age-specific incidence and age-specific incidence rates of new tuberculosis cases in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
0 to 4		1	1	0.9
5 to 9	1		1	0.9
10 to 14				-
15 to 19	4	3	7	6.3
20 to 29	16	25	41	14.9
30 to 39	12	19	31	11.9
40 to 49	12	10	22	9.8
50 to 59	9	8	17	8.1
60 to 69	6	11	17	11.2
70+	8	12	20	14.4
Total	**68**	**89**	**157**	**9.2**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

Among the four major ethnic groups, Asian people had the highest incidence rate, with 21.7 cases per 100,000. It's worth noting the rise of TB cases in the Middle Eastern/Latin American/African population which are responsible for five of the seven cases in the European or other group (Table 70).

Table 70: Ethnic group specific new tuberculosis cases and incidence rates in the Auckland region (2019)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	46	61	107	21.7
European or Other	3	4	7	0.8
Māori	2	9	11	5.5
Pacific peoples	17	14	31	13.6
Unknown		1	1	-
Total	**68**	**89**	**157**	**9.2**

*Rates are based on 2019 projected mid-year population, ethnicity is Total Response (Source: Statistics New Zealand)

Of the 157 cases, 132 (84 per cent) of new TB cases were born outside of New Zealand. The probable source countries were India (43%), China (13%), the Philippines (13%), Tonga (4%), South Africa (4%), Samoa (2%), and Fiji (2%) (Table 71). The average duration of time between arrival in New Zealand and onset date was 13 years. Fourteen cases were diagnosed within the first two years of their arrival, and ten within one year.

Table 71: Source countries for new tuberculosis cases born outside New Zealand in the Auckland region (2019)

Source country	Proportion of cases born outside NZ (%)
India	43
China	13
Philippines	13
Tonga	4
South Africa	4
Samoa	2
Fiji	2
Indonesia	2
Pakistan	2
Afghanistan	2
Cambodia	2
Other*	14
Total	**100**

*18 different countries 1 each

There was known contact with a case for 22 per cent of new cases, and no known contact in 62 per cent of cases. The remainder of cases (15 per cent) were reported as “Unknown”.

Occupational groups are shown in Table 72. Unemployed people made up 22 per cent of cases in 2019, well up from 10 per cent in 2018. The numbers of new TB cases in the remaining occupational groups were relatively stable, with retired people at 15 per cent and students at 12 per cent of cases. Healthcare workers account for six cases, which is about the average for the previous four years (5.5).

Table 68: Occupational group for new tuberculosis cases in the Auckland region 2015 – 2019

Occupational group	2015	2016	2017	2018	2019	2019 (%)
Unemployed or beneficiary	24	13	26	16	35	22
Student	26	31	23	22	19	12
Service industry	23	25	19	22	14	9
Retired persons	31	21	20	29	23	15
Administration roles	16	15	13	6	9	6
Food handler	12	4	13	8	7	4
Unknown	6	15	6	15	16	10
Tradesperson/factory worker	8	8	9	12	9	6
Visitor to NZ	5	3	7	2	3	2
Healthcare worker	5	11	4	2	6	4
Technician			4	6	2	1
Children 0-to-15 years	1	2	1	2	1	1
Self-employed			2	7		
Teacher		1		3	1	1
Music, art & sports	2					
Prison inmate	1				1	1
Total	**164**	**151**	**148**	**155**	**157**	**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 more than half of the cases occurring in NZDep zones 7, 8, 9, and 10 (Figure 58).

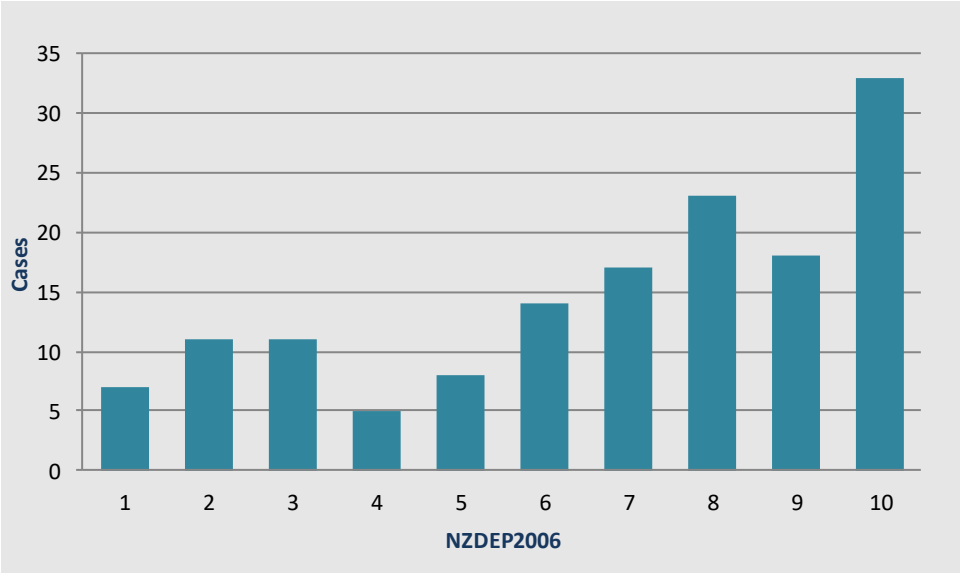


Figure 58: Distribution of new TB cases by NZDep in the Auckland region (2019)

Drug resistance to isoniazid was found in only one new TB case (compared to eight in 2018), and this case was also resistant to Ethambutol. This multidrug resistant case source country was the Philippines.

4.11.2 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 thus 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 111 LTBI cases were reported in 2019, compared with 106 in 2018 and 136 cases in 2017 (Figure 59). Only a minority of LTBI cases are diagnosed so this does not represent a true incidence rate.

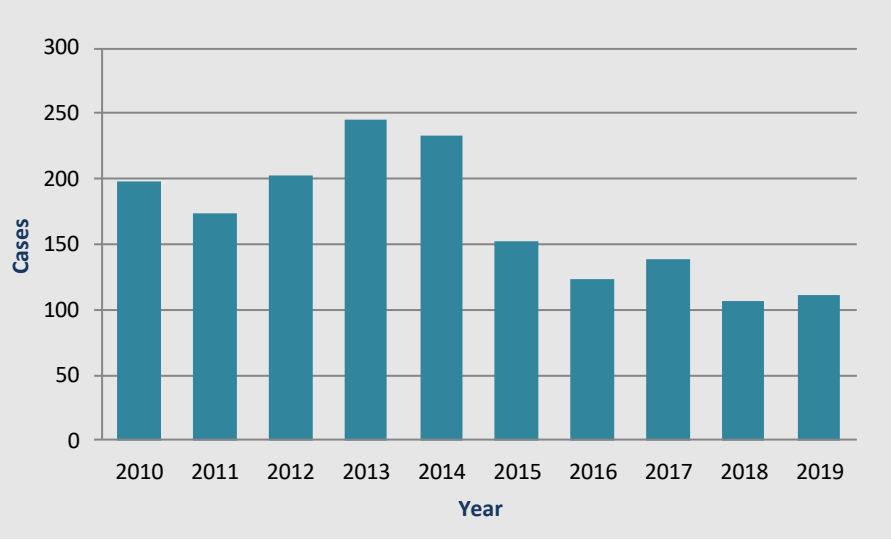


Figure 59: LTBI cases in the Auckland region, 2010 - 2019

Cases occurred throughout the year with peaks in March and July 2019 (Figure 60).

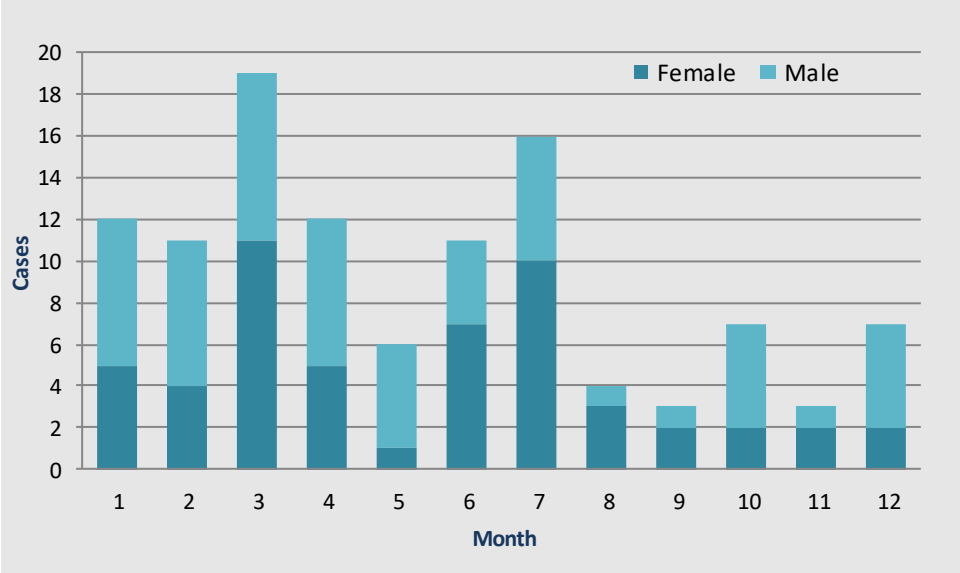


Figure 60: Monthly distribution of LTBI notifications in the Auckland region (2019)

The incidence rate was 6.4 cases per 100,000 population, with the highest age-specific incidence rate in the less-than-five-year-old age group (14.8/100,000), followed by the next two youngest age groups up to age 14 (Table 73). The male to female ratio is similar at 1.1:1.

Table 73: Age-specific incidence and age-specific incidence rates of LTBI in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
0 to 4	8	8	16	14.9
5 to 9	2	7	9	7.9
10 to 14	6	4	10	9.2
15 to 19		1	1	0.9
20 to 29	5	7	12	4.3
30 to 39	11	7	18	6.9
40 to 49	7	9	16	7.2
50 to 59	10	4	14	6.7
60 to 69	5	6	11	7.2
70+		4	4	2.9
Total	**54**	**57**	**111**	**6.5**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

The Asian ethnic group had the highest incidence rate (13 per 100,000), followed closely by Pacific People (7.9 per 100,000) (Table 70). Within the European and Other group there were five cases belonging to the Middle Eastern/Latin American/African ethnic group (Table 74).

Table 74: Ethnic group specific latent tuberculosis cases and incidence rates in the Auckland region (2019)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	31	33	64	13.0
European or Other	8	11	19	2.4
Māori	5	2	7	3.5
Pacific peoples	9	9	18	7.9
Unknown	1	2	3	-
Total	**54**	**57**	**111**	**6.5**

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

There were four TB preventative treatment cases during 2019. These cases were aged between 36 and 66-years-old (median age = 50). Three were of Asian ethnicity and one of European or Other.

The last remaining subgroup of tuberculosis that is monitored by ARPHS is the relapse or reactivations of tuberculosis disease. In 2019 there were seven cases in this group, and this number has remained relatively stable over the years. The age range was 28-to-88 years, and all were of Asian ethnicity. One case was smear positive.

4.11.3 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 its 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 2019, there were two confirmed cases. Both cases presented with skin and peripheral nervous manifestations, were aged between 15 and 29, and had acquired their illness in the Pacific.

5 Environmental related diseases

Key points

- Legionellosis notifications were consistent with the 10-year average for 2019, with cases clustering in autumn and spring. The predominate serotype in Autumn is *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 2019 were boosted by an increase in routine occupational testing by Kāinga Ora – Homes and Communities. Of the non-occupational cases the majority were associated with the removal of lead-based paints.
- The main cause of foodborne intoxication for 2019 was gastroenteritis caused by *Vibrio parahaemolyticus*. This may occur sporadically, but 23 reported cases were linked to the consumption of New Zealand grown mussels distributed through a Foodstuffs supermarket chain.
- There were 29 hazardous substances cases notified during 2019, a reduction from 40 in 2018. The incidence rate was highest in the under-five age group. The majority of cases were from poisoning by ingestion or by inhaled fumes and the majority of events took place in the home.

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 aerosolized water and/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 42 legionellosis cases were reported, down from 61 in 2018, and 82 in 2016 (Figure 61). 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 2.4 cases per 100,000, compared to the rest of New Zealand at 3.8 cases per 100,000.

Of the 42 cases notified, all received hospital treatment. Three deaths were reported in 2019, giving a case-fatality rate of 7.1 per cent. Two of the three deaths were associated *with L. pneumophila serotype 1* and one was associated with L*. longbeachae*. There were no legionellosis outbreaks in 2019.

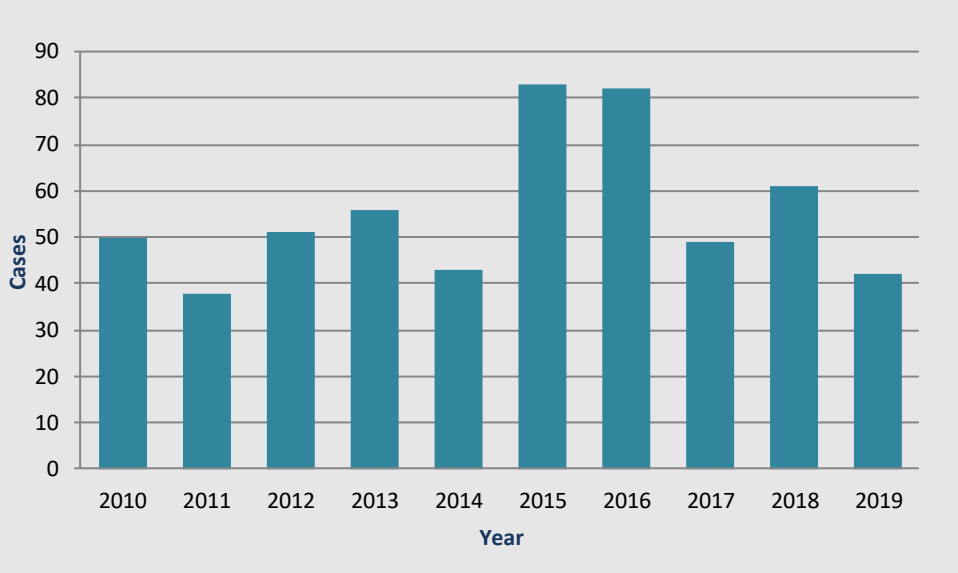


Figure 61: Legionellosis cases in the Auckland region 2010 - 2019

There were three cases involving patients who contracted the disease while staying overseas. The rest of the cases occurred singly and sporadically throughout the Auckland region throughout the year, with a peak in November as exposures to gardening soil and potting mix resulted in an increase in disease (Figure 62).

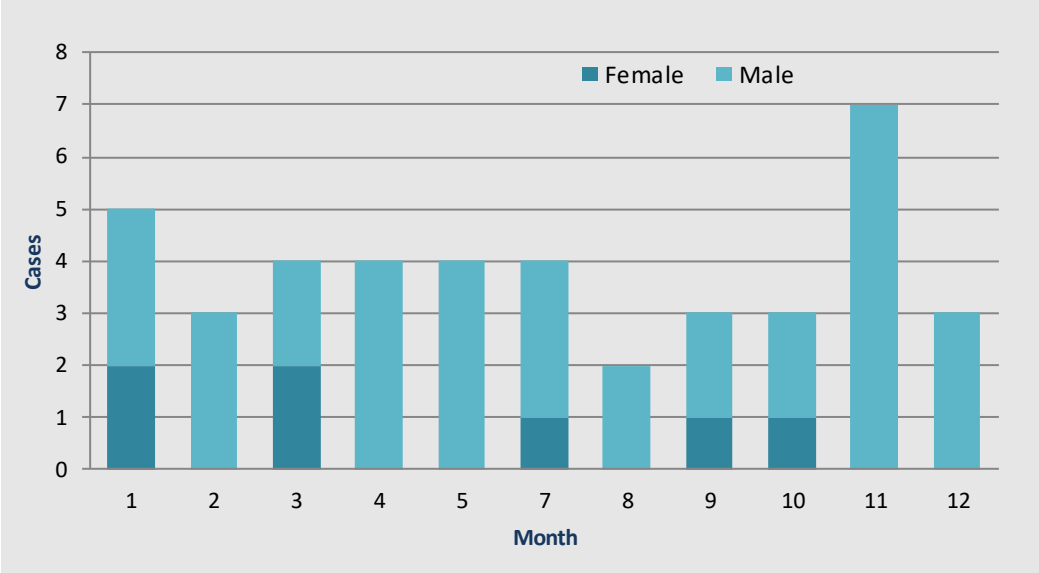


Figure 62: Monthly distribution of legionellosis cases in the Auckland region (2019)

The male to female ratio was 5:1 with the ages of the reported cases ranging from 27 to 89 years. The highest age-specific incidence rate was among persons aged 70-plus (Table 75).

Table 75: Age-specific incidence and age-specific incidence rates of legionellosis in the Auckland region (2019)

Age group	Female	Male	Total	Rate per 100,000*
20 to 29		1	1	0.4
30 to 39	1	3	4	1.5
40 to 49	1	2	3	1.3
50 to 59		6	6	2.8
60 to 69	2	11	13	8.2
70+	3	12	15	103
Total	**7**	**35**	**42**	**2.4**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand).

Among the four major ethnic groups, Māori had the highest incidence rate (3.6 per 100,000), followed by European or Other (2.7/100,000), Pacific peoples (1.9 per 100,000) and Asian (1.2 per 100,000). The reason for the low incidence rate amongst Asian populations is not known, but it's certainly not explained by deprivation as similar numbers were in NZDEP levels 8, 9 and 10 (Table 76).

Table 76: Ethnic group specific legionellosis cases and incidence rates in the Auckland region (2019)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	1	5	6	1.2
European or Other	3	21	24	2.7
Māori		7	7	3.6
Pacific peoples	3	2	5	1.9
Total	**7**	**35**	**42**	**2.4**

*Rates are based on 2019 projected mid-year population, ethnicity is Total Response (Source: Statistics New Zealand)

Of the 42 reported cases where immunosuppressive illness status was recorded, 42 per cent had evidence of concurrent immunosuppressive illness.

The predominant serotype for 2019 was *L. pneumophila serogroup 1* (61 per cent), which is typically associated with aerosolized water followed by *L. longbeachae (*34 per cent*),* typically associated with soil and compost products (Table 77). Sixteen samples were not further typed and there were an additional six L*egionella pneumophila* cases that were not further serotyped.

Table 77: Legionella serotypes in the Auckland region (2019)

Legionella serotype	Total
Legionella species not otherwise typed	16
Legionella longbeachae	9
Legionella pneumophila serogroup 1	8
Legionella pneumophila (not typed further)	6
Legionella pneumophila serogroup 2	1
Legionella pneumophila serogroup 7	1
Legionella bozemanae	1
Total	**42**

The monthly distribution of *Legionella* serotypes is shown in Figure 63. There is an observed increase in *L. longbeachae* in spring and summer as people have greater exposure to soil, gardens, composts and potting mixes. *L pneumophila 1* notifications are usually predominant during the first and second quarter of the year but, for 2019, they occurred throughout the year.

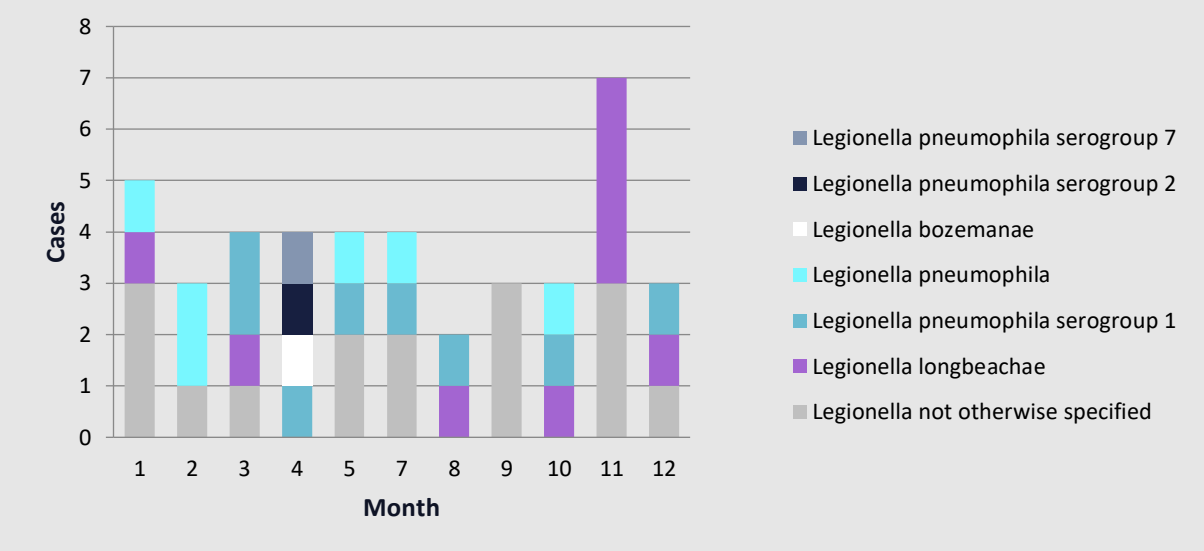


Figure 63: Monthly distribution of *legionella* serotypes in the Auckland region (2019)

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 116 lead cases in 2019, the same figure as for 2018 but well up from the 2017 total of 45 (Figure 64). Notifications were received throughout the year, with various spikes due to an increase in occupational testing; including large numbers of Housing New Zealand Kāinga Ora – Homes and Communities' contractors undergoing occupational testing.

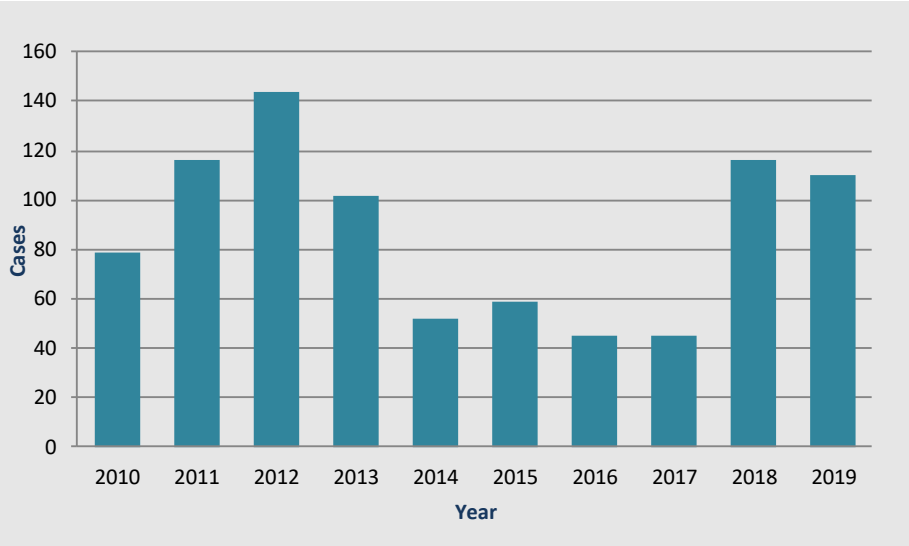


Figure 64: Lead absorption cases in the Auckland region 2010 – 2019

The overall incidence rate was 6.3 cases per 100,000 population. The highest age-specific rate was among people aged 50-to-59, followed by the 60-to-69–year-old age group (Table 78). The male to female ratio was 8:1. Among the four major ethnic groups, Pacific peoples had the highest incidence rate (19.5 per 100,000), followed by Māori (5.6 per 100,000) (Table 79).

Table 78: Age-specific incidence rates of lead absorption in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
1 to 4	2	1	3	2.8
5 to 9	1	2	3	2.6
15 to 19		3	3	2.7
20 to 29	1	19	20	7.3
30 to 39	1	17	18	6.6
40 to 49	2	18	20	8.8
50 to 59	2	24	26	12.2
60 to 69		15	15	9.5
70+	1		1	0.7
Total	**10**	**99**	**109**	**6.3**

*Rates are based on 2019-estimated mid-year population (Source: Statistics New Zealand)

Table 79: Ethnic group-specific lead absorption cases and incidence rates in the Auckland region (2019)

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	1	2	3	0.6
European or Other	1	22	23	2.6
Māori	1	10	11	5.6
Middle Eastern/Latin American/African		1	1	2.5
Pacific peoples	6	45	51	19.5
Unknown	1	19	20	-
Total	**10**	**99**	**109**	**6.3**

*Rates are based on 2019 projected mid-year population, ethnicity is Total Response (Source: Statistics New Zealand)

There were 94 occupational exposure cases. Of these, 68 were identified during routine screening. The average blood lead level overall was 1.1 μmol/l - slightly higher than in 2018 (0.94μmol/l). The individual highest level was found in a painter (3.1μmol/l) as part of the nationwide occupational testing undertaken by Kāinga Ora. Of the non-Kāinga Ora cases, the highest levels were also seen in those involved with painting and paint stripping (2.0 and 2.2μmol/l) (Table 80).

Table 80: Exposure sources in occupational lead absorption cases in the Auckland region (2019)

Source of exposure	Cases	Average blood lead level
Routine testing (occupation not stated)	50	1.06
Painter/Decorator	14	0.91
Foundry worker	10	1.28
Not Stated	7	0.69
Radiator repair	3	0.55
Pump manufacture	2	0.55
Shooter	2	0.55
Glass fitter	1	0.68
Gas pipeline engineer	1	0.76
Packer	1	1.84
Boat yard exposure	1	0.67
Lead worker (sinkers)	1	2.29
Construction worker	1	0.55
Total	**94**	**1.1**

Of the 11 non-occupational exposures, nine were associated with the stripping and painting of houses previously painted with lead-based paints (Table 81). The highest blood lead level in a non-occupational exposure case was 1.23, seen in a child.

Table 81: Sources for non-occupational lead absorption cases and average blood lead levels in the Auckland region (2019)

Occupation	Total	Average blood lead level
Ayurvedic medications /Kohl eyeliner	1	0.53
Paint removal / renovation	9	0.81
Shooter	1	0.79

5.3 Illness from foodborne toxins

5.3.1 Toxic shellfish poisoning

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

Paralytic shellfish poisoning (PSP) is caused by a group of chemicals called the saxitoxins and gonyautoxins. These chemicals all differ in their toxicity to humans, and the toxin load may vary, depending on the species of shellfish and the species of algae producing the toxin. Toxic algae of the species *Gymnodinium catenatum, Alexandrium minutum* and *Alexandrium catenella* commonly cause PSP toxicity in New Zealand shellfish.

There were no cases of toxic shellfish poisoning notified. The last case notified was in 2014.

5.3.2 Vibrio parahaemolyticus

Vibrio parahaemolyticus is a bacteria that infects the bowel. People from New Zealand are most likely to catch Vibrio parahaemolyticus from consuming raw seafood that has been contaminated or not stored at the proper temperature. It is not usually passed from person to person, but this can occur where someone has poor personal hygiene.

The incubation period is usually around 24 hours, but can be between 4 and 96 hours.

There were 32 notifications for gastroenteritis from foodborne toxins during 2019. These were identified using a new PCR test for *Vibrio* by LabTests. This proved to be an adult disease with an incidence of 1.2 per 100,000 people. Notifications occurred throughout 2019 with a peak in May. The male to female ratio was 1.2:1. The highest incidence was seen in the 60-to-69-year-old age group followed by 50-to-59-year-olds. Māori were overrepresented with an incidence rate of 4.4 per 100,000 people. Of the 32 cases, six were hospitalised and there were no deaths. Five cases were acquired overseas, in Fiji

(3), Kiribati (1), and Indonesia (1). Two of these were caused by ciguatera-contaminated fish from Fiji and the remainder were due to *Vibrio parahaemolyticus*.

During 2019, 23 cases of *Vibrio parahaemolyticus* were reported that were linked to the consumption of New Zealand-grown mussels distributed through a supermarket chain. Eleven cases had consumed seafood chowder and 12 had consumed raw mussels.

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 (s. 75).

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 this data was made available to ARPHS only by Auckland DHB but, from 2018, all the region's hospitals were able to contribute. This 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. Although ED level data is good, there is no reporting 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 29 hazardous substances cases notified during 2019, a reduction from 40 in 2018. The incidence rate was highest in the under-five-year-old age groups (Table 82).

Table 82: Hazardous substances injury cases by age group in the Auckland region (2019)

Age-group	Female	Male	Total	Rate per 100,000*
<1	1	2	3	13.9
1 to 4	5	2	7	8.1
15 to 19	2		2	1.8
20 to 29	2	1	3	1.1
30 to 39	2	4	6	2.2
40 to 49		2	2	0.9
50 to 59	3	2	5	2.3
70+	1		1	0.7
Total	**16**	**13**	**29**	**1.7**

*Rates are based on 2019-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 83).

Table 83: Hazardous substances injury cases by age-group in the Auckland region 2019

Ethnic group	Female	Male	Total	Rate per 100,000*
Asian	2	3	5	1.0
European or Other	9	7	16	1.8
Māori	1	1	2	1.0
Middle Eastern/Latin American/African		1	1	2.5
Pacific peoples	4	1	5	1.9
Total	**16**	**13**	**29**	**1.7**

*Rates are based on 2019 projected mid-year population, ethnicity is Total Response (Source: Statistics New Zealand)

Of the 29 cases, 16 incidents occurred in the home and three at work. Of the work-related cases, two occurred in hospitals (nitrous oxide gas leak) and one was from exposure to sterilising gases in a food processing plant. Of the home incidents, 11 were due to accidental ingestion of household products and five were from inhaling fumes. All but one was reported as being assessed at hospital, and there were no deaths.

The majority of cases were for poisoning by ingestion or by inhaled fumes, and the majority of events took place in the home (Tables 84 and 85).

Table 84: Hazardous substances injury cases by type of injury in the Auckland region (2019)

Type of injury	Cases
Accidental chemical ingestions	16
Inhaled fumes	11
Conjunctival burns	2
Total	**29**

Table 85: Auckland region hazardous substances cases by setting (2019)

Place of exposure	Total
Home	16
Work	3
Other/unknown	10
Total	**29**

The hazardous agent involved is shown in Table 86. The emergence of diffuser oils as a hazard for young children is of interest with three cases reported. Overall, the most common substance causing harm was hypochlorite bleach followed by a single event associated with a defective valve on a nitrous oxide tank.

Table 86: Hazardous substances injuries by agent in the Auckland region (2019)

Hazardous agent	Total
Acetone	1
Carbon Monoxide	1
Carpet Cleaning Powder	1
Cleaner	1
Diffuser/Essential oil	3
Drain Cleaner	1
Engine degreaser	1
Ethylene Glycol	3
Flea Spray	1
Fly Spray	1
Hair dye	1
Nitrous oxide	3
Petrol	1
Rat Poison	1
Sodium hydroxide	2
Sodium hypochlorite/Bleach	4
Tobacco	1
Toluene	1
Unknown	1
Total	**29**

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 influenza 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 of age.
- 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.
- Taeniasis notifications were in the low single-digit numbers and are sometimes detected during refugee screening.
- Diphtheria remains rare in New Zealand. The last case was a child with cutaneous diphtheria in 2017.

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, causing chronic disease, which usually persists for life. Acute symptoms include profuse sweating and joint and muscle pain.

There were no confirmed cases of Brucellosis notified in 2019.

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 were no cases of HiB confirmed out of 31 *Haemophilus influenzae* notifications for the year. The last notified case was a single HiB notification 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 that are infected by the parasite. Commonly infected animals include dogs, which become infected by eating the organs of animals, such as sheep or rodents, that contain the cysts.

There were no cases of hydatid disease notified. 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, including tick bites, ingestion of unpasteurized milk or dairy products, and human to human transmission, 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 2019.

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.

There was one probable case of overseas acquired rickettsial disease, specifically Rickettsia conorii, in a case following a visit to India. Rickettsial diseases are increasingly recognised in India and are considered as emerging and re-emerging diseases there (Rahi et al, 2015).

6.6 Murine typhus

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 were no cases of murine typhus notified in 2019. The most recent case was in 2017.

6.7 Diphtheria

Diphtheria is a rare but serious disease caused by toxin-producing strains of Corynebacterium. The bacteria produce a toxin (chemical) which affects the body and can lead to nerve paralysis and heart failure. It usually causes infection of the throat but can also cause skin infections.

Diphtheria is highly contagious. It is spread by coughs and sneezes, or through close contact with someone who is infected. Skin infections may be caused by traditional tattooing.

All babies in New Zealand can be immunised against diphtheria as part of their free childhood immunisations at 6 weeks, 3 months and 5 months old. A booster is also offered at 45 and 65 years of age.

There were no confirmed cases of *Corynebacterium diphtheria* notified in 2019. There was one case of cutaneous diphtheria in 2017.

6.8 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 infection with the eggs of *T. solium* from contaminated food and water. A specific form of cysticercosis called neurocysticercosis is said to be the most common infection of the central nervous system.

There were five confirmed cases of taeniasis, compared with four in 2018, four in 2017, and one in 2016. Most cases were acquired overseas; one each from Africa, Iran, Burma and Thailand. One case was not associated with recent overseas travel, but no source was found.

7 Environmental health indicators

Environmental health indicators (EHIs) are measures that summarise the relationship between the environment and health.

Key points

- The weather extremes of rainfall did not occur in 2019 compared with 2018 and 2017. The Auckland Airport station reported average levels of rainfall for autumn, spring and summer, but a drier winter.
- NIWA reported the spring and summer temperatures of 2018 and 2019 as being average or cooler. Consecutive days of very warm temperatures can negatively impact older adults' health.
- Population increase is likely to result in growing pressures on the environment and health-related services, and potential cause 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 can be 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). In summary, EHIs:

- help 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 the effectiveness of policy actions
- promote specific policy issues

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. Environmental Health Indicators give us information and statistics on how the environment affects New Zealanders' health.

7.2 ARPHS Environmental Health Indicators project and data collection

ARPHS selected five EHIs in 2016 as its foundations for an environmental health surveillance tool. Since that time, ARPHS has monitored activity across these five areas, and is working towards establishing a more comprehensive long-term monitoring program.

The five indicators are:

- rainfall
- mean monthly temperature (maximum)
- land use
- population growth
- air quality (PM2.5 and PM10).

In the future, the impact of these five indicators on human health will be further measured by:

- mortality data
- morbidity data - though this analysis has not yet started and would require some statistical analysis and reconciliation to ensure consistency with the international literature

The most recently available data collection for the 2019 calendar year is summarised in the figures below. ARPHS will continue collecting data and reporting on climate sensitive EHIs.

7.2.1 Rainfall

The weather extremes of rainfall did not occur in 2019 compared with 2018 and 2017. The Auckland Airport station reported average levels of rainfall for autumn, spring and summer but a drier winter. For some years we have entertained hypotheses that when rainfall is persistently high and there is more surface water, that there is an increase 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

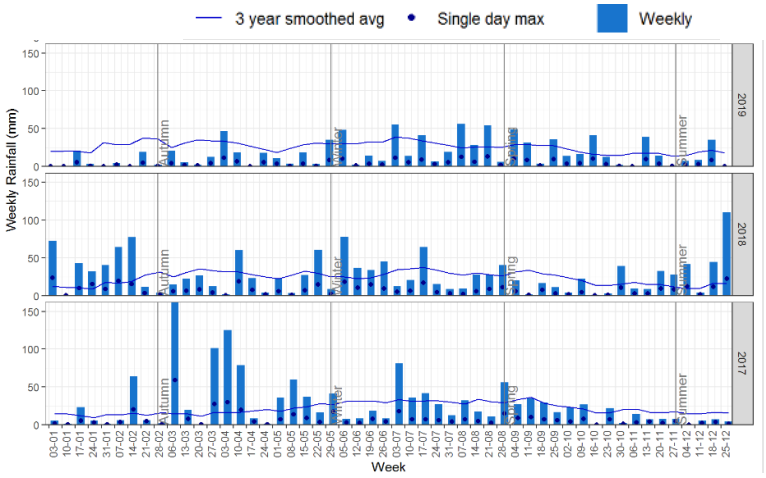


Figure 65: Auckland Airport rainfall 2017-2019

Source: NIWA

7.2.2 Rain days

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

The ten heavy rain days for 2019 was well down on the 18 for 2018 and 24 in 2017, and in no month did the number of 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.

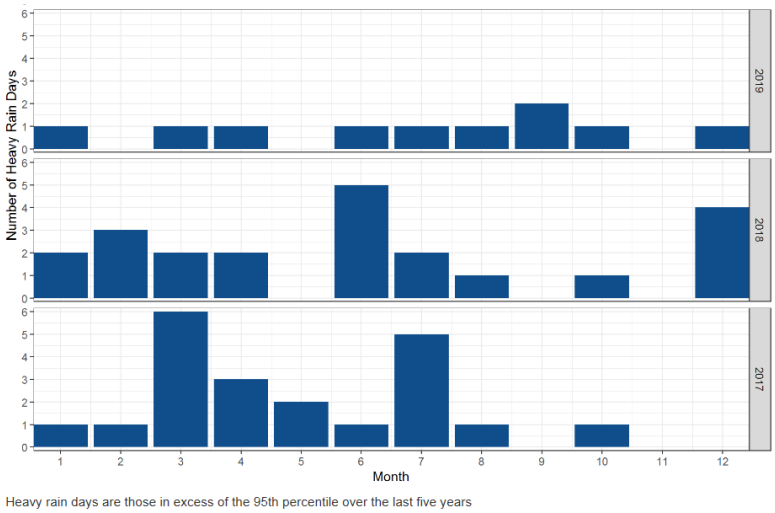


Figure 66: Auckland Airport rain days by month 2017 - 2019

7.2.3 Temperature

One of the key climate measures is the average weekly temperature. Overall NIWA rated spring and summer of 2017 as warmer, but spring and summer of 2018 and 2019 as average or cooler (Figure 67). Our emerging interest here is where there have been consecutive days of very warm temperatures and the resultant impact on older adults' health.

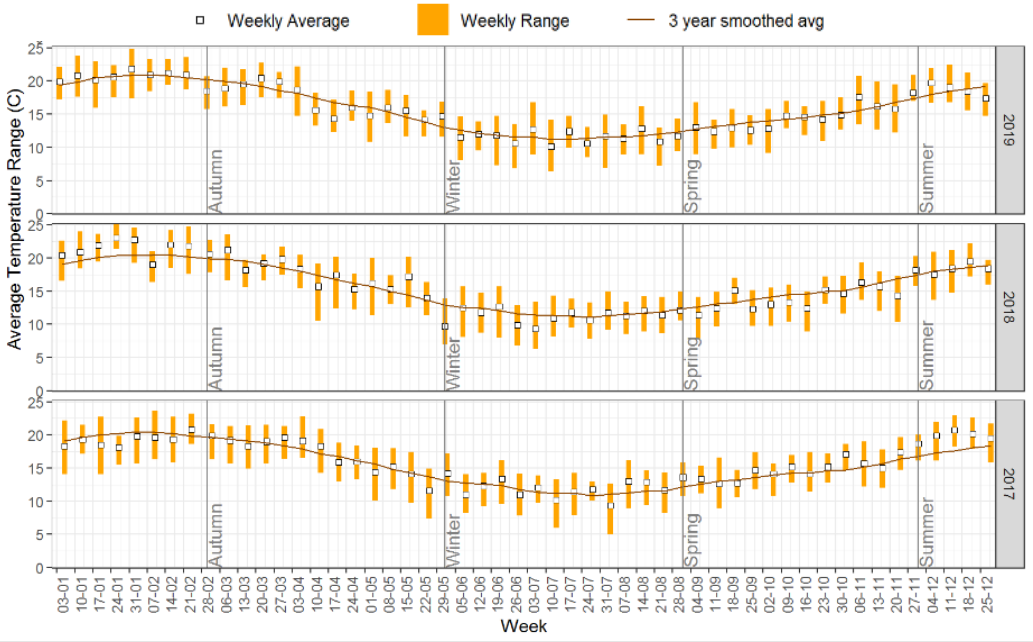


Figure 67: Auckland average weekly temperature range 2017-2019

Source: NIWA

8 Outbreaks

Key points

- The number of outbreaks in 2019 remained relatively low.
- Of the non-foodborne outbreaks, measles (1,755 cases), mumps (eight cases) and TB (nine cases) had the greatest impact.
- The mumps outbreak was interesting because the mode of transmission was thought to be a shared vaping device.
- The TB outbreak involved a large number of contacts.
- Of the foodborne diseases, the most common cause was norovirus in the residential/long-term care facility setting. The causes and settings of these outbreaks are many and varied.
- Of note were an adenovirus outbreak in an Aged Care Facility; sixteen salmonellosis outbreaks; and a Group A streptococcus foodborne outbreak that affected 48 attendees and staff at an open day event.

Auckland Regional Public Health Service identified or received 137 outbreak notifications in 2019. This is a slight increase on 2018 as the number of outbreaks requiring management had been decreasing slowly over the preceding five years (126 in 2018, 146 in 2017, and 166 in 2016) (Figure 77). The most substantial outbreaks was the measles outbreak that spanned from March 2019 to the end of the year.

It's important to note that these are reported outbreaks and there will have been many non-notified outbreaks.

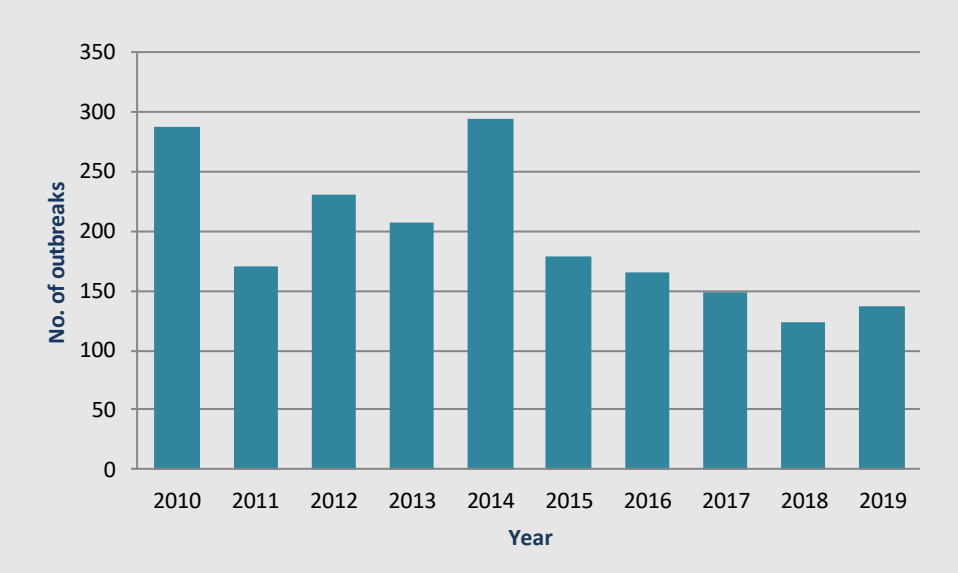


Figure 68: Outbreaks by year in the Auckland region 2010 – 2019

There are typically more outbreaks reported in summer and early spring. In 2019, outbreaks were reported throughout the year, but with fewer outbreaks in July and October (Figure 69).

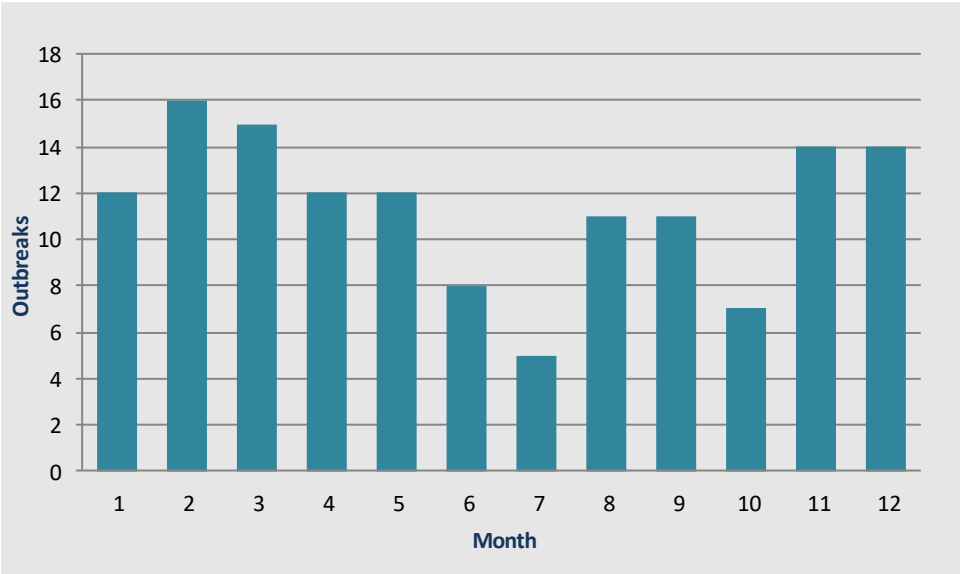


Figure 69: Outbreaks identified by ARPHS in the Auckland region (2019)

There were 31 different causative agents and these are shown in Table 87.

Table 87: Number of outbreaks identified by or reported to ARPHS 2015 – 2019

Pathogen	2015	2016	2017	2018	2019
Adenovirus			1		1
Astrovirus	1				
Bacillus				1	
Campylobacter	1		1	1	2
Ciguatera fish poisoning			1		1
Clostridium	3			1	1
Cryptosporidium	12	19	17	1*	4
Diphtheria	1				
Giardia	27	18	11	2	1
Hepatitis B					
Hepatitis A	1		3	1	1
Hazardous Substances				1	
Histamine (scombroid) fish poisoning		1	1		2
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
Neisseria meningitidis		1			
Norovirus	50	35	49	51	44
Pertussis			1	1	-
Rotavirus				1	2
Rheumatic fever				1	
Salmonella	16	12	8	9*	18
Sapovirus	1	7			1
Shigella	7	1	6	6	8
Staphylococcus	1				
Streptococcus (foodborne)					1
Typhoid			1	2	1
VTEC/EHEC	11	9	7	12	8
Yersinia		1			2
Unknown	40	54	36	34	32
Total	**179**	**166**	**146**	**127**	**137**

Of the 137 outbreaks, 130 were foodborne and the cause was found for 98 (75 per cent), similar to 2018 (72 per cent) and 2017 (74 per cent). The remaining seven outbreaks were non-foodborne. The number of cases implicated in each non-foodborne outbreak is shown in Table 88.

Table 88: Number of non-foodborne outbreaks and cases in the Auckland region (2019)

Pathogen	Outbreak	Cases
Lead absorption	2	7
Measles	3	1755
Mumps	1	8*
Mycobacterium tuberculosis	1	9
Total	**7**	**1779**

*One case was from another PHU

8.1 Non foodborne outbreaks

8.1.1 Lead absorption

The seven cases of lead absorption were household members affected by the removal of lead-based paints. Additional information on this is available in section 5.2.

8.1.2 Measles

The measles outbreak, for all intents and purposes, was one large outbreak. During the outbreak ARPHS monitored two strains - D3 and D9 - that were circulating in New Zealand as two separate outbreaks. This helped to identify transmission links between cases or groups of cases. D3 had its origin in Thailand and D9 was circulating globally. There was an additional outbreak created for operational reasons involving two persons on a flight from Samoa.

Overall, there were 1,755 cases notified in New Zealand. Additional information on this is available in section 4.1.

8.1.3 Mumps

This was an interesting outbreak of eight cases, where all were linked to a crate beer party in Whangamatā at the end of the university semester and final exams. The mode of transmission was thought to be a shared vaping device and one case of transmission to another patron at a bar they attended. Additional information on this is available in section 4.2.

8.1.4 Mycobacterium tuberculosis

There were nine cases in this South Auckland cluster, aged between three and 59-years-old, and a large number of contacts. For privacy, details are not included here.

8.2 Foodborne outbreaks

Norovirus, salmonellosis, shigellosis and VTEC were responsible for the greatest number of outbreaks in 2019 (Table 89). In 2019 there were 32 outbreaks of gastroenteritis for which a cause could not be found. We would expect the majority of these ‘unknown cause’ outbreaks to also be norovirus outbreaks. Potential reasons for this ‘unknown’ status include negative testing, or single household food complainants choosing not to follow up with the requested stool sample.

Six outbreaks had an overseas origin. The largest of these was an outbreak of Salmonella Branderup affecting 11 people from one large family group attending a reunion at a Queensland island resort. Four other travel-related outbreaks occurred in small family units. Three were caused by Shigella, originating from Samoa, Tonga and India (Shigella flexneri 1, Shigella sonnei type a and Shigella flexneri type Y variant respectively), and one was caused by Yersina enterocolitica in a family returning from the United Kingdom. The sixth outbreak, involving nine cases, was caused by Salmonella and was linked to the consumption of eggs at a popular Tongan restaurant/cafe. This was typed as Salmonella Enteritidis phage type 21.

All foodborne outbreaks by size, disease, and the total number of cases are shown in Tables 89 and 906.

Table 89: Foodborne outbreaks in the Auckland region by size and number of cases (2019)

	Size of outbreak											
Pathogen	2	3	4	5	6	7	8	9	10 -19	20 - 49	50 - 100	Total
Adenovirus									1			1
Campylobacter	1	1										2
Ciguatera			1									1
Clostridium perfringens										1		1
Cryptosporidium	2		2									4
Gastroenteritis - unknown cause	7	2	2	4	2	1	1	2	10	1		32
Giardia			1									1
Hepatitis A		1										1
Histamine (scombroid) fish poisoning	1			1								2
Norovirus	1	2	1	2	2	1	1	2	19	9	4	44
Rotavirus							1		1			2
Salmonella	10	1	2		1					1	1	16
Sapovirus										1		1
Shigella	2	2	1									5
Streptococcus (foodborne)										1		1
Typhoid		1										1
VTEC	7		1									8
Yersinia		1										1
Total	**31**	**11**	**11**	**7**	**5**	**2**	**3**	**4**	**31**	**14**	**5**	**124**

*Excludes overseas outbreaks

Norovirus outbreaks caused illness in 835 cases, down from 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 gastroenteritis cases where norovirus was suspected but unable to be confirmed.

Salmonella was found to be the source of 16 outbreaks (with 145 salmonella-associated cases) and Shigella was the identified source of 14 cases across five outbreaks (see table 90).

VTEC was responsible for smaller outbreaks in 2019, but of concern was that three of these outbreaks were caused by O157:H7. Of the remainder, two were caused by O26:H11, one O103:HNTB and one ONT:H2.

Table 90: Foodborne outbreaks in the Auckland region by pathogen and number of cases (2019)

Pathogen	Cases
Adenovirus	19
Campylobacter	5
Ciguatera	4
Clostridium perfringens	20
Cryptosporidium	12
Gastroenteritis - unknown cause	241
Giardia	4
Hepatitis A	3
Histamine (scombroid) fish poisoning	7
Norovirus	835
Rotavirus	26
Salmonella	145
Sapovirus	21
Shigella	14
Streptococcus (foodborne)	48
Typhoid	3
VTEC	18
Yersinia	3
Total	**1428**

Further description of these outbreaks follows.

8.2.1 Adenovirus

This outbreak started in January 2019 at an Aged Residential Care (ARC) facility. In all there were 19 cases notified out of 50 individuals exposed over a 13-day period. The age range was 58-to-98-years-old. All cases presented with vomiting and diarrhoea, and an average illness duration of three days. The source was not found.

8.2.2 Ciguatera

A family outbreak of four people out of five who were exposed when they consumed privately imported contaminated fish.

8.2.3 Scombroid poisoning

Five members of the same family, aged 12-to-24-years-old, became rapidly unwell after consuming a pizza that was suspected to have been improperly stored before consumption. This was referred to the Ministry for Primary Industries (MPI) for further investigation. However, food samples tested negative.

8.2.4 Rotavirus

This was an outbreak that affected 18 children and six staff located across four areas of a semirural Early Learning Service (ELS). The outbreak, caused by Rotavirus G3P[8], occurred over seven days. The centre had 82 attendees and nine staff. Of the 18 children affected, all had received at least one rotavirus vaccination, 10 had received two, and seven had received three. The attack rate was 18 of 82 attendees exposed (22 per cent) and six of nine staff exposed (66 per cent). Overseas studies give attack rates of 70 per cent in unvaccinated children (Pérez-Ortín et al., 2019). In this outbreak vaccine effectiveness was 69 per cent. Public health messaging was disseminated to all parents resulting in rapid resolution.

Note: RV1 (Rotarix, GSK) is a live attenuated monovalent human G1P1A[8] strain rotavirus vaccine. It protects against non-G1 serotypes (these include G2P[4], G3P[8], G8P[4], G9P[8] and G12P[6]).

8.2.5 Salmonella

There were 16 salmonellosis outbreaks in 2019.

Ten 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. Details of other *Salmonella* outbreaks are as follows:

Salmonella typhimurium phage type 108/170

The first case from this multi-jurisdictional outbreak was notified on 23 December 2018 and the last case on 8 April 2019. Salmonella typhimurium phage type 108/170 was the causative agent and it affected 70 people aged six-to-72-years (median age was 37 years old). This dispersed outbreak was eventually linked to the consumption of contaminated alfalfa sprouts. (Odds Ratio 9.3 (95% CI 2.8 to 35.2)). A product recall was issued on March 29, 2019.

Salmonella enteriditis phage type 28

This outbreak came to ARPHS' attention through the investigation of several salmonellosis cases where a common event linked them to a central city restaurant. During the outbreak investigation, eight other groups were linked to the same restaurant on different days in the subsequent weeks. In all, 38 confirmed and probable cases occurred over a three-week period. A self-completion questionnaire was offered for the bigger groups that had attended functions held at the restaurant and standard phone interviews were completed for the single cases. The desserts menu emerged with the highest odds ratios. Food samples returned negative results as did food products included in the various dishes on offer.

The Ministry for Primary Industries and Auckland Council were involved and took part in the site visit. All staff but one completed stool samples. A waiter (but not a food handler) tested positive for salmonella on a stool sample. The waiter was asymptomatic, but during the interview it transpired that he had eaten most of the food on the menu at one time or another, including desserts, as the restaurant supplied the staff with the same meals being served to patrons.

Salmonella Branderup

In this outbreak, 19 members of the same family travelled to an island resort in the Whitsunday Islands, Queensland. Of the 19 members, 11 became unwell. Stool testing in New Zealand revealed a mix of pathogens, with a total of two confirmed salmonella cases and one cryptosporidiosis case. One infant required hospitalisation on their return to New Zealand, but the stool sample did not identify a pathogen. One other infant was hospitalised on their return to Dunedin. The Salmonella was identified as Salmonella Branderup. Australian health authorities were informed but were unable to identify any other local cases at the resort. However, ARPHS' interviews did establish that a nurse on the island had said other children had been experiencing gastroenteritis-like illness. Kangaroos, wallaroos and birds roam the island where the resort is located and families independently reported seeing large quantities of animal droppings present throughout the resort, but especially around the pools. This included some droppings on poolside furniture and matting surrounding the pool. Resort staff swept these away, but it's not known whether any other disinfection took place.

Salmonella Enteritidis phage type 21

This outbreak involved nine individuals who had consumed food at a popular cafe in Tonga. Four cases were from Auckland, the other three were from Christchurch (1) and Wellington (2). The majority of the cases consumed an egg meal from the breakfast/brunch menu.

Salmonella Enteriditis phage type 8

The common event here was a gathering of nine people for a family birthday celebration where they all consumed portions of a birthday cake. All became unwell and another family member who consumed the cake the day after also became unwell. It transpired that the mother who made the cake had been unwell during the cake making process.

8.2.6 Sapovirus

In this Early Learning Service (ELS) in West Auckland, 21 cases were reported from an exposed population of 118 attendees and staff. The outbreak was detected during the follow-up of one child who had been notified with VTEC. During this interview with the ELS it was revealed that many other children were unwell and subsequent sampling revealed

the causative agent was not VTEC, but sapovirus. Hand hygiene, exclusion and disinfection advice had the outbreak under control in five days.

8.2.7 Shigellosis

The largest shigellosis outbreak was in a household of four due to *Shigella sonnei*. It occurred over a period of one week, and its duration was prolonged due to person-to-person spread. The original source was not identified.

8.2.8 Streptococcus (foodborne)

In November 2019 a health setting open day was held, after which 48 attendees and staff became unwell with fever, sore throat and gastroenteritis over a period of 12 days. It was estimated there were approximately 85 attendees. The laboratory notified ARPHS on detection of Group A streptococcus as the food borne outbreak source. The food was prepared onsite and it was felt there had been some cross contamination from one of the food handlers who had been unwell with a sore throat. Despite best efforts, a lack of refrigeration space for pre-prepared food may have also contributed. The event did not have a set invite list and, as such, there was some difficulty in contacting everyone who attended.

An outbreak strategy was developed which included:

- Group A Streptococcus (GAS) positive cases were prescribed penicillin/amoxicillin for 10 days.
- Follow-up of health setting staff and event attendees by ARPHS and the relevant DHB.
- Wraparound services provided attendees with information and advised them to see their GP if they or any household contacts became symptomatic. Some cases occurring amongst this group may not have been reported.
- Household contacts who developed symptoms were followed up by ARPHS and if they met the case definition, had a throat swab and antibiotics for 10 days.
- Where there were three or more symptomatic household members, and where one had been confirmed as a case, treatment of the whole household was recommended.

8.2.9 Typhoid

This three-person outbreak occurred in a South Auckland family. A 17-year-old was first notified, and, on screening household members, two additional cases were found. There was no history of recent travel by the cases or consumption of imported food. The grandmother who prepared most of their food had a history of recent travel but tested negative.

8.2.10 VTEC

VTEC outbreaks are uncommon as there is usually limited person-to-person spread; outbreaks are often confined to families where there has been a common exposure and typically only number two or three cases. In 2019 there was one VTEC outbreak involving four cases from seven exposed family members who were exposed to an unwell baby goat.

8.3 Foodborne outbreak settings

Long-term care facilities had the greatest number of outbreaks (36) and cases (557). Outbreaks in the home (34) were numerous but involved a smaller number of cases (110). Childcare centres had 25 outbreaks, involving 301 children, compared with schools, where there was only one outbreak involving 10 children and staff. This was well down from 2018 when more than 500 school children were affected (Tables 91 and Table 92).

Table 91: Foodborne outbreaks in the Auckland region by setting and number of cases (2019)

Setting	No. of outbreaks	Total no. of cases
Catered event	4	200
Childcare centre	25	301
Home	34	110
Hospital	3	8
Hostel/boarding house	2	29
Long term care facility	36	557
Multi-jurisdictional outbreak	1	70
Restaurant/cafe/bakery	12	94
School	1	10
Takeaway food outlet	4	13
Wedding	1	34
Funeral	1	2
Total	**124**	**1428**

There were 21 outbreaks involving only two people in either a household and/or food premise setting, and six outbreaks in the same settings where three people were affected.

Table 92: Number of foodborne outbreaks by setting and outbreak size, Auckland region (2019)

Setting	Size of outbreak											Total
	2	3	4	5	6	7	8	9	10 - 19	20 - 49	50 - 100	
Catered event										3	1	4
Childcare centre	1		2	3	1		1	1	13	3		25
Home	21	6	5						2			34
Hospital	1	2										3
Hostel/ boarding house								1		1		2
Long term care facility		2	3	2	2	2	2	2	13	5	3	36
Multi-jurisdictional outbreak											1	1
Restaurant/ cafe/ bakery	5	1		1	2				2	1		12
School									1			1
Takeaway food outlet	2		1	1								4
Wedding										1		1
Funeral	1											1
Total	**31**	**11**	**11**	**7**	**5**	**2**	**3**	**4**	**31**	**14**	**5**	**124**

In the household setting, the largest outbreak involved 15 cases. In the restaurant setting, the largest outbreak affected 38 people. Catered events were responsible for four of the larger outbreaks, the biggest being 83 cases. In hospitals in Auckland there were three outbreaks involving only eight cases.

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

- one large outbreak at a catered event (83 cases)
- three outbreaks in long term care facilities, involving 52, 55 and 58 cases respectively
- one nationwide outbreak caused by Salmonella Typhimurium phage type 108/170 involving 70 cases

Table 89 shows the spectrum of pathogens in various settings, with the widest spectrum in the home, childcare, and food outlet settings. A pathogen was able to be determined in 75 per cent of outbreaks.

Table 93: Number of foodborne outbreaks in each exposure setting, by pathogen, in the Auckland region (2019)

Setting	Size of outbreak											Total
	2	3	4	5	6	7	8	9	10 - 19	20 - 49	50 - 100	
Catered event										3	1	4
Childcare centre	1		2	3	1		1	1	13	3		25
Home	21	6	5						2			34
Hospital	1	2										3
Hostel/boarding house								1		1		2
Long term care facility		2	3	2	2	2	2	2	13	5	3	36
Multi-jurisdictional outbreak											1	1
Restaurant/cafe/bakery	5	1		1	2				2	1		12
School									1			1
Take away food outlet	2		1	1								4
Wedding										1		1
Funeral	1											1
Total	**31**	**11**	**11**	**7**	**5**	**2**	**3**	**4**	**31**	**14**	**5**	**124**

References and resources

References

Craig, A. T., Heywood, A. E., & Worth, H. (2020). Measles epidemic in Samoa and other Pacific islands. The Lancet. Infectious Diseases, 20(3), 273–275. **https://doi.org/10.1016/S1473-3099(20)30053-0**

Dobrowsky, P. H., van Deventer, A., De Kwaadsteniet, M., Ndlovu, T., Khan, S., Cloete, T. E., & Khan, W. (2014). Prevalence of virulence genes associated with pathogenic Escherichia coli strains isolated from domestically harvested rainwater during low- and high-rainfall periods. Applied and environmental microbiology, 80(5), 1633–1638. **https://doi.org/10.1128/AEM.03061-13**

Fisman, D. N., Lim, S., Wellenius, G. A., Johnson, C., Britz, P., Gaskins, M., Maher, J., Mittleman, M. A., Spain, C. V., Haas, C. N., & Newbern, C. (2005). It's not the heat, it's the humidity: wet weather increases legionellosis risk in the greater Philadelphia metropolitan area. The Journal of Infectious Diseases, 192(12), 2066–2073. **https://doi.org/10.1086/498248**

Hazardous Substances and New Organisms Act 1996. https://www.legislation.govt.nz/act/public/1996/0030/latest/DLM381222.html

Ministry of Health. (2012). Communicable Disease Control Manual. Ministry of Health. https://www.health.govt.nz/our-work/diseases-and-conditions/communicable-disease-control-manual

Oliver, J. R., Pierse, N., Stefanogiannis, N., Jackson, C., & Baker, M. G. (2017). Acute rheumatic fever and exposure to poor housing conditions in New Zealand: A descriptive study. Journal of Paediatrics and Child Health, 53(4), 358–364. **https://doi.org/10.1111/jpc.13421**

Pérez-Ortín, R., Santiso-Bellón, C., Vila-Vicent, S., Carmona-Vicente, N., Rodríguez-Díaz, J., & Buesa, J. (2019). Rotavirus symptomatic infection among unvaccinated and vaccinated children in Valencia, Spain. BMC Infectious Diseases, 19(1), 998. **https://doi.org/10.1186/s12879-019-4550-x**

Rahi, M., Gupte, M. D., Bhargava, A., Varghese, G. M., & Arora, R. (2015). DHR-ICMR Guidelines for diagnosis & management of Rickettsial diseases in India. The Indian Journal of Medical Research, 141(4), 417–422. **https://doi.org/10.4103/0971-5916.159279**

Semenza, J. C., Lindgren, E., Balkanyi, L., Espinosa, L., Almqvist, M. S., Penttinen, P., & Rocklöv, J. (2016). Determinants and Drivers of Infectious Disease Threat Events in Europe. Emerging infectious diseases, 22(4), 581–589. **https://doi.org/10.3201/eid2204**

World Health Organization. (2019). Global tuberculosis report 2019. Geneva, Switzerland: World Health Organization

World Health Organization. (2022). Hepatitis D. https://www.who.int/news-room/fact-sheets/detail/hepatitis-d

Resources

Books

- Heymann, D. (2015). *Control of Communicable Diseases Manual*, ISBN 978-87553-018-5
- Begg, J., Blair,I., Reintjes,R., Weinburg,J., (2004) *Communicable Disease Control Handbook*
- Ministry of Health. (2017). *Immunisation Handbook*
- Mandell, Douglas and Bennetts (2015) *Principles and Practice of Infectious Disease* (Eighth edition)

Other data sources

- Statistics New Zealand (SNZ): **http://archive.stats.govt.nz/** for 2019 estimated resident population numbers
- ESR Public Health Surveillance **https://surv.esr.cri.nz**
- ARPHS Fact Sheets **www.arphs.govt.nz**
- ARPHS Normal and After hours Protocols (internal access only)
- ARPHS Surveillance Strategy 2016-2018, 2018 to 2022 (Draft) (Internal access only)
- Ministry for Primary Industries (MPI): **www.mpi.govt.nz/travel-and-recreation/fishing/shellfish-biotoxin-alerts/**

EpiSurv Reports

Episurv reports supply the basic epidemiological data though, for all intents and purposes, this is now also extracted directly out of NDCMS

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

NIWA

Cliflo database: **https://cliflo.niwa.co.nz/**

NZ Stats

https://www.stats.govt.nz/information-releases/agricultural-production-statistics-june-2017-provisional

MfE

- **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

Appendix 1: Notifiable Diseases in New Zealand

Diseases that are notifiable to the Medical Officer of Health are:

Acute gastroenteritis (when part of a suspected outbreak)

AIDS

Anthrax

Arboviral diseases e.g. Dengue fever

Brucellosis

Campylobacteriosis

Cholera

Creutzfeldt-Jakob disease

Cryptosporidiosis

Cysticercosis

Decompression Sickness

Diphtheria

Enterobacter sakazakii invasive disease

Giardiasis

Haemophilus influenza B

Hepatitis (acute A,B,C or viral NOS)

Hydatid Disease

Influenza (High pathogenic Avian)

Invasive Pneumococcal Disease

Lead Poisoning

Legionellosis

Leprosy

Leptospirosis

Listeriosis

Malaria

Measles

Meningoencephalitis (primary amoebic)

Mumps

Neisseria meningitidis (invasive disease)

Pertussis

Plague

Poisoning arising from chemical contamination of the environment

Poliomyelitis

Rabies

Rheumatic fever

Rickettsial diseases

Rubella

Salmonellosis

SARS

Shigellosis

Taeniasis

Tetanus

Trichinosis

Tuberculosis (all forms)

Typhoid and paratyphoid fever

Viral haemorrhagic fevers

Yellow fever

Yersiniosis