Science for Communities
He Pūtaiao, He Tāngata

INVASIVE PNEUMOCOCCAL DISEASE BIANNUAL REPORT: JULY 2022 TO JUNE 2023

Prepared as part of a Ministry of Health contract for scientific services

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- Staff in the ESR Invasive Pathogens Laboratory for serotyping data.
- Staff in the ESR Antibiotic Reference Laboratory for antimicrobial susceptibility data.

DISCLAIMER

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KEY FINDINGS

This report describes the epidemiology of IPD in New Zealand in 2022/23. The analyses are based on IPD notifications in the EpiSurv database, as well as information from the national immunisation register and ESR's national antimicrobial resistance reference laboratory.

- In the 12 months ending 30 June 2023, there were 692 cases of Invasive pneumococcal disease (IPD) notified (13.5 cases per 100,000).
- Since 2021, the incidence of IPD has been increasing steadily with the incidence in 2022/23 higher than 2018/19 when it was 10.7 per 100,000. The increase has been driven primarily by increases in the incidence among Māori and Pacific peoples with the incidence rates among European/Other and Asian ethnic groups remaining relatively stable since 2013/14.
- Pacific peoples have higher rates than other ethnic groups, and the most vulnerable age groups, those under 5 years and those aged 60 years and over are disproportionately affected.
- Serotype 19A remains the most common serotype, followed by serotype 8 and then serotype 3. IPD cases due to serotypes included in the PCV10 vaccine have been uncommon since 2017/18 when PCV10 was introduced to the immunisation programme.
- In 2022/23, the majority (85%) of IPD cases in children who were eligible for the PCV vaccine had been vaccinated. The majority of these vaccinated cases were infected with a serotype not contained in the vaccine they had received. Approximately 18%of typed cases were infected by a serotype not covered by any pneumococcal vaccine (PCV20 and 23PPV).

This report has identified that IPD continues to affect the most vulnerable populations in New Zealand and that pneumococcal conjugate vaccines provide good protection against the serotypes they contain. It is important to continually monitor trends in IPD epidemiology to inform vaccine decisions in the future. Areas that require particular attention include monitoring of serotypes to identify emergence of serotypes not covered by current vaccines and monitoring of trends in age and ethnic group where there are clear disparities. To further reduce the incidence of IPD in New Zealand it is important that immunisation coverage is increased with a focus in improving equity.

Not all IPD is vaccine preventable, and this highlights the importance of efforts to address systemic and health care access issues that may contribute to the spread of *S. pneumoniae* infection.

INTRODUCTION

Invasive pneumococcal disease (IPD) refers to disease due to *Streptococcus pneumoniae* (*S pneumoniae*) entering a sterile site, such as blood, pleural fluid, or cerebrospinal fluid. IPD represents the most severe end of the disease spectrum caused by this bacterium. The most common clinical presentations in IPD are bacteraemic pneumonia, non-localised bacteraemia (bacteraemia without focus), and meningitis. Older adults generally have bacteraemic pneumonia, while young children may have any of the three, with meningitis being the most severe.

S pneumoniae can also cause non-invasive infections such acute otitis media (predominantly in children) and sinusitis (predominantly older children and adults). Non-invasive *S pneumoniae* infections are not notifiable and are not discussed within this report.

IPD is a vaccine preventable disease with vaccines available that provide protection against different serotypes of the bacterium. A pneumococcal vaccine has been part of the New Zealand childhood immunisation schedule since 2008. The history of the pneumococcal vaccine programme in New Zealand is summarised in Table 1. (1)

Table 1. Pneumococcal conjugate vaccine history in New Zealand

Date	Vaccination schedule change
2006	PCV7 and 23PPV introduced for high-risk individuals.
2008	Introduced to the Schedule in June as PCV7 at ages 6 weeks, 3 months, 5 months and 15 months.
2011	PCV10 replaced PCV7 on the Schedule. PCV13 replaced PCV7 for high-risk children.
2014	PCV13 replaced PCV10 on the Schedule.
2015	PCV13 became available for patients of any age with certain high-risk conditions.
2017	PCV10 replaced PCV13 on the Schedule. PCV13 and 23PPV continues for high-risk individuals
2020	PCV10 recommended as a 2-dose primary schedule plus booster dose given at 6 weeks, 5 months and 12 months. PCV13 remained at 3-dose schedule plus booster for high-risk infants (ie given at ages 6 weeks, 3, 5 and 12 months)
2022	PCV13 replaced PCV10 on the Schedule in a 2-dose primary plus booster in December. An additional 3-month dose continued for high-risk infants.

PCV13 is currently the funded vaccine on the childhood immunisation schedule. Two doses of PCV13 are given as the primary course, at 6 weeks and 5 months, with a booster at age 12 months. Children who started their immunisation course with PCV10 prior to December 2022 can complete it with PCV13. PCV13 is not funded for those who have previously been fully vaccinated with PCV10. In addition, PCV13 and 23 PPV are available for vaccination and re-vaccination for people of any age with eligible conditions.(1)

This report provides an overview of the epidemiology of IPD for the 12-month period ending 30 June 2023. It also presents trends from July 2013. This report will be produced biannually and will replace the *quarterly and annual reports* that were produced previously.

METHODS

The case data presented in this report are based on the information recorded on EpiSurv, the national notifiable disease surveillance system, as of 25 October 2023. Any updates made to EpiSurv data by public health unit staff after this date will not be reflected in this report. Episurv data are supplemented with serotype and antimicrobial susceptibility data from the ESR national laboratory-based surveillance of invasive *S. pneumoniae* isolates. The immunisation status of cases that were eligible for PCV vaccination was extracted from the National Immunisation Register (NIR).

IPD CASE DEFINITION

IPD has been a notifiable disease since 2008. A confirmed case is one that has a clinically compatible illness that is laboratory confirmed. Most cases present with either meningitis, pneumonia, or septicaemia. Laboratory confirmation requires at least one of the following (2):

- isolation of *S. pneumoniae* from blood, cerebrospinal fluid (CSF) or another normally sterile site (eg. joint fluid, pleural fluid)
- detection of *S. pneumoniae* nucleic acid from blood, CSF or another normally sterile site
- a positive *S. pneumoniae* antigen test on CSF or pleural fluid

Pleural fluid was added in 2016 as a sterile site. (2) As a result, this addition may have slightly increased the total number of IPD cases identified after that date relative to previous years.

CALCULATION OF POPULATION RATES

All rates presented in this report are crude rates.

The 2017–2022 mid-year population estimates published by Statistics New Zealand were used to calculate the incidence rates for total population.

All rates are presented as the number of cases per 100,000 population. Rates have not been reported where there were fewer than five cases in any category as this produces unstable rates.

ETHNICITY

Prioritised ethnicity is used in this report. Ethnicity is prioritised in the following order: Māori, Pacific peoples, Asian, and European/Other/Middle Eastern/Latin American/African (MELAA) ethnicity. For more detail on classification refer to the Ministry of Health ethnicity data protocols. (3)

The incidence rates for ethnic groups were calculated by applying the usually resident 2018 census population ethnic proportions to the 2017–2022 mid-year population estimates.

SOCIO-ECONOMIC DEPRIVATION

The New Zealand index of deprivation 2018 (NZDep2018) is used to measure socio-economic deprivation. NZDep2018 is derived from a weighted combination of nine variables from the 2018 census, each reflecting a different aspect of material and social deprivation (4). The deprivation score is calculated for each geographical mesh block in New Zealand.

This report presents NZDep2018 by quintiles, where 1 represents the least deprived areas and 5 the most deprived areas.

The denominator data used to determine disease rates for NZDep2018 categories is based on the proportion of people in each NZDep2018 category from the usually resident 2018 census population.

TRENDS

Trend data are presented for 12-month periods from 1 July to 30 June each year.

INVASIVE PNEUMOCOCCAL DISEASE IN NEW ZEALAND

There were 692 cases of IPD notified in New Zealand in 2022/23 (13.5 cases per 100,000).

Figure 1 shows the incidence of IPD from 2013/14 to 2022/23 for the total population. The incidence of IPD has been increasing steadily since 2020/21 with the incidence in 2022/23 the highest it has been over the total 10-year period since 2013/14.

Figure 1. Incidence of invasive pneumococcal disease in New Zealand, rate per 100,000, 2013/14 to 2022/23

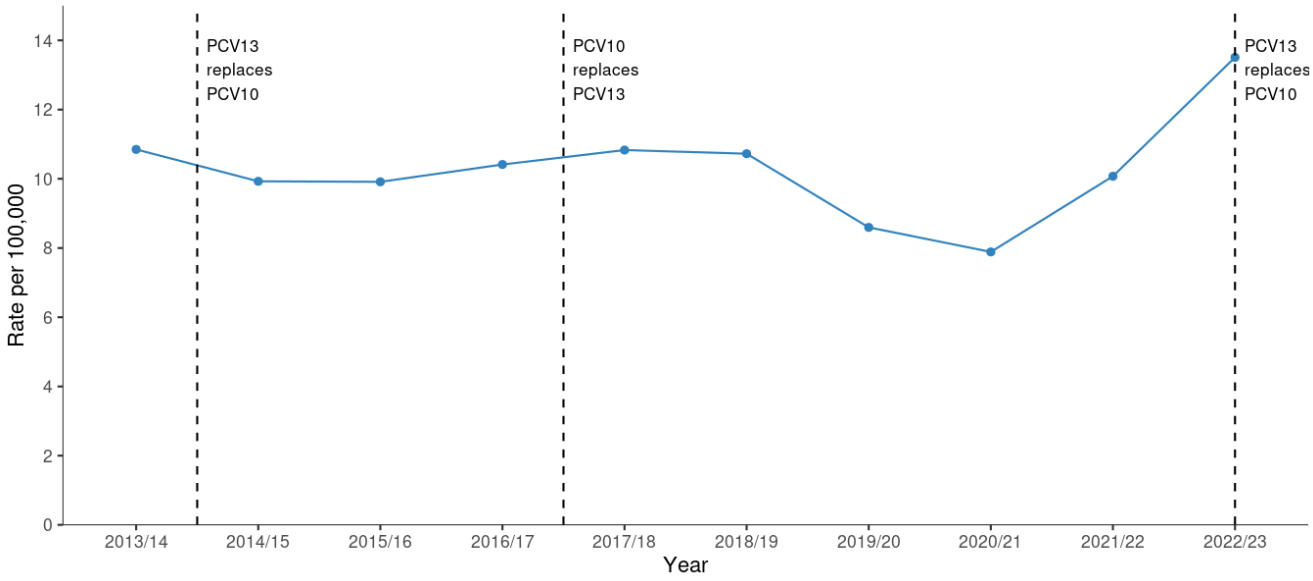


Figure 2 shows the cumulative number of IPD cases per year from 2018 to June 2023.

Overall, up to June 2023 the number of cases continue to track higher than previous years. This trend differs by age with children aged 5 years and under tracking at similar levels to previous years, whereas people aged over 5 tracking higher (Figure 3).

Figure 2. Cumulative number of invasive pneumococcal disease cases per year, January 2018 - June 2023

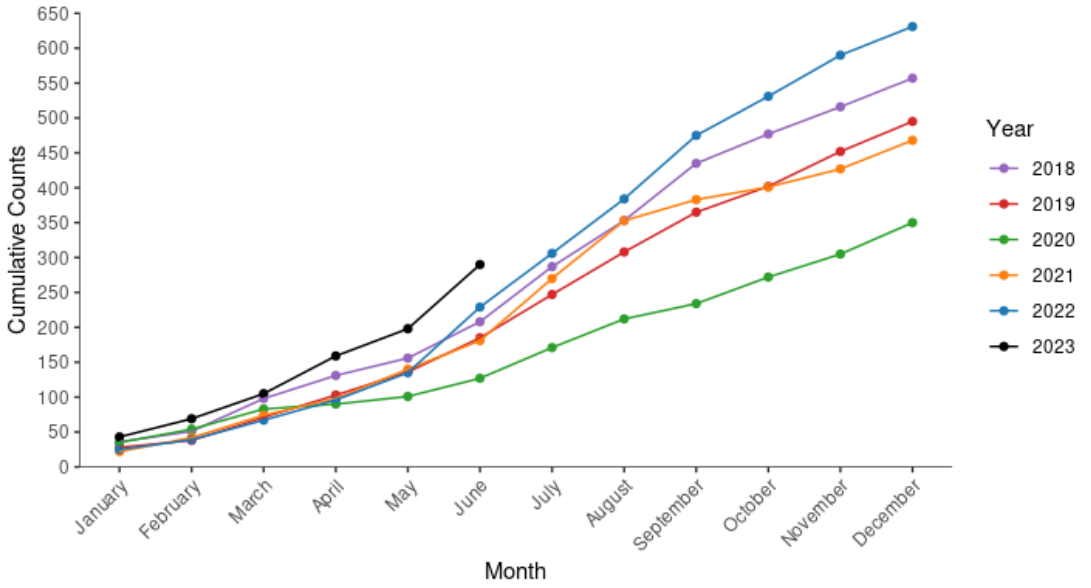
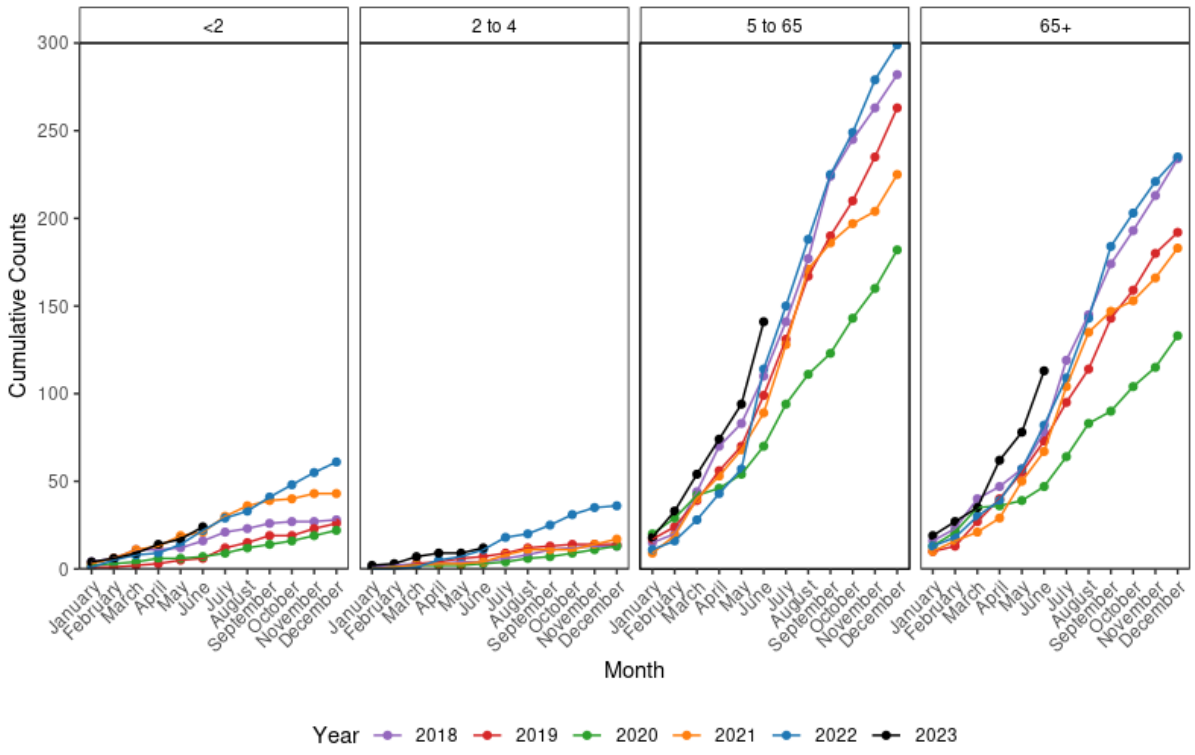
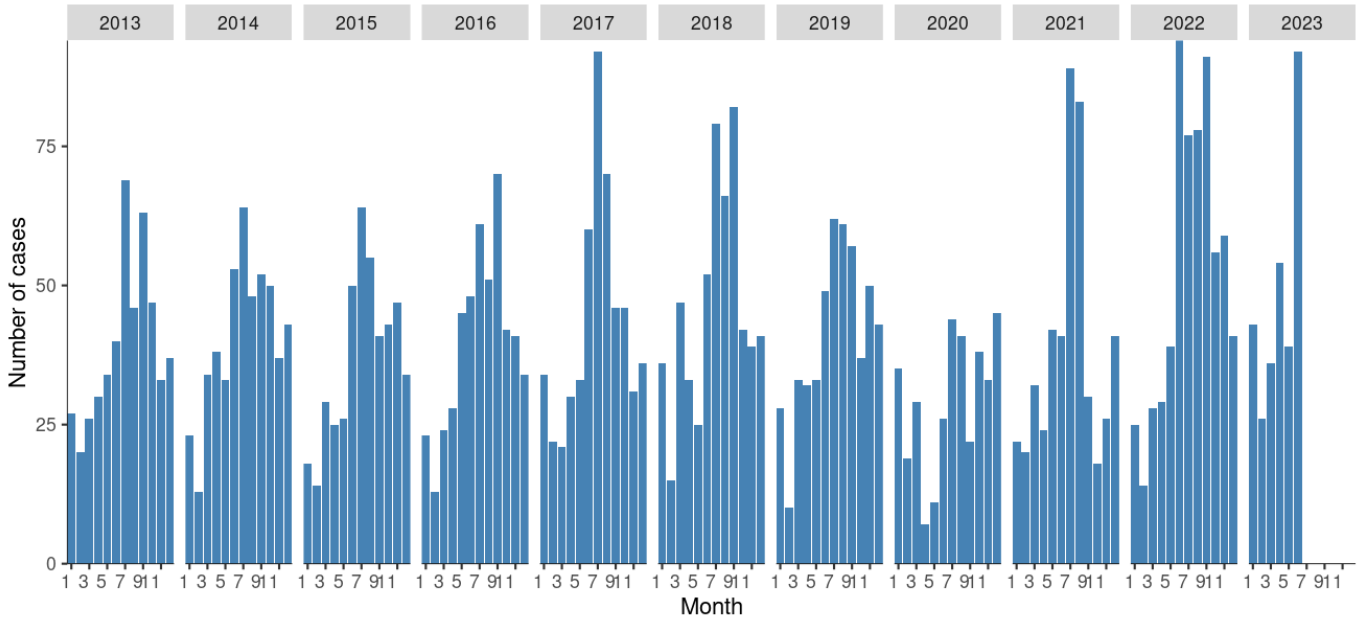


Figure 3. Cumulative number of invasive pneumococcal disease cases per year by age group, January 2018 – June 2023



IPD follows a seasonal pattern with higher numbers seen in the winter months (Figure 4).

Figure 4. Number of cases of invasive pneumococcal disease by month and year, 2013 - June 2023



INCIDENCE OF INVASIVE PNEUMOCOCCAL DISEASE BY AGE GROUP AND SEX

The incidence of IPD follows a U-shaped distribution by age (Figure 5). In 2022/23, infants under 2 years and adults 80 years and over had the highest incidence of IPD (51.6 per 100,000 and 41.6 per 100,000 respectively). Males under two years had the highest rate of IPD (65.4 per 100,000), followed by males aged 80 years and over (45.0 per 100,000) (Figure 5). This U-shaped distribution has also been seen in previous years.

Figure 5. Incidence of invasive pneumococcal disease by age group and sex, rate per 100,000, 2022/23

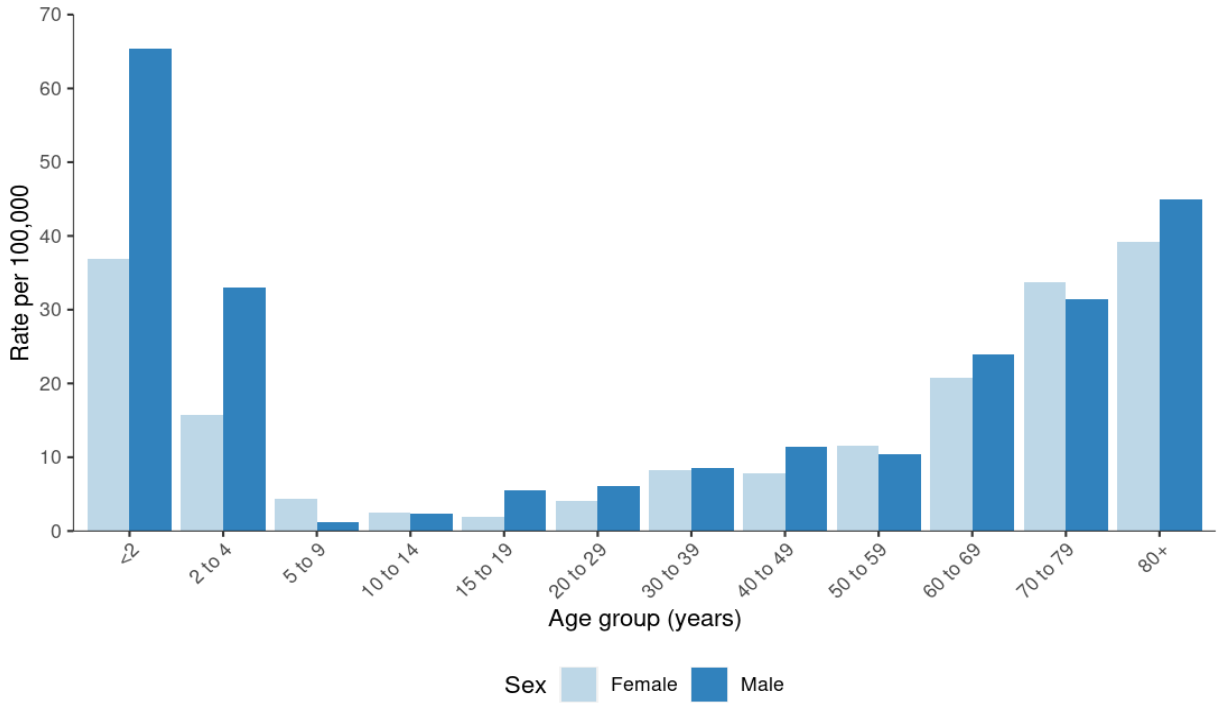


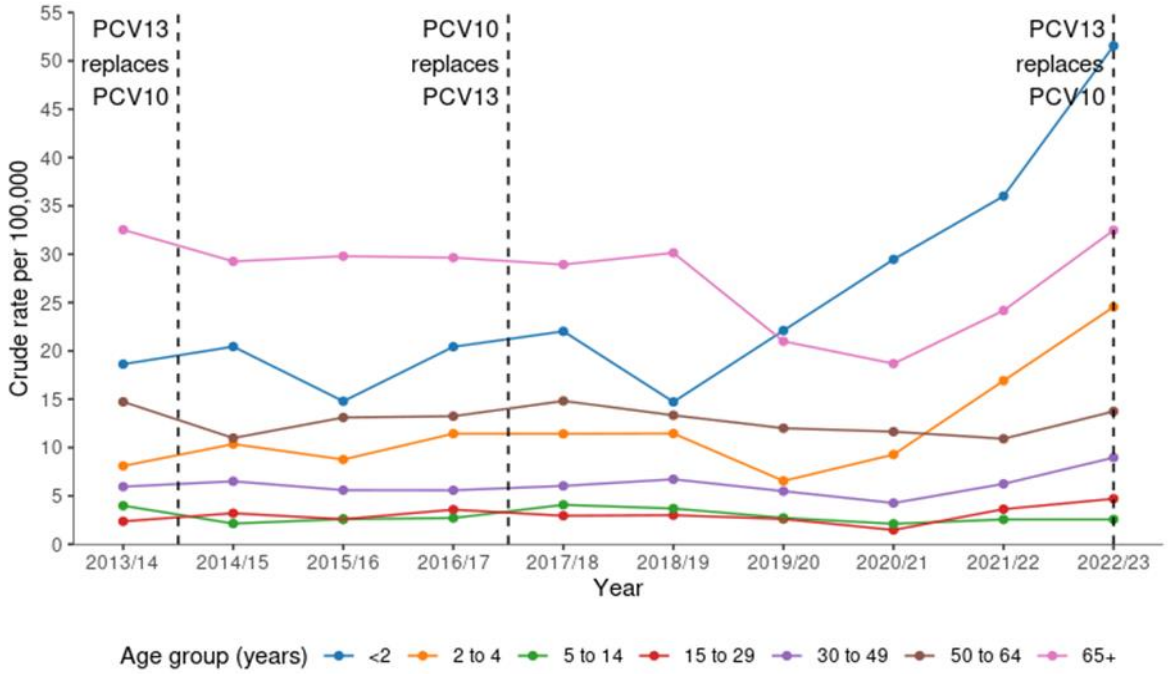
Figure 6 shows IPD trends over time by age group. Prior to 2018/19, those aged 65 years and over had the highest incidence of IPD, followed by those aged under two years.

There has been an increasing trend in the incidence of IPD in all age groups apart from those aged 5 to 14 years. The increase was first seen in those aged under 2 years in 2019/20, followed by the those aged 2 to 4 years in 2020/21 and those aged 15 to 29 years, 30 to 49 and over 65 years in 2021/22.

Since 2018/19, there has been a steady increase in incidence in those aged under two years, and from 2019/20 onwards, this age group has had the highest rate. In 2022/23, the incidence for those aged under two years is 2.5 times that of 2018/19.

The incidence in those aged 2 to 4 years has also increased since 2019/20 and this age group has had the third highest incidence since 2021/22 – prior to that time, those aged 50-64 years had the third highest incidence.

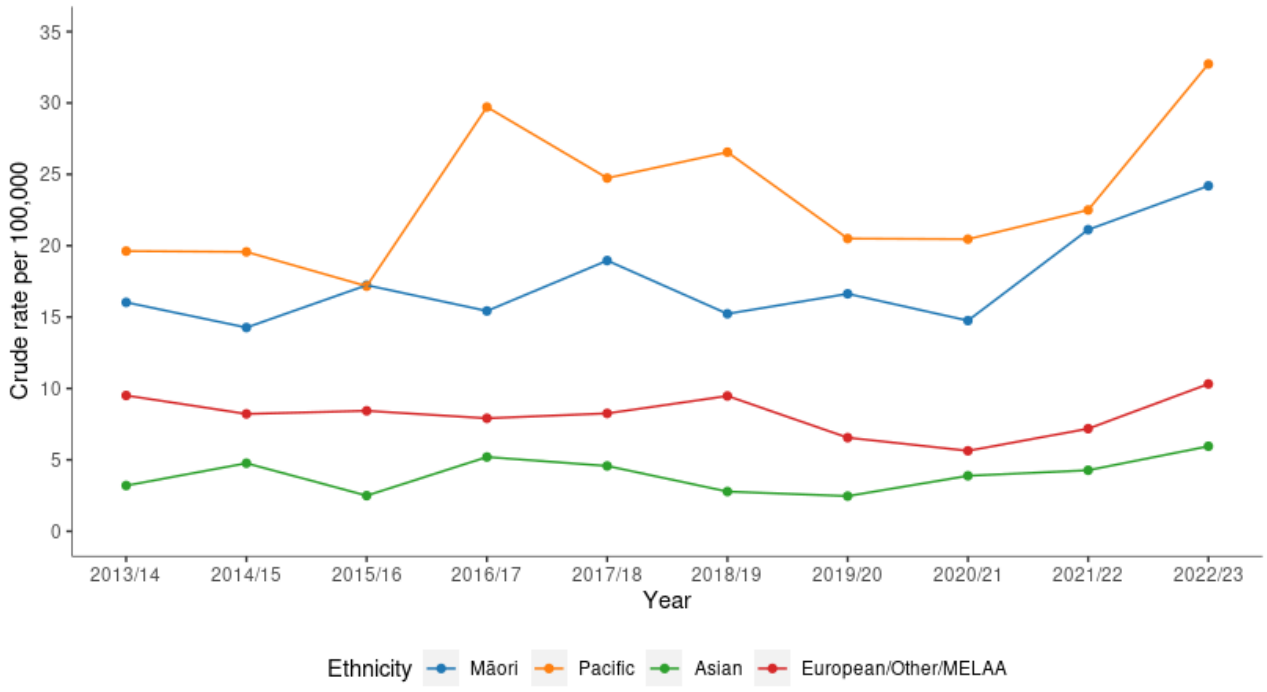
Figure 6. Incidence of invasive pneumococcal by age group, rate per 100,000, 2013/14 to 2022/23



INVASIVE PNEUMOCOCCAL DISEASE BY ETHNIC GROUP

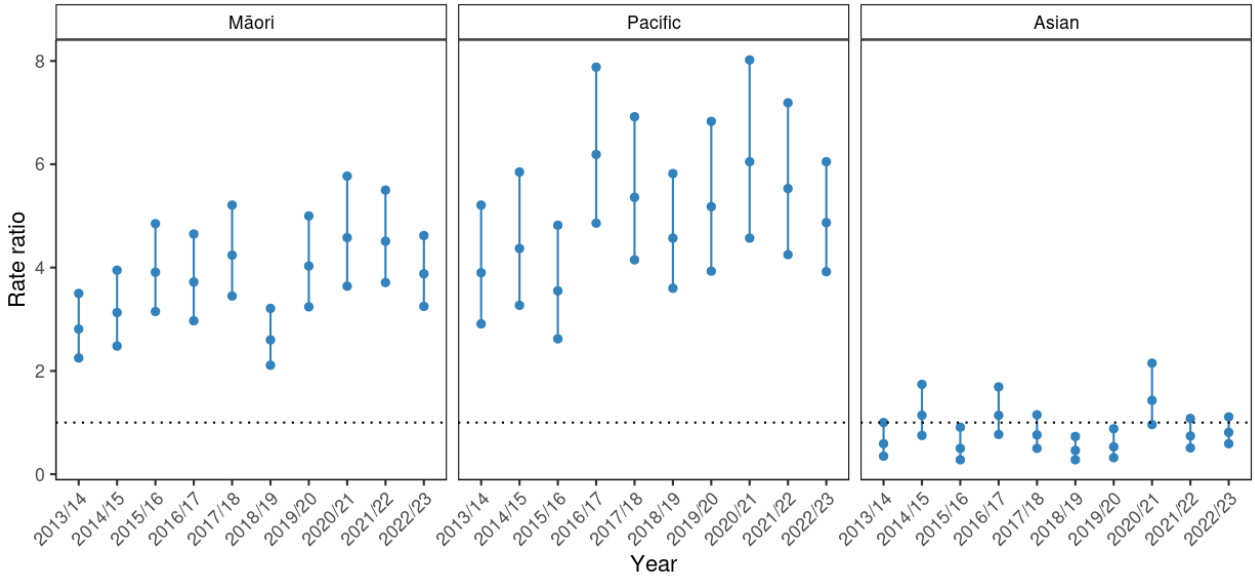
Pacific peoples consistently experience the highest rates of IPD, followed by Māori (Figure 7). Incidence rates among European/Other/MELAA and Asian ethnic groups have remained relatively stable since 2013/14 whilst rates have increased for both Māori and Pacific peoples, particularly since 2020/21 (Figure 7).

Figure 7. Incidence of invasive pneumococcal disease by prioritised ethnicity, rate per 100,000, 2013/14 to 2022/23



In 2022/23, Māori and Pacific people had 3.9 and 4.9 times, respectively, the incidence rate of IPD compared to European/Other/MELAA after adjusting for age. These inequities have increased over time. In 2013/14, Māori and Pacific people had 2.8 and 3.9 respectively the incidence in European / Other people after adjusting for age (Figure 8).

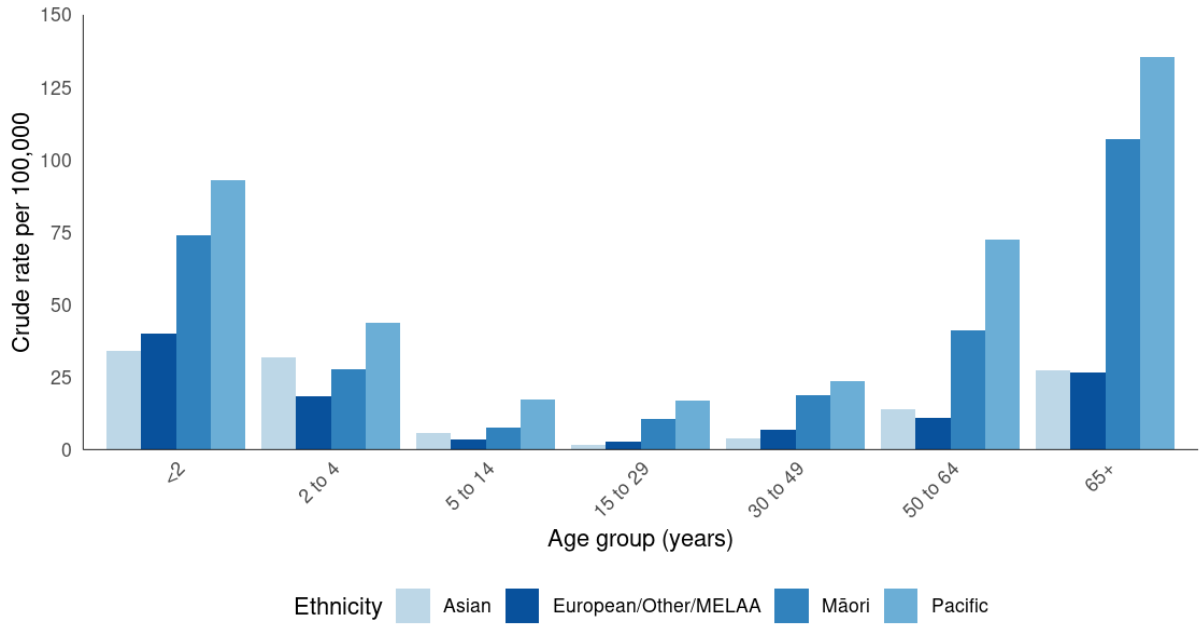
Figure 8. Invasive pneumococcal disease - rate ratios and 95 % confidence intervals by ethnicity and year, adjusted by age (reference group European/Other/MELAA)



Māori and Pacific people experience higher rates of IPD across all age groups (Figure 9). In 2022/23, Māori and Pacific adults aged over 65 years had the highest rate of IPD, followed by Māori and Pacific children aged under 2 years. For those aged 65 years and over, Māori (105.9 per 100,000) and Pacific people (123.9 per 100,000) have 4-6 times the incidence of IPD among European/Other/MELAA (24.1 per 100,000) and Asian people (21.6 per 100,000), For those aged 50 to 64, Māori (40.0 per 100,000) and Pacific peoples (51.6 per 100,000) had 5-9 times the rate of IPD among European/Other/MELAA (7.8 per 100,000) and Asian peoples (5.7 per 100,000).

Among children aged under 2 years, Māori and Pacific had 1.8 and 2.4 times, respectively, the incidence seen in European/Other/MELAA children.

Figure 9. Incidence of invasive pneumococcal rates by ethnicity, rate per 100,000,2022/23



INVASIVE PNEUMOCOCCAL DISEASE BY REGION

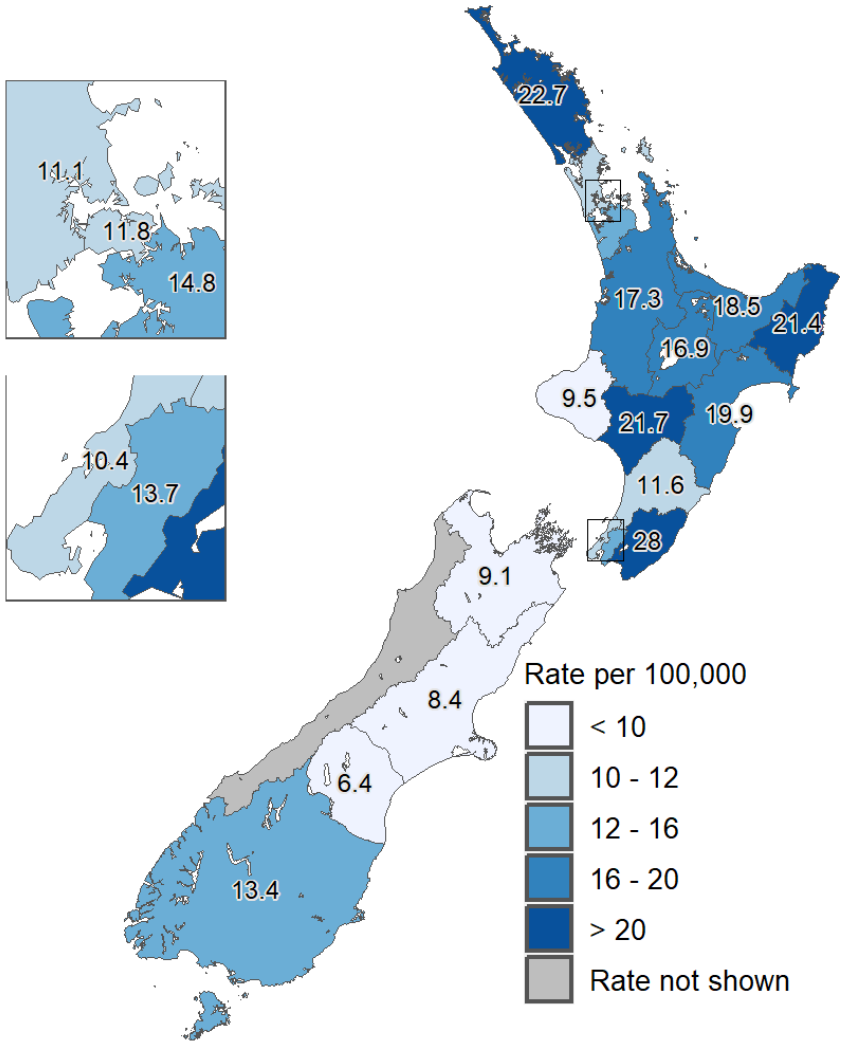
Te Manawa Taki had the highest overall IPD incidence in 2022/23, followed by Central North Island, then Northern (Table 2). Te Waipounamu had the lowest rate in 2022/23.

Table 2. Invasive pneumococcal disease by region, numbers and rate per 100,000, 2022/23

Area	<2		2–4		5–64		65+		Total	
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate
Northern	25	51.7	23	31.8	125	8.1	91	34.4	264	13.6
Te Manawa Taki	16	61.9	5	12.9	77	10.0	72	40.0	170	16.8
Central North Island	14	62.3	8	23.7	73	9.6	48	29.7	143	14.6
Te Waipounamu	8	31.3	9	23.5	43	4.7	55	25.9	115	9.6
Total	**63**	**51.6**	**45**	**24.6**	**318**	**8.0**	**266**	**32.5**	**692**	**13.5**

Figure 10 provides further detail on the incidence of IPD in 2022/23 across New Zealand by district. The districts with the highest incidence of IPD in 2022/23 were Wairarapa (28.0 per 100,000), Northland (22.7 per 100,000), Whanganui (21.7 per 100,000) and Tairawhiti (21.4 per 100,000). There were no cases of IPD in the West Coast in 2022/23.

Figure 10. Geographic distribution of invasive pneumococcal disease cases, rates per 100,000, 2022/23

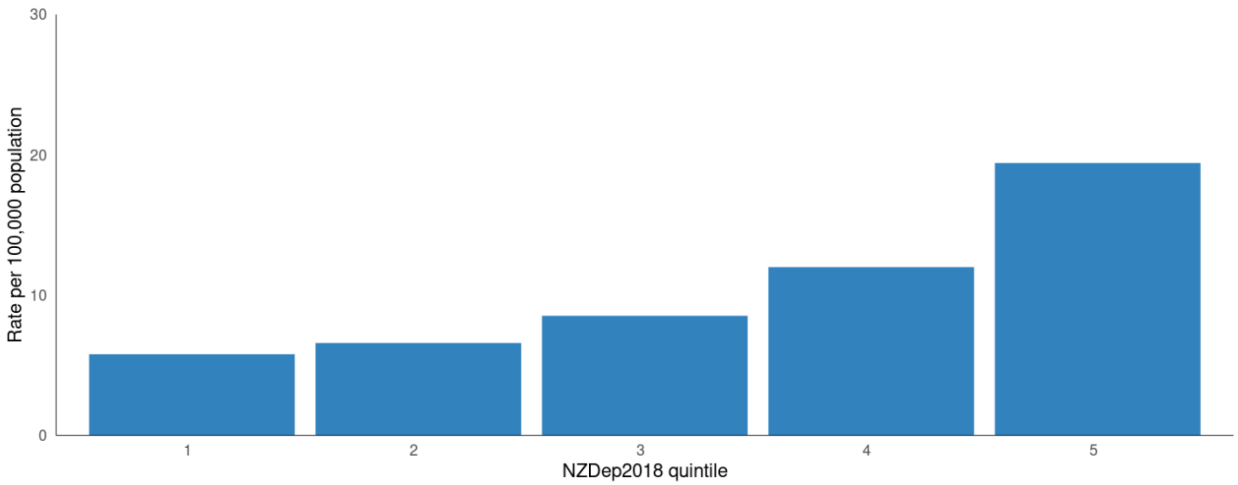


INVASIVE PNEUMOCOCCAL DISEASE BY DEPRIVATION

The NZDep 2018 quintile could be assigned for 94.9% of IPD cases during 2022/23.

The average total population rate for July 2018 to June 2023 shows a clear trend by NZDep2018 quintiles, with quintile 5 experiencing the highest rate (19.3 per 100,000) and quintile 1 experiencing the lowest (5.7 per 100,000). 60.2% of cases (1597/2654) were in the most deprived quintiles 4 and 5 (Figure 11).

Figure 11. Incidence of invasive pneumococcal disease cases by NZDep2018 quintile, rate per 100,000, 2022/23



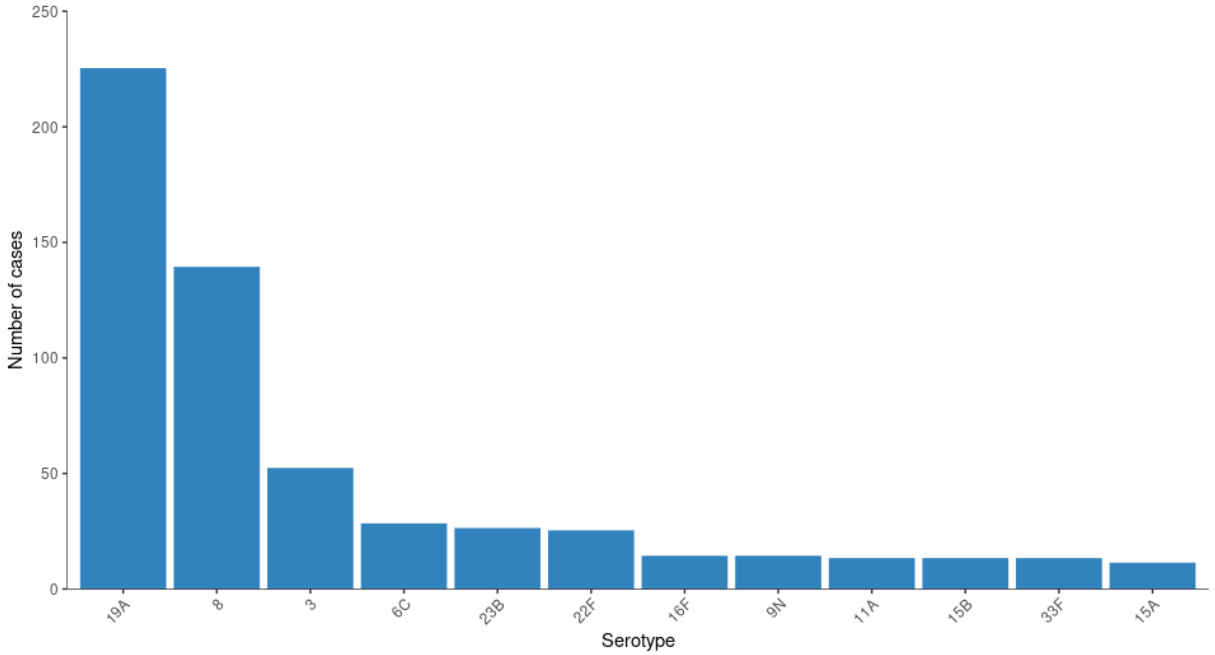
EuropeanOther/MELAA and Māori follow similar trends, with rates increasing with increasing NZDep quintiles, however, the rate for Māori is higher than for European/Other/MELAA across all quintiles. Within Asian and Pacific populations, rates are similar across NZDep2018 quintiles, however, rates for Asian populations remain low and are markedly lower for each quintile compared to Pacific people.

INVASIVE PNEUMOCOCCAL DISEASE BY SEROTYPE

There are over 90 serotypes of *S. pneumoniae* that cause disease.

Figure 12 shows the most common serotypes causing IPD in New Zealand in 2022/23. In 2022/23, serotype 19A was the most common serotype (34.7% of all cases where a serotype was identified), followed by serotype 8 (21.4%) and serotype 3 (8.0%). IPD cases due to serotypes included in the PCV10 vaccine have been uncommon since 2017/18. In 2022/23 there were 23 cases - 3.5% of all cases where a serotype was identified - of IPD caused by serotypes contained in the PCV10.

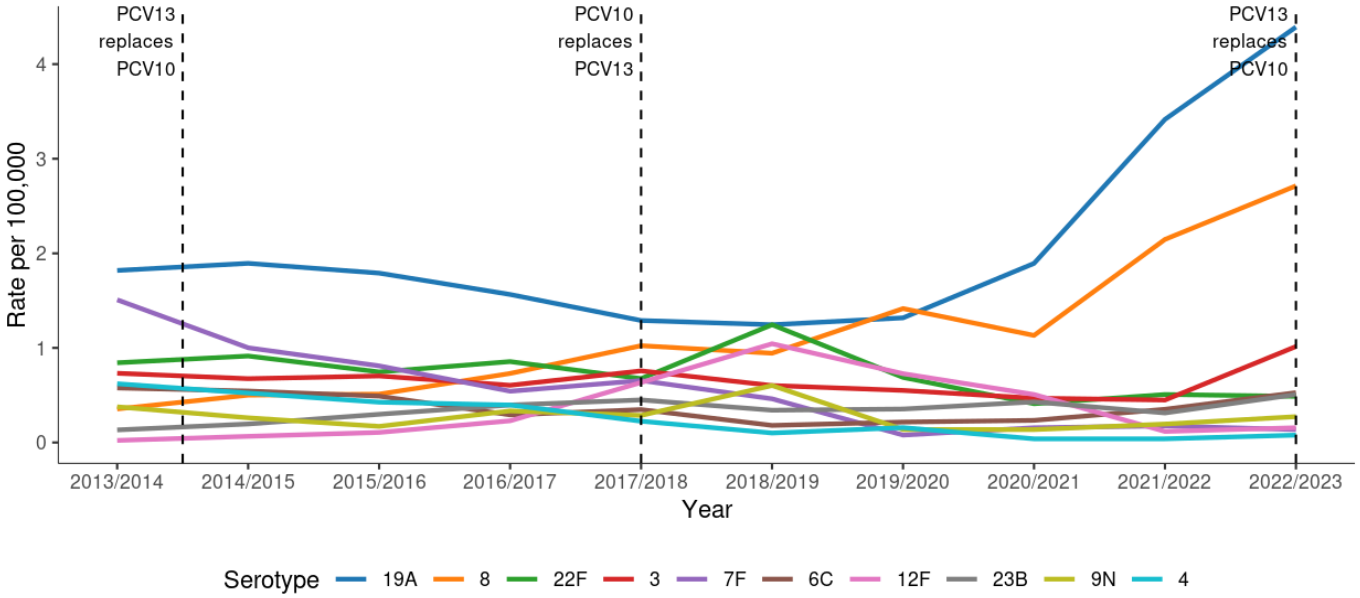
Figure 12. Invasive pneumococcal serotypes, July 2022/23[1]



[1] Only serotypes where there were more than 9 IPD cases are shown.

Figure 13 shows the trend in the incidence of IPD serotypes in New Zealand from 2013/14 to 2022/23. Serotype 19A has been the dominant serotype since 2013/14. The incidence of serotype 19A was relatively stable until 2019/20 when there was a sharp increase. Serotype 8 has been the second most common serotype seen in New Zealand since 2020/21. Of note, the incidence of 19A and 8 was similar in 2019/20. The incidence of serotype 8 has been increasing since 2014/15.

Figure 13. Invasive pneumococcal serotypes, 2013/14 to 2022/23

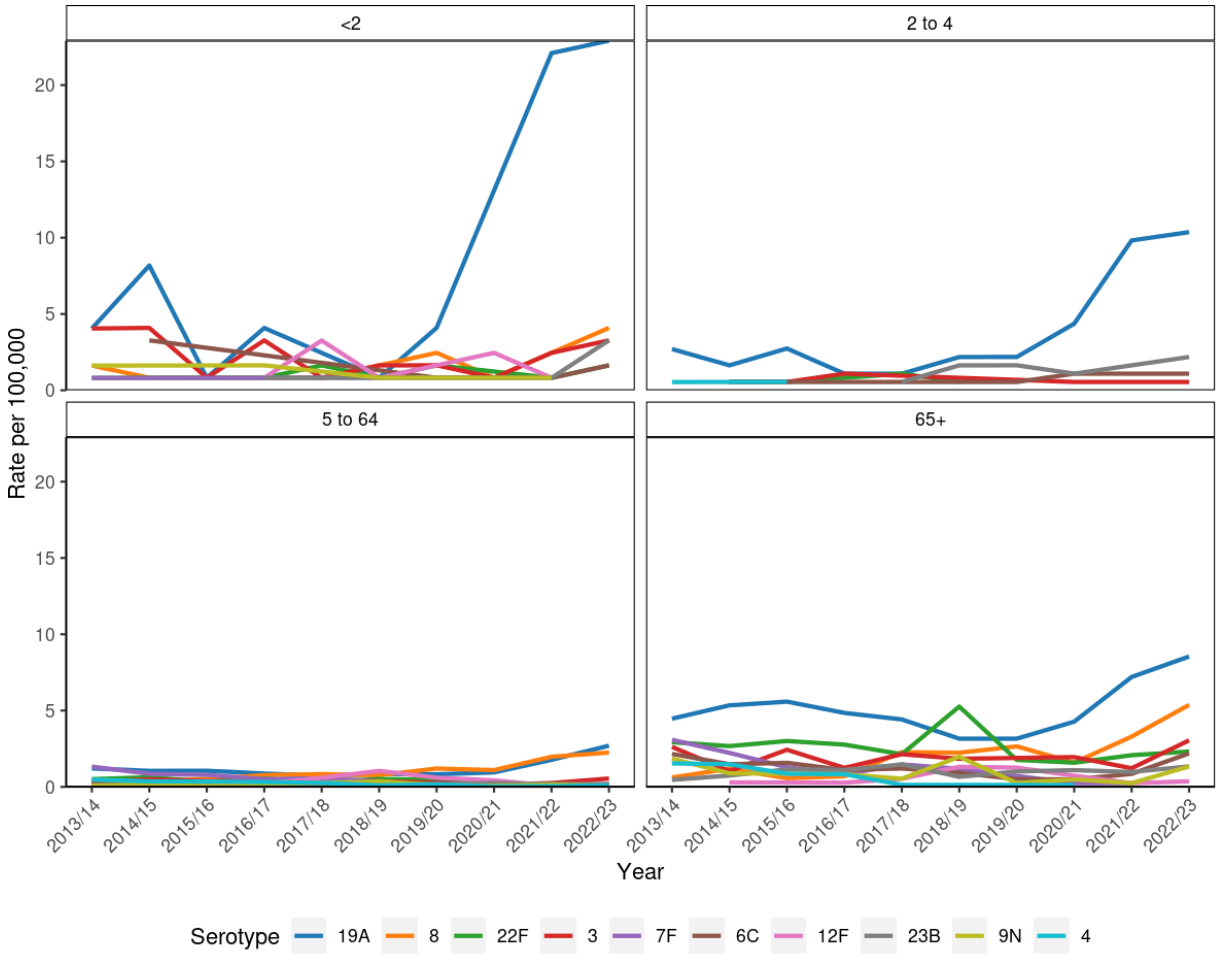


Serotype trends by age

In 2022/23, serotype 19A was the predominant serotype in all age groups (Figure 14). Serotype 8 was the second most common serotype both children under 2 years as well as adults over 65 years – however the incidence of 19A was 5.6 times and 1.6 times respectively that of 8 in these age groups.

There was a similar incidence for all serotypes among those aged 5 to 64 years, acknowledging that numbers are low within this broad age group.

Figure 14. Common serotypes by age group, rate per 100,000,



HOSPITALISATIONS AND DEATHS

Hospitalisation status was recorded for 686 / 692 (99.1%) cases in 2022/23. Almost all cases (666 (97.1%)) where hospitalisation status was recorded were hospitalised.

A clinical presentation was recorded for all cases in 2022/23 (Table 3). Pneumonia was the most common presentation across all age groups, followed by bacteraemia without focus. A presentation with meningitis was more common in children under 1 years compared to other age groups.

Table 3. Invasive pneumococcal disease, clinical presentation by age group, 2022/23[1]

Age group (years)	Meningitis		Empyema		Pneumonia		Bacteraemia		Other		Total
	n	%	n	%	n	%	n	%	n	%	n
<1	7	22.6	3	9.7	10	32.3	8	25.8	3	9.7	31
1	3	9.4	13	40.6	7	21.9	6	18.8	3	9.4	32
2–4	2	4.4	20	44.4	9	20.0	12	26.7	2	4.4	45
5–64	17	5.3	12	3.8	240	75.5	44	13.8	5	1.6	318
≥65	12	4.5	5	1.9	195	73.3	48	18.0	6	2.3	266
Total	**41**	**5.9**	**53**	**7.7**	**461**	**66.6**	**118**	**17.1**	**19**	**2.7**	**692**

[1] N: number of cases with 'yes' recorded for the clinical presentation. Any cases for which *S. pneumoniae* was identified in CSF were considered to be cases of pneumococcal meningitis. If more than one clinical presentation has been recorded, clinical presentations have been prioritised as: meningitis, empyema, pneumonia, bacteraemia, other. %: percentage of cases within the age group with the clinical presentation. 'Other' includes septic arthritis. At least one clinical presentation was recorded for 692 (100%) of cases notified in July 2022 to June 2023.

Based on the information in EpiSurv, in 2022/23, there were 25 deaths due to IPD. Sixty percent of deaths occurred in those aged over 65 years. It is important to note that the main cause of death is not final for most cases.

IMMUNISATION STATUS

A pneumococcal vaccine was introduced to the schedule in 2008. As a result, all cases aged 14 years and under would have been eligible for a pneumococcal vaccine. As described in Table 4, the conjugate vaccine offered changed regularly over time and different cohorts with this age group received varying degrees of protection against different serotypes.

PCV13 replaced PCV10 on the childhood immunisation schedule in December 2022. This report covers the first 6 months of the change to PCV13, with the eligible population aged between 0 and 6 months.

Overall, in 2022/23, there were 125 IPD cases in vaccine eligible children (aged under 15 years). NIR data was available for 106 of these children that had at least one dose of vaccine. The 19 vaccine eligible cases who did not have NIR data available were assumed to be unvaccinated. Table 4 provides a summary of the cases by age group and the type of vaccine they received.

In 2022/23, 16 cases of IPD were notified in children aged 6 months and under, 15 of these children had been vaccinated. In 13 out of 15 vaccinated cases, disease was due to a serotype not contained in the vaccine they had received, and the serotype has not been determined for the remaining two vaccinated cases.

The majority of cases were children aged 7 months to 5 years with 96 cases of IPD notified in this age group. Eighty of these children had been vaccinated, 75 with PCV10, two with PCV13 and the remainder with a combination of the two vaccines. No children were infected with a serotype contained in the PCV10 vaccine. There were 38 cases infected with 19A (50%) and 2 cases infected with serotype 3 - all these children had been vaccinated for age with PCV10. The remainder of infections were due to either an unknown or non-PCV serotype.

The majority of children aged 6 years and over who had been vaccinated had been infected with a non-PCV serotype.

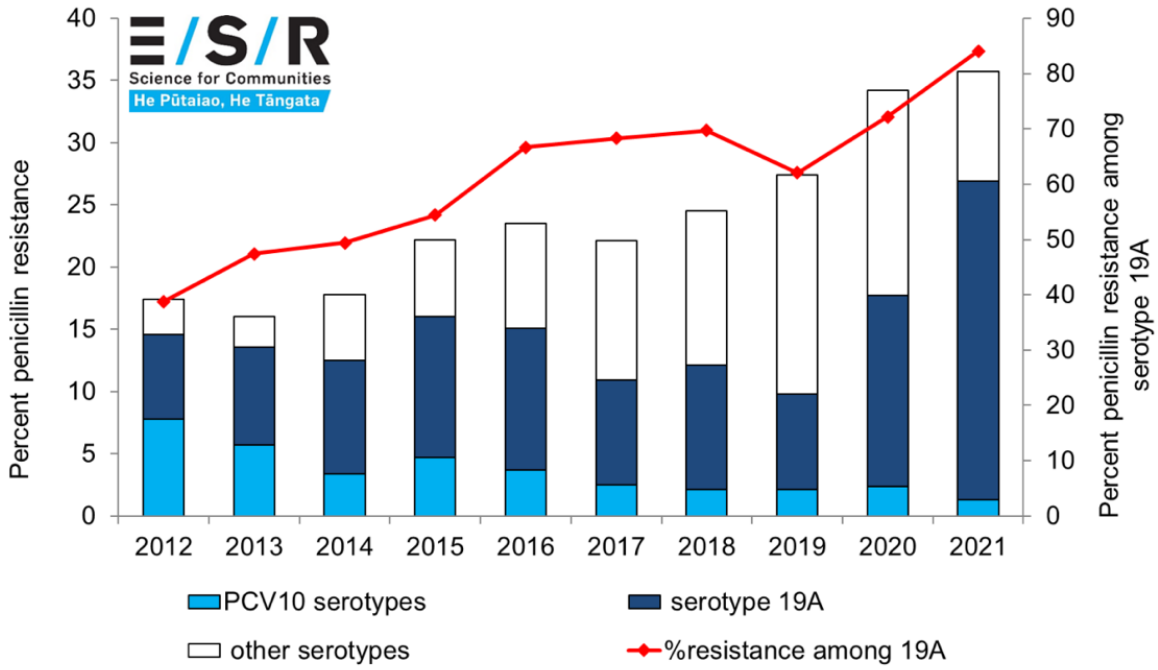
Table 4. Invasive pneumococcal disease, by age and vaccine type, 2022/23

Age group (total number of cases)	Pneumococcal conjugate vaccine type	Total number of cases vaccinated (with one or more vaccine)	Vaccinated cases with serotype covered by vaccine	Vaccinated cases with serotype not covered by the vaccine
0–6 months (16)	PCV10	8	0	8 (2 cases – serotype 19A; 2 cases – serotype 3; 2 cases – nonPCV serotype; 2 cases unknown – unknown serotype:)
	PCV10/PCV13 (one dose of PCV10, then one dose of PCV13)	1	0	1 (nonPCV serotype)
	PCV13	6	0	6 (5 cases – nonPCV serotype; 1 case – unknown serotype)
7 months - 5 years (96)	PCV10	75	0	75 (38 cases – serotype 19A; 2 cases – serotype 3; 16 cases – nonPCV serotype; 19 cases – unknown serotype)
	PCV10/PCV13	3	2 (19A)	1 (nonPCV serotype)
	PCV13	2	0	2 (unknown)
6–9 years (5)	PCV10	2	0	2 (nonPCV)
	PCV10/PCV13	2	1 (serotype 3)	1 (nonPCV)
	PCV13	1	0	1 (nonPCV)
10–12 years (5)	PCV10	1	0	1 (nonPCV)
	PCV7/PCV10	1	0	1 (19A serotype)
	PCV10/PCV13	1	1 (19A)	0
13–14 years (3)	PCV7	3	0	1 – serotype 7F; 2 - nonPCV serotype

ANTIMICROBIAL RESISTANCE

Penicillin resistance in invasive pneumococci has increased over the last decade. This increase has largely been driven by an increase in the prevalence of serotype 19A isolates. Penicillin resistance in has increased from 38.8% 2012 to 84.1% of 19A isolates in 2021 (Figure 15).

Figure 15. Penicillin-resistance amongst pneumococci from invasive disease cases, 2012–2021



Note: The bar chart and scale on the left-hand vertical axis show the percentage of pneumococcal isolates from invasive disease that were penicillin resistant (meningitis breakpoints). Each bar is split to indicate the proportion of the penicillin-resistant isolates that were PCV7 serotypes, the proportion that were serotype 19A and the proportion that were other serotypes. The line graph and scale on the right-hand vertical axis show the percentage of serotype 19A isolates that were penicillin resistant.

DISCUSSION

This report describes the epidemiology of IPD in New Zealand in 2022/23. The analyses are based on IPD notifications in the EpiSurv database, as well as information from the national immunisation register and ESR's national antimicrobial resistance reference laboratory.

Overall, there were 692 cases of IPD notified in 2022/23 (13.5 cases per 100,000). The incidence of IPD in the total population has been increasing since 2020/21 and the incidence in 2022/23 is the highest it has been in the past 10 years. This trend has been driven primarily by increases in the incidence among Māori and Pacific peoples with the incidence rates among European/Other and Asian ethnic groups remaining relatively stable since 2013/14.

The increasing trend has occurred in all age groups, apart from those aged 5 to 14 years. The increase occurred first in those aged under 2 years in 2019/20, followed by the those aged 2 to 4 years in 2020/21 and those aged 15 to 29 years, 30 to 49 and over 65 years in 2021/22.

Between 2019/20 and 2022/23, the greatest increase in incidence has been seen in those aged 2 to 4 years (3.5 times increase), followed by those aged under 2 years (2.3 times increase). Over the same period, the incidence rate in those aged over 65 increased 1.5 times.

The incidence of IPD varies by age and ethnicity. The age distribution of IPD follows a U-shaped curve, with those aged under 2 years and those aged over 65 years having the highest rates in 2022/23 (51.6 and 32.5 per 100,000 respectively). The increase in rate by age is seen earlier in Māori and Pacific people (from 50-64 years) compared to European/Other/MELAA and Asian people.

Māori and Pacific peoples experience the highest incidence of IPD. This higher incidence is consistent across all age groups. a. In 2022/23, Māori and Pacific adults aged over 65 years had the highest rate of IPD, followed by Māori and Pacific children aged under 2 years. Māori and Pacific people aged 65 and over have 4-6 times the incidence of IPD among European/Other/MELAA and Asian people. While the incidence rates are slightly lower, the disparities are even greater for Māori and Pacific peoples aged 50 to 64, in which rates are 5–9 times the rate of IPD among European/Other/MELAA (and Asian peoples).

In 2022/23, Māori and Pacific people had 3.9 and 4.9 times, respectively the incidence rate of IPD compared to European/Other after adjusting for age. These inequities have increased over time. In 2013/14, Māori and Pacific people had 2.8 and 3.9 respectively the incidence in European/Other people after adjusting for age.

Serotype 19A is now the predominant serotype in all age groups. Serotype 19A has been increasing since 2019/20 in children aged <5 years and since 2020/21 in those aged over 65. Those aged <2, 2 to 4, 5 to 14, and 15 to 29 years had a similar number of 19A cases in 2022/23 compared to 2021/22. The number of 19A cases recorded for 2022/23 was markedly higher than in 2021/22 for age groups 30 years and over.

Penicillin resistance in invasive pneumococci has increased over the last decade. This increase has largely been driven by an increase in the prevalence of serotype 19A isolates and increasing penicillin resistance in these isolates which has increased from 38.8% 2012 to 84.1% of 19A isolates in 2021.

IMPACT OF NATIONAL IMMUNISATION PROGRAMME ON IPD INCIDENCE IN NEW ZEALAND

Monitoring the epidemiology of IPD in New Zealand provides insight into the effectiveness of the PCV immunisation programme, including whether the immunisation is working and whether we have the most appropriate vaccine on the schedule.

The epidemiology shows that the vaccine is effective at protecting against the serotypes it covers. PCV10 vaccine was introduced to the immunisation programme in 2017 and IPD cases due to serotypes included in the PCV10 vaccine have been uncommon since 2017/18. In 2022/23 there were 23 cases of IPD caused by serotypes contained in the PCV10. In addition, in 2022/23, the majority of vaccinated cases were infected with a serotype not contained in the vaccine they had received.

The increasing trend in IPD, driven by increases in serotype 19A informed a decision to re-introduce PCV13 into the immunisation schedule in December 2022. The vaccine is given at 6 weeks and 5 months with a booster at 12 months. Infants who had received PCV10 as part of their routine immunisation prior to 2022 are able to receive PCV13 to complete the series.

This report covers the period ending in June 2023, therefore, it is too early to assess the impact that this change in the schedule has had on IPD trends. However, there is an indication in the cumulative numbers that there has been a decrease in the incidence of IPD in children aged under 2 years and 2–4 years, with the numbers in 2023 to end of June similar to previous years, rather than continuing on an increasing trend.

The incidence in those aged over 65 years is high and numbers continue to track higher than previous years, again driven by serotype 19A. As with previous PCV vaccine introductions, the change in vaccine in the childhood immunisation schedule to PCV13 will have an indirect impact on the incidence in older age groups over time but the effect is unlikely to be seen until 2024/25. In New Zealand, adults aged over 65 are recommended to receive one pneumococcal vaccine, although the vaccine is not funded for this age group (1). To reduce the incidence of disease, consideration could be made to making funded PCV13 available for older people as has been done in Australia. Aboriginal and Torres Strait Islander adults aged 50 years and over and other adults aged 70 years and over are eligible for funded pneumococcal vaccine in Australia. (5) Consideration could also be given to a catch-up campaign for 2–4 year olds as vaccinating this age group will not only address the incidence of disease in this cohort but may lead to an earlier indirect impact on addressing the incidence in older people (by reducing carriage in 2-4 year olds).

Serotype replacement is a phenomenon associated with IPD. The history of IPD in New Zealand and overseas shows that serotype replacement occurs following the introduction of vaccine. [24] In New Zealand, there have been increases in the proportion of IPD cases caused by non-vaccine strains after each vaccine introduction, for example, an increase to serotype 8. There is also evidence for non-PCV13 serotype replacement in countries where the paediatric national immunisation programme uses PCV13 (6).

The second most common serotype in New Zealand is currently serotype 8 which has been increasing in New Zealand since 2014/15. Serotype 8 is not covered by the vaccines currently available in New Zealand. PCV20 is now available overseas and covers serotype 8, 10A, 11A, 12F, 15B, 22F and 23F in addition to the serotypes covered by PCV13.A recent study found PCV15 and PCV20 would cover an additional 10.6% and 38.2%, respectively, of serotypes not contained in PCV13, in countries where PCV13 was used in national immunisation programmes (8). Of note, for the New Zealand context, PCV15 does not cover serotype 8. It will be important to continue

monitoring serotypes causing disease to enable evidence-based decisions around immunisation programme in the future.

CONCLUSION

Given the recent changes to the vaccine programme, the phenomenon of serotype replacement and the availability and development of new vaccines, it is important to continually monitor trends in IPD epidemiology to inform vaccine decisions in the future. Areas that require particular attention include monitoring of serotypes to identify emergence of serotypes not covered by current vaccines and monitoring of trends in age and ethnic group where there are clear disparities.

In addition to the changes in the PCV immunisation programme over time, there has been a recent decline in childhood immunisation coverage in New Zealand and increasing disparities in immunisation coverage. To further reduce the incidence of IPD in New Zealand it is important that immunisation coverage is increased with a focus in improving equity.

It is also important to note that not all IPD is vaccine-preventable. This highlights the importance of efforts to address systemic and health care access issues that may contribute to the spread of *S. pneumoniae* infection.

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