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# INVASIVE GROUP A STREPTOCOCCAL INFECTION IN NEW ZEALAND, 2023


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## Disclaimer

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# ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| CI | Confidence interval |
| DNA | Deoxyribonucleic acid |
| *emm* | M protein gene |
| ESR | Institute of Environmental Science and Research Ltd |
| GAS | Group A streptococcus |
| HISO | Health Information Standards Organisation |
| ICD-10-AM | International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification |
| iGAS | Invasive group A streptococcal (infection) |
| IPL | ESR Invasive Pathogens Laboratory |
| NHI | National health index |
| NMDS | National Minimum Dataset (hospital discharges) |
| NZDep2018 | New Zealand index of deprivation 2018 |
| PCR | Polymerase chain reaction |
| RSV | Respiratory syncytial virus |

# SUMMARY

This report presents an overview of the epidemiology of invasive group A streptococcal (iGAS) infection in New Zealand in 2023. Surveillance of iGAS infection is undertaken by ESR, based on isolates sent to the ESR Invasive Pathogens Laboratory (IPL) from diagnostic laboratories in New Zealand.

## Key findings

- Following the 2022/2023 iGAS increase in numerous high-income countries, there was also an increase in the incidence of iGAS in New Zealand. In 2023, iGAS infections rose to 10.9 cases per 100,000 population, compared with 4.8 per 100,000 in 2022 and 8.3 per 100,000 in 2019 (prior to the COVID-19 pandemic). This is the highest reported rate since at least 2002.
- In 2023, as in previous years, the highest incidence rates were among the youngest (less than 1 year) and oldest (80 years and over) age groups, with rates of 25.0 and 35.9 per 100,000 population, respectively. However, the most notable increase in incidence rates was among children aged 1–9 years, with a four-fold increase in 2023 compared with 2022 (from 2.5 to 9.9 per 100,000) and a three-fold increase compared with the pre-COVID-19 pandemic year 2019 (from 3.0 to 9.9 per 100,000). This increase among children is consistent with the 2022/2023 iGAS increase seen overseas.
- Pacific peoples and Māori were inequitably affected by iGAS infections with rates five and three times higher than the European or Other ethnic group, respectively. The higher incidence among Pacific peoples and Māori was seen for most age groups and all NZDep2018 quintiles.
- iGAS infection was also strongly associated with socioeconomic deprivation; almost two-thirds of iGAS cases lived in more deprived areas (NZDep2018 quintiles 4 and 5).
- In 2023, 62 unique *emm* types were characterised among iGAS isolates. *emm*1, *emm*12, *emm*92, and *emm*89 were the most common, with *emm*1 and *emm*12 increasing sharply between 2022 and 2023. The same *emm* types were also common in the 2022/2023 iGAS increase seen overseas.
- Ongoing surveillance of iGAS infection and molecular typing of isolates will be important to continue to monitor trends in New Zealand.

# INTRODUCTION

Invasive group A streptococcal (iGAS) infections are part of the spectrum of disease that can be caused by the bacterium group A streptococcus (GAS), which includes necrotising fasciitis, cellulitis, bacteraemia, pneumonia, puerperal sepsis, and toxic shock syndrome. GAS also causes non-invasive diseases, such as pharyngitis, skin infections, and scarlet fever. Additional sequelae of GAS infection include acute rheumatic fever and post streptococcal glomerulonephritis. Together, invasive and non-invasive GAS diseases account for considerable mortality and morbidity in New Zealand [1, 2].

From early to mid-2022, several high-income countries (including the United Kingdom, France, Ireland, the Netherlands, Sweden, Canada, the United States, and Australia) reported a marked increase in GAS and iGAS infections, especially among children aged less than 10 years [3-7].

This report provides an overview of the epidemiology of iGAS infections in New Zealand in 2023.

# METHODS

In New Zealand, diagnostic laboratories refer iGAS isolates to the ESR Invasive Pathogens Laboratory (IPL) for confirmation.

The following data was extracted from the ESR laboratory information system on 12 February 2024 for isolates collected between 1 January and 31 December 2023:

- national health index (NHI);
- age and sex;
- sample collection date;
- sample type (for example, blood, wound, tissue);
- symptoms, if available.

The NHI was used to obtain further information on cases, including ethnicity, New Zealand Index of Deprivation 2018 (NZDep2018), and date of death (if applicable). In addition, NHIs were used to obtain hospitalisation and diagnosis data (based on ICD-10-AM coding) from the National Minimum Dataset (NMDS). Diagnosis codes were also used to identify cases of invasive infection from non-sterile sites. The NMDS data was extracted on 4 March 2024.

## Defining iGAS infections

Isolates that were included in this analysis were those collected by diagnostic laboratories in New Zealand in 2023 which met the case definition of iGAS infection.

The iGAS infection case definition that we used is:

1. isolation of GAS from a normally sterile site (e.g., blood, cerebrospinal fluid, joint, pleural, pericardial fluid) with or without evidence of severity;

OR

2. isolation of GAS from a non-sterile site with evidence of severity (e.g., streptococcal toxic-shock syndrome, necrotising fasciitis, meningitis or death).

The following ICD-10-AM codes were used to confirm whether GAS isolated from a non-sterile site met condition 2:

- A40.0 (sepsis due to streptococcus, group A)
- A48.3 (toxic shock syndrome)
- M72.6 (necrotising fasciitis)
- O85 (puerperal sepsis)

## Population rates

All rates presented in this report are crude rates.

The 2023 mid-year population estimates from Statistics New Zealand were used to calculate the incidence rates.

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. Level 1 ethnicity is used with ethnicity prioritised in the following order: Māori, Pacific peoples, Asian, and European or Other. For more detail on classification refer to the HISO Ethnicity Data Protocols [8].

Level 2 prioritised ethnicity is used to further describe the distribution of ethnicities in the Pacific peoples ethnic group. These are prioritised in the following order: Tokelauan, Fijian, Niuean, Tongan, Cook Island Māori, Samoan, and Other Pacific Peoples.

The incidence rates for level 1 ethnic groups were calculated by applying the ethnic proportions for the 2018 estimated resident population to the 2023 mid-year population estimates.

### Socio-economic deprivation

The 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 socioeconomic deprivation [9]. The deprivation score is calculated for each geographical mesh block in New Zealand.

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

### 30-day mortality rate

Mortality due to iGAS infection was estimated by reviewing deaths that occurred within 30 days of sample collection.

The 30-day mortality rate was calculated by dividing the number of cases who died within 30 days of sample collection by the total number of cases in a given year. If a sample collection date was not provided, the date the sample was received at ESR was used. This measure is used as a proxy for iGAS mortality. Since the associated death may not have been due to the iGAS infection, these results should be interpreted with caution.

### *emm* typing

Diagnostic laboratories identify GAS isolates by culture following receipt of clinical samples. The diagnostic laboratories send isolates that meet the iGAS criteria to the ESR IPL for *emm* typing. Molecular typing is performed by polymerase chain reaction (PCR) and deoxyribonucleic acid (DNA) sequencing of the *emm* gene (method described by Beall et al [10]).

### *emm* type diversity

The Simpson's reciprocal index was used to estimate iGAS strain diversity [11, 12].

# IGAS INFECTION IN NEW ZEALAND

There were 568 iGAS isolates referred to ESR in 2023. Table 1 summarises the number of isolates by sample site. Similar to previous years, almost all of the isolates (541/568, 95.2%) were from a sterile site, and the majority of these (508/541, 93.9%) were from blood cultures. Only a small proportion (4.8%) of isolates from iGAS infection cases were from non-sterile or unknown body sites.

**Table 1. Invasive GAS isolates by sample site, 2023**

| Isolate site | | Number of isolates | Percent |
|---|---|---|---|
| Sterile site | Blood | 508 | 89.4 |
| | Bone and Joints | 23 | 4.0 |
| | Body fluids | 10 | 1.8 |
| | **Total** | **541** | **95.2** |
| Non-sterile or unknown site | | 27 | 4.8 |
| **Total number of isolates** | | **568** | **100** |

## *Incidence of iGAS infection in New Zealand*

There was an increase in the incidence of iGAS infections in 2023, with a rate of 10.9 per 100,000 (568 cases), compared with 4.8 per 100,000 (244 cases) in 2022 (Figure 1). This is the highest annual rate reported since at least 2002. Between 2014 and 2019, rates of iGAS infection fluctuated and ranged between 7.0 and 9.4 per 100,000 in 2011. No changes in isolate referral criteria have occurred between 2002 and 2023. A decrease in iGAS infections occurred in 2020–2022 coinciding with the COVID-19 pandemic years.

**Figure 1. Incidence of iGAS infections in New Zealand, 2014–2023**

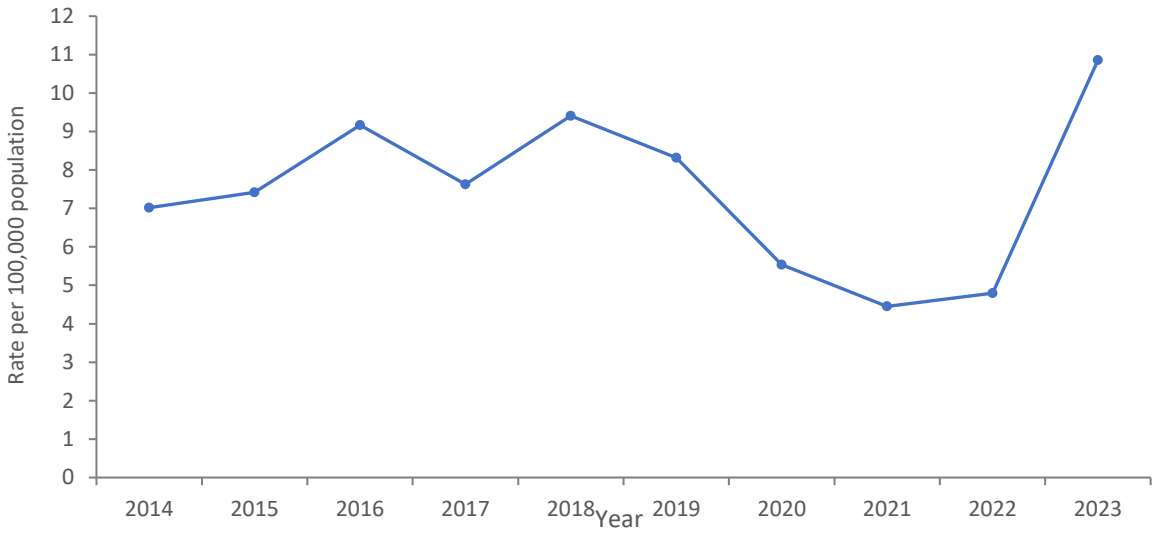
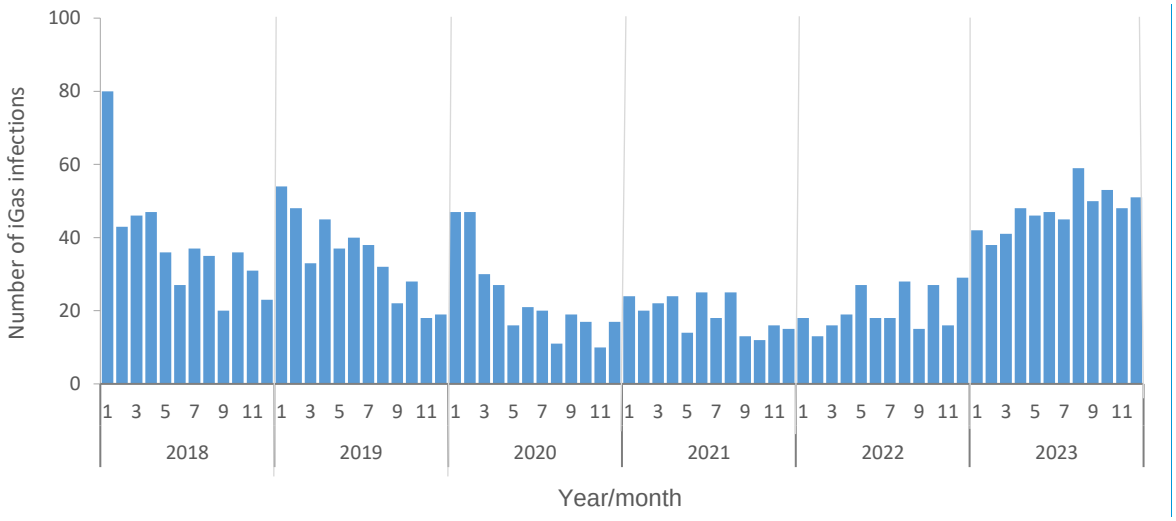



Figure 2 shows that there is no clear seasonal pattern for iGAS infection in New Zealand. In 2023, the highest number of cases was reported in August (59 cases).

**Figure 2. Number of iGAS infections by month of sample collection, 2018–2023**

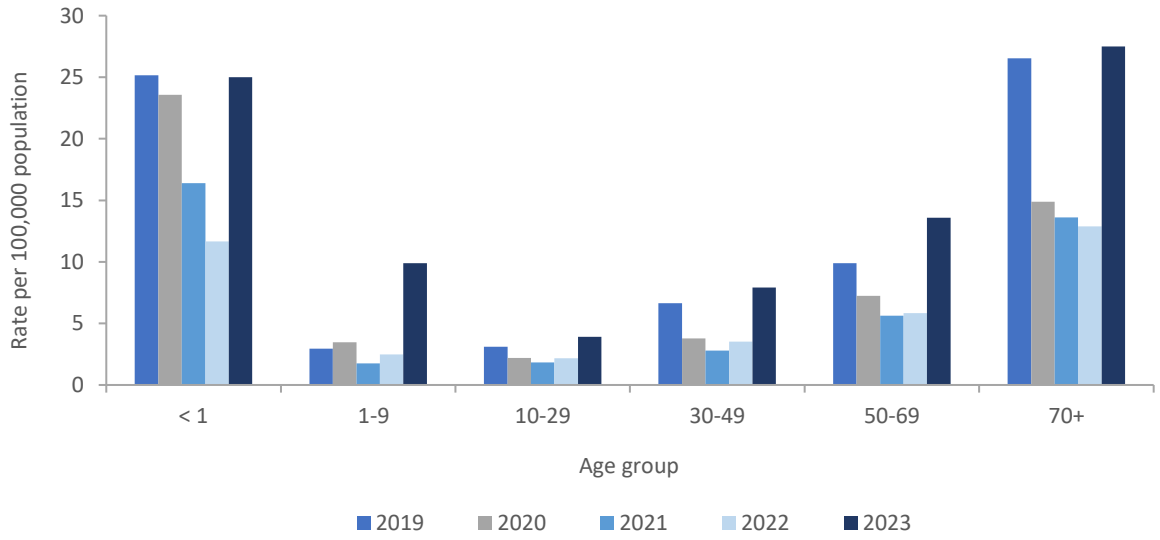


## *Incidence of iGAS infection by age group*

Infants aged less than 1 year, and adults aged 80 years and over had the highest rates of iGAS infection in 2023 (25.0 and 35.9 per 100,000 respectively).

Among children aged 1–9 years, there was a four-fold increase in the incidence of iGAS infections in 2023, compared with 2022 (from 2.5 to 9.9 per 100,000), and a three-fold increase compared with 2019 (from 3.0 to 9.9 per 100,000) (Figure 3). In comparison, iGAS infection rates for infants aged less than 1 year and adults aged 70 years and over more than doubled compared with 2022 (11.7 to 25.0 per 100,000, and 12.9 to 27.5 per 100,000 respectively), but were similar to rates in 2019 (25.2 and 26.5 per 100,000 respectively).

**Figure 3. iGAS infection rates by age group, 2018–2023**

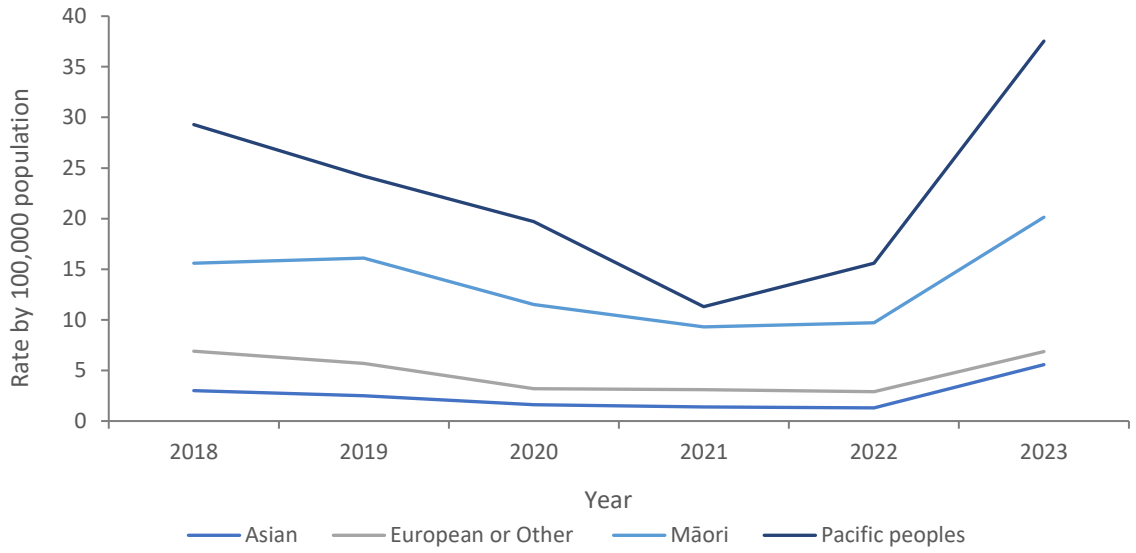



As in previous years, males had a higher rate of iGAS infection than females (11.8 and 9.9 per 100,000 respectively).

## *Incidence of iGAS infection by ethnicity*

Ethnicity was recorded for all 568 iGAS infections in 2023. Pacific peoples experienced the highest rate of iGAS infection (37.5 per 100,000), followed by Māori (20.1 per 100,000). Compared with 2022, iGAS infection rates increased across all ethnic groups, and this increase was highest among Pacific peoples and Māori (Figure 4). Table 2 in the appendix shows iGAS infections by ethnicity for 2018–2023.

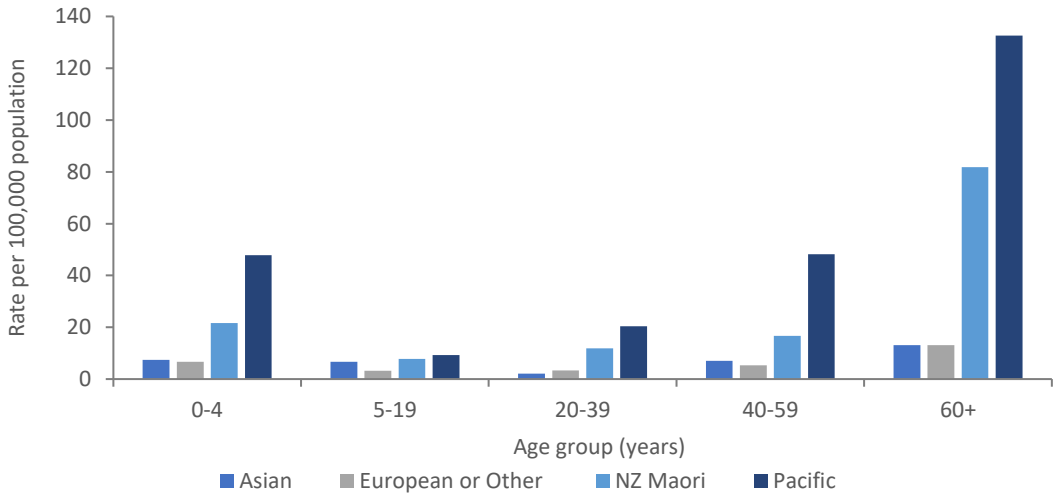
**Figure 4. iGAS infection rates by prioritised ethnicity, 2018–2023**




Samoan and Tongan are the largest Pacific ethnic groups in New Zealand. Of the 130 iGAS infections among Pacific peoples in 2023, most were Samoan (60 cases), followed by Tongan (32 cases), Cook Islands Māori and Fijian (12 cases each) and Niuean (7 cases). The remaining cases were identified as Other Pacific peoples (5 cases), or Pacific not further defined (1 case).

Figure 5 shows iGAS infection rates by age group and ethnicity in 2023. Pacific peoples had the highest rates among all age groups. Pacific peoples aged 60 years and over had the highest rate overall (132.6 per 100,000).

**Figure 5. iGAS infection rates by age and prioritised ethnicity, 2023**

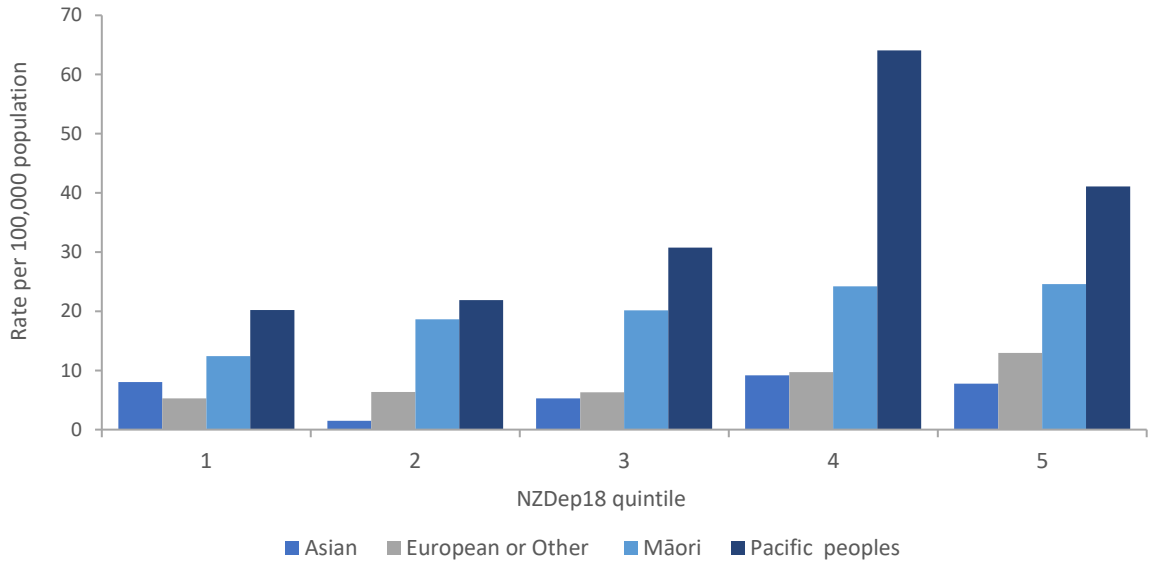


## *Incidence of iGAS infection by socioeconomic deprivation*

An NZDep2018 quintile could be assigned for 98.4% (559/568) of iGAS infections. The rate of iGAS infection increased with increasing socioeconomic deprivation, from 6.4 per 100,000 in quintile 1 to 21.2 per 100,000 in quintile 5; a more than three-fold increase (Table 3). Almost two-thirds (62.7%) of iGAS infections were in people living in the most deprived quintiles (NZDep2018 quintiles 4 and 5).

An increase in iGAS infection with increasing deprivation was seen among the Māori and European or Other ethnic groups. However, the Pacific peoples and Asian ethnic groups saw the highest rates in NZDep2018 quintile 4 (Figure 6). Across all NZDep2018 quintiles, Pacific peoples had the highest rate, followed by Māori.

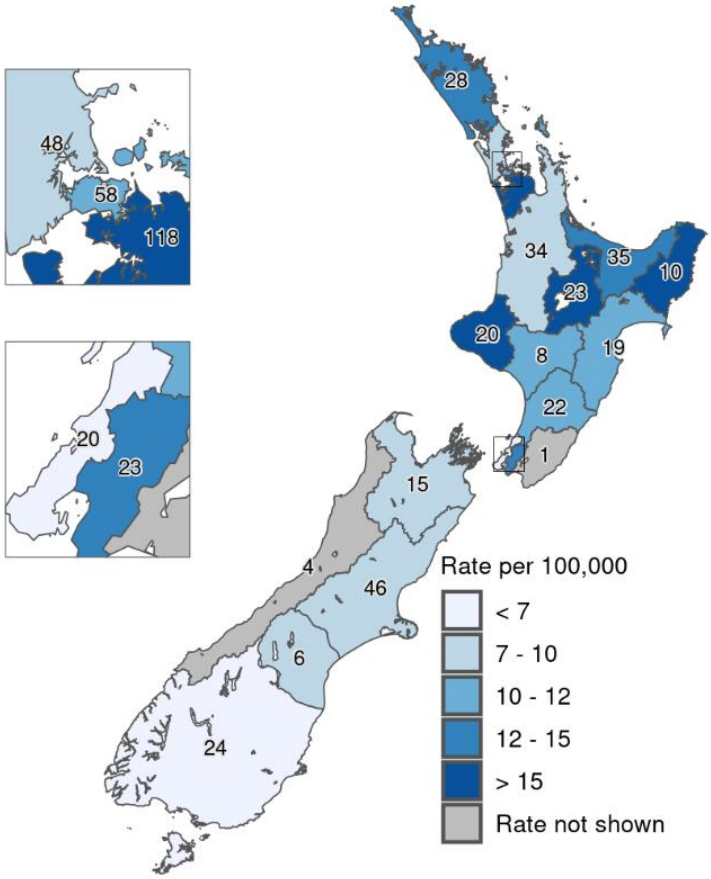
**Figure 6. iGAS infection rates by prioritised ethnicity and NZDep2018 quintile, 2023**



## *Incidence of iGAS infection by health district*

The health district was known for 98.2% (558/568) of iGAS infections in 2023. Lakes (19.2 per 100,000), Tairāwhiti (19.0 per 100,000), Counties Manukau (18.9 per 100,000) and Taranaki (15.5 per 100,000) districts had the highest rates of iGAS infection (Figure 7). Table 4 shows iGAS infection rates by health district for 2018–2023.

**Figure 7. iGAS infections by health district, 2023**



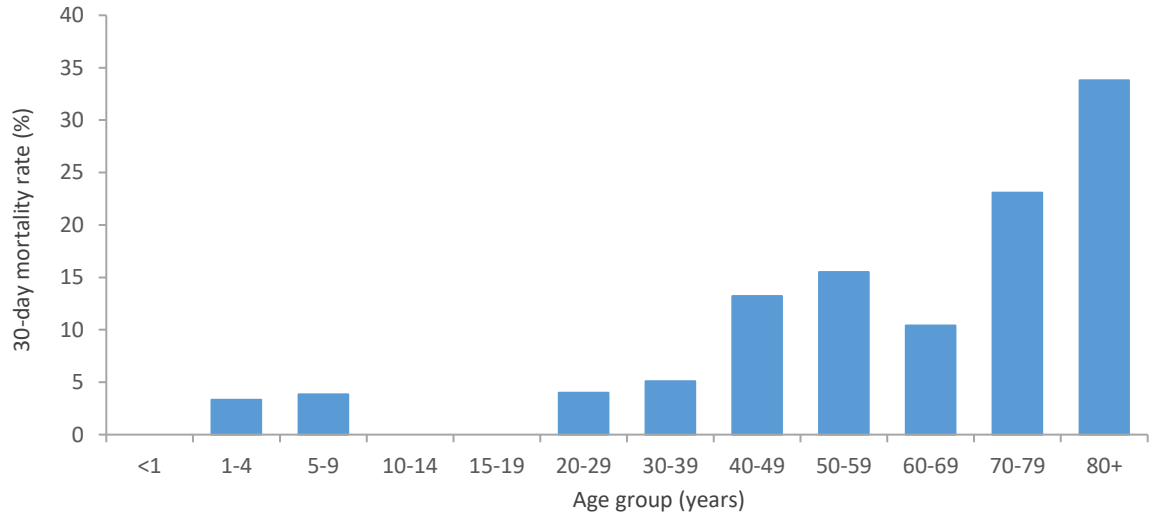

Rates not shown if count <5

## *30-day mortality*

In 2023, there were 80 deaths that occurred within 30 days of collection of an iGAS sample. The 30-day mortality rate for iGAS infections in 2023 was 14.1%, compared with the 2017–2022 average of 10.5%.

The 30-day mortality rate increased with age, with the highest rate among those aged 80 years and over (33.8%), followed by those aged 70–79 years (23.1%). There were no deaths reported for infants aged less than 1 year, and young people aged 10–14 and 15–19 years within 30 days of sample collection (Figure 8).

**Figure 8. 30-day mortality rate for iGAS infection by age group, 2023**



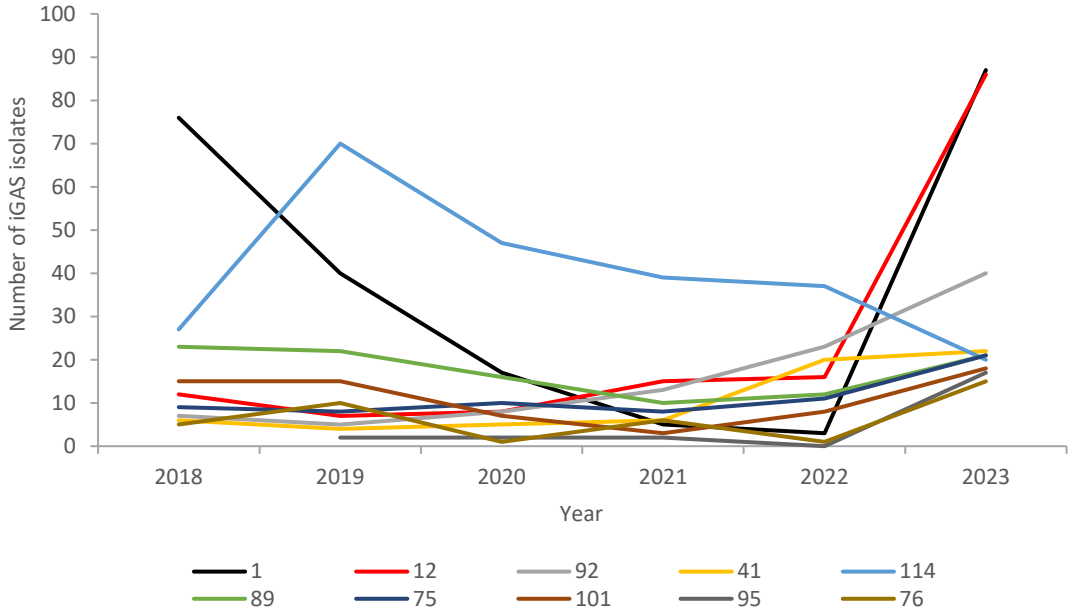

Minor differences were seen in the 30-day mortality rate by ethnicity. The mortality rate was 15.8% for the European or Other ethnic group, 14.5% for Māori, and 13.1% for Pacific peoples. Those of Asian ethnicity had the lowest mortality rate at 6.8%.

## *emm type distribution*

*emm* typing was carried out on all 568 iGAS isolates received by the IPL in 2023. There were 62 *emm* types associated with iGAS infections in New Zealand in 2023. This is compared with 47 different *emm* types in 2022, 37 *emm* types in 2021, and 51 *emm* types in 2020.

The most common *emm* types were *emm*1 and *emm*12, accounting for 15% of isolates each. Both *emm*1 and *emm*12 increased sharply from 2022 to 2023. In contrast, *emm*114, which has been the dominant strain since 2019, decreased in 2023 (Figure 9). Table 5 in the Appendix shows the number of iGAS infections by *emm* type from 2018 to 2023.

**Figure 9. Number of iGAS infections among the 10 most common *emm* types, 2018–2023**




In 2023, the Simpson's reciprocal index was 15.81 (95% Confidence Interval (CI): 15.80–15.81), suggesting a moderate diversity of *emm* types. Between 2018 and 2023, there has been an overall decreasing trend in the diversity of *emm* types (Table 6).

# DISCUSSION

## iGAS infections increased in New Zealand in 2023, mirroring the 2022/2023 increase overseas

There was a sharp increase in the incidence of iGAS infections between 2022 and 2023 (from 4.8 to 10.9 per 100,000), following a period of low incidence during the COVID-19 pandemic. The incidence of iGAS infections in 2023 is the highest reported in New Zealand in more than 20 years. Between 2002 and 2022, iGAS infection rates ranged from 3.8 per 100,000 in 2002 to 9.3 per 100,000 in 2011 [13].

This increase in iGAS infections follows the 2022/2023 iGAS increase seen in high income countries (including in the United Kingdom, France, Ireland, the Netherlands, Sweden, Canada, the United States and Australia [3-7]), which coincided with the easing of pandemic restrictions. While higher case numbers continue to be seen in a number of countries, including parts of Canada and Australia [14-16], in the United Kingdom, iGAS infections have decreased but remain higher than pre-pandemic levels [17].

The drivers of the increase in iGAS infections in New Zealand and overseas remain unclear. A possible explanation is that low exposure to GAS and predisposing illnesses due to COVID-19 pandemic measures may have reduced immunity to GAS, particularly among children. Increased population mixing and a rise in predisposing viral illnesses (e.g., respiratory viruses or varicella zoster) post-pandemic have also been theorised to contribute to this increase [6, 18].The delay in the increase in iGAS infections in New Zealand may be due to the removal of COVID-19 restrictions in New Zealand occurring later than many other countries, and/or delayed introduction of iGAS strains that were common in the iGAS increase overseas.

No clear seasonal pattern was seen in iGAS infection 2023, similar to previous years. This is in contrast to some other temperate climates, where GAS and iGAS infections typically peak in winter and early spring, coinciding with increases in respiratory infections, including influenza and respiratory syncytial virus (RSV) [19, 20].

## iGAS increases were most notable among children

In 2023, iGAS infections followed a U-shaped curve, with those aged less than 1 year and 80 years and over having the highest rates. The largest increases compared with the pre-pandemic era were among children aged 1–9 years; this is consistent with reports from a number of countries during the 2022/23 iGAS increase where an increase in paediatric infections was noted [18, 21-23].

## Inequities in iGAS infections persist

As in previous years, ethnic inequities were seen in overall rates, with rates among Pacific peoples five times higher than European or Other, and rates among Māori three times higher. Pacific peoples and Māori had the highest rates across all NZDep2018 quintiles and most age groups. These disparities are similar to ethnic inequities reported internationally, with iGAS infections disproportionally affecting Indigenous peoples and other ethnic minorities [24-26].

Socioeconomic deprivation continues to be strongly associated with iGAS infection. Almost two-thirds of iGAS infections are reported among people living in areas with higher socioeconomic deprivation (quintiles 4 and 5).

## *emm*1 *and emm*12 increased sharply to become the dominant *emm* types in 2023

In 2023, the most dominant *emm* types were *emm*1, *emm*12, and *emm*92, with the prevalence of *emm*1 and *emm*12 increasing sharply from 2022 to 2023. The 2022/23 iGAS increase overseas shows a similar distribution, with *emm*1 and *emm*12 identified as the dominant *emm* types in the United Kingdom [7], the Netherlands [21], Australia [22], Italy [27], the United States [23], Denmark [28], and France [6]. A number of studies highlight *emm*1 as a major contributor to the iGAS increase [28, 29]. In particular, the M1UK strain has gained considerable attention in the context of the 2022/2023 iGAS increase, given its increasing prevalence, higher virulence, and *emm*1's association with more severe infection than other genotypes [28, 30, 31]. M1UK was the most prevalent variant during the 2022/23 winter season in both England and Australia and accounted for 31% of all cases under 15 years in England [18, 29].

The Simpson's reciprocal index in 2023 was 15.8 and, considering the 62 *emm* types characterised in 2023, this suggests there were some dominant *emm* types combined with a reasonable level of strain diversity. The 2023 index is slightly lower than that reported in a 2018–2019 sample of school-aged children with GAS infections in Auckland (20.2; 95%CI: 16.6–23.8) [32], and falls within the range reported in a recent study that examined GAS *emm* type diversity in low- and high-income settings [33]. Overall, there has been a slight decline in *emm* type diversity since 2018.

The 30-day mortality rate increased in 2023, rising from an average rate of 10.5% in 2017–2022 to 14.8% in 2023. Higher case fatality rates were reported in some countries during the 2022/2023 iGAS increase, including Canada [34], and Ireland [35]. It has been postulated that the dominance of *emm*1 GAS drove the rise in mortality observed in multiple high-income countries in 2022/2023 [33, 34]. The shift in *emm* types in New Zealand in 2023 may have contributed to the increase in the 30-day mortality rate seen amongst iGAS infection cases. While further research is needed to better understand the distribution of M1UK in New Zealand, M1UK was detected in New Zealand as early as 2018 [20].

Whole genome sequencing information was not available for our 2023 surveillance data, therefore the prevalence and distribution of M1UK in New Zealand has not been described in this report.

## Data interpretation and limitations

There are a few notable limitations to the data used in this report. Firstly, iGAS is currently not a notifiable disease in New Zealand, and surveillance relies on voluntary referral of isolates to ESR. An audit of iGAS isolates referred to the ESR IPL in 2022 found that 84% of isolates identified by participating laboratories were referred to ESR and that the current surveillance system underestimates the burden of iGAS infection in New Zealand [13]. Following the audit, the findings were shared with laboratories with a reminder to refer samples to ESR. This may have changed referral patterns for isolates to ESR in 2023 and could affect trend data. Later in 2024 iGAS infection will become a notifiable disease, which will likely increase iGAS reporting.

The ethnic-specific population estimates were based on the 2018 census population and adjusted for any undercounting by Statistics New Zealand using information from multiple sources. Despite these efforts to adjust population estimates and impute missing ethnicity data, research suggests that undercounts of Pacific and Māori populations remain [36]. NHI data are also known to undercount both Māori and Pacific peoples. Together, these limitations affect the quality and reliability of our Māori and Pacific population data and therefore the estimates of iGAS incidence in these groups [37]. Additionally, reliable and up-to-date population denominators for L2 Pacific ethnicities were not available [36], precluding the ability to calculate incidence rates for these groups.

Finally, whole genome sequencing data was not available as part of our surveillance data. Therefore, we were unable to describe the distribution of the iGAS M1UK lineage.

# CONCLUSION

There was an increase in iGAS infections in New Zealand in 2023, with the highest annual rate seen in more than 20 years, at 10.9 per 100,000. iGAS rates were highest among the youngest (less than 1 year) and oldest (80 years and over) age groups. While iGAS infections increased across all age groups, the increase was most notable among those aged 1–4 and 5–9 years compared with the pre-COVID-19 pandemic era. Additionally, an increase in the 30-day mortality rate was seen in 2023. In 2023, *emm*1 and *emm*12 were the most common *emm* types. These trends are consistent with those reported during the 2022/2023 iGAS increase overseas.

Inequities continue to be experienced by Māori and Pacific peoples. Given the high and increasing number of iGAS infections seen in 2023, continued surveillance of iGAS infections, alongside efforts to address systemic and health care access issues, remain important. The upcoming change to make iGAS notifiable will improve the completeness of reporting and data collection for iGAS infection surveillance in New Zealand.

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# APPENDIX

### Table 2. Number of cases and rate of iGAS infection by prioritised ethnicity, 2018–2023

| Ethnic group | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | | 2023 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] |
| Māori | 127 | 15.6 | 133 | 16.1 | 97 | 11.5 | 79 | 9.3 | 83 | 9.7 | 172 | 20.1 |
| Pacific | 97 | 29.3 | 81 | 24.2 | 67 | 19.7 | 39 | 11.3 | 54 | 15.6 | 130 | 37.5 |
| Asian | 22 | 3 | 19 | 2.5 | 12 | 1.6 | 11 | 1.4 | 10 | 1.3 | 44 | 5.6 |
| European/Other | 207 | 6.9 | 174 | 5.7 | 100 | 3.2 | 99 | 3.1 | 90 | 2.9 | 222 | 6.9 |
| Unknown | 8 | | 7 | | 6 | | | | 7 | | | |
| **Total** | **461** | **9.4** | **414** | **8.3** | **282** | **5.5** | **228** | **4.5** | **244** | **4.8** | **568** | **10.8** |

[1] Rate per 100,000 population.

### Table 3. Number of cases and rate of iGAS infection by prioritised ethnicity and NZDep2018 quintile, 2023

| NZDep2018 quintile | Asian | | European or Other | | Māori | | Pacific peoples | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] |
| 1 (least deprived) | 9 | 8.0 | 37 | 5.3 | 8 | 12.4 | 3 | 20.2 | 57 | 6.4 |
| 2 | 2 | 1.5 | 42 | 6.4 | 16 | 18.7 | 5 | 21.9 | 65 | 7.2 |
| 3 | 8 | 5.3 | 39 | 6.3 | 23 | 20.1 | 11 | 30.8 | 81 | 8.8 |
| 4 | 14 | 9.2 | 54 | 9.7 | 42 | 24.2 | 39 | 64.1 | 149 | 15.8 |
| 5 (most deprived) | 9 | 7.7 | 47 | 13.0 | 81 | 24.6 | 70 | 41.1 | 207 | 21.2 |

[1] Rate per 100,000 population.

## Table 4. Number of cases and rate of iGAS infection by health district, 2018–2023

| Health district | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | | 2023 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] | Cases | Rate[1] |
| Northland | 41 | 22.1 | 35 | 18.5 | 15 | 7.7 | 19 | 9.6 | 20 | 9.9 | 28 | 13.7 |
| Waitematā | 40 | 6.5 | 44 | 7.0 | 31 | 4.9 | 17 | 2.7 | 22 | 3.5 | 48 | 7.4 |
| Auckland | 56 | 11.4 | 37 | 7.4 | 26 | 5.1 | 30 | 6.0 | 23 | 4.8 | 58 | 11.8 |
| Counties Manukau | 106 | 18.7 | 88 | 15.2 | 78 | 13.1 | 35 | 5.8 | 44 | 7.3 | 118 | 18.9 |
| Waikato | 35 | 8.3 | 36 | 8.4 | 21 | 4.8 | 22 | 4.9 | 19 | 4.2 | 34 | 7.4 |
| Lakes | 9 | 7.9 | 22 | 19.1 | 7 | 6.0 | 8 | 6.8 | 7 | 5.9 | 23 | 19.2 |
| Bay of Plenty | 11 | 4.4 | 26 | 10.1 | 18 | 6.8 | 23 | 8.5 | 24 | 8.7 | 35 | 12.5 |
| Tairāwhiti | 9 | 18.2 | 5 | 10.0 | 8 | 15.7 | 6 | 11.7 | 4 | - | 10 | 19.0 |
| Hawke's Bay | 17 | 9.9 | 16 | 9.2 | 20 | 11.1 | 13 | 7.2 | 12 | 6.6 | 19 | 10.3 |
| Taranaki | 15 | 12.4 | 15 | 12.2 | 9 | 7.2 | 9 | 7.1 | 0 | - | 20 | 15.5 |
| MidCentral | 14 | 7.7 | 8 | 4.3 | 7 | 3.7 | 9 | 4.8 | 3 | - | 22 | 11.4 |
| Whanganui | 8 | 12.0 | 6 | 8.9 | 3 | - | 2 | - | 9 | 12.9 | 8 | 11.4 |
| Capital & Coast | 15 | 4.7 | 15 | 4.7 | 7 | 2.2 | 4 | - | 12 | 3.7 | 20 | 6.1 |
| Hutt Valley | 5 | 3.2 | 10 | 6.4 | 6 | 3.8 | 2 | - | 4 | - | 23 | 14.2 |
| Wairarapa | 2 | - | 1 | - | 1 | - | 0 | - | 2 | - | 1 | - |
| Nelson Marlborough | 12 | 7.7 | 3 | - | 1 | - | 8 | 4.9 | 1 | - | 15 | 9.0 |
| West Coast | 0 | - | 1 | - | 0. | - | 0 | - | 0 | - | 4 | - |
| Canterbury | 34 | 6.1 | 24 | 4.2 | 17 | 2.9 | 13 | 2.2 | 17 | 2.9 | 46 | 7.6 |
| South Canterbury | 10 | 16.4 | 5 | 8.2 | 1 | - | 0 | - | 0 | - | 6 | 9.5 |
| Southern | 19 | 5.6 | 11 | 3.2 | 5 | 1.4 | 8 | 2.3 | 10 | 2.9 | 24 | 6.7 |

[1] Rate per 100,000 population. Where there were fewer than five cases in any category, a rate has not been calculated.

## Table 5. Number of iGAS infections by *emm* type, 2018–2023

| *emm* type* | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| **1** | 76 | 40 | 17 | 5 | 3 | 87 |
| **12** | 12 | 7 | 8 | 15 | 16 | 86 |
| **92** | 7 | 5 | 8 | 13 | 23 | 40 |
| **41** | 6 | 4 | 5 | 6 | 20 | 22 |
| **114** | 27 | 70 | 47 | 39 | 37 | 20 |
| **89** | 23 | 22 | 16 | 10 | 12 | 21 |
| **75** | 9 | 8 | 10 | 8 | 11 | 21 |
| **101** | 15 | 15 | 7 | 3 | 8 | 18 |
| **95** | 0 | 2 | 2 | 2 | 0 | 17 |
| **76** | 5 | 10 | 1 | 6 | 1 | 15 |
| **108** | 6 | 0 | 0 | 7 | 6 | 14 |
| **53** | 19 | 30 | 32 | 28 | 11 | 14 |
| **58** | 17 | 2 | 1 | 2 | 4 | 14 |
| **82** | 15 | 9 | 11 | 8 | 7 | 14 |
| **103** | 38 | 27 | 20 | 12 | 12 | 13 |
| **77** | 8 | 5 | 3 | 4 | 4 | 11 |
| **81** | 22 | 18 | 11 | 7 | 2 | 10 |
| **22** | 2 | 7 | 4 | 5 | 5 | 9 |
| **44** | 9 | 9 | 0 | 3 | 3 | 8 |
| **91** | 6 | 8 | 4 | 4 | 4 | 8 |
| **49** | 7 | 12 | 11 | 7 | 1 | 7 |
| **3** | 6 | 1 | 3 |  | 2 | 6 |
| **28** | 4 | 9 | 4 | 4 | 2 | 5 |
| **65** | 5 | 12 | 2 | 4 | 1 | 5 |
| **86** | 2 | 1 | 0 | 0 | 0 | 5 |
| **112** | 4 | 3 | 0 | 2 | 0 | 4 |
| **116** | 2 | 0 | 2 | 3 | 0 | 4 |
| **4** | 13 | 10 | 5 | 3 | 1 | 3 |
| **59** | 4 | 5 | 2 | 1 | 3 | 3 |
| **100** | 2 | 0 | 1 | 0 | 6 | 3 |
| **25** | 1 | 1 | 2 | 0 | 0 | 3 |
| **68** | 3 | 2 | 2 | 0 | 0 | 3 |
| **9** | 0 | 1 | 1 | 0 | 0 | 3 |
| **110** | 2 | 1 | 0 | 0 | 0 | 3 |
| **71** | 2 | 1 | 0 | 0 | 0 | 3 |
| **33** | 1 | 0 | 0 | 1 | 0 | 3 |
| **99** | 1 | 0 | 0 | 0 | 0 | 3 |
| **109** | 0 | 0 | 0 | 0 | 0 | 3 |
| **197** | 0 | 0 | 0 | 0 | 0 | 3 |

**emm* types with less than two cases in 2023 have not been included in the table

### Table 6. Simpson's reciprocal index, 2018–2023

| Year | Simpson's reciprocal index (95% CI) |
|---|---|
| 2018 | 20.54 (20.53–20.55) |
| 2019 | 16.97 (16.96–16.98) |
| 2020 | 15.60 (15.58–15.61) |
| 2021 | 16.74 (16.73–16.76) |
| 2022 | 17.68 (17.67–17.69) |
| 2023 | 15.81 (15.80–15.81) |


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