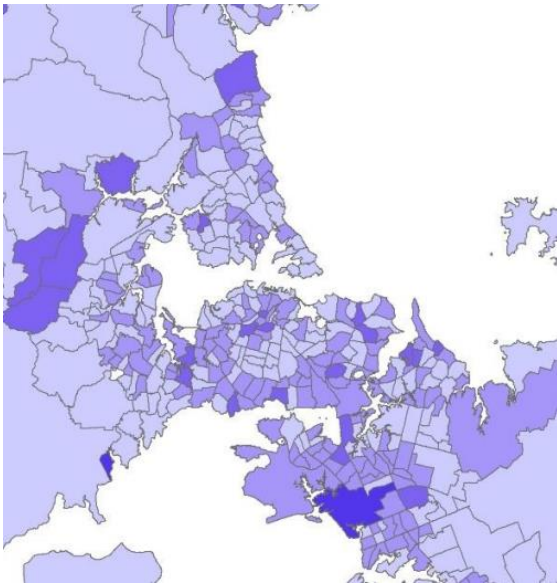
Investigating the rates and spatial distribution of childhood ambulatory sensitive hospitalisations in New Zealand



Report written for
the Ministry of Health
by GeoHealth Laboratory

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Report aims

The GeoHealth Laboratory developed this report in collaboration with the Ministry of Health to help policymakers understand the distribution of childhood ambulatory sensitive hospitalisations (ASHs) within New Zealand. This report supports actions 6 and 8 of the New Zealand Health Strategy: ensuring the right services are delivered at the right location in an equitable, clinically and financially sustainable way, and increasing the effort on prevention, early intervention, rehabilitation and wellbeing. An additional long report provides technical details on methods and more detailed results is available from GeoHealthLab@canterbury.ac.nz.

What is already known

Key risk factors for ASH include inadequate vaccination, lack of early detection and treatment of acute conditions, and inadequate control of chronic conditions. Social determinants affect health, and inequalities exist by population groups; there is some evidence that rates for males are higher, as are those for Māori and Pacific children and those who live in more deprived areas. Universal mass vaccination programmes are an effective preventive measure, and evidence for the effectiveness of community water fluoridation is strong.

What this study adds

Nationwide cross-sectional surveys and registers show that a wide range of factors affect ASH rates, including community water fluoridation, vaccination and enrolment in primary health organisations (PHO).

- ASH rates vary by age, ethnicity, area-level deprivation, and rural/urban classification.
- Spatial variation in ASH rates by district health board was present.
- The highest ASH rate was generally in areas with health service availability of up to 30 minutes' driving time.
- Areas with fluoridated water were associated with lower dental ASH rates, and there was some evidence that this difference was exaggerated in the most deprived areas.
- Gastroenteritis ASH rates declined following the introduction of the rotavirus vaccine.
- A higher percentage of enrolment in PHOs was related to lower ASH rates.

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Background: For New Zealand children, ambulatory sensitive hospitalisations (ASHs) account for approximately 30% of all acute and arranged medical and surgical discharges each year. The leading causes include respiratory, dental, dermatological and gastroenteritis ASH conditions. Evidence shows that rates differ by age, gender, ethnicity and area-level deprivation. It is now recognised that ASH rates may also be influenced not only by primary care, but by broader policy measures or social determinants. In addition to exploring variation by key demographic factors such as age group, ethnicity and area-level deprivation, more research is needed that investigates spatial variation and other wider influences of childhood ASH rates, such as community water fluoridation, vaccination or enrolment in health services. For the purpose of this report *under 5* refers to 0–4 years of age and *under 13* refers to 5–12 years.

Methods: Data on ASH conditions was extracted from the National Minimum Dataset (NMDS) for all children aged 0–12 across New Zealand using six years of pooled data (n=1,081,491) (2011 [Q3] to 2017 [Q2]). Age, gender, ethnicity, meshblock ID and ASH conditions (respiratory, dental, dermatological, and gastroenteritis) were provided and extracted based on the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) conditions standard.[1] Health services, including hospitals, general practices, pharmacies and community oral health services, were mapped in terms of driving time (minutes) availability (under 30, 30 to under 60 and 60 minutes or more). All travel time estimates were based on driving minutes by motor vehicle from the closest health service facility for each New Zealand 2013 Census meshblock using population-weighted centroids. Water fluoridation maps are based on 2011 and 2016 data obtained from the Institute of Environmental Science and Research (ESR). Rotavirus vaccination records were obtained from the National Immunisation Register (NIR) and the Primary Health Organisation (PHO) Enrolment Collection (2018 [Q3]). The numbers of children aged under 5 and under 13 were extracted from the 2013 Census, which allows for the calculation of hospitalisations per 1000 of the population. Analyses were completed using ArcGIS 10.4.1 (©ESRI Inc.), SPSS v21, and RStudio v3.5.1.

Results: While the ASH rate varied in magnitude by condition and age group, generally there was a social gradient across all ASH conditions. Figure A1 (see appendix) shows the most deprived quintile exhibiting the highest ASH rate. Dermatological, respiratory and gastroenteritis ASH rates were highest in main urban areas and reduced gradually as rurality increased. However, as shown in Figure A2 (see appendix) dental ASH rates were highest in minor urban areas. Areas under 30 minutes' driving time from health services predominantly had the highest ASH rate for both age groups.

Figure A3 (see appendix) shows that the ASH rate varied both by DHB and by condition. Dermatological ASH rates varied markedly between the North and South Island. High dental ASH rates were noted in Northland and Tairāwhiti for both age 0-4 and 5-12 years. Gastroenteritis ASH rates were dominated by admissions of those children aged 0-4, with particularly high rates in several DHBs including Hutt Valley and Bay of Plenty. Finally, several DHBs had notably high respiratory ASH rates. Further details are provided in the long report.

Health services were correlated spatially, and excessive ASH rates (higher than average across all conditions) accumulated in certain DHBs. There were statistically significant correlations between the different health services in each Census Area Unit (CAU), which suggests community oral health services, general practices, pharmacies and hospitals are located together. Figure A4 (see appendix) shows significant variation in ASH rate by ethnicity. While caution should be applied[2] when interpreting actual rates, this provides some evidence that across most of the ASH conditions, rates were highest for Pacific and Māori populations, particularly respiratory ASH rates.

CAUs defined as fluoridated in 2011 and 2016 had the lowest dental ASH rates for both age groups, and the highest rates were seen in those areas defined as not fluoridated in 2011 and 2016 (Figure 1). The dental ASH rates for children aged under 5 differed significantly by deprivation quintile and type of water fluoridation area (Figure 2). Rates were higher in more deprived areas; however, the difference between fluoridated CAUs and those that were not fluoridated seemed to be more marked in the most deprived areas. Rates and trends in children aged under 13 years were broadly similar (Figure 3).

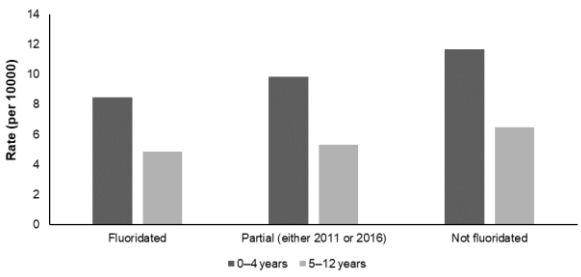

Figure 1. Fluoridation and dental ASH rates

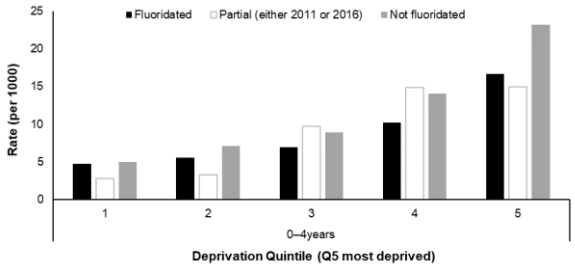

Figure 2. Fluoridation and dental ASH rates by deprivation quintile (under 5)

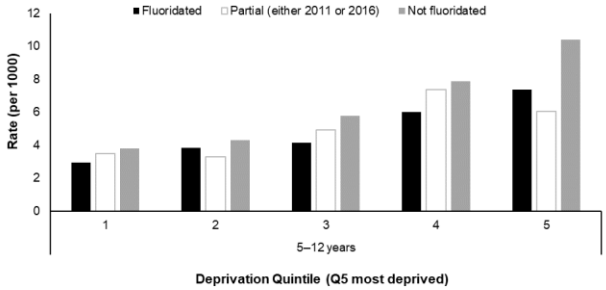

Figure 3. Fluoridation and dental ASH rates by deprivation quintile (under 13)

Gastroenteritis ASH rates dropped from 2014 onwards following the introduction of the rotavirus vaccine (from 5.33/1000 in 2014, to 3.92/1000 in 2015, to 3.43/1000 in 2016). From 2014 to 2015, children under 5 had the largest decrease in hospital admissions (from 15.6/1000 to 10.3/1000), the year immediately after the vaccine was introduced. Figure 4 shows the decrease for Auckland.

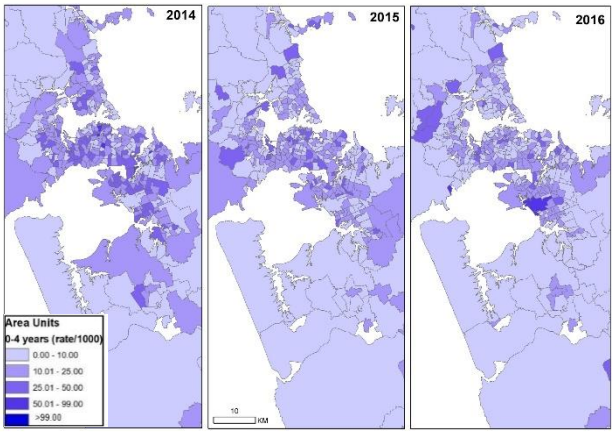

Figure 4. Decrease in gastroenteritis ASH rates from 2014 to 2016.

A higher percentage of enrolments in PHOs was related to lower ASH rates, particularly for those under 5. However, effects were smaller when compared to the impact of other factors such as area-level deprivation. There was a slight social gradient in those with no rotavirus vaccine; the most deprived areas had the highest counts of no rotavirus vaccine recorded. Areas with the highest ratio of those fully vaccinated compared to no vaccination had the lowest gastroenteritis ASH rates.

Conclusions: This report uses several nationwide cross-sectional surveys and registries to add novel findings to current evidence regarding ASH rates within New Zealand. It identifies spatial variation in both health service availability and ASH rates by age group (under 5 and under 13 years) and demonstrates evidence that ASH rates were also affected by wider factors such as water fluoridation, vaccination and enrolment in PHOs. There was also notable variation by area-level deprivation and ethnicity. All limitations are fully outlined in the long report.

Key message for policy: Evidence in this report suggests that New Zealand public health has much to offer broader society. Through collaborative multi-sector planning, it may be possible to address some of the wider determinants of health that are highlighted in this report. Policy could consider:

- the spatial variation in ASH rates, differences by age groups, area-level deprivation, and ethnicity, and consider health services and ASH rates together rather than in isolation, as both may cluster
- how the extension of water fluoridation may contribute to reduced dental ASH rates in New Zealand
- how the rotavirus vaccination contributes to reduced gastroenteritis ASH rate
- that a higher percentage of enrolment in PHOs was related to lower ASH rates.

Future work: Upcoming projects could use a more dynamic definition of place rather than relying on meshblock. This would provide a better estimation of availability. Dental ASH rates were highest in minor urban areas and this may be an interesting area to investigate further perhaps by using New Zealand Health Survey data in terms of actual visits to a dentist or number of teeth extractions. Considering this, the community water fluoridation data would be a potentially powerful supplementary analysis. It would be interesting to investigate air pollution and respiratory ASH rates subject to data availability. Finally, it may be useful to link other wider factors such as housing type using data sources such as the Integrated Data Infrastructure (IDI) to better understand ASH respiratory rates.

Appendix

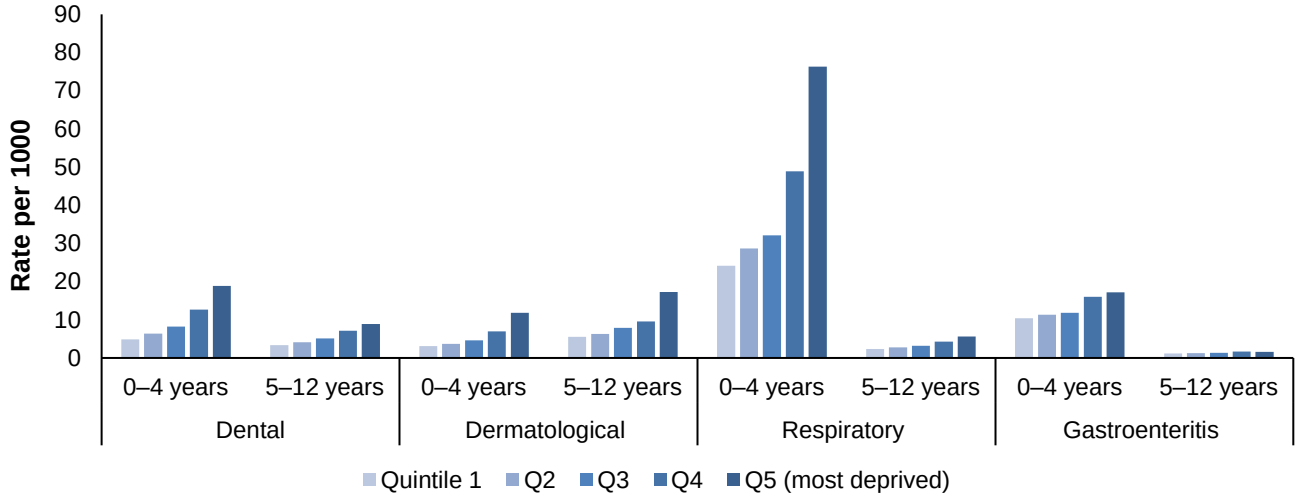

Figure A1. ASH rates by deprivation quintile and age group

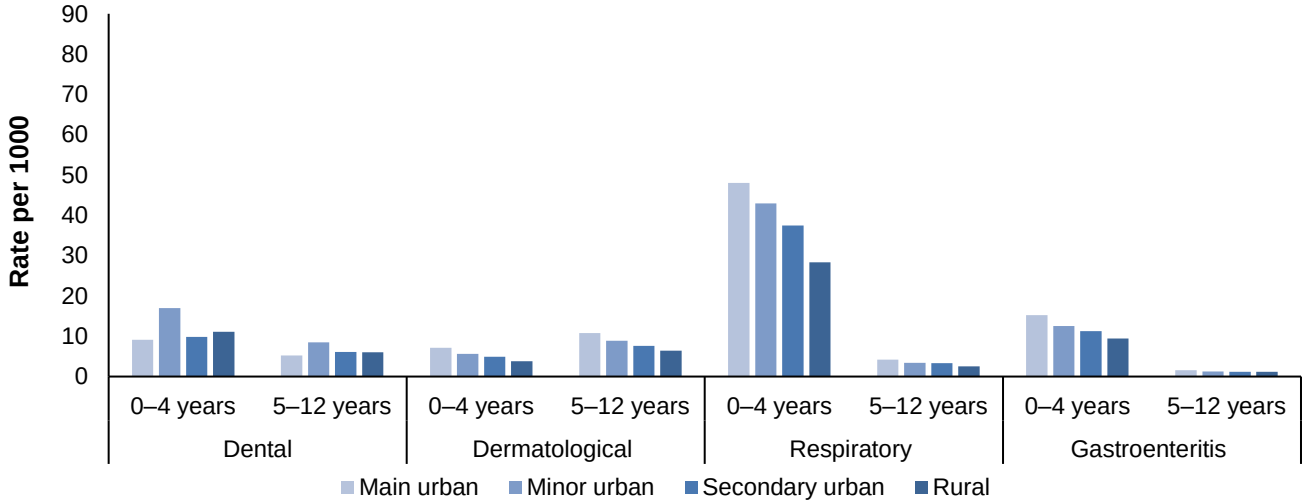

Figure A2. ASH rates by rural/urban classification and age group

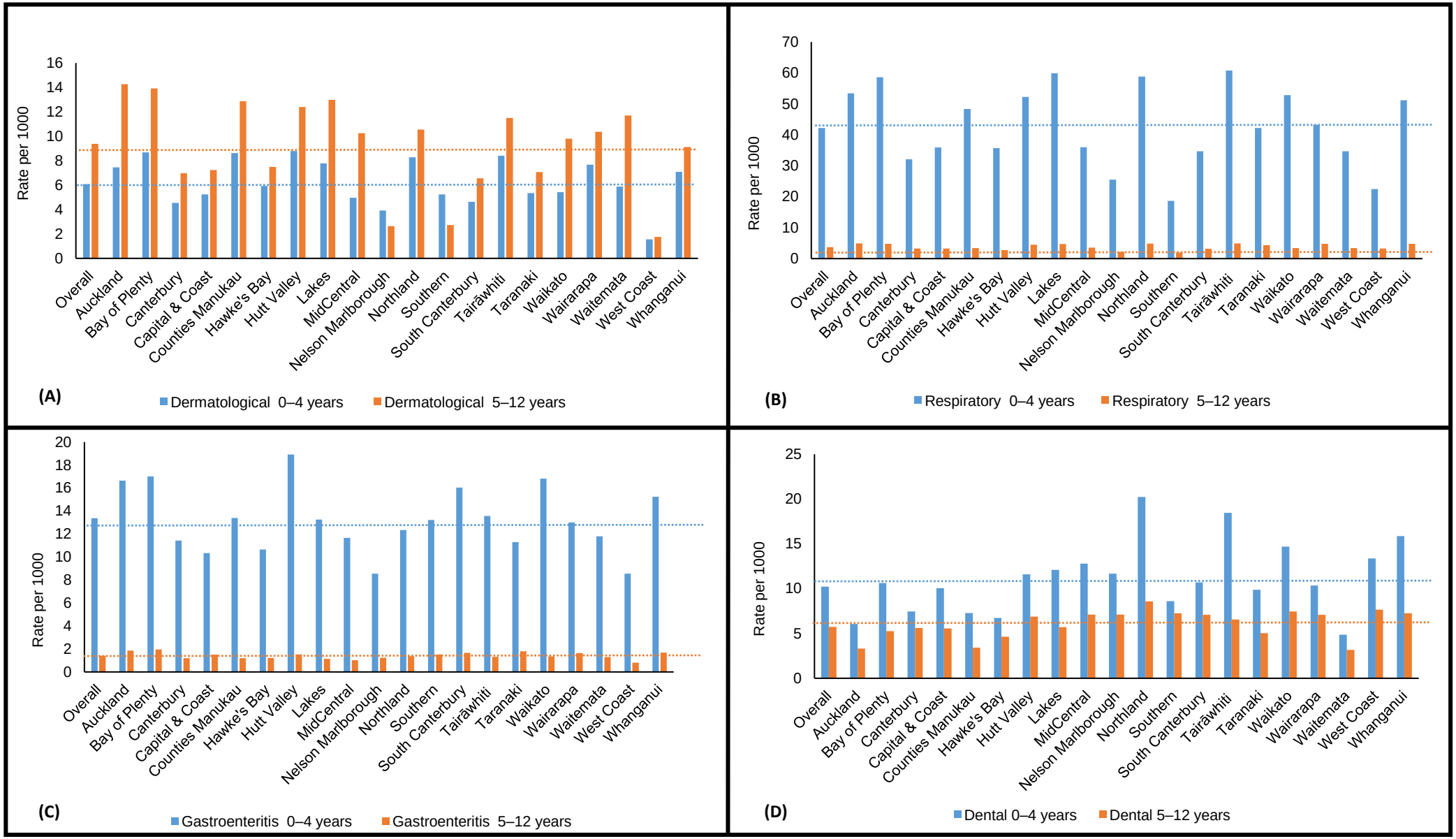

Figure A3. ASH rate by district health board and age group (0–4 and 5–12 years)

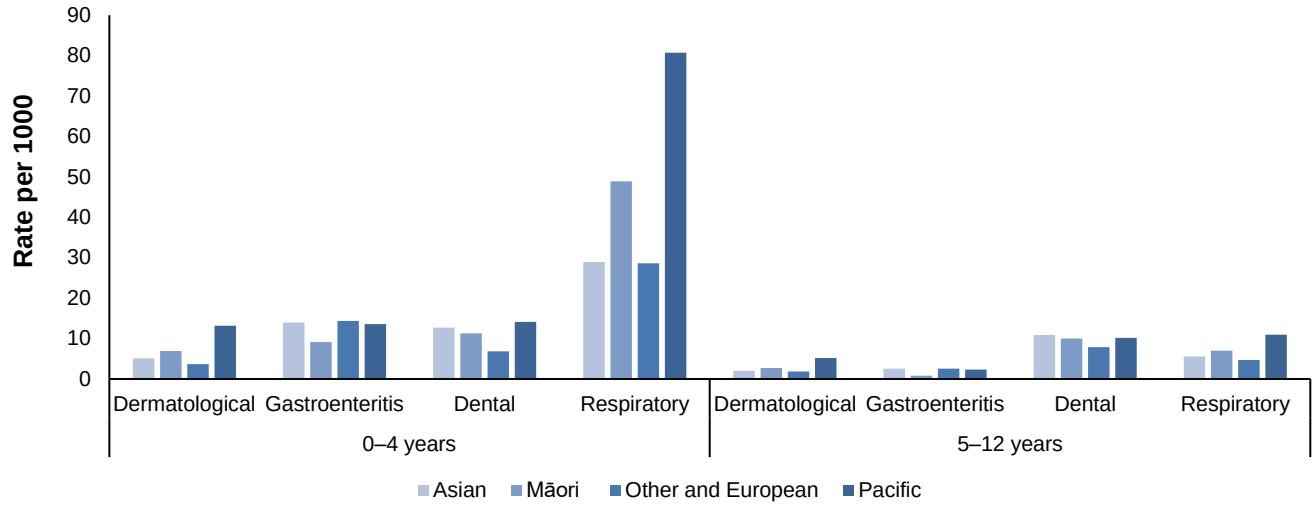

Figure A4. Variation in ASH rates by ethnicity and age group

Endnotes

[1] World Health Organization. 2016. *International Statistical Classification of Diseases and Related Health Problems 10th Revision*. URL: https://icd.who.int/browse10/2016/en

[2] Figure A3 uses estimated coverage for populations with low numbers for some ethnicities. This limitation may be exaggerated because the underlying population estimates come from Stats NZ population projections, and the rates by ethnicity come from the NMDS (two different data sources). For instance, age groups where the total population of the area is less than 2,000 have been rounded to the nearest five. This may introduce error when numbers are low in CAUs. Therefore, results for ASH rates by ethnicity should be interpreted with a degree of caution considering these limitations.

The GeoHealth Laboratory (GHL) is a strategic partnership between the New Zealand Ministry of Health and the University of Canterbury. This report presents research undertaken as part of the annual work programme. Content for the work programme is developed through collaboration between these parties and is intended to align with Government priorities. The Ministry of Health provides (where applicable) data and guidance for the work programme, with analyses and report writing being the responsibility of the GHL research team. Contact regarding the content of this report should be established with the GHL directly.