

Persisting variance in middle ear ventilation tube insertion in Auckland children: why ethnic disparity continues

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ABSTRACT

AIM: Insertion of ventilation tubes (VTs) is a common surgical treatment for recurrent and persistent otitis media, but surgical practice varies internationally. The current study explored variations in practice within New Zealand by examining VT insertion rates. The aim of the study was to determine time trends and current variations in VT insertion rates by ethnicity and district health board (DHB), with a focus on comparison of two DHBs in Auckland (Counties Manukau and Auckland DHB) to national average data.

METHOD: Data for surgical procedures were analysed in the Atlas of Healthcare Variation domain, available via the Health Quality & Safety Commission website. Publicly funded events for New Zealand residents over a 10-year period (2009–2018) were examined for 0–4-year-olds. Individuals were assigned to their DHB of residence. VT rates for each DHB are presented per 1,000 population, with upper and lower confidence intervals calculated to the 95% level.

RESULTS: There was a general decline in the rates of VT insertions for the 0–4-year-olds over the 2009–2018 decade. Analysis of the 2018 year showed variation by ethnicity and DHB. In CMDHB, ADHB and nationally, Asian and Pacific ethnic groups had the lowest rates of VT insertions compared to other ethnic groups. In CMDHB, the VT rates for Māori, Pacific and Asian children were less than half that of their respective groups in ADHB. The NZ European/Other ethnic group had the highest rates of VT insertions in CMDHB and nationally, but in ADHB, the rate for the NZ European/Other group was similar to that for Māori.

CONCLUSION: These results are incongruent with evidence that Māori and Pacific children in New Zealand experience a greater burden of middle ear disease than NZ European children. The finding of persisting inequities in VT treatment for middle ear disease in 0–4-year-olds, with greatest impact on Pacific children, suggests that there may be a need for targeted middle ear screening for preschool children to detect pre-schoolers with ear disease, earlier than the 4-year-old B4 School Check.

Acute otitis media (AOM) is a leading childhood illness accounting for many physician visits and antibiotic prescriptions in developed countries.¹ It is experienced by more than 80% of children globally by the age of three years, with 10–30% experiencing repeated episodes.² Persistent otitis media with effusion (OME), commonly known as “glue ear”, occurs in up to 25% of children following AOM,³ though it can also occur as a primary disorder.⁴ OME is associated with fluid collection in the middle ear, which may result in a conductive hearing loss of variable severity.⁵ Though most cases of OME resolve spontaneously, complications may include chronic otitis media with structural changes to the middle ear.⁴ Hearing loss resulting from chronic OME in early childhood is also associated with delayed acquisi-

tion of speech and language, as well as attention, learning and behavioural problems, and typically occurs during the most intensive period for a child’s language development.⁶

Insertion of ventilation tubes (VTs), also known as tympanostomy tubes, or “grommets”, is a common surgical treatment for recurrent AOM and persistent OME. At the time of insertion of VTs, the surgeon is able to aspirate middle ear fluid, allowing for an abrupt change in the natural history of the disease. Systematic reviews^{4,7} have found that VTs are able to reduce the duration of OME episodes, as well as improve hearing at both six months and one year after surgery, compared to watchful waiting.

Rates for insertion of VTs vary geographically according to local practice, clinical guidelines and

availability of surgical resource.^{8,9} In New Zealand, general practitioners (GPs) most often refer children to specialist services for consideration of VT insertions. Children may be referred to GPs if a hearing problem is identified by providers of the Well Child Tamariki Ora (WCTO) programme—a series of eight free health visits available to all New Zealand families.³ The final preschool visit, referred to as the B4 School Check, occurs when the child turns four years of age. The hearing component of the screen involves a pure tone audiometry test, followed by tympanometry if the child does not pass pure tone screening.¹⁰

New Zealand has an increasingly diverse population.¹¹ Ethnic and regional disparities in the disease burden and treatment rates of AOM and OME exist in NZ. For example, McCallum and colleagues³ found that between 2002–2008, among 0–4-year-olds, Māori and Pacific children had higher rates of acute hospitalisations for AOM, yet lower rates of elective admissions for VTs, compared to European children. These differences were also more pronounced for children from the most deprived areas, suggesting that children with higher levels of need may be receiving lower levels of treatment.³ Māori and Pacific children are also less likely to have a completed B4 School Check, which perpetuates existing ethnic disparities in hearing problems and middle ear disease.¹⁰

In the Auckland Region of New Zealand, the Counties Manukau and Auckland district health boards (DHBs) are neighbouring and largely metropolitan DHBs with relatively different population profiles.^{12,13} CMDHB serves a much higher proportion of Pacific and Māori people (22% and 16.3% of the DHB population, respectively) compared to ADHB (11% and 8.2%). These DHBs also differ in their levels of deprivation. CMDHB has proportionally more people in the most deprived quintile (majority Māori and Pacific people) and fewer people in the less deprived quintiles. In contrast, ADHB has more people in the less deprived quintiles, and fewer people in the more deprived quintiles.^{12,13}

The Health Quality & Safety Commission of NZ (the Commission) provides an Atlas of Healthcare Variation, which presents nationwide rates for specific health services on tables, graphs and geographical maps,¹⁴ and allows monitoring of VT insertion rates and other surgical procedures. Using the Atlas domain (last updated in September 2020), in the current study we aimed to determine the time trends and explore current variations in VT insertion rates by ethnicity and district health

boards (DHBs), with a focus on comparison of two DHBs in Auckland to the national average. Data from the latest available year (2018) were analysed to discern more recent variations.

Method

Data for surgical procedures were analysed in the Atlas of Healthcare Variation domain, available via the Commission website.¹⁵ The data encompass publicly funded events for New Zealand residents (including publicly funded procedures outsourced to private hospitals) over a 10-year period (2009–2018). Data relating to VT procedures were taken from the National Minimum Dataset (NMDs), which is a collection of nationwide hospital discharge information, including coded clinical data for day-stay and inpatients.¹⁶ The specific procedure codes corresponding to VT insertion were under “myringotomy with insertion of tube, unilateral” and “myringotomy with insertion of tube, bilateral”. In the Atlas of Healthcare Variation domain, individuals were assigned to their district health board (DHB) based on their residential address.

VT rates for each DHB are presented per 1,000 population (of the specific ages and ethnic groups in question) with upper and lower confidence intervals calculated to the 95% level. Individuals identifying with more than one ethnic group were assigned to a single mutually exclusive group, based on the following hierarchy: Māori, Pacific peoples, Asian, NZ European/Other. In order to maintain confidentiality, data are not presented if the resulting number of people was less than 10.¹⁷ Population data relating to ethnicity and DHBs were taken from Statistics NZ and the Ministry of Health.¹⁷ The data were then filtered to include only the age group of interest (0–4-year-olds), and a time graph for rates of VT insertions between the years of 2009–2018 was generated. The national average rates for this age group during the latest available year (2018) were also further analysed, alongside the rates for Auckland and Counties Manukau DHBs. These results were then stratified by ethnicity for these respective regions (national, ADHB, CMDHB).

Results

Variation over time

National average rates of VT insertions for the 0–4-years age group showed a general downwards trend over the 10-year period, with 12.0

procedures per 1,000 population in 2009, and 9.3 procedures per 1,000 population in 2018 (Figure 1). The rates for CMDHB also showed a general downwards trend over the same time period, with 9.6 and 6.1 procedures per 1,000 population in 2009 and 2018, respectively. CMDHB consistently showed lower rates of VT insertions from 2009–2018 compared with the national average rates. In comparison, ADHB procedure rates were 11.8 and 10.2 per 1000 population in 2009 and 2018, respectively, and were similar to that of the national average (taking confidence intervals into consideration). Figure 1 shows a transient drop in VT insertions in 2010 at ADHB; we believe this reflects a re-organisation of the services at that time rather than a change in disease presentation or incidence of disease.

Variation by ethnic group and DHB (2018)

Table 1 and Figure 2 present results separated by primary ethnicity. Focusing on the results for the 2018 year, ADHB's 0–4-year-olds had the highest rates of VT insertions for all ethnic groups, compared to the corresponding ethnic groups in CMDHB and the national average. CMDHB's 0–4-year-olds had the lowest VT insertion rates for all ethnic groups compared to ADHB and the national average, except

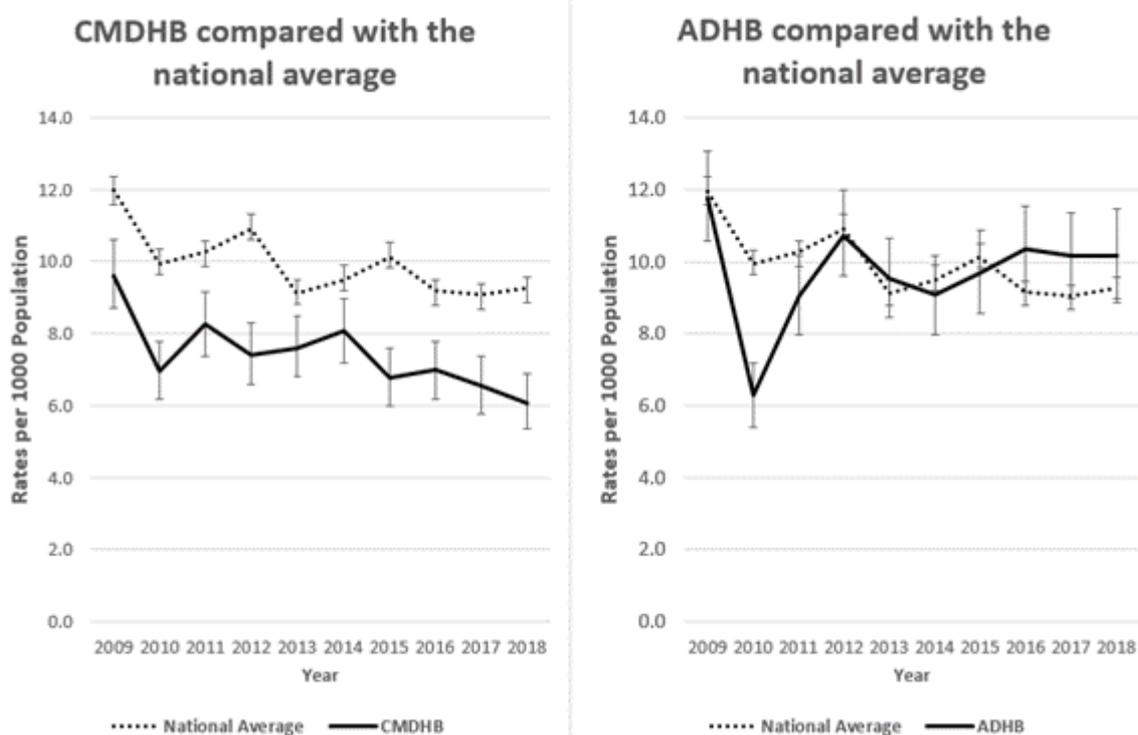
for the NZ European/Other group. The NZ European/Other group in CMDHB had rates of VT insertions that were higher than that of the national average.

Overall, the Asian ethnic group had the lowest rates, and the Pacific group had the second lowest rates of VT insertions compared to all other ethnic groups, nationally and for ADHB and CMDHB. Figure 2 shows that the pattern of VT insertions across ethnicity groups for ADHB is comparable to the national average. VT rates for CMDHB show a greater imbalance across groups, when the NZ European/Other group is compared to other ethnicity groups. The NZ European/Other group had the highest rates of VT insertions compared to all other ethnicity groups in CMDHB and the national average.

Discussion

On the whole, there was a general decline in the rates of VT insertions for the 0–4-years age group over the 2009–2018 decade. This aligns with the general decline in the incidence of AOM and OME internationally since the mid-1990s with stricter diagnostic criteria,¹⁸ as well as the move towards more conservative management guidelines.¹⁹ Another potential explanation may be the introduction of the pneumococcal vaccine into

Figure 1: Rates of VT insertions for the 0–4-years age group over 2009–2018.



Note: error bars represent 95% confidence intervals.

New Zealand's national immunisation schedule in 2008. In 2016, however, Best et al.²⁰ reported the impact of the change in immunisation regime on otitis media microbiology, and found no change in the microbiology of middle ear fluid in two cohorts of children having VT insertion.

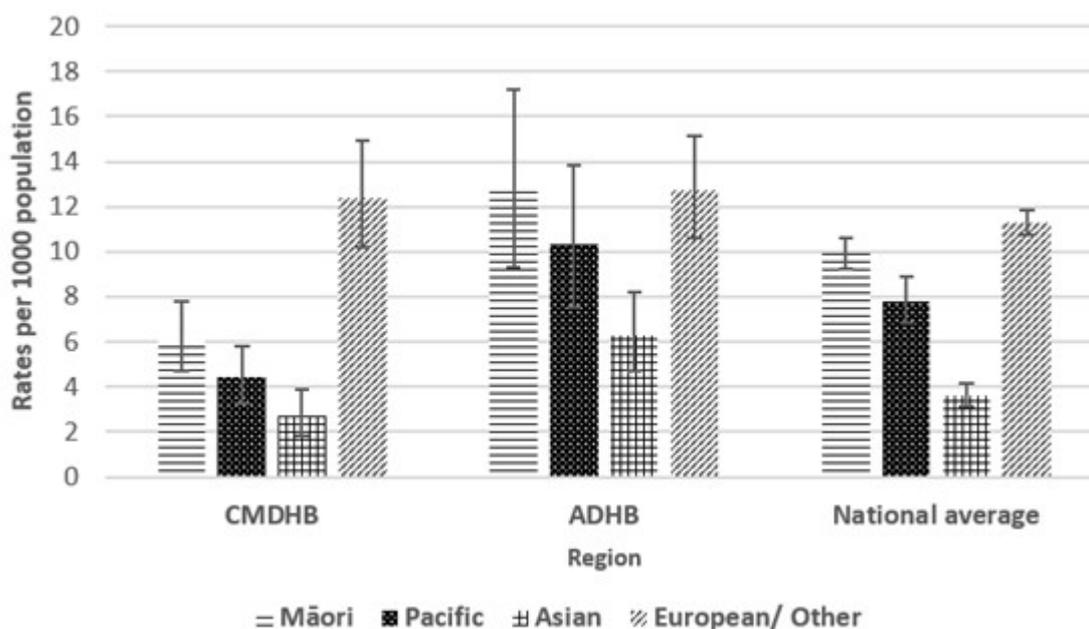
Analysis of the 2018 year showed variation by ethnicity and DHB. Two neighbouring, largely metropolitan DHBs within the Auckland Region were compared because their proximity removes some of the potential explanations for variation. Given that there is an overlap in the specialists working in the two DHBs, it is less likely that any differences can be explained simply by different medical practice or clinical decision-making once children enter the service. This does not preclude

different decisions on the basis of availability of services. For example, GPs may refer differently depending on how likely they think it is that a referral will be accepted. In CMDHB, ADHB and nationally, the Asian and Pacific ethnic groups had the lowest and second lowest rates of VT insertions, respectively, compared to other ethnic groups. The NZ European/Other ethnic group had the highest rates of VT insertions in CMDHB and nationally, but in ADHB, the rate for the NZ European/Other group was similar to that for Māori. In CMDHB, the VT rates for Māori, Pacific and Asian children, in particular, were less than half that of their respective groups in ADHB. This is striking, and raises the question as to why there was such a large difference for these ethnic groups across DHBs.

Table 1: Rates of VT insertions for the 0–4-years age group per 1,000 population, 2018.

Region	Ethnicity			
	Māori	Pacific	Asian	NZ European/Other
CMDHB	6.1	4.4	2.7	12.4
ADHB	12.8	10.3	6.3	12.7
National average	9.9	7.8	3.6	11.3

Figure 2. Rates of VT insertions for the 0-4-years age group per 1000 population, 2018.



Note: error bars represent 95% confidence intervals.

The results related to ethnicity are incongruent with the evidence that Māori and Pacific children experience a greater burden of middle ear disease than NZ European children.^{3,6,21} Recent data show rates of hospitalisations due to AOM for 0–4-year-olds between 2014–2018 were higher for Māori (1.7 per 1000) and Pacific (2.5 per 1000) children compared to NZ European (1.6 per 1000).²² Pacific children are also greatly affected by conditions that may improve with VT insertion,²³ and the Pacific Islands families study estimated that prevalence of OME or AOM among Pacific two-year-olds was 26.9%.⁶ The lack of an apparent relationship between burden of ear disease and VT insertion rates leads us to consider other explanations for these ethnic and geographic disparities in surgical interventions.

Socio-economic status is one likely contributing factor, as suggested by both national and international findings. Health inequities associated with poverty persist in New Zealand, despite children being able to access free primary healthcare and publicly-funded interventions.^{24,25} In the current analysis, ethnic disparities in VT insertions for the 0–4-years age group in 2018 were more pronounced in CMDHB than in ADHB, which is relatively consistent with other study findings where ethnic disparities in surgical admissions were greater in areas of higher deprivation.³ Socio-economic factors may be contributing to this, given the difference in deprivation profiles of the CMDHB and ADHB populations.^{12,13} Overseas data also point to socio-economic influences on VT insertion rates. For example, Falster et al.'s study²⁶ of VT insertions in New South Wales (NSW) found that Australian Aboriginal children (disproportionately affected by socio-economic disadvantage) were less likely to undergo VT insertions than non-Aboriginal children, despite the group experiencing a higher prevalence of otitis media. The situation is consistent with the inverse care law, where the availability of quality medical care is inversely proportional to the level of need experienced by groups in a population.²⁷ While socio-economic status and financial access barriers are drivers of the inverse care law in themselves,²⁸ they are interrelated with other social factors. For example, socio-economically advantaged children generally have better means of accessing health services beyond simply having private health insurance, as parents with higher levels of education or health literacy may be more equipped to navigate complex health systems, granting their children easier access to special-

ist health services.^{26,28} McCallum et al.³ allude to other possible barriers related to socio-economic disadvantage, including inability of parents to seek time off work to take children to appointments and/or costs related to attendance for their health check.

In association with socio-economic status, however, barriers to health service access related to ethnicity cannot be overlooked. Adverse impacts of colonisation on Māori wellbeing stem from key losses including land, cultural identities, political/economic independence and whānau Māori as a protective collective.²⁹ The resulting effect is that Māori (and Pacific) groups continue to face access barriers at multiple stages throughout the clinical continuum (for example, at screening, follow-up and treatment). A recent review of the WCTO programme commissioned by the Ministry of Health emphasises how the effect of colonisation is evident within these screening services.²⁹ While WCTO has its merits as a universal programme, it is fundamentally built on a Western model of care without involvement from Māori leaders or families, using tools which have not been validated for other cultures.^{23,29} A recent report on Pacific health from the Commission highlights similar issues around WCTO for Pacific families, with the majority of current screening providers not able to provide holistic care, or respond to the specific needs of families as well as the smaller Pacific providers can.²³ These cultural barriers to access may contribute to why only 59% of infants from Pacific families received all WCTO core contacts in their first year of life in 2019, compared to 81% of infants from non-Māori, non-Pacific families.²³ It is also evident that when Pacific children do access screening services such as the B4 School Check, children with serious problems like speech/language or behavioural challenges are not being detected by the programme.²³ In 2007–2008, Pacific 0–4-year-olds were found to have lower first Ear Nose and Throat (ENT) clinic appointment rates than NZ European children of the same age.³ Both Māori and Pacific 0–4-year-olds also had higher non-attendance rates for their first ENT clinic appointments compared to their NZ European counterparts, suggesting that barriers to health services are faced not only at the point of primary care, but also once referral is made to specialist services.³

Reviewers of the WCTO express a need for the redesign of the programme to be framed on Kapa Māori concepts of health and wellbeing.³⁰ This takes the form of Māori leaders, whānau

Māori and community in key decision-making roles that oversee the design, implementation and governance of the programme, ensuring a whānau-centred and strength-based approach. There is emphasis on offering flexibility, consistency and reliability, as well as the need to work seamlessly with other services in addressing the social determinants of health.³⁰ With the upcoming reform of the New Zealand public health system to include a new Māori Health Authority,³¹ and recent public discourse focusing on ethnic variance in the provision and acceptance of medical treatments in light of the COVID-19 pandemic, there may be an opportunity to ensure these requirements are fulfilled.

A strength of this study is the analysis of a national dataset that captures all New Zealand children receiving services through the DHBs. There are limitations, however. Firstly, only public data are accounted for, though inclusion of privately funded events would likely accentuate the demonstrated disparities among different ethnicity groups and the two DHBs. Secondly, the data are observational and do not reveal any impact of treatment. There is also uncertainty around some of the factors potentially influencing risk, disease prevalence and treatment pathways, such as socio-economic status and differences in how referral guidelines are used. Due to the differences in the CMDHB and ADHB demographics, VT insertion rates are also not directly comparable, and the discussion points around “expected” rates of intervention are based on what is understood about the burden of AOM or OME in existing literature. Furthermore, it is difficult to determine a standard rate of VT insertions against which DHBs should be compared. With this in mind, clinical reasons for referral (and potential barriers) for consideration of VT insertions should be explored, to determine whether there is over- or under-use in New Zealand.

Further research could also investigate Māori and Pacific families’ experiences in accessing

screening programmes and specialist services such as otolaryngology. Families’ experiences within ADHB and CMDHB could inform how such services could be made more culturally responsive and appropriate for the needs of their communities. Hearing issues in Māori and Pacific children continue to be missed under the current New Zealand hearing screening regime, and hence this also warrants further research.²³ Though this regime includes universal newborn hearing screening and a pure tone hearing test at age four years as part of the B4 School Check, it overlooks the high prevalence and impact of ear disease in 2–3-year-olds. It also does not universally check children in later school years, despite evidence for the impact of ongoing conductive hearing loss on learning and development.³² This is problematic given the apparent greater burden of ear disease particularly amongst Pacific children and the persistence of this into later school years.³³

Conclusion

This study highlights the value of comparing surgical intervention rates across DHBs, over time and across ethnicity groups. The data show a general trend of declining VT insertion rates across the country, which may be linked to a change in prevalence of ear disease in New Zealand. Although recent changes in the immunisation regime may be contributing to lower rates of AOM, and consequently (perhaps) lower rates of OME, to our knowledge there is as yet no published evidence supporting this. The finding of inequities in VT treatment for middle ear disease, with greatest impact on Pacific children, suggests significant socio-economic and cultural barriers to access. It also suggests that there may be a need for targeted middle ear screening for preschool children to detect 2–3-year-olds with ear disease, as well as the 4-year-olds who may not be completing the B4 School Check.

COMPETING INTERESTS

Nil.

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