Variation and improving services: case studies and key questions

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Executive summary

Addressing variation in health services is one of the major challenges for clinicians and managers, both in New Zealand and internationally. Observing variation raises difficult questions about the equity, quality and consistency of care, and is an important starting point for quality improvement and service development. Better management of variation is one of the core elements of performance improvement identified by an Expert Advisory Group to the Ministry of Health in developing a new Integrated Performance and Incentive Framework (Expert Advisory Group 2014).

The Health Quality & Safety Commission's Atlas of Healthcare Variation (the HQSC Atlas) is a starting point for analysing variation in a local area, and for developing service improvement activities to address variation. This guidance provides advice and examples of analysing variation and working towards reducing variability and improving care. It considers two case studies of variation derived from the HQSC Atlas and applies a generic framework to each in order to tease out the issues relevant to the local population, and to identify priorities for quality improvement. The two case studies are polypharmacy in the elderly, analysed in the context of the Canterbury population, and the use of ventilation tubes (grommets) for children under five, analysed in the context of the Waitematā population.

The generic framework considers these questions:

- Is there uncertainty or ambiguity in the clinical evidence?
- Are there quality issues?
- Is there inequity for patients?
- Is there inefficient use of resources?
- What environmental and population factors are relevant?
- How much variation should you expect?

In the examples of the two case studies this approach leads to quite different conclusions about the most productive approach for improving quality of care for the local population. In the case of polypharmacy the indicated approach is

centred around improved information and support for clinicians, while in the case of grommets, patient expectation and information are key strategies.

Ultimately, managing variation is about the core functions of clinical governance. Both within New Zealand and internationally there is increasing interest in using observations of variation as the starting point for identifying and prioritising quality improvement and clinical governance activities. The HQSC Atlas approach can support careful analysis, judicious use of clinical judgement, and challenging work with clinical professionals. Effectively utilised, there is enormous potential for positive effect in the form of improved health services for patients and communities.

1. Case study: polypharmacy in the elderly

1.1 Background

Polypharmacy is defined in various ways, including: the use of multiple medications or medications which are not indicated; inappropriate or unnecessary drug use; use of many or more concurrent medicines; mismatch between medicine and diagnosis; or potentially inappropriate prescribing. Where many definitions are possible, it is important to identify the definition which is most meaningful in the local context, and to the clinicians who will be involved in the discussion about addressing variation.

Since elderly people have a higher rate of comorbid conditions than younger people, applying routine treatment guidelines can easily lead to polypharmacy. This can bring risks of adverse effects and interactions, non-adherence, medication errors, falls, hospital admission and increased mortality. Polypharmacy raises difficult issues about the application of clinical evidence to the case of complex patients with multiple comorbidities.

Atlas information

The HQSC Atlas provides several views of polypharmacy data. It provides data for people aged 65 and older, and specific measures for:

- people receiving five or more long-term medications
- people receiving five to seven long-term medications
- people receiving eight to ten long-term medications
- people receiving 11 or more long-term medications.

There are particular issues of risk, especially for falls, where sedatives and other psychoactive medicines are involved. Combinations of other medicines with anticoagulants can also flag clinical risk. The HQSC Atlas therefore provides specific cuts of data for people who receive:

- an antipsychotic
- benzodiazepine/zopiclone
- both an antipsychotic and a benzodiazepine
- both an antiplatelet and an anticoagulant.

Atlas results for Canterbury

In 2009, the HQSC Atlas shows that moderate polypharmacy (5 to 7 long-term medicines) for people aged over 64 in Canterbury is not higher than across the rest of New Zealand, but that Canterbury is significantly higher than the rest of New Zealand in the number of people aged over 64 with 8 to 10, and 11 or more, medications.

Canterbury is shown as purple in Figures 1–6 and Figure 8 below.

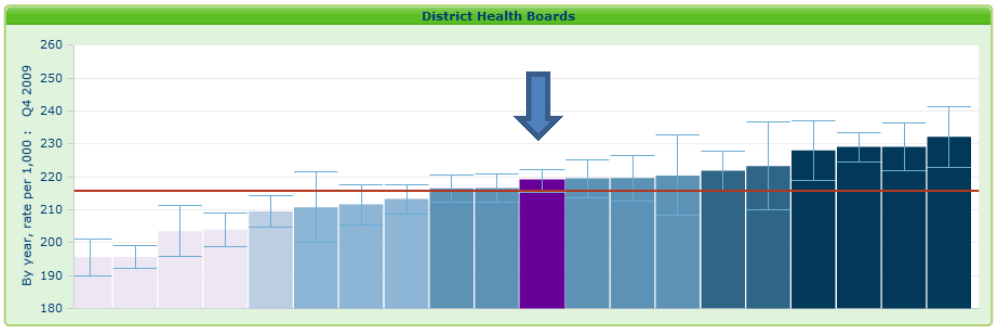

Figure 1: Canterbury – 5 to 7 long-term medications 2009

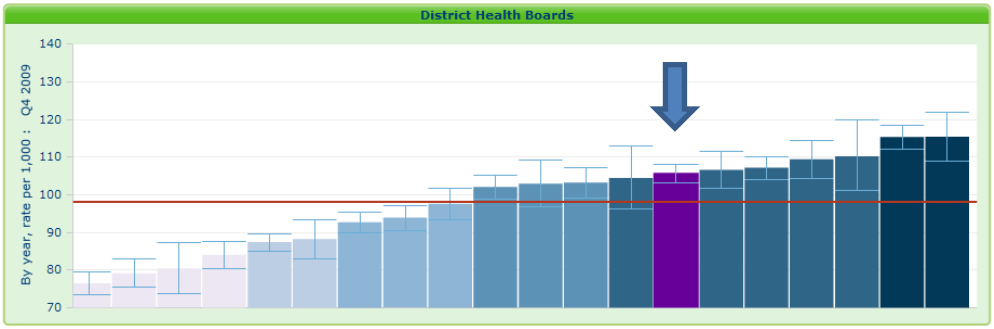

Figure 2: Canterbury – 8 to 10 long-term medications 2009

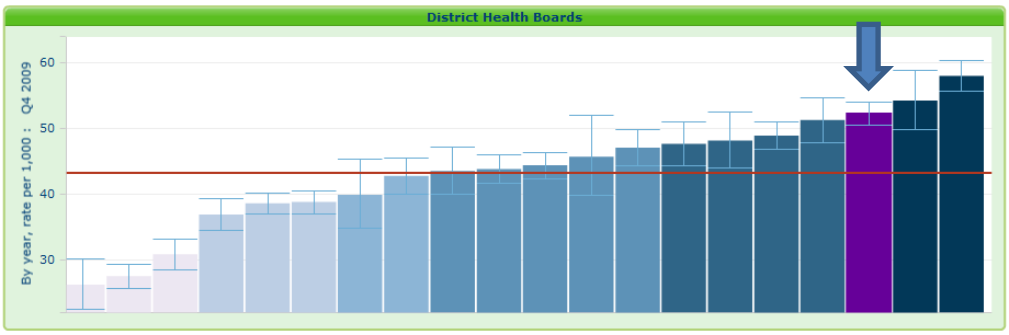

Figure 3: Canterbury – 11 or more long-term medications 2009

In 2009 Canterbury had the highest rate of antipsychotic prescribing for the elderly in New Zealand, by a substantial margin.

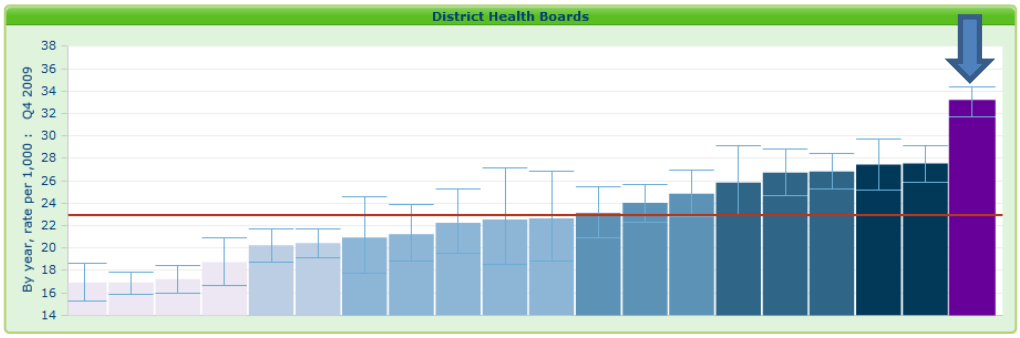

Figure 4: Antipsychotics for people aged 65 and over 2009

By contrast the rate of benzodiazepines for people aged over 64 was not significantly higher in Canterbury than the New Zealand average.

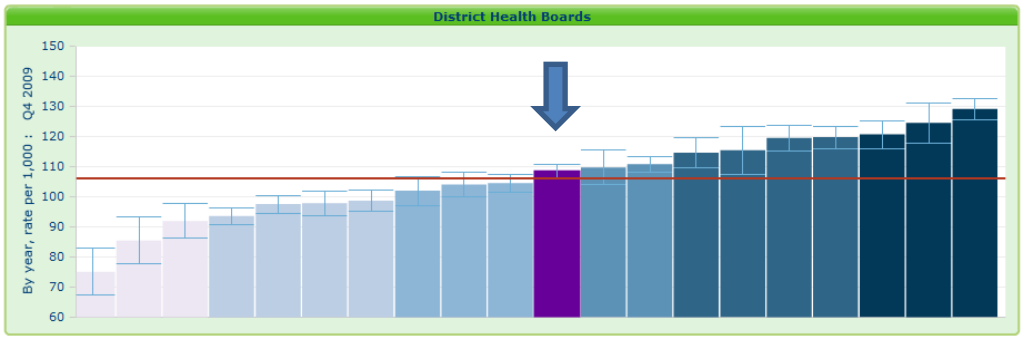

Figure 5: Benzodiazepines for people aged 65 and over 2009

Pegasus Health education programmes

Pegasus Health works with the majority of general practices in Christchurch. Pegasus delivered an education programme on polypharmacy to participating general practitioners in September 2009, and the HQSC Atlas confirms that Canterbury polypharmacy levels have dropped since then. Pegasus also delivered an education programme to general practitioners on atypical antipsychotics in May 2010, and provided specific feedback on rates of quetiapine prescribing. In 2011, Canterbury's level of high polypharmacy was very close to the national rate, although antipsychotic prescribing for the elderly remained very high.

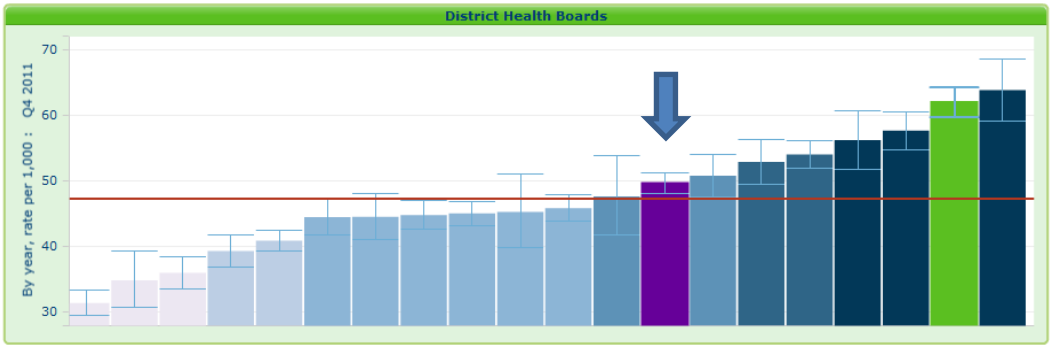

Figure 6: Canterbury – 11 or more long-term medications 2011

This result is in part due to the trend in polypharmacy declining slightly in Canterbury, while increasing across the rest of New Zealand. Canterbury clearly has a different polypharmacy trend from the rest of the country over this time period in the high polypharmacy group, where patients have 11 or more long-term medicines.

Figure 7: Patients aged 65+ with 11 or more medications 2009–2011

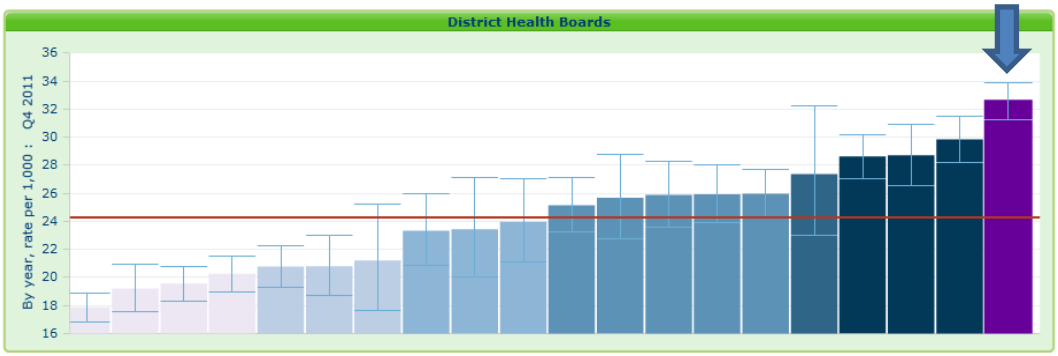

Figure 8: Antipsychotics for people aged 65 and over 2011

While Canterbury is high for antipsychotics across all age bands for the elderly, this is particularly the case for the very elderly, aged 85 and over.

Figure 9: Antipsychotics by age band

1.2 Review

Are the data complete and accurate?

The data used to analyse variation are very complete and accurate in terms of dispensed prescription medicines, although prescribed (but not dispensed) and over-the-counter medication are not included in the data. The national dataset on dispensing has the advantage of being nationally validated and regularly updated. The challenge is that these data cannot easily be linked to patient denominator information within a PHO, making analysis at the level of individual prescriber very difficult, if not impossible, to conduct robustly. This is particularly the case in polypharmacy, because it is inherent in the nature of the problem that there will often be many prescribers involved in the care of the patient, so attributing prescribing decisions to any one practitioner is difficult to do in a robust fashion. In using the HQSC Atlas data as a starting point for looking at polypharmacy in Canterbury, the analysis therefore focuses upon describing patterns of polypharmacy across the district, and is complemented by providing query files to general practitioners to facilitate their analysis of data from their own practice systems.

The difficulty with facilitating analysis of data from practice management systems is that, since it is clear that many different prescribers are commonly involved in the care of this patient group, a practice management system may only capture part of the prescribing picture for a given patient. In this case the data, while readily accessible to the general practitioner, may be incomplete, and provide limited support for reviewing patient management.

The answers to these challenges involve working to improve information at two levels. The first is to continue the implementation of shared care records, allowing general practitioners, pharmacists and hospital clinicians to share information for the care of individual patients. In the case of Canterbury, electronic shared care records are well down the path of implementation, and are supporting clinicians to have more complete information about the care provided to patients under their management.

The second challenge is to improve the management of national pharmaceutical datasets so that they can be linked, securely and with appropriate restrictions

upon access and use, to denominator data from patient registers. From the perspective of analysing variation in prescribing within a district, this allows significantly more valuable analysis to be performed in a robust fashion, and information to be provided to clinicians about their own practice.

Is there uncertainty or ambiguity in the clinical evidence?

There is both clarity and uncertainty in clinical evidence around polypharmacy, summarised in the HQSC Atlas. Evidence of the downsides of polypharmacy is clear, both in New Zealand and international data, with increased medicine interactions, and hospitalisations (Davis et al 2002). Polypharmacy is clearly associated with increased risk of side effects, interactions, adverse events and hospital admissions (Patterson et al 2012). There is a lack of evidence for the use of antipsychotics in the elderly.

At another level, evidence about polypharmacy in disease management is often unclear, or the applicability of evidence is uncertain. If practice guidelines focus on advice for the management of patients with a single disease, the prescriber may be left with considerable uncertainty about the best management of a patient with complex comorbidities. Polypharmacy for the elderly, then, is a phenomenon which emerges in the presence of considerable uncertainty at the individual level about the clinical best practice, and there is scope to provide advice and support to prescribers who work within this uncertain environment.

Are there quality issues?

Variation in polypharmacy primarily raises questions about quality of care. There is extensive material which can be provided to local prescribers about adverse events, and about addressing polypharmacy for elderly people (eg, Patterson et al 2012), while New Zealand studies have been conducted which document the level of hospital admission which can be attributed to medication error, strongly associated with polypharmacy (Davis et al 2002).

Is there inequity for patients?

Polypharmacy is not an equity issue in itself, although the consequences of polypharmacy may fall out differently for patients in different categories of age, sex and ethnicity. Polypharmacy may need to be balanced against the potential for unmet need for medicines for some population groups.

Is there inefficient use of resources?

Most variation in polypharmacy does not directly raise issues about the inefficient use of health system resources, although where the consequences of polypharmacy involve pharmacists in addressing complex medication issues, or avoidable hospital activity as a consequence of adverse events, polypharmacy may be associated with avoidable use of health care resources.

Where polypharmacy variation may raise a more direct question about the efficient use of health care resources is in the use of antipsychotics. The antipsychotics olanzapine, quetiapine and risperidone accounted for $2.9 million in medicine cost for the Canterbury health system in the 2009 calendar year, with prescribing analysis suggesting that low-dose off-label prescribing is likely to account for a significant element of this, particularly with quetiapine. There may well be potential to redirect some of this health care resource to other more beneficial uses.

What environmental and population factors are relevant?

There are many complex environmental factors which could increase or decrease the prevalence of polypharmacy in a given area, or for a given prescriber. In Canterbury these include:

- information systems, and access to shared care records, allowing clinicians to have a comprehensive view of care provided to individual patients. These have been widely implemented in Canterbury since 2010.
- the presence of multidisciplinary medicines review programmes, such as medicines therapy assessment or medicines management programmes. Medicines management has been implemented in Canterbury, with a large number of patients having their medication reviewed by a community pharmacist.
- hospital discharge policies, and secondary care clinical practices
- the general health of the population. In an area of high morbidity, a greater degree of polypharmacy might be expected. While Canterbury has a large population of elderly people, there is no specific reason to think that they have a higher general level of morbidity than other parts of New Zealand.
- the number of psycho-geriatric beds in the district, which is high in Canterbury

- the Canterbury earthquakes. These have likely had an adverse impact on the physical and mental health of the population, potentially creating marked increase in health need for some population groups. Evidence from other natural disasters finds a particular impact on mental health across the population, which anecdotally is supported by the experience in Canterbury.

Each of these factors can have a strong influence upon the environment in which individual primary care practitioners manage patients with complex comorbidity. System-level structures, such as shared information systems and medicines review programmes, have the potential to make a marked difference to the information available to prescribers, and to support the decisions they make with individual patients.

The other important system-level factor arises from hospital practice. As with many aspects of care, particular practices or procedures in a hospital can affect a whole population, across many different primary care services. In the case of Canterbury, hospital services have engaged in a specific programme for reviewing polypharmacy upon discharge (known as the Pill Pruning Project), which in this case is complementary to education programmes delivered to general practitioners.

How much variation should you expect?

At the inter-district level it might be expected that there would be substantial variation in polypharmacy, since there are a number of environmental or system-level factors which are likely to vary across districts. But within a district the numbers of elderly receiving multiple medications is large, and the effect of random variation between individual prescribers is likely to be small. It could be expected that within a district there should be relatively little polypharmacy variation, although measuring this robustly is complex because of the difficulty of linking patients to prescribers in a simple and robust fashion. If there is substantial variation between practitioners this is likely to represent an issue of quality of care, and it could reasonably be expected that this should narrow with improved clinical guidance and information systems.

1.3 Analysis

The data issues in analysing polypharmacy are complex. The dataset available to Pegasus comes from the national pharmaceutical data warehouse, available to most DHBs and many PHOs and networks, and is the same basic source of information used by HQSC to develop the Atlas. This dataset is comprehensive, very complete and well validated.

The major challenge with the data is that, while prescribers are identified by medical council number, patient identifiers are encrypted. This means that patient information cannot be linked to other data, such as PHO registers. Consequently, attributing the prescribing for any one patient to a particular prescriber is difficult. For example, in the last quarter of 2009, 3862 people were prescribed 11 or more continued medicines, using a methodology similar to that in the HQSC Atlas. These patients had an average of 3.6 different prescribers involved in their care over a six-month period. Only 16 percent of these patients were prescribed medicines by a single doctor in the six-month period.

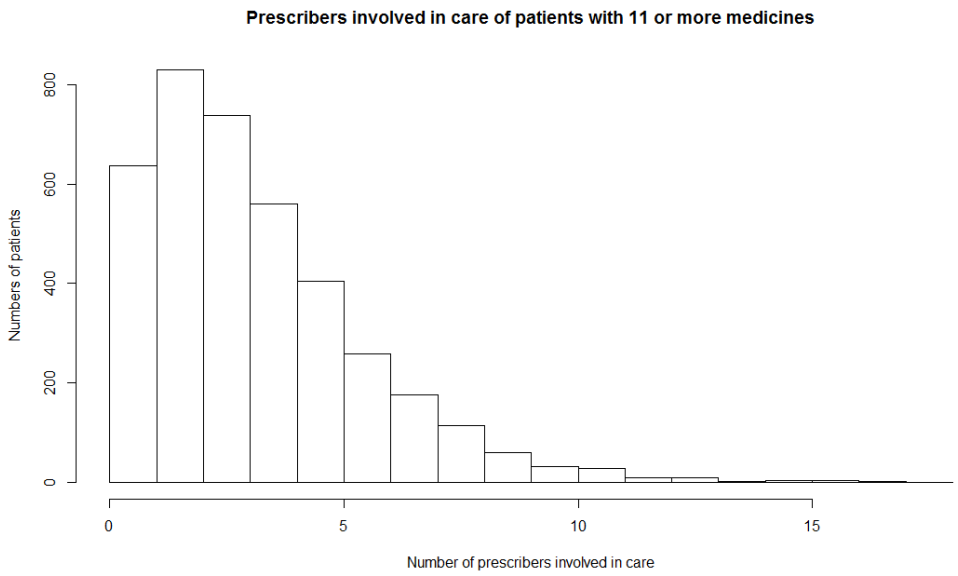

Figure 10: Number of prescribers per patient

Although in principle a patient's general practitioner should have an overall coordinating role in prescribing medication for an individual person, and reviewing prescribing post hospital discharge is an important task for a general practitioner,

the data do not support attribution of an individual's care to registration with a specific general practitioner. This means firstly that analysis of variation within the district is very difficult, and secondly that it is not possible to use these data to feed back polypharmacy information to individual prescribers with a high degree of robustness.

The strategy to address this is twofold:

- Firstly, use the pharmaceutical warehouse data to describe the general characteristics of polypharmacy in this population.
- Secondly, provide prescribers with tools to analyse their own information from practice data.

At Therapeutic Group level 2, the most common categories of medicines for patients receiving 5–7 medicines are shown in Table 1.

Therapeutic Group 2	Patients receiving medicine
Analgesics	12,918
Antithrombotic Agents	10,085
Lipid-Modifying Agents	7738
Agents Affecting the Renin-Angiotensin	7395
Beta Adrenoceptor Blockers	6769
Antiulcerants	5163
Diuretics	5077
Vitamins	4625
Calcium Channel Blockers	4251
Minerals	3248
Antidepressants	2946
Diabetes	2455
Laxatives	1714
Drugs Affecting Bone Metabolism	1662
Thyroid and Antithyroid Agents	1561
Alpha Adrenoceptor Blockers	1532
Sedatives and Hypnotics	1434
Non-Steroidal Anti-Inflammatory Drugs	1177
Nasal Preparations	1058
Nitrates	1027

Table 1: Top 20 medicines for patients receiving 5–7 medicines 2009

The contents and rank order of medicines in this table is similar for patients receiving a larger number of medicines, and across the two periods for which data were available. It is unsurprising that the core medicines are those associated with heart disease and secondary prevention, with laxatives, diabetes, antidepressants, thyroid and sedative agents entering the list lower down.

Using an approximate population denominator, the graph in Figure 11 shows the rate of polypharmacy for the two years by age band. The overall pattern appears to be that higher levels of polypharmacy have remained fairly stable, while there has been some increase in moderate polypharmacy (5–7 medicines) for the very elderly.

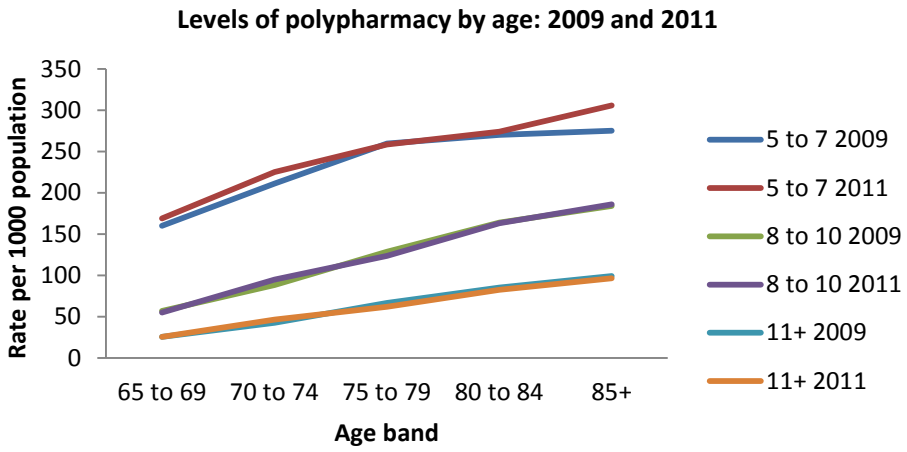

Figure 11: Polypharmacy trends in Canterbury

Canterbury shows a high proportion of antipsychotic prescribing for the elderly. In this dataset, 1435 patients received olanzapine, quetiapine or risperidone in Q4 2009, which had increased to 1512 patients in Q4 2011. Patients receiving these medications were on average receiving 7.5 different medicines in 2009, which had increased slightly to an average of 7.6 medicines in 2011.

Comparing the age profile of patients receiving these three antipsychotics between the two years, Canterbury appears to have reduced the proportion of very elderly receiving these medicines, but has seen an accompanying increase in their use in people aged 65–69. This younger group are unlikely to have their medications strongly influenced by psycho-geriatric facilities.

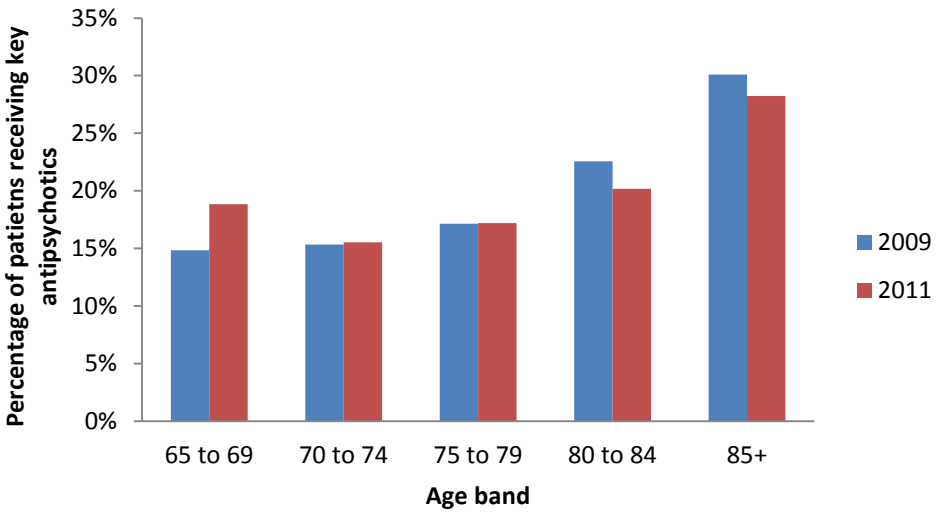

Figure 12: Age profile for key antipsychotics

1.4 Actions

Given the analysis of patterns of polypharmacy in Canterbury, and the review of causes and impacts of variation, the following quality improvement approaches are likely to be worthwhile and effective. These approaches have been undertaken in Canterbury in various ways since 2009, and in combination appear to have had some impact upon polypharmacy for the very elderly, although not in the younger old group, aged 65–80.

Approach	Rationale
Guidance for prescribers about reviewing and stopping medication	The major area of uncertainty for prescribers is the application of evidence and guidelines where patients have complex comorbidities. The Pegasus education round in 2009 provided evidence on pharmacokinetics in the elderly; a framework, supported by literature, for decision-making about treatment with the elderly; advice on specific medications which carry heightened risks; and evidence on benefits after discontinuing medications. This directly addresses the major area of uncertainty for prescribers which is likely to lead to polypharmacy. Reviewing and extending this guidance as it applies to a younger group may be appropriate.

Provide specific evidence and guidance on antipsychotic use	An education round on atypical antipsychotics was delivered in 2010, and further work may be needed to monitor and follow up in this area.
Improved sharing of patient information	Polypharmacy touches upon the activity of multiple health professionals. Improving the shared information between health professionals supports prescribers in making informed decisions with patients, and helps to make them aware of the full range of medicines being received by a patient.
Facilitate prescribers' analysis of their own data.	Pegasus provided MedTech queries to help general practitioners identify patients from their own practices who receive multiple long-term medications. Analysis of practice could be further supported by follow-up and structured comparison of data in peer groups.
Work with secondary care clinicians to align primary and secondary care prescribing patterns	Hospital activity is likely to be an important driver of prescribing patterns post discharge, supporting secondary care clinicians with evidence and guidance, as well as designing hospital processes. An important multidisciplinary approach is likely to be needed for the management of psychogeriatric beds, where there may be a particular issue in Canterbury.

As with any analysis of health data, there are many questions which arise and which are worthy of further investigation. Some of these issues are susceptible to further analysis with information which is already available in primary care in Canterbury, while other questions may require further information, or better capacity to link datasets to support robust analysis.

Key questions for further investigation are:

- What is driving the use of antipsychotics in the younger elderly?
- Can prescribing data be attributed accurately to general practice populations?
- If prescribing data could be linked to hospital discharge data, could specific analysis of patterns of medication post discharge be examined and fed back to both primary and secondary clinicians?
- How variable is the uptake of medicines management programmes and the use of multidisciplinary pharmacist input to manage polypharmacy across the district?

1.5 Commentary

This case study of variation in polypharmacy highlights a number of points.

- Because the same data were available, and the HQSC Atlas website provides explicit documentation of the methodology used, reproducing the particular definitions of polypharmacy used in the HQSC Atlas was reasonably straightforward. There were some ambiguities in the documented method, including whether the years used were calendar or financial.
- Because the HQSC Atlas definition of polypharmacy was easily reproduced, various slices of Atlas data for the particular district were a useful starting point, and provided a good overall context for the pattern and trend of variation.
- In this case, using national data to provide direct feedback to individual primary care prescribers is difficult to do robustly. Providing data to general practitioners on their own practice requires working with them to use their own practice management system information.
- It was possible to extend some elements of the analysis to tease out additional components of variation at a local level, although this was limited by the data available.
- In this case, a number of quality improvement initiatives in this area had already been developed and implemented, and may have contributed to the stable level of polypharmacy, compared to the national trend.
- Reviewing polypharmacy for Canterbury reveals a number of environmental drivers of polypharmacy, suggesting that a quality improvement focus should be both upon primary care prescribers and upon system factors, including clinical information systems, hospital prescribing and discharge, and delivering multidisciplinary medicine review programmes.
- Pharmaceutical data are very rich, but they are also complex to analyse. It is important to be able to manage a large dataset with a suitable database programme, and to be meticulous about the logic of calculating patient ages and rates. It is easy for simple mistakes to produce artefactual conclusions, and it is important that analysis be peer reviewed thoroughly before being shared with clinicians.

Overall, even in an area as complex and multifactorial as polypharmacy, where the ability to link data to individual practitioner is limited, a systematic approach suggests a range of quality improvement interventions which can be undertaken within a district. In a complex field such as this it is likely that a number of simultaneous approaches to the issue will be more successful than a single approach, so the combination of working with individual prescribers with system-

level approaches such as information sharing, the pharmacist medicines management programme, and hospital “pill pruning project” will all contribute towards a result. The example in Canterbury, where the trend in polypharmacy has remained steady by comparison with a nationally increasing trajectory of polypharmacy, suggests that these approaches can, in combination, have some impact.

2. Case study: ventilation tubes

2.1 Background

In New Zealand, ventilation tubes (commonly known as grommets) are most commonly used to treat recurrent acute otitis media and otitis media with effusion (OME, or 'glue ear'). Over 90 percent of children in New Zealand are believed to experience an episode of OME before they reach school age. Alternative treatments for these conditions include watchful waiting and antibiotics.

A review of evidence for a New Zealand PHO in 2012 found that while a number of Cochrane reviews had shown that grommets were beneficial in improving hearing over a period of six months post-surgery, longer term outcomes were no better under surgery than without. The conclusion is that in children with OME, the effect of grommets on hearing is small and diminishes after 6 to 9 months, by which time natural resolution also leads to improved hearing in non-surgically treated children. While grommets may reduce recurrent acute otitis media, they also bring complications, including an increased risk of mild tympanosclerosis, and tympanic membrane abnormalities.

Atlas information

The HQSC Atlas provides several views of grommet data for patients aged under 15. The unit of measure is the number of grommet surgeries performed per 1000 population. This is summarised by the rate per year by DHB (for three years, ending June 2012). The data can be broken down by ethnicity and five-year age band.

Atlas results for Waitematā

Between July 2009 and July 2012, Waitematā had an average annual rate of 7.5 grommets per 1000 population (for patients under the age of 15). This is 14 percent higher than the national average of 6.6. The rate in Waitematā increased over the three years, while the national rate remained constant over the time period.

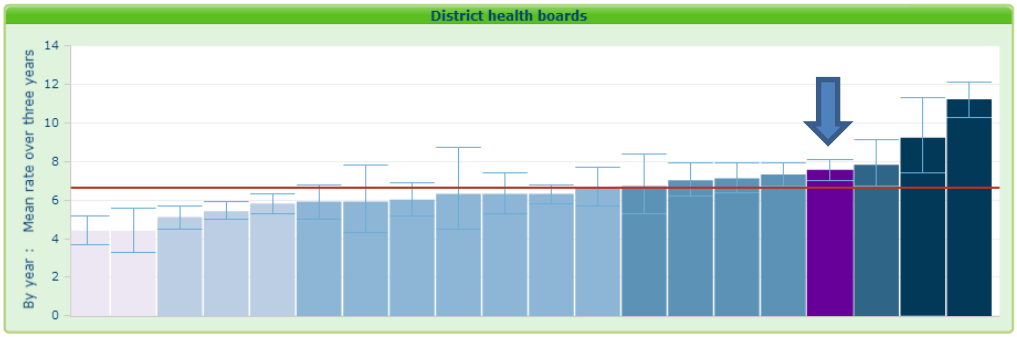

Figure 13: Grommet surgeries per 1000 population by DHB, three-year average June 2009 to July 2012

Across the country the highest rate of grommets is in those aged 0–4 and who are Māori. In Waitematā this difference is greater than the national average. This can be seen in Figures 14 and 15. Waitematā appears to differ from the national average, particularly in the rate of grommet use for younger children, under 5, rather than for children aged 5 to 14 (**orange = Waitematā**, **red = national average**).

Figure 14: Grommet surgery by age group 2012

Figure 15: Grommet surgery by ethnic group 2012

The significant difference in grommets for Waitematā therefore appears to be in the high rate which they provide for children under 5, and for Māori children, in particular.

Approximately half of New Zealand's DHBs have guidelines for referral and for surgery. Waitematā have guidelines for both.

	Referral	Surgery
Waitematā	Yes	Yes
Other DHBs	10 Yes 9 No	9 Yes 10 No

Table 2: OME guidelines in DHBs

2.2 Review

Are the data complete and accurate?

The data in the HQSC Atlas derive from the National Minimum Dataset. While this is therefore complete and accurate on its own terms, there are a number of issues which might limit the conclusions which could be drawn.

- Where there is a vigorous private health care market, as is the case in Waitematā, privately funded surgery will not appear in the National Minimum Dataset. This could have the impact of underestimating the true level of referral for grommets in some areas, and of creating an appearance of variation where none exists. However, in the case of Waitematā, the overall rate is higher than in the rest of New Zealand, especially for younger children, even without considering the additional volume of surgery provided privately. The impact of missing private sector data would therefore be to underestimate Waitematā's rate of grommet use, making the difference from the national rate even greater than estimated in this dataset.
- The HQSC methodology does not distinguish between grommet procedures for a single ventilation tube, or where two tubes are inserted at once. Different practice across different hospitals could potentially distort comparisons, if some hospitals have a policy of doing only one ear at a time while others will do both.

There is considerable potential for analysing local data, but this would require collaboration between PHOs and the DHB. The best approach would probably be to try to link data, with suitable privacy protocols in place, between the DHB for inpatient and outpatient care, and practice registers, for the denominator of enrolled children. Analyses which could be performed would include:

- general practice rates of grommet insertion
- more detailed analysis of deprivation and ethnicity effects in the rate of grommet insertion, and how they interact
- potentially linking to prescribing data to look at how many episodes of antibiotics have been used in the population of children who have received grommets
- if diagnosis data are available, measuring the proportion of children diagnosed with acute otitis media and OME who receive grommets.

As an initial starting point for locality analysis, it is possible to use national data to examine whether there is variation within Waitematā, albeit on a geographical basis rather than on the basis of enrolment with different practices.

Is there uncertainty or ambiguity in the clinical evidence?

The evidence on benefits and risks from use of grommets is relatively clear. There are several Cochrane reviews showing relatively limited and short-term benefit, and guidelines have been made available in Waitematā. The National Health Committee issued a technology note in January 2013 summarising the evidence for use of grommets, which noted the substantial variation in use of the procedure across DHBs, and that no standard pathway of care exists across DHBs.

Overall, there is relatively little uncertainty in the evidence for the clinical impact and appropriate use of grommets.

Are there quality issues?

Inappropriate use of grommets can risk exposing children to complications such as tympanosclerosis, which may in turn have a moderate impact upon hearing. Use of grommets also exposes children to anaesthetic risk. The quality issue is generally about whether children are exposed to unnecessary care which brings little benefit.

Is there inequity for patients?

At one level there is clearly a difference in the use of grommets between Māori children and those of other ethnicities. The high use among Māori children could reflect a greater prevalence of OME and acute otitis media in this population, or it could reflect later presentation with greater recurrence or more severity, thereby raising the probability of referral. The major question of inequity which variation in grommet use raises is about the effective provision of preventive care for children of Māori ethnicity. The Communicable Disease Centre recommends avoiding second-hand smoke and air pollution, ensuring full immunisation and breastfeeding as preventive measures for paediatric ear infections.

Is there inefficient use of resources?

Elective surgical procedures are in high demand in New Zealand, and the shortage of supply and length of waiting time to receive surgery are prominent and politically controversial issues. If elective surgery is being used inappropriately, or with a low level of benefit, this represents an inefficient use of resources which could potentially be better used for the health of the population. In this case the resources include the specialist surgical workforce, both in assessment consultations and in theatre time, as well as the nursing and allied workforce involved in delivering the services, the physical resources of theatre, and the time and resources of the patient and their family, who may have to set aside time and possibly travel to hospital services. There is considerable scope for variation in use of grommets to suggest inefficient use of health system resources.

What environmental and population factors are relevant?

As well as the individual referral decisions of clinicians in primary care, a number of environmental factors could influence the rate of grommet use.

- *Patient expectations and community experience*. Grommets are a good example of preference-sensitive care, in which the benefits and downsides are not necessarily clear. In this case community expectations of the benefit of grommet use could be an important factor in the overall utilisation of ventilation tubes, and there may be a place for improving consumer information for parents.
- *Surgical practice*. Since hospital services tend to be relatively centralised within a district, the practice of a small number of hospital specialists can influence patterns of care across a whole population.
- *High prevalence rates*. If there is a higher prevalence rate of OME and acute otitis media, then the issue is less one of patterns of health care, and more one of epidemiology and prevention
- *High levels of severity*. If patients present later, having experienced more occurrences of OME and acute otitis media, this may generate a higher level of referral. Higher levels of severity can be related to health-seeking behaviour, which can vary markedly across different cultures, and with barriers to accessing primary care.

Environmental and population factors could potentially be very important in determining local rates of use of grommets.

How much variation should you expect?

While there is variation across New Zealand, at a rate of approximately 10 per 1000 under-5-year-olds, grommets are still a relatively rare procedure in population terms. The statistics of this are robust at district level (the HQSC Atlas shows clear differences with confidence intervals between DHBs), but analysis may be more difficult within districts, as a relatively unusual procedure with smaller numbers of children could be difficult to compare across practices and small communities. Random variability is likely to be a challenge for analysis. This issue is examined further in the analysis below.

2.3 Analysis

The data used for this analysis were extracted from the National Minimum Dataset, and therefore have the limitation that they do not include information on private sector procedures, nor can they be linked to primary care denominator data. But these limitations do not mean that the information is not useful for drawing conclusions about variation, equity and effective use of public health resources. The data do include more detailed area information, based upon patient residence, which allow some degree of analysis of whether there is variation within the district.

Compared to the rest of New Zealand, Waitematā has:

- approximately half the proportion of Māori people, and nearly twice the proportion of Asian. Since Māori have a high rate of grommets insertion, this would predict a lower overall rate for Waitematā, all things being equal.
- less deprivation (mean 2.7 vs 3.1, on the NZDep06 quintile scale), with only 10 percent of people in the most deprived quintile
- similar sex and age distribution to the national average.

Within the Waitematā district, there are 144 area units, with an average of 250 children under 5 living in each one. In the year ending June 2012 there were 552 ventilation tube surgeries for children in Waitematā. The rate of surgery for children across the area units in Waitematā is shown in Figure 16.

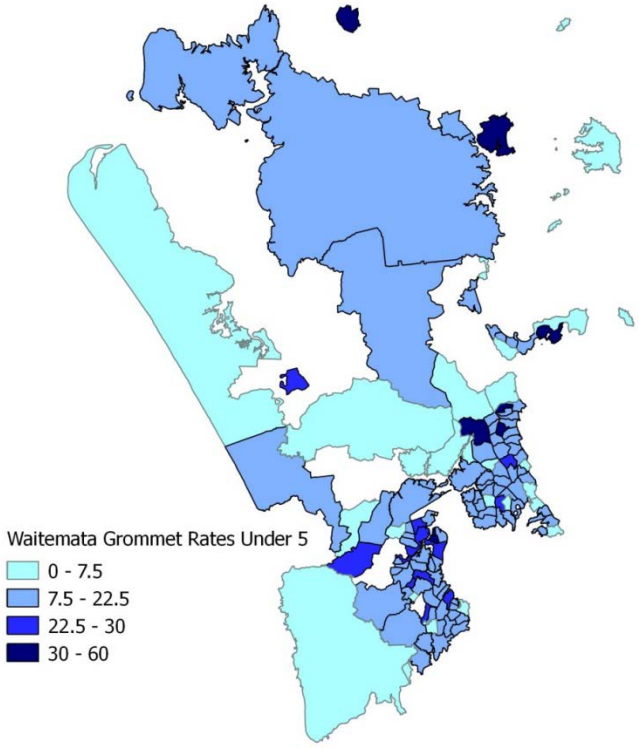

Figure 16: Grommet surgery/1000 children aged 0–4 by census area unit

Rates of grommet insertion per 1000 children under five appear to vary markedly across the district. However, while the mean number of children living in a census area unit is approximately 250, there is a considerable range, and some areas have smaller numbers of young children. A simulation of how much variation is expected across Waitematā area units shows that the expected variation is almost identical to the variation actually observed. While there is a wide distribution with a long tail of higher rates, this is exactly what would be expected on the basis of a relatively rare intervention at population level (see Figure 17 – the coloured bars show the actual distribution, the black line shows the simulated distribution, with 95 percent confidence intervals in broken lines above and below).

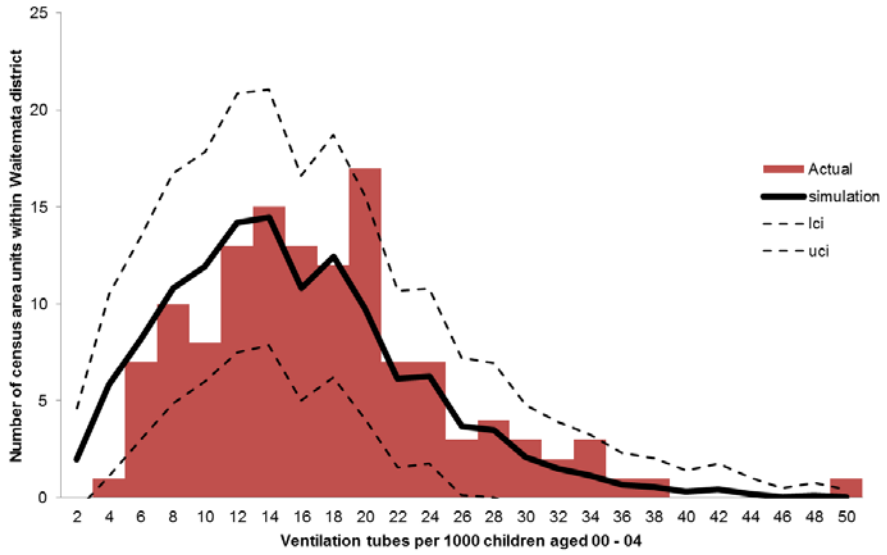

Figure 17: Expected and observed variation in grommet surgery rates by census area unit

Within Waitematā, there was no strong relationship observed between the deprivation of patients and the rate of grommets, although there is a slightly higher rate in children from deprivation quintile four. The interaction between deprivation and ethnicity could be a subject of further analysis at local level.

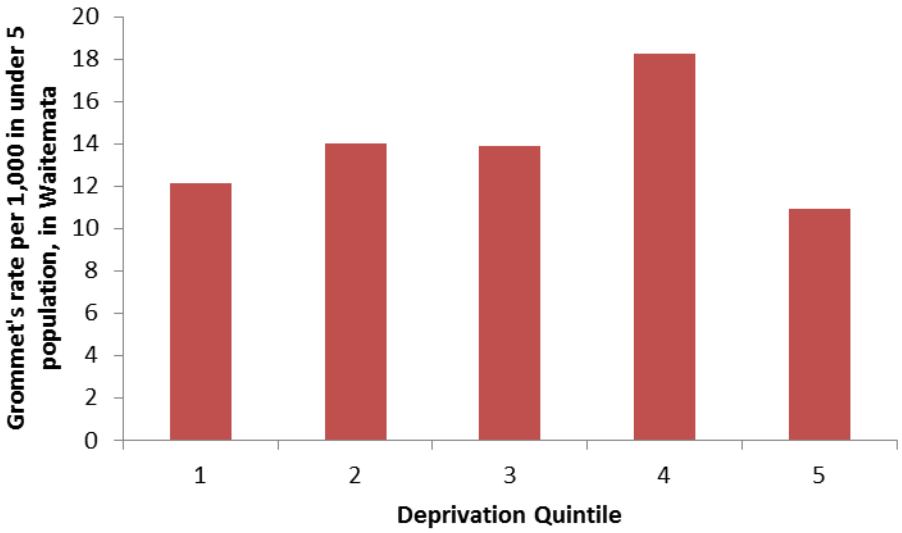

Figure 18: Grommet operations by deprivation category/1000 children 0–4

2.4 Actions

Given this analysis, and what is already known about the issue of ventilation tubes, the following approaches are likely to be worth investigating. These are premised upon the basis that Waitematā has a high rate of grommet use as a district, although there is little evidence of strong variation within the district. An analysis on the basis of enrolled patient denominators might change this view, but on the present information the focus of quality improvement should be much more upon shifting the whole curve of grommet use within Waitematā, rather than focusing on variation across individual referrers and specific practice populations. Essentially, reviewing this variation suggests that the issue is one of significance, with implications for both the quality of care and the efficient use of health resources, and that environmental factors operating across the district are likely to be more important than specific aspects of practice style and difference in clinical decision-making among referrers.

Approach	Rationale
Review patient information resources	If patient demand is a major factor, then resources to support general practice in informing patients about the evidence on benefit and risk of ventilation tubes may help referrers to manage demand, and support referrers to engage in watchful waiting, rather than early referral. There may be potential to work with preschool education facilities and other community organisations to disseminate information to the wider population, and to modify demand for the procedure.
Undertake clinical audit	Support referrers to undertake clinical audit of children referred with grommets, collecting and critiquing information on presentation, recurrence, and management prior to referral.
Undertake work on prevalence of OME and acute otitis media	A possible approach could be to establish a number of pilot practices to code consistently for OME and acute otitis media, allowing accurate assessment of the local burden of disease. While Gribben et al (2012) have analysed the prevalence of acute otitis media nationally, those results do not allow differential analysis by district, and understanding whether Waitematā was different in this respect would help to inform future action. An informed planning and funding role across the health system is likely to seek the best available information on cost-effectiveness and need for grommets, and to work with funding mechanisms and pathways to match the estimate of most appropriate and cost-effective need.

2.5 Commentary

This brief example of variation in ventilation tubes highlights a number of points:

- the interconnectedness of the issue across the health system, from patient information and knowledge, to referrer evidence, to surgical practice
- the importance of environmental factors in determining local patterns of health care
- apparent large local-level variation can be an artefact of small numbers and low rates, meaning that within a district, variation is a less important factor than the overall level of utilisation in the district

- the need for further information, but much of this is centred around the actual incidence of the disease, and understanding the nature of need and demand in the population, rather than necessarily being focused upon clinicians and their practice.

3. Understanding variation

3.1 Types of care

A common approach to thinking about the impact of variation is to consider the kind of care involved, and how susceptible it might be to different influences upon clinical decision-making. Wennberg (2011) has developed the following approach.

- *Effective care:* defined as interventions for which the benefits far outweigh the risks; in this case the 'right' rate of treatment is 100 percent of patients defined by evidence-based guidelines to be in need. Unwarranted variation is generally a matter of underuse.
- *Preference-sensitive care:* when more than one generally accepted treatment option is available, such as elective surgery. The right rate should depend on informed patient choice, but treatment rates can vary extensively because of differences in professional opinion.
- *Supply-sensitive care:* clinical activities such as doctor visits, diagnostic tests, and hospital admissions, for which the frequency of use relates to the capacity of the local health care system. The key issue with this one is that, at least in the United States, those living in regions with a high-intensity pattern of care have worse or no better survival than those living in low-intensity regions. This means that greater intensity of care does not necessarily equate to improved outcomes.

This taxonomy explicitly addresses the issue of how clinicians and patients make decisions about care, and makes useful distinctions between the kind of influences which might generate variation.

3.2 Key questions

It is important to focus quality improvement efforts where they will make the most difference, and to make the best judgement about the nature of a given example of variation possible with the available data. Before trying to address variation, it is therefore important to think about what it means and why it matters in any one particular case. Systematically considering these questions can help in deciding how to interpret observations of variation.

1 Is there uncertainty or ambiguity in the clinical evidence?

Wide variation can be an indicator that clinical evidence is ambiguous or difficult to apply, or that there is a change in practice which is spreading throughout a group of professionals. This raises one of the fundamental issues in interpreting variation – which is that across an observed range of practice, it can sometimes be very difficult to identify the preferred rate of intervention or service delivery at a population level.

2 Are there quality issues?

Observing variation can raise questions about the underlying quality of care, particularly if there is clear evidence about where an intervention should be used, and what benefits and side effects exist. Where evidence is less clear, then issues of quality associated with variation are likely to be more difficult to pin down, with different points of view among professionals about what constitutes best practice.

Where variation is suspected to be a sign of a quality problem, the challenge is typically to seek to narrow the curve, bringing practice within a closer range of consensus (Figure 19).

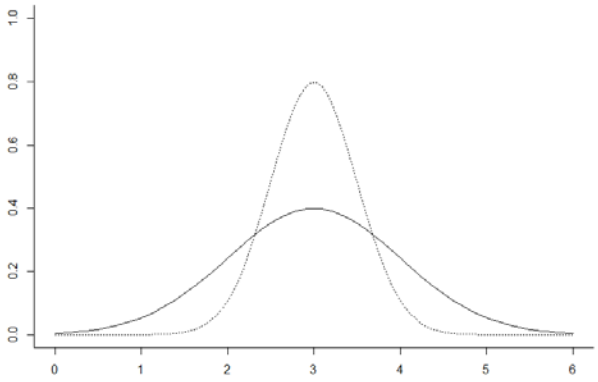

Figure 19: Narrowing a wide distribution

3 Is there inequity for patients?

Variation can be a sign of inequity in the delivery of health services. This can operate in two different ways.

- *Inequity in resource allocation*. Variation can reflect differences in the resource devoted to different populations, and can potentially reveal differences in fairness or equity of resource allocation, or underlying differences in which resources are used across different services. For example, a high intervention rate might reflect supplier-induced demand, where a high rate of supply means a high rate of delivery (eg, more private hospitals means more private surgery, even where need across populations is equal).
- *Inequity of access*. Inequity of access can be related to inequity of resources, but can also be a wider issue of access on the basis of timing of service delivery, financial barriers, workforce mix and availability, and other factors.

Inequity can manifest as a difference in distributions for different demographic groups (eg, in men and women for cardiovascular disease treatment, as seen in the HQSC Atlas), in which case the challenge is to merge two distributions into a single curve (Figure 20).

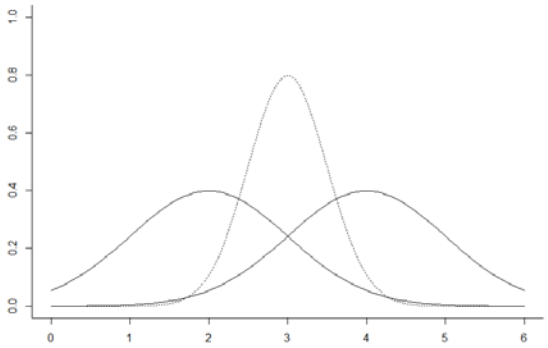

Figure 20: Bringing two different distributions together

4 Is there inefficient use of resources?

A common question raised by observing variation is whether resources are being used efficiently and effectively. Typically, if two areas have very different rates of intervention, then either under-servicing or over-servicing might be suspected in one of the areas. This is often a difficult question to disentangle from observations of variation, since greater resource devoted to a service on a

population basis (eg, higher prescribing of analgesics) might actually reflect a lack of resource elsewhere in the health system (eg, waiting times for surgery).

In this case, the goal is likely to be to shift the whole curve, as well as to narrow it, either by ensuring that at least a minimum level of resource is delivered (if the problem is under-servicing), or setting limits to the maximum amount of service which the system can resource.

For example, under-servicing might mean that the goal is to shift the curve to the right, narrow the variation and set a minimum level of intervention (Figure 21).

Figure 21: Addressing under-servicing

If there is an issue of over-servicing, the challenge will be to move the curve to the left, and to narrow the variation. If over-servicing and under-servicing both exist at once, then the issue reduces to the general problem of improving quality, and narrowing the distribution. Working with clinical leaders to establish consensus on whether there is under-servicing or over-servicing for specific interventions can play a key role in addressing issues of variation.

5 What environmental and population factors are relevant?

Variation, especially across areas, can reflect a range of environmental and population factors, as well as variation in individual clinical decision-making. Such factors include population age, sex, ethnicity and deprivation structure, but might also include aspects such as differing levels of hospital service provision, which in turn can impact upon the way that primary care delivers services. Factors such

as rurality, or particular health-related risks (such as a dangerous road, or presence of particular industries), could reasonably result in different ways of delivering care and different approaches to practice at the individual clinical level.

New Zealand has a relatively localised health system, with a high level of discretion for DHBs to make decisions in response to different needs and priorities. So some degree of variation is to be expected, and is built into the structure of the health system. Understanding the role of environmental influences upon clinical practice and the delivery of care can be an important starting point for developing service and quality improvement programmes. This aspect of variation can be an important catalyst for thinking about what influences clinical practice in a given area, and whether those influences are appropriate for the needs of the population.

6 How much variation should you expect?

Variation is often seen as a surprise, but many things can drive variability, including the random statistics of small numbers, differences in training, and differences in patient expectation. Before deciding whether variation is a problem it can be helpful to step back and assess how much variation you should actually expect to see.

Considering how much variation to expect can involve:

- reviewing the clarity of evidence for clinical decision-making
- assessing whether small numbers and statistical effects generate variation
- considering environmental drivers of variation across different areas.

In the end, the question of how much variation is too much is a judgement, and pragmatically should depend upon what is believed about the impact of variation, and whether there are ways of addressing it. If there is substantial variation in some measure, but it does not provoke concerns about quality, equity or efficiency, then it may not be worth devoting precious quality improvement resources to addressing the issue. By contrast, if even a relatively small level of variation raises serious issues about quality of care, then it is worthy of attention and follow-up.

4. Addressing variation

4.1 Need to manage variation

The challenges of quality, equity and efficiency are all, in themselves, good reasons for health service organisations to use the tools available to them for addressing variation. The direction set by the Ministry of Health Expert Advisory Group for an Integrated Performance and Incentive Framework (IPIF) for primary care performance explicitly envisages a focus on variation at a local level. In this framework PHOs and DHBs take responsibility for managing resources more effectively, and for using clinical governance mechanisms to reduce variability. This is likely to take place at two levels: variation on national system level indicators will be monitored centrally, while local alliances will be likely to have a high degree of freedom to identify and address quality and resource issues within each district across New Zealand. Reducing variation in clinical outcomes and in effective resource use is likely to be an increasingly explicit element of performance monitoring in New Zealand health care. There will be increasing expectation that planners and funders will work collaboratively with service delivery organisations to monitor and manage variation (Expert Advisory Group 2014).

4.2 Approaches for managing variation

At a high level, Wennberg (2010) recommends adopting three key strategies for addressing the challenges of variation:

- promoting organised systems of health care delivery to prevent underuse of effective care. Team medicine seems to lead to less unwarranted variation.
- establishing informed patient choice as the ethical and legal standard for decisions surrounding elective surgeries, drugs, tests, and procedures, and care at the end of life. In terms of preference-sensitive care, treating patients according to their preferences – and not giving them treatments they do not want – requires a clinical environment that supports shared decision-making and encourages the active engagement of patients in the choice of treatment.

- improving the science of health care delivery. In terms of supply-sensitive care, the most important challenge to the clinical and research communities is to rationalise the clinical pathways for managing chronic disease: to undertake the clinical research required to convert supply-sensitive care into evidence-based care that is effective or preference-sensitive.

The generic approach is therefore to engage in effective service improvement and clinical governance as the mechanism for addressing the fundamental issues raised by variation. Achieving this requires effective, expert clinical leadership and high quality analysis, conducted by clinicians and analysts working closely together.

The toolbox for addressing variation includes the following five key elements.

1 Good analysis (but don't get hung up on perfection)

Good quantitative analysis, informed by strong clinical expertise, is essential. It is important for analysts to bring technical expertise about datasets, data validity and statistical techniques, and to work closely with clinicians who can refine questions about what is going on in the data, and understand the significance of different observations. Ideally analysts and clinicians should work together, interrogating data and cutting it in different ways, coming to a joint interpretation of the observed variation which is both statistically and clinically robust.

The HQSC Atlas provides data at DHB level on a number of quality indicators. This information is presented in context with a summary of relevant evidence for each indicator, and with the definitions and methodology used in the underlying analysis (circled in the Atlas page example in
Figure 22 below). This resource represents a flying start for analysis on these indicators, since the complex job of assessing the data and developing workable definitions that are comparable across areas has already been completed. For example, working definitions of polypharmacy are provided in the background material linked to Atlas pages, and these can serve as a guide for analysts to extract and present data in a standardised and comparable format.

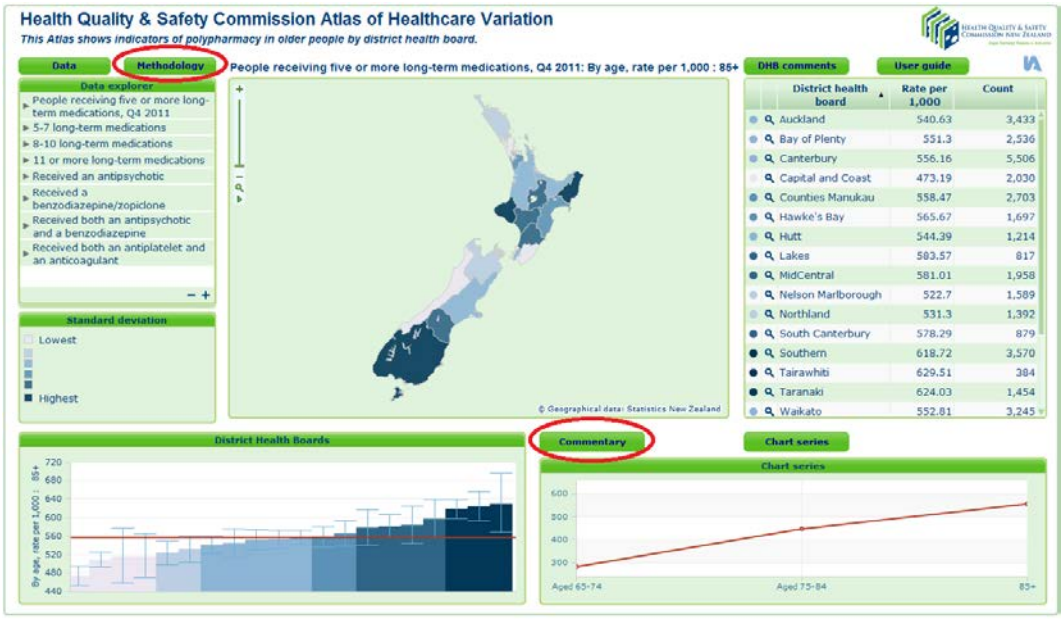

Figure 22: HQSC Atlas of Healthcare Variation

While it is important to ensure that analysis is robust, and to avoid being trapped into misleading conclusions about variability, it is also important to be realistic about what information can be collected and analysed, and how much can be interpreted from that information. It is nearly always possible to conclude something robust and defensible, so long as data interpretation is performed carefully, is informed by both statistical and clinical expertise, and the limitations of interpreting data are clearly acknowledged. In the areas of gout, cardiovascular disease and diabetes, the HQSC Atlas definitions of patient populations are the result of extensive clinical and expert debate on the best way to define and measure the populations and interventions involved.

2 Patient expectations and information

Where evidence is unclear, or where there are choices and trade-offs to be made about treatment, then ensuring that patients are well informed and able to make their own choices is a good response to observing variation. This is particularly the case where services are preference-sensitive, and patients need support and information from health professionals in order to weigh up the advantages and disadvantages of treatment.

3 Work with practitioners at extremes of variation

It is important to be clear that a practitioner who is at the extreme end of some measure of service may be there for a good reason, or even purely by chance – particularly if they see a small number of patients, or have a patient population with special characteristics. If there are practitioners who appear to be well outside the usual range, then they should be provided with comparative information which informs them about their practice, and a professional peer could be assigned to work with them in order to understand whether their practice genuinely is different, whether there is a need for change, and what support the practitioner needs.

Some organisations may be tempted to take a punitive attitude towards professionals who are outliers on service measures, but a measured approach based upon good information and peer expertise is often more likely to result in service improvement.

4 Using and disseminating clinical information

Good analysis is important, but its impact depends upon effective use of the information with clinicians. The key elements here are:

- identifying strengths and weaknesses in information at practice level, and providing support so that information can be continuously improved
- providing tools for clinicians within practices to interrogate and compare their own clinical information, allowing for exploration and dissection of data within individual practice teams
- providing well analysed material back to clinicians, comparing their activity to their peers within a network or across an area.

The important principles are that the collection and dissemination of information should be friendly to clinicians, providing clinicians with the tools and support they need to answer questions about practice, and to provide information and evidence in an accessible, useable fashion. These are core clinical governance functions of PHOs and networks, although the degree to which they are delivered can be variable across New Zealand.

5 Consensus management and service design

Where evidence is ambiguous or unclear, there may be benefit in attempting to establish local consensus on disease management, based upon evidence and international best practice, and acknowledging the role of varying patient preference. In the absence of clear evidence it may be reasonable to have a range of practice, but if the result is inequity in treatment across the population, or a mismatch of clinical resources which could be used more effectively, then it may be important to establish more standardised approaches to care. For the indicators covered in the HQSC Atlas, links are provided to evidence on best practice and patient pathways.

Examples of consensus patient management built into service design include standardised referral or post-discharge protocols. Increasingly, in New Zealand, a range of disease management programmes provide resources more consistently to clinicians, and potentially reduce variation in the management of key conditions. Providing ready access to specialist opinion when needed, with clarity about the information needed with a referral, can support primary care professionals and reduce variation in the use of diagnostics and referral patterns.

5. References

Davis PB, Lay-Yee R, Briant R, et al. 2002. Adverse events in New Zealand public hospitals I: Occurrence and impact. *New Zealand Medical Journal* 115(1167).

Diehr P. 1990. What is too much variation? The null hypothesis in small-area analysis. *Health Services Research* 24(6): 741–71.

Expert Advisory Group. 2014. *Integrated performance and incentive framework: Expert Advisory Group final report.* Wellington: Ministry of Health. URL: http://www.hiirc.org.nz/page/45527/

Gribben B, Salkeld LJ, Hoare S, et al. 2012. The incidence of acute otitis media in New Zealand children under five years of age in the primary care setting. *Journal of Primary Health Care* 4(3): 205–12.

Wennberg J. 2010. *Tracking medicine: A researcher's quest to understand health care.* Oxford: University Press.

Wennberg J. 2011. Time to tackle unwarranted variations in practice. *British Medical Journal* 342(7799): 687–90.

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