QUANTITATIVE RESEARCH
https://doi.org/10.1071/HC22037

Journal of Primary Health Care

Assessing need for primary care services: analysis of New Zealand Health Survey data

Kenny Hau[A,*], Jacqueline Cumming[B], Maite Iruzun Lopez[B], Mona Jeffreys[B], Tessa Senior[B] and Peter Crampton[A]

For full list of author affiliations and declarations see end of paper

***Correspondence to:**
Kenny Hau
Centre for Hauora Māori, University of Otago, PO Box 56, Dunedin, New Zealand
Email: kenny.hau@tdhb.org.nz

Handling Editor:
Tim Stokes

Received: 14 June 2022
Accepted: 30 September 2022
Published: 2 November 2022

Cite this:
Hau K *et al.*
Journal of Primary Health Care 2022; **14**(4): 295–301.
doi:10.1071/HC22037

ABSTRACT

Introduction. The 2001 *Primary Health Care Strategy* provided significant new government funding for primary care (general practice and related services) via capitation funding formulas. However, there remain important unanswered questions about how capitation funding formulas should be redesigned to ensure equitable and sustainable service provision to all population groups. **Aim.** To compare levels of chronic illness, utilisation, and unmet need in patients categorised as 'high-need' with those categorised as non-'high-need' using the definitions that are used in the current funding context, in order to inform primary care funding formula design. **Methods.** Respondents of the New Zealand Health Survey (2018–19) were categorised into 'high-need' and non-'high-need', as defined in current funding formulas. We analysed: (i) presence, and number, of chronic diseases; (ii) self-reported primary care utilisation (previous 12 months); and (iii) self-reported unmet need for primary care (previous 12 months). Analyses used integrated survey weights to account for survey design. **Results.** In total, 29% of respondents were 'high-need', of whom 50.2% reported one or more chronic conditions (vs 47.8% of non-'high-need' respondents). 'High-need' respondents were more likely than non-'high-need' respondents to: report three or more chronic conditions (14.4% vs 13.7%); visit a general practitioner more often (seven or more visits per year: 9.9% vs 6.6%); and report barriers to care. **Discussion.** There is an urgent need for further quantification of the funding requirements of general practices serving high proportions of 'high-need' patients in order to ensure their viability, sustainability and the provision of quality of care.

Keywords: capitation funding, chronic illness, general practice, health care utilisation, health equity, high-need, primary care.

Introduction

Equity of primary care service delivery is a pressing policy objective because, in Aotearoa New Zealand's health system, primary care acts as the entry point into the health system and as gatekeeper to secondary services.[1,2] The routine use of capitation funding formulas for general practice and related services was introduced in Aotearoa New Zealand in the early 2000s, as part of the implementation of the 2001 *Primary Health Care Strategy*.[3] Currently, there are multiple formulas and funding streams, covering general practice care, health promotion, Services to Improve Access, Care Plus, rural workforce retention, management services, Very-Low-Cost Access, zero-fees for children, and community service card holders.[4] The strengths and weaknesses of the formulas, and the details of the different funding streams, have been described elsewhere.[5–11] Over the past decade, there have been frequent calls for a review of the capitation funding formulas; for example, from the National Hauora Coalition.[8] The 'Moodie report' was published in 2015,[12] but no substantial changes to the formulas resulted. More recently, claimants to the Waitangi Tribunal commissioned a report that estimated the substantial amount to which the formulas resulted in underfunding of Māori primary health organisations over an 18-year period.[13]

WHAT GAP THIS FILLS

What is already known: Primary care in Aotearoa New Zealand is principally funded through capitation-based funding to general practices, supplemented by user co-payments. There is substantial international literature on different approaches to adjusting capitation funding for 'high-need' patients, but there remain important unanswered questions about the best approach to adopt in the Aotearoa New Zealand context. In particular, there is a need for further quantification of the funding requirements of practices serving high proportions of 'high-need' patients in order to ensure their viability and sustainability.

What this study adds: This paper compares levels of chronic illness, utilisation, and unmet need in patients categorised as 'high-need' with those categorised as non-'high-need', using the definitions that are used in the current funding context, in order to inform the development of new capitation funding formulas.

One of the questions that has arisen repeatedly is the extent to which the current funding formulas for general practice services in Aotearoa New Zealand are perpetuating existing inequities or acting to redress them. Poorly designed formulas that do not adequately adjust for differences in need across practices lead to some practices being (relatively) 'over-paid', whereas others struggle financially to deliver care. Most Māori-owned, Pacific-owned, very-low-cost access (VLCA), and community trust primary care organisations tend to have high proportions of 'high-needs' patients and are far less likely to be able to make up any shortfalls in funding through raising user charges.[8]

The policy context for primary care funding has changed substantially over the past 2 years and will likely continue to change as health system reforms are implemented over coming years. Important recent influences on the policy context include the primary care claims to the Waitangi Tribunal,[14] and the resulting Tribunal report,[15] and the Health and Disability System Review with its resulting recommendations[2,16] and government response.[17] Although the policy context continues to evolve, there remains an urgent need for further review and modification of the capitation funding formulas. In particular, there is a need for further quantification of the funding requirements of practices serving high proportions of 'high-need' patients, including many Māori and Pacific practices, in order to ensure their viability and sustainability. There is substantial international literature on different approaches to adjusting capitation funding for 'high-need' patients,[18–22] but there remain important unanswered questions about the best approach to adopt in the Aotearoa New Zealand context. Therefore, the aim of this research was to compare levels of chronic illness, utilisation, and unmet need in patients categorised as 'high-need' with those categorised as non-'high-need', in order to inform primary care funding formula design. In the context of current funding formulas, 'high-need' patients are defined as those who fit one or more of these three criteria: Māori and/or Pacific ethnicity, and/or live in an area that is classified as New Zealand Index of Deprivation (NZDep) quintile 5.[11]

Methods

We chose the New Zealand Health Survey (NZHS) as the data source for this study because, to the best of our knowledge, it was the only national data collection that provided national data related to self-reported health need (diagnosis of chronic diseases); self-reported utilisation (general practitioner (GP) visits); and unmet health need (deferral of GP visits because of barriers to access). The NZHS is a survey with a multi-stage, stratified, probability-proportional-to-size (PPS) sampling design.[23] Briefly, the primary sampling units (PSUs) are from Statistics New Zealand's household survey frame. There are two sampling stages; the survey is designed to ensure sufficient Māori are included for meaningful analysis. The response rate in 2018–19 was 80%, with 13 572 adults aged $\geq$15 years included in the study. Children were excluded from the current study because the chronic disease burden and funding context differs substantially for children.

Interviews were conducted face-to-face in respondents' homes. The specific questions that were used in this study were self-reported presence of any one of the following chronic conditions diagnosed by a doctor: arthritis; osteoarthritis; rheumatoid arthritis; asthma; type II diabetes (after age 25 years); gout; heart failure; ischaemic heart disease; angina; heart attack; depression, bipolar or anxiety; chronic pain; stroke. For purposes of our analysis, we grouped arthritis, osteoarthritis and rheumatoid arthritis as 'arthritis', and ischaemic heart disease, angina and heart attack as 'ischaemic heart disease'. Chronic conditions were defined as a physical or mental illness that has lasted, or is expected to last, for $>$ 6 months. Participants were also asked to recall the number of times they had visited a GP in the last 12 months. They were also asked whether they had at least one instance of unmet need from the following: GP or after hours care due to cost or lack of transport, or inability to get an appointment at their usual medical centre within 24 h.

Statistical analysis

Additional variables from the NZHS that were analysed were prioritised ethnicity and socioeconomic deprivation (New Zealand Index of Deprivation, 2018; NZDep2018) quintile. In the NZHS, participants chose to report one or more ethnicities from a list of eight, and/or specify further ethnicities. We grouped the data using the system of prioritised ethnicity,

commonly used in Aotearoa New Zealand for analyses of health data,[24] in which Māori who identify only as Māori, or as Māori plus one or more additional ethnicities, are categorised as Māori; Pacific peoples who identify solely as a Pacific ethnicity, or Pacific plus one or more additional ethnicities other than Māori, are analysed in the Pacific group; and likewise for Asian people. The remainder of the population are analysed as a non-Māori, non-Pacific, non-Asian group, hereafter termed the NZ European/Other ethnicities group.

Socioeconomic deprivation was measured using the NZDep2018 index.[25] This is an area-based measure that categorises small areas according to levels of deprivation based on nine census variables. Statistics New Zealand matched the place of residence of the participant to the relevant Census Area Unit (CAU), and the data have been analysed in NZDep quintiles.

The study sample was then categorised into two groups, 'high-need' and non-'high-need', based on ethnicity and area-level deprivation, with 'high-need' defined as Māori or Pacific ethnicity, or living in NZDep quintile 5, and the remainder of the cohort defined as non-'high-need'. This definition is in accordance with definitions currently used in capitation funding arrangements.[11] For both the 'high-need' and non-'high-need' groups, we calculated measures of need using the following markers: (i) presence, and number of, chronic diseases; (ii) self-reported primary care utilisation (GP visits) in the previous 12 months; and (iii) self-reported unmet need (deferral of GP visits because of barriers to access).

All analyses were conducted using the integrated survey weights, accounting for clustering by primary sampling unit and strata, and are presented as weighted proportions. The results presented are, therefore, broadly representative of the Aotearoa New Zealand population.

Ethics

Ethics review of this study was not sought as the study involved analysis of secondary data (an existing dataset held and curated by Statistics New Zealand). Access to the data used in this study was provided by Statistics New Zealand under conditions designed to keep individual information secure in accordance with the requirements of the *Statistics Act 1975*.

Results

Table 1 shows the age, gender, ethnicity and socioeconomic distributions in the weighted sample. There was a younger age distribution among 'high-need' patients (Table 1), with a mean age of 41.2 years, compared to 47.5 years among the non-'high-need' group ($P < 0.0001$). In the weighted sample, the proportion of the total population that fell into the 'high-need' category was 29%. Of these, 40.8% were Māori, 20.6% were Pacific, 8.7% were Asian, and 29.9% were 'NZ European/Other' (largely New Zealand European). There were no Māori or Pacific respondents in the non-'high-need' category, given the definition of the 'high-need' category.

Table 1. Distribution of sociodemographic characteristics, by need status,[A] 2018–19 (weighted).

Variable	Total population (%)	'High-need' (%)	Non-'high-need' (%)	Difference (% points)
Proportion		29	71	
Age group (years)				
15–24	16.6	22.7	14.2	8.6
25–34	17.6	20.8	16.3	4.5
35–44	15.3	16.4	14.9	1.5
45–54	16.2	14.6	16.9	−2.3
55–64	15.0	12.1	16.2	−4.1
65–74	11.2	8.5	12.2	−3.7
75+	8.1	4.9	9.4	−4.5
Mean age (years)	45.7	41.2	47.5	−6.3
P-value	<0.0001			
Median age (years)	45	39	47	−8.0
Gender				
Male	48.7	47.5	49	−1.7
Female	51.3	52.5	51	1.7
Ethnicity				
Māori	11.7	40.8	0.0	40.8
Pacific	5.9	20.6	0.0	20.6
Asian	14.1	8.7	16.2	−7.5
NZ European/ Other	68.3	29.9	83.8	−53.9
Socioeconomic deprivation				
1	20.2	5.1	26.3	−21.2
2	20.1	6.4	25.7	−19.3
3	20.3	9.3	24.7	−15.4
4	20.4	13.2	23.3	−10.1
5	19.0	66.1	0.0	66.1

[A]'High-need' is defined as Māori or Pacific ethnicity or living in NZDep quintile 5 (most socioeconomically deprived).

The proportion of respondents with one or more of nine different chronic conditions is shown in Table 2, along with the proportion with any chronic condition. Overall, 50.2% of 'high-need' respondents reported any chronic condition versus 47.8% of non-'high-need' respondents ($P = 0.0082$). Differences between the groups were particularly high for asthma and Type II diabetes, each with approximately 5 percentage points higher prevalence in the 'high-need' group;

Table 2. Chronic condition type by need status,[A] 2018–19 (weighted).

Chronic condition	All (%)	'High-need' (%)	Non-'high-need' (%)	Difference (% points)	*P*-value
Any chronic condition	48.5	50.2	47.8	2.4	0.0082
Asthma	11.5	15.2	10	5.2	<0.0001
Type II diabetes	6.4	9.8	5.1	4.7	<0.0001
Gout	2.6	3.9	2.2	1.7	<0.0001
Chronic pain	19.4	20.2	19	1.2	0.0811
Stroke	1.6	2.2	1.4	0.8	0.0009
Mental health disorders	19.8	20.2	19.6	0.6	0.3889
Heart failure	1.9	2.1	1.8	0.3	0.2264
Ischaemic heart disease	4.3	4.3	4.3	0	0.9261
Arthritis	16.2	14.3	17	−2.7	<0.0001

[A]'High-need' is defined as Māori or Pacific ethnicity or living in NZDep quintile 5 (most socioeconomically deprived).

Table 3. Chronic condition distribution by need status,[A] 2018–19 (weighted).

Number of chronic conditions	'High-need' (%)	Non-'high-need' (%)	Difference (% points)
0	49.8	52.2	−2.4
1	25.0	22.7	2.3
2	10.8	11.5	−0.7
3+	14.4	13.7	0.7
P-value = <0.0001			

[A]'High-need' is defined as Māori or Pacific ethnicity or living in NZDep quintile 5 (most socioeconomically deprived).

Table 4. Mean number of GP visits in the last 12 months by need status,[A] 2018–19 (weighted).

Number of GP visits	'High-need' (%)	Non-'high-need' (%)	Difference (% points)
0	23.6	21.0	2.6
1–3	44.1	50.4	−6.3
4–6	22.5	22.0	0.5
7–11	5.7	3.9	1.8
12+	4.2	2.7	1.5
P-value = < 0.0001			

[A]'High-need' is defined as Māori or Pacific ethnicity or living in NZDep quintile 5 (most socioeconomically deprived).

these same 'high-need' respondents also reported a lower prevalence of arthritis. There was no difference in the reported level of heart failure and ischaemic heart disease between the 'high-need' and non-'high-need' groups. Of the 'high-need' group, 10.8% had two chronic conditions, versus 11.5% in the non-'high-need' group ($P < 0.0001$), and 14.4% of the 'high-need' group had three or more chronic conditions, versus 13.7% in the non-'high-need' group ($P < 0.0001$) (Table 3). 'High-need' respondents were more likely to visit the GP more often; 9.9% reported seven or more visits in the past year, compared to 6.6% in non-'high-need' respondents ($P < 0.0001$) (Table 4). 'High-need' respondents were also more likely to have not seen a GP at all in the previous year (Table 4). There was a higher level of unmet need reported by 'high-need' respondents compared with non-'high-need' respondents (Table 5).

Discussion

In this nationally representative sample, the 'high-need' respondents had a higher number of chronic conditions and higher utilisation of primary care services compared with those classified as non-'high-need'. With regards to GP utilisation, the 'high-need' respondents had a higher frequency of no visits, and of seven of more visits per year. For the 'high-need' respondents, we also found that there were higher levels of unmet need across all measures of unmet need. The prevalence of chronic conditions in the two groups is influenced by the difference in the age distribution of the two groups, reflecting the lower age distribution of Māori and Pacific populations in the national population compared with the NZ European/Other ethnicities population. This is likely to explain the higher rates of arthritis in the non-'high-need' category. The absence of a significant difference in the rates of heart failure and ischaemic heart disease between the two groups is unexpected, given the known distribution of risk factors across different ethnic and socioeconomic groups.[26]

A strength of this study is the use of NZHS data and our approach to analysis. The NZHS is a nationwide population-based survey, with a high response rate and minimal missing data, due to the face-to-face nature of the data collection. We used a weighted analysis, based on the integral weights supplied by Statistics New Zealand, so the results broadly reflect the sociodemographic composition of Aotearoa New Zealand,

Table 5. Unmet need by need status,[A] 2018–19 (weighted).

Unmet need	'High-need' (%)	Non-'high-need' (%)	Difference (% points)	*P* value
Unable to get primary care appointment in next 24 h (GP, nurse or other healthcare worker)	22.7	20.1	2.6	0.0006
Unmet need for GP due to transport	5.7	1.6	4.1	<0.0001
Unmet need for GP due to cost	19.1	11.1	8	<0.0001
Unmet need for primary care due to no appointment in 24 h, or transport, or cost	37.2	28.0	9.2	<0.0001
Visited ED when thought GP could have treated them	33.3	23.9	9.4	<0.0001

[A]'High-need' is defined as Māori or Pacific ethnicity or living in NZDep quintile 5 (most socioeconomically deprived).

based on age (5-year bands), sex, ethnicity (Māori, Pacific, Asian and European/Other) and area-level socioeconomic deprivation quintiles.[27] This suggests that the results are likely to be generalisable to the population as a whole.

There are three limitations to this study. First, the questions on chronic conditions in the survey asked about doctor-diagnosed conditions, with the exception of chronic pain, which was asked about as a symptom not a diagnosis. Given that we know that access to, and effectiveness of, the health system is lower for Māori,[28,29] as well as for Pacific people and those living in areas of higher socioeconomic deprivation, the people who we have defined as 'high-need' had less opportunity to be diagnosed with these conditions in primary care. For example, hospitalisations for cardiovascular disease are >50% higher for Māori compared to non-Māori,[30] but we do not see such a difference in doctor-diagnosed ischaemic heart disease. It is therefore likely that some of the differences in the prevalence of conditions between 'high-need' and non-'high-need' respondent groups that we report are underestimated in the NZHS.

Second, the use of survey data may be problematic for estimating the prevalence of some chronic conditions because disability arising from the condition may influence participation in the survey. Of those conditions that were included in the NZHS, the most likely to be underestimated is probably stroke; people who have had a stroke may be less likely to agree to participate in a survey. This may explain the low overall prevalence of stroke (1.6% compared to, for example, 4.3% for ischaemic heart disease). Furthermore, the analyses in this study were confined to the variables in the NZHS dataset and some chronic conditions, for example Alzheimer's disease, were not included in this study.

Third, there is a possibility of mis-classification in the GP utilisation measures, due to errors in recall of the number of visits that a person had to the GP in the previous year. We have compared self-reported data on GP consultations to those reported in administrative data, and there appears to be a close relationship between the two (Irurzun Lopez M and Jeffreys M, unpubl. data). Differences in reported GP utilisation are unlikely to be differential between the 'high-need' and non-'high-need' patient groups, and any resulting error is likely to be an underestimate between the two groups, rather than bias, *per se*. Similar errors may occur with the measures of unmet need reported here, as they too are self-reported data.

The implications for policy and future research are threefold. First, this study has highlighted some of the differences between groups currently categorised, for the purposes of funding, as 'high-need' and non-'high-need'. These differences, which include age distribution and the prevalence of multiple chronic conditions, are likely to have substantial funding implications for primary care service providers, especially those serving populations with high proportions of 'high-need' patients (as the average funding per person is based on age and gender, but does not increase with the increasing proportion of 'high-need' patients). The details of these funding implications are not elucidated by this study, and this remains a high priority for future research. Second, for future funding formula design, suitable data sources will be essential; although GP enrolment and utilisation data are of high quality, they do not recognise unmet need or those who are not enrolled. In the future, unmet need should be considered in funding formulas and included in performance measures. Third, from the perspective of funding formula design and equity of funding, it is important to note that age and gender, but not ethnicity, are the basis for the most significant capitation funding formula (for first-level services).

In conclusion, there are differences between groups currently categorised as 'high-need' and non-'high-need', including age distribution, prevalence of multiple chronic conditions, utilisation rates and barriers to care. Their concentration in some practices is likely to have substantial funding implications for primary care service providers. There is an urgent need for further quantification of the funding requirements of practices serving high proportions of 'high-need' patients in order to ensure their viability, sustainability and the quality of services. The current capitation funding formulas have not been properly revised and updated since their introduction about 20 years ago. Any such review should examine the pros and cons of different variables, and how to take into account premature morbidity and mortality in Māori and Pacific populations, and unmet need in 'high-need' populations.

References

1 Goodyear-Smith F, Ashton T. New Zealand health system: universalism struggles with persisting inequities. *Lancet* 2019; 394(10196): 432–42. doi:10.1016/S0140-6736(19)31238-3
2 Health and Disability System Review. Health and Disability System Review - Interim Report. Hauora Manaaki ki Aotearoa Whānui – Pūrongo mō Tēnei Wā. Wellington: Health and Disability System Review; 2019.
3 King A. The Primary Health Care Strategy. Wellington: Ministry of Health; 2001.
4 Ministry of Health. Capitation rates from 1 July 2021. All rates exclude GST and are annualised amounts. Wellington: Ministry of Health; 2021. Available at https://www.health.govt.nz/our-work/primary-health-care/primary-health-care-subsidies-and-services/capitation-rates [Accessed 20 August 2021].
5 Hefford M, Crampton P, Foley J. Reducing health disparities through primary care reform: the New Zealand experiment. *Health Policy* 2005; 72: 9–23. doi:10.1016/j.healthpol.2004.06.005
6 Crampton P, Foley J. Why are we weighting? Equity considerations in primary health care resource allocation formulas. In: Dew K, Matheson A, editors. Understanding Health Inequalities in Aotearoa New Zealand. Dunedin: Otago University Press; 2008. pp. 133–45.
7 Cumming J, Mays N. New Zealand's Primary Health Care Strategy: early effects of the new financing and payment system for general practice and future challenges. *Health Econ Policy Law* 2011; 6: 1–21. doi:10.1017/S1744133109990260
8 National Hauora Coalition. The Sustainability of Very High-Needs Pirmary Care Practices in a Capitated Environment. National Hauora Coalition; 2016.
9 Foley J. Social equity and primary healthcare financing: lessons from New Zealand. *Aust J Prim Health* 2018; 24: 299–303. doi:10.1071/PY17153
10 Brooking K. Kei mua i te aroaro o te rōpū whakamana i te tiriti o waitangi before the waitangi tribunal wai 2575 in the matter of the treaty of Waitangi Act 1975 and in the matter of the health services and outcomes kaupapa inquiry, evidence of keriana louise brooking 7 September 2018. Available at https://forms.justice.govt.nz/search/Documents/WT/wt_DOC_142252871/Wai%202575%2C%20A062.pdf [Accessed 16 January 2019].
11 Crampton P. The ongoing evolution of capitation funding for primary care: the December 2018 PHO capitation funding changes for Community Services Card holders. *N Z Med J* 2019; 132(1498): 69–78.
12 Primary Care Working Group on General Practice Sustainability. Primary Care Working Group on General Practice Sustainability, Report to the Minister of Health Wellington. 2015. Available at https://www.nzdoctor.co.nz/sites/default/files/2017-09/pcwg-general-practice-sustainability-public-report%281%29.pdf [Accessed 25 January 2019].
13 Love T, Moore D, Milkop A, *et al.* Methodology for Estimating the Underfunding of Māori Primary Health Care. Wellington: Sapere; 2021. Available at https://srgexpert.com/wp-content/uploads/2021/08/Methodology-for-Estimating-the-Underfunding-of-Maori-Primary-Health-Care.pdf [updated 27 July].
14 Baker G, Baxter J, Crampton P. The primary healthcare claims to the Waitangi Tribunal. *N Z Med J* 2019; 132(1505): 7–13.
15 Waitangi Tribunal. Hauora, Report on Stage One of the Health Services and Outcomes Kaupapa Inquiry, Pre-publication version, WAI 2575 Waitangi Tribunal Report 2019. Available at https://forms.justice.govt.nz/search/Documents/WT/wt_DOC_152801817/Hauora%20W.pdf [Accessed 14 July 2019].
16 Health and Disability System Review. Health and Disability System Review, Final Report Pūrongo Whakamutunga. Wellington Health and Disability System Review; 2020.
17 Department of the Prime Minister and Cabinet. The new health system. Wellington: Department of the Prime Minister and Cabinet; 2021. Available at https://dpmc.govt.nz/our-business-units/transition-unit/response-health-and-disability-system-review/information [Accessed 20 August 2021].
18 Sibley LM, Glazier RH. Evaluation of the equity of age–sex adjusted primary care capitation payments in Ontario, Canada. *Health Policy (Amsterdam)* 2011; 104(2): 186–92. doi:10.1016/j.healthpol.2011.10.008
19 Antioch KM, Walsh MK. Risk-adjusted capitation funding models for chronic disease in Australia: alternatives to casemix funding. *Eur J Health Econ* 2002; 3(2): 83–93. doi:10.1007/s10198-002-0096-7
20 Rice N, Smith PC. Capitation and risk adjustment in health care financing: an international progress report. *Milbank Q* 2001; 79: 81–113. doi:10.1111/1468-0009.00197
21 Penno E, Gauld R, Audas R. How are population-based funding formulae for healthcare composed? A comparative analysis of seven models. *BMC Health Serv Res* 2013; 13(1): 470–70. doi:10.1186/1472-6963-13-470
22 Smith P. Formula funding of public services. New York: Routledge; 2006.
23 Ministry of Health. Content Guide 2018/19: New Zealand Health Survey; 2019. Available at https://www.health.govt.nz/publication/content-guide-2018-19-new-zealand-health-survey [Accessed 31 August 2022].
24 Ministry of Health. Ethnicity Data Protocols HISO 10001: 2017. Wellington: Ministry of Health; 2017.
25 Atkinson J, Salmond C, Crampton P. NZDep2018 Index of Deprivation, User's Manual. Wellington: University of Otago; 2019. Available at https://www.otago.ac.nz/wellington/departments/publichealth/research/hirp/otago020194.html
26 Pylypchuk R, Wells S, Kerr A, *et al.* Cardiovascular disease risk prediction equations in 400 000 primary care patients in New Zealand: a derivation and validation study. *Lancet* 2018; 391(10133): 1897–907. doi:10.1016/S0140-6736(18)30664-0
27 Ministry of Health. Content Guide 2018/19: New Zealand Health Survey. Wellington: Ministry of Health; 2019. Available at https://www.health.govt.nz/publication/content-guide-2018-19-new-zeal-and-health-survey [Accessed 8 July 2021].
28 Health Quality and Safety Commission New Zealand. A Window on the Quality of New Zealand's Health Care 2019, He tirohanga ki te oritenga hauora o te Maori, A view on Maori health equity. Wellington: Health Quality and Safety Commission New Zealand; 2019.
29 Health Quality and Safety Commission New Zealand. A Window on the Quality of New Zealand's Health Care 2018. Wellington: Health Quality and Safety Commission New Zealand; 2018.
30 Ministry of Health. Wai 2575 Māori Health Trends Report. Wellington: Ministry of Health; 2019.

Data availability. Access to the data used in this study was provided by Statistics New Zealand under conditions designed to keep individual information secure in accordance with the requirements of the *Statistics Act 1975*.

Conflicts of interest. The views, opinions, findings and conclusions or recommendations expressed in this paper are strictly those of the authors. They do not necessarily reflect the views of the institutions where the authors currently work. The paper is presented not as policy, but with a view to inform and stimulate wider debate.

Declaration of funding. We are grateful for funding from the Health Research Council (Programme Grant 18/667), and the Royal New Zealand College of General Practitioners (Research and Education Committee Grant 2021) for aspects of this study.

Acknowledgements. We would like to acknowledge the helpful and insightful comments made by colleagues on earlier drafts of this paper, and by the anonymous reviewers of the paper. We take full responsibility for any errors or omissions in, or for the correctness of, the information contained in this paper. The authors are grateful to the participants in the New Zealand Health Survey. The opinions presented are those of the authors and do not necessarily represent an official view of Statistics New Zealand.

Author affiliations
[A]Centre for Hauora Māori, University of Otago, PO Box 56, Dunedin, New Zealand.
[B]Te Hikuwai Rangahau Hauora | Health Services Research Centre; Te Herenga Waka-Victoria University of Wellington, Wellington, New Zealand.