





BMJ Open National cross-sectional study of the sociodemographic characteristics of Aotearoa New Zealand's regulated health workforce pre-registration students: a mirror on society?

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ABSTRACT

Objectives To provide a sociodemographic profile of students enrolled in their first year of a health professional pre-registration programme offered within New Zealand (NZ) tertiary institutions.

Design Observational, cross-sectional study. Data were sought from NZ tertiary education institutions for all eligible students accepted into the first 'professional' year of a health professional programme for the 5-year period 2016–2020 inclusive. Variables of interest: gender, citizenship, ethnicity, rural classification, socioeconomic deprivation, school type and school socioeconomic scores. Analyses were carried out using the R statistics software.

Setting Aotearoa NZ.

Participants All students (domestic and international) accepted into the first 'professional' year of a health professional programme leading to registration under the Health Practitioners Competence Assurance Act 2003.

Results NZ's health workforce pre-registration students do not reflect the diverse communities they will serve in several important dimensions. There is a systematic underrepresentation of students who identify as Māori and Pacific, and students who come from low socioeconomic and rural backgrounds. The enrolment rate for Māori students is about 99 per 100 000 eligible population and for some Pacific ethnic groups is lower still, compared with 152 per 100 000 for NZ European students. The unadjusted rate ratio for enrolment for both Māori students and Pacific students versus 'NZ European and Other' students is approximately 0.7.

Conclusions We recommend that: (1) there should be a nationally coordinated system for collecting and reporting on the sociodemographic characteristics of the health workforce pre-registration; (2) mechanisms be developed to allow the agencies that fund tertiary education to base their funding decisions directly on the projected health workforce needs of the health system and (3) tertiary education funding decisions be based on Te Tiriti o Waitangi (the foundational constitutional agreement between the Indigenous people, Māori and the British Crown signed in 1840) and have a strong pro-equity focus.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This is the first national study of its type in New Zealand.
- ⇒ This was a national study that aimed to include all tertiary programmes leading to registration in a regulated health profession, over a 5-year period.
- ⇒ The participation rate among tertiary institutions was 10 out of 23 eligible institutions (participating institutions included both of the country's medicine programmes, both pharmacy programmes, the sole dentistry programme, all oral health programmes, two of the three physiotherapy programmes, two of the three medical laboratory science programmes, three of the five midwifery programmes and nine of the country's eighteen nursing programmes).
- ⇒ We were not able to report data on gender diversity as a result of institutional coding practices.

INTRODUCTION

Health workforce planning is a core activity of health systems for ensuring high-quality, sustainable and equitable health services.^{1–8} Aotearoa New Zealand (NZ) was populated by Māori, the Indigenous people, for many hundreds of years prior to the advent of settler colonisation by Great Britain in the nineteenth and twentieth centuries. This process resulted in the wholesale theft of land from Māori and their social and economic marginalisation in the European-orientated settler colonial society, along with highly inequitable health outcomes.⁹ At the 2018 Census about 16.5% of the total population identified as Māori and about 8% identified with one or more Pacific ethnicities.¹⁰

There are constitutional, equity and needs-based imperatives to optimise health gain for Māori with an impetus to make more effective the policies and processes that underpin

health workforce production.^{11 12} From a constitutional perspective, workforce production should be guided by Te Tiriti o Waitangi, the foundational constitutional agreement between Māori and the British Crown signed in 1840. While there have been national debates about the causes and remedies of the exclusion of Māori from many key components of the health workforce, and about how prospective health professional students should be selected and educated in ways that best serve the needs of different communities,^{11–15} there remains a lack of clear policy directed at fulfilling Te Tiriti o Waitangi and achieving equity objectives in the health workforce. From equity and needs-based perspectives, there are arguments that health professionals from diverse backgrounds contribute to health equity through the impact their careers have on the education of others, they are more likely to focus their research on the communities they serve and engage with, and their leadership has the potential to benefit the entire system.^{16–19}

With these responsibilities in mind, NZ has recently implemented health reforms, with the creation of two new national agencies, Te Aka Whai Ora (Māori Health Authority) and Te Whatu Ora (Health New Zealand). These two agencies sit alongside the Ministry of Health (MoH), and all three are responsible for ensuring the production of a fit-for-purpose, sustainable health workforce.²⁰ In order for these agencies to carry out health workforce planning and implement effective health workforce policies, a number of conditions must be met, including but not limited to, (1) understanding the current and projected health workforce needs of the health system; (2) access to up-to-date data on the numbers and sociodemographic characteristics of students enrolled in tertiary institution health professional programmes; (3) the presence of effective policy levers to determine the number and characteristics of students and trainees. It is debatable the extent to which the first condition is met.^{1–3} Currently, the second condition is not met because, to the best of our knowledge, there are no easily accessible national data collections on the number and characteristics of health professional students. In regard to the third condition, as in other countries, there is a need to strengthen the alignment between the policies of the secondary and tertiary education systems and the needs of the health workforce.²¹ For example, while the Tertiary Education Commission (responsible for funding post-compulsory education and training in NZ) limits the number of applicants for some healthcare professions (eg, medicine, dentistry), these limits are not clearly linked to national need. Generally, these limits reflect capacity challenges with meeting clinical learning requirements. This picture of the health workforce in NZ is further complicated by high levels of both emigration and immigration of health professionals (eg, nurses and doctors).³

To address the absence of easily accessible data on the current health workforce pre-registration, this study aimed to provide a sociodemographic profile of all students enrolled in their first year of a health professional

programme offered within NZ tertiary institutions. This paper describes the study's methods and presents the results for all health professional programmes combined. Policy recommendations are made based on the findings and the experience of carrying out the study. Detailed results pertaining to the cohorts of students enrolled in individual health professional programmes will be published separately.

METHODS

Position statement

It is essential to contextualise this study within NZ's colonial history. The authors acknowledge the indigenous rights of Māori and that these rights have been systematically breached. These breaches preceded the signing of Te Tiriti o Waitangi in 1840 and have continued unabated after the signing.²² These actions have, and continue to, privilege NZ Europeans and exclude Māori.^{12 20 23} In addition, Pacific peoples, a collective term used to describe the more than 40 different ethnic groups with indigenous ancestral links to the Pacific islands, but who now live in NZ, have also been excluded.²⁴ While exclusion is not limited to Māori and Pacific peoples, they are recognised here due to their unique place in NZ society.

Critically, in undertaking this research, senior Māori and Pacific researchers have contributed to the design, data analysis and interpretation of the data to ensure that the research is safe and positive for Māori and Pacific peoples and will lead to recommendations that address inequity within the health workforce and improve health outcomes.

Health professional programmes and student eligibility

All students (domestic and international) accepted into the first 'professional' year of a health professional programme leading to registration under the Health Practitioners Competence Assurance Act 2003²⁵ during the 5-year period 2016–2020 inclusive were eligible to be included in the study. Some undergraduate health professional programmes include one or two semesters of generic study, before commencement of the discipline-specific programme components. In these situations, students were not counted until they had commenced the discipline-specific courses. Regulated health professional programmes invited to take part in this study are displayed in [box 1](#).²⁵ Relevant tertiary institutions were identified through the websites of the regulatory authorities.

Data sources

Student data were extracted, on our request, from each participating tertiary institution's central student records system. NZ denominator population data were sourced from the 2018 Census.²⁶ In order to match denominator populations to the age distribution of students in different health professional programmes, we used different age-band denominators for different programmes (data available on request).

Box 1 Regulated health professional programmes included in the study*

- ⇒ Anaesthetic technology.
- ⇒ Chiropractic.
- ⇒ Dentistry, clinical dental technology, dental technology.
- ⇒ Dietetics.
- ⇒ Medical imaging and radiation therapy.
- ⇒ Medical laboratory science.
- ⇒ Medicine.
- ⇒ Midwifery.
- ⇒ Nursing.
- ⇒ Occupational therapy.
- ⇒ Optometry and optical dispensing.
- ⇒ Oral health therapy (dental hygiene, dental therapy).
- ⇒ Osteopathy.
- ⇒ Paramedicine.
- ⇒ Pharmacy.
- ⇒ Physiotherapy.
- ⇒ Podiatry.
- ⇒ Psychology.
- ⇒ Psychotherapy.

*Traditional Chinese medicine was not a regulated health profession at the time data were collected.

Variables

Gender

Gender data were limited to the binary categories of male or female because this is how data were provided by the participating tertiary institutions.

Citizenship

Student citizenship was classified into the following categories: NZ citizens and permanent residents; Tokelau/Niue/Cook Island citizens (these NZ realm states have a special status by virtue of their resident's having NZ citizenship²⁷); Australian citizens; international citizens. For tertiary institution purposes, based on the allocation of funding by the Tertiary Education Commission, domestic students are those students who are NZ Citizens, or NZ Permanent Residents, or citizens of Tokelau/Niue/Cook Islands, or Australia.

Ethnicity classification/definitions

When students enrol at an NZ tertiary institution they can nominate up to three ethnicities they identify with; these ethnicities are self-declared. Students can change which ethnicities they associate with at any point in time. We classified ethnicity using:

- ▶ Five level 1²⁸ groupings Māori, Pacific, Asian, Other and European; classified according to the prioritised output method.
- ▶ Seventeen level 2 groupings²⁸ classified according to the total response method.

With prioritised output 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 categorised as Pacific; and likewise for Asian people.²⁸ The 'Asian' category, as used in the NZ health sector, includes students from East, South and Southeast Asia but excludes people from the Middle East and Central Asia.

In the level 2 groupings the total response classification is used, where row percentages sum to more than 100% because each student could nominate more than one ethnic group affiliation. In analyses of Māori, Pacific and Asian groupings using the total response classification the reference category is the NZ European and Other category.

Rural classification

We used two rural/urban classifications to describe the geographical distribution of students' home addresses at the time of their application to the health professional programme: (1) Stats NZ's (NZ's official data agency) urban accessibility classification and (2) the Geographic Classification for Health (GCH).

The purpose of Stats NZ's urban Accessibility classification is to identify rural areas and small urban areas according to their proximity, or degree of remoteness, to larger urban areas.²⁹ Drive time was used to categorise the degree of urban accessibility or rural remoteness at Statistical Area 1 (SA1s) level. SA1s are categorised on a scale from high urban accessibility to very remote based on the drive time to their closest major, large and medium urban areas.

The GCH is a rural-urban geographic classification designed for use in health research and policy.³⁰ The GCH taxonomy is comprised five categories, two urban and three rural, that reflect degrees of reducing urban influence and increasing rurality. The GCH uses a framework, based on population and drive time to urban areas, to assign a GCH category to all of NZ's SA1s.

Socioeconomic deprivation

Socioeconomic deprivation was measured using the NZDep2018 (NZDep) index of socioeconomic deprivation for small areas.³¹ NZDep is an area-based measure combining nine variables from NZ's five yearly census that reflect eight dimensions of deprivation. Each NZDep index is created for small areas built from one or more contiguous SA1s that generally contain between 100 and 200 people. The NZDep indexes were created from the proportions of people in each census-specific small area with each of nine characteristics related to deprivation.

The NZDep scale runs from 1 to 10 where, for example, a value of 10 indicates that the SA1 is in the most deprived 10% of small areas in NZ. At a national level, the number of people in each NZDep category is roughly equal.

In order to link the student and NZDep datasets, the SA1 associated with the home residence of each student was attached to individual records in each tertiary institution's student dataset (domestic students only). The corresponding NZDep value for each domestic student's home address was then added. Home addresses were

Table 1 All programmes—enrolments by school decile recorded, New Zealand citizens and permanent residents, 2016–2020 inclusive

	School decile recorded		Total (N=19694)
	No (N=2602)	Yes (N=17092)	
State	0 (0.0%)	13 142 (76.9%)	13 142 (66.7%)
State integrated	0 (0.0%)	2834 (16.6%)	2834 (14.4%)
Private	158 (6.1%)	1116 (6.5%)	1274 (6.5%)
Unlisted (closed)	372 (14.3%)	0 (0.0%)	372 (1.9%)
Correspondence	133 (5.1%)	0 (0.0%)	133 (0.7%)
Home	50 (1.9%)	0 (0.0%)	50 (0.3%)
Overseas	1306 (50.2%)	0 (0.0%)	1306 (6.6%)
Not recorded	583 (22.4%)	0 (0.0%)	583 (3.0%)

collected by tertiary institutions in a student's first year of study and are derived from the contact address provided by students when they first enrol.

School type and socioeconomic scores

Schools were categorised according to their designation: state (the majority of schools in NZ; government-owned and fully state funded); state integrated (mostly schools that started as private or religious schools and have become part of the state system); private (non-state schools that must meet certain standards to be registered; privately funded); unlisted (there was a small number of unlisted schools, which had recently closed); correspondence (a state-funded distance education school that offers programmes that are mostly delivered online); home schooling (parents educate their child at home).

The Ministry of Education uses a school rating scale to indicate the extent to which it draws its students from low socioeconomic communities. In contrast to the NZDep categories, decile 1 schools are the 10% of schools with the highest proportion of students from low socioeconomic communities and decile 10 schools are the 10% of schools with the lowest proportion of these students. A school decile does not measure the standard of education delivered at a school. It is not possible to calculate a school socioeconomic decile rating for students who went to correspondence school or an overseas school.

Table 1 describes enrolments by school decile and clarifies why some students did not have a school decile record. For most of these students, the last recorded school was overseas (noting that these analyses were restricted to NZ Citizens and permanent residents). A large number of private schools did have a decile recorded, and those that did not are included as '10' (most advantaged) in figure 2. Of the private schools with a decile recorded, 82% were decile 10 and 14% were decile 9.

Statistical analyses

All data manipulation and analyses were carried out using the R statistics software.³² Tabulated counts of students were merged with matching population denominator datasets obtained from Stats NZ. Enrolment rates per

100 000 population were calculated with 95% Wilson binomial CIs. Enrolment rate ratios with 95% CI, derived from Poisson regression models, were used to compare enrolment rates by prioritised ethnicity with and without adjustment for NZDep2018.

Patient and public involvement statement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Responding and non-responding institutions and numbers of students

We identified 23 institutions in total that provided health professional programmes leading to registration under the Health Practitioners Competence Assurance Act 2003²⁵ and were therefore eligible to participate in the study. Data were received from 10 of these, including from all the large university institutions with multiple health professional programmes. Data were obtained for nine of the country's 18 pre-registration nursing programmes (7448 students). The programmes belonging to the 13 tertiary education institutions that did not provide data to this study are listed in table 2. The reasons for data not being available for eligible institutions are listed in table 3, the most common of which was no response (six institutions) followed by a refusal to share data because of privacy concerns (three institutions). Table 4 provides information on all the health professional programmes included in the study, the types of tertiary education institutions teaching those programmes, and the number of NZ citizen and permanent resident students enrolled in each programme for the years 2016–2020 inclusive (a total of 19 694 students). It was not possible to determine the number of eligible enrolled students in the 13 institutions that did not provide data.

Citizenship

The majority (94.6%) of health professional students enrolled over the 2016–2020 period inclusive were either

Table 2 Number of programmes not included in the study data

Health professional programme	Number of programmes that did not provide data
Nursing	9
Psychotherapy or psychology	4
Paramedicine	2
Dietetics	1
Medical imaging	1
Medical laboratory science	1
Midwifery	1
Occupational therapy	1
Optometry	1
Osteopathy	1
Physiotherapy	1

NZ citizens or permanent residents, or from NZ realm states of Tokelau, Niue and the Cook Islands (table 5). 1.0% were Australian citizens and 4.4% were international students.

Age and gender

There was a greater proportion of females enrolled in health professional programmes compared with males (79.0% and 20.9%, respectively). As expected, most students were in the 18–29 years age range (figure 1).

School types and socioeconomic rating

In total, 66.7% of health professional students had attended a state school, 14.4% a state-integrated school and 6.5% a private school (table 1). The distribution of students according to the socioeconomic decile rating of the school, and by school type, is shown in figure 2. The distribution is heavily skewed towards schools rated as being towards the socioeconomically advantaged end of the 10-point rating scale.

Table 3 Reasons given for tertiary institutions not providing data

Reason for not providing data	Number of tertiary education institutions
No response to invitation	6
Refused to share data because of privacy concerns	3
Refused to share data because of workload involved with data extraction	2
Refused to share data, no reason given	2
Total	13

Ethnicity and socioeconomic deprivation

Māori and most categories of Pacific students had lower overall rates of enrolment, and Chinese and Southeast Asian students had higher rates (figure 3). Enrolment rates by ethnic group and socioeconomic deprivation are shown in figure 4; for all ethnic groups enrolment rates had a nearly linear negative relationship with increasing small area deprivation (NZDep2018). Figure 5 shows unadjusted and deprivation-adjusted rate ratios for enrolment for different ethnic groups relative to the NZ European and Other category.

Rural/urban distribution

Enrolments were higher for students from urban areas compared with those from rural areas (figure 6). The lower enrolment rates for rural-background students of all ethnic groups are shown in figure 7, and in particular the lower rates for Māori and Pacific students from both rural and urban backgrounds.

DISCUSSION

To the best of our knowledge this is NZ's first national study to report on the sociodemographic characteristics of the health workforce pre-registration. This paper reports on aggregated data for 20606 health professional students. The key finding of this paper is that NZ's pre-registration health professional students do not reflect the diverse communities they will serve in several important dimensions. Overall, there is a systematic under-representation of students who identify as Māori and Pacific, and who come from rural and from low socioeconomic backgrounds. For example, the enrolment rate for Māori students is about 99 per 100 000 eligible population and for some Pacific ethnicities is well under 100 per 100 000 eligible population, compared with 152 per 100 000 for the NZ European ethnic group (figure 3). The unadjusted rate ratio for enrolment for both Māori students and Pacific students versus 'NZ European and Other' students is approximately 0.7 (figure 5). The fact that the socioeconomic-adjusted (NZDep2018) rates of enrolment for Māori students and Pacific students are very close to the rate of the 'NZ European and Other' students is reflective of the fact that Māori and Pacific communities live predominantly in socioeconomically deprived areas,³³ highlighting the importance of an approach to health workforce planning that takes into account the intersection of different social and economic drivers of inequity. In addition, the results of this study are heavily influenced by nursing, the largest programme and one with relatively low levels of ethnic and socioeconomic inequity (results not shown).

These findings are significant because of the central importance of the health workforce planning function within national health systems,^{21 34} and the importance of the makeup of the health workforce in contributing to pro-equity health outcomes for different population groups. For example, there is evidence that the communities

Table 4 All programmes—number of contributing institutions and student enrolments by institution type and programme (New Zealand citizens and permanent residents), 2016–2020 inclusive

	Universities		Institutes of technology and polytechnics		All institutions	
	Institutions	Enrolments	Institutions	Enrolments	Institutions	Enrolments
Anaesthetic technology	1	199	0	0	1	199
Chiropractic	0	0	1	378	1*	378
Dentistry	1	328	0	0	1	328
Dental technology	1	59	0	0	1	59
Dietetics	2	202	0	0	2	202
Medical laboratory science	2	332	0	0	2	332
Medical imaging	1	113	2	376	3	489
Medicine	2	2718	0	0	2	2718
Midwifery	1	535	2	537	3	1072
Nursing	3	2139	6	5309	9	7448
Occupational therapy	1	513	1	721	2	1234
Optometry and optical dispensing	1	280	0	0	1	280
Osteopathy	0	0	1	64	1	64
Oral health	2	483	0	0	2	483
Paramedicine	1	932	0	0	1	932
Pharmacy	2	1009	0	0	2	1009
Physiotherapy	2	1480	0	0	2	1480
Podiatry	1	193	0	0	1	193
Psychology	3	556	0	0	3	556
Psychotherapy	1	105	0	0	1	105
Radiation therapy	1	133	0	0	1	133

*Chiropractic is taught at a private training establishment which is not an institute of technology, polytechnic or a university.

that students are raised in influence their career decisions in terms of the communities they choose to serve; furthermore the presence in the health system of health professionals from a range of backgrounds has been

hypothesised to help address biases in healthcare delivery that can lead to inequities in health outcomes.^{35–38} In NZ the under-representation of Māori students is of particular concern given the health sector's stated commitment

Table 5 All programmes—enrolments by citizenship, all ages and nationalities, 2016–2020 inclusive

	2016 (N=4051)	2017 (N=3906)	2018 (N=4015)	2019 (N=4327)	2020 (N=4307)	Total (N=20 606)
New Zealand citizen	3367 (83.1%)	3196 (81.8%)	3322 (82.7%)	3554 (82.1%)	3502 (81.3%)	16 941 (82.2%)
New Zealand permanent resident	484 (11.9%)	498 (12.7%)	469 (11.7%)	531 (12.3%)	557 (12.9%)	2539 (12.3%)
Tokelau/Niue/Cook Island citizens	0 (0.0%)	0 (0.0%)	3 (0.1%)	2 (0.0%)	1 (0.0%)	6 (0.0%)
Australian citizens	47 (1.2%)	40 (1.0%)	33 (0.8%)	47 (1.1%)	41 (1.0%)	208 (1.0%)
International citizens	153 (3.8%)	172 (4.4%)	188 (4.7%)	193 (4.5%)	206 (4.8%)	912 (4.4%)

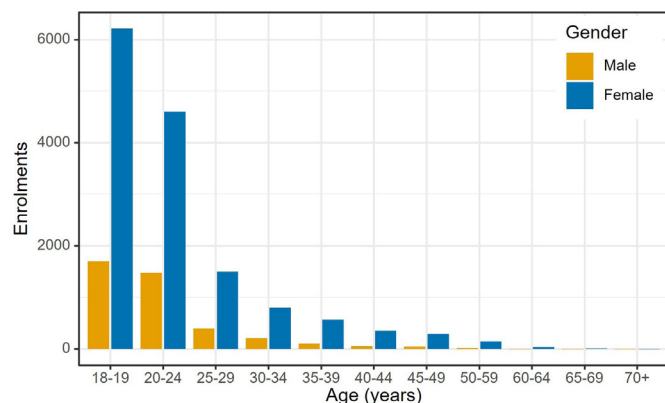


Figure 1 All programmes—enrolments by age and gender, New Zealand citizens and permanent residents, 2016–2020 inclusive.

to Te Tiriti o Waitangi and the Indigenous rights of Māori as the original inhabitants in NZ.^{39 40} In light of this evidence, it is unlikely that NZ's health needs, and the inequities therein, will be adequately addressed by the current health workforce pre-registration.

Considerable time, effort and resource went into conducting this study, highlighting the lack of a nationally consistent approach to routine data collection, reporting and planning in relation to the sociodemographic characteristics of the health workforce pre-registration. Of concern, ethnicity data collection does not align with best practice and potentially introduces numerator/denominator bias given differences in data collection between the education and health workforce sectors.⁴¹ This lack of a consistent approach to data collection contributes to the larger problem of lack of effective linkages and coordination between policy and funding related to tertiary education, and health workforce planning (carried out by the MoH and the two new agencies the Māori Health Authority and Health New Zealand). The admissions processes of universities, institutes of technology and polytechnics are largely driven by the Tertiary Education Commission's funding bands and caps rather than by the workforce needs of the health system.

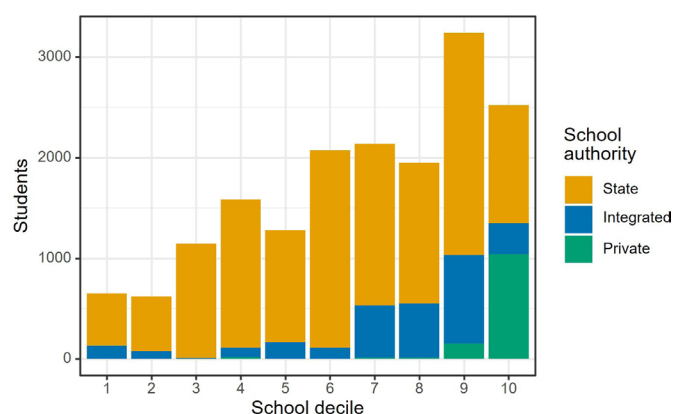


Figure 2 All programmes—enrolments by school decile and authority, New Zealand citizens and permanent residents, 2016–2020 inclusive.

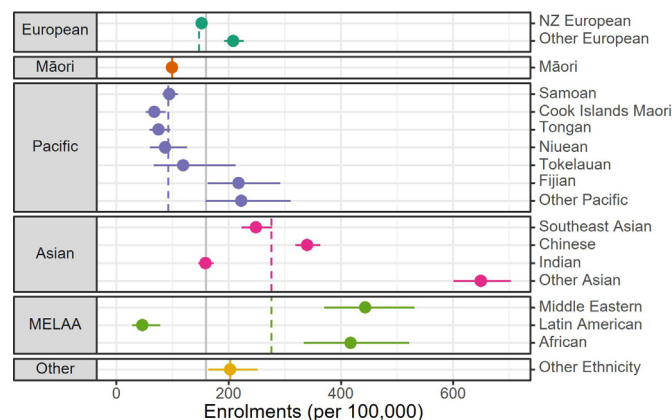


Figure 3 All programmes—enrolment rates by ethnicity,* ages 18–29 years inclusive, New Zealand (NZ) citizens and permanent residents, 2016–2020 inclusive. *Ethnicity: total response. Vertical grey indicates overall enrolment rate, dashed line indicates enrolment rate for level 1 ethnic group, dots (lines) represent enrolment rate (95% CI) for level 2 ethnic group. MELAA, Middle Eastern, Latin American or African.

In conducting this study, it became evident that there is a lack of consistency among tertiary education institutions in relation to information sharing, centred primarily on privacy concerns in relation to student data and different interpretations of the Privacy Act. A priority for future research is the further exploration of the ethical implications of and barriers to data sharing by tertiary education institutions and means of overcoming the barriers to data sharing to inform efforts to increase participation in studies of this nature. It is also evident that few, if any, tertiary institutions are systematically collecting data on gender. Given the health inequities experienced by people with marginalised gender identities, there is a clear need for accurate data on the gender diversity of

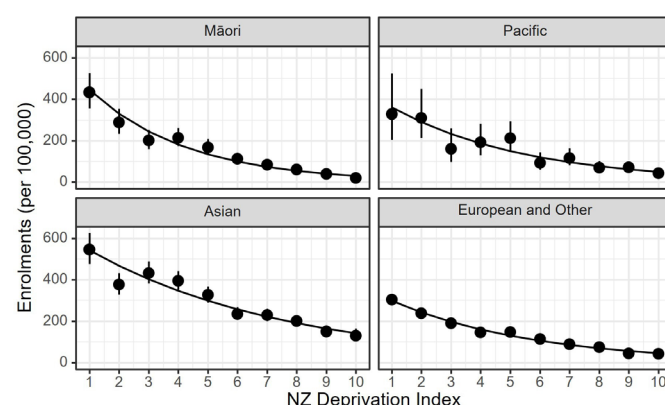


Figure 4 All programmes—enrolment rates by socioeconomic deprivation (NZDep2018) and ethnicity,* ages 18–29 years inclusive, New Zealand (NZ) citizens and permanent residents, 2016–2020 inclusive. *Ethnicity: prioritised level 1. Dots (vertical lines) represent observed rates (95% CI), horizontal lines represent modelled rates treating NZDep2018 as a continuous variable; NZ Deprivation index 1=least socioeconomically deprived, 10=most socioeconomically deprived.

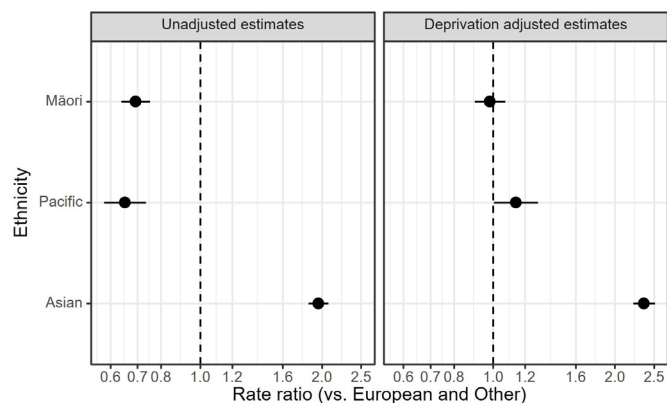


Figure 5 All programmes—differences in enrolment rates by ethnicity,* ages 18–29 years inclusive, New Zealand citizens and permanent residents, 2016–2020 inclusive. *Ethnicity: prioritised level 1. Vertical dashed line represents line of no difference. Dots (horizontal lines) represent rate ratios (95% CI).

the health workforce pre-registration.⁴² Future research priorities also include the measurement of changes in the sociodemographic profile of student cohorts over time, and the measurement of completion and attrition rates for each health professional programme adopting a strengths-based approach to understanding the facilitators as well as barriers to inclusion, to determine if commencing cohorts are similar to graduating cohorts.

This was a national study that included all regulated health professional programmes in tertiary institutions, encompassing five consecutive years. The participation rate among tertiary institutions was 10 out of 23 eligible institutions. The study included both of the country's medicine programmes, both pharmacy programmes, the sole dentistry programme, all oral health programmes, two of the three physiotherapy programmes, two of the

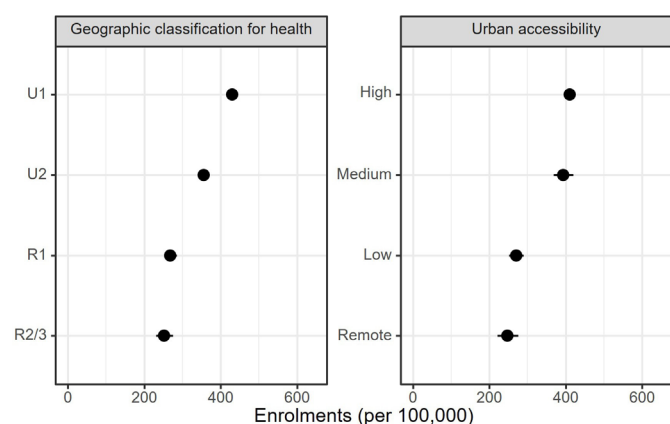


Figure 6 All programmes—enrolment rates by geographical area,* ages 18–29 years inclusive, New Zealand citizens and permanent residents, 2016–2020 inclusive. *Geographical area: Geographical Classification for Health (GCH) and urban accessibility; for GCH the two most remote rural categories, R2 and R3, are combined because of very small numbers in the R3 category. Dots (lines) represent enrolment rate (95% CI) within each geographical area.

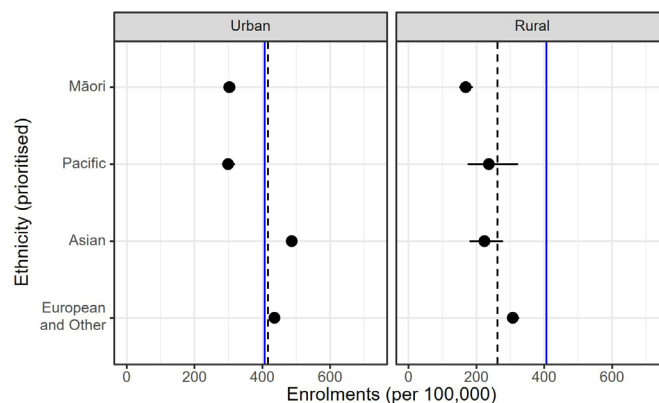


Figure 7 All programmes—enrolment rates by geographical area* and ethnicity,* ages 18–29 years inclusive, New Zealand citizens and permanent residents, 2016–2020 inclusive. *Geographical area: Geographical Classification for Health (see the Methods section for details). Ethnicity: prioritised. Solid blue line indicates overall enrolment rate, dashed line indicates enrolment rate for geographical area, dots (lines) represent enrolment rate (95% CI) for level 1 ethnic group within area.

three medical laboratory science programmes, three of the five midwifery programmes and nine of the country's eighteen nursing programmes. The results are therefore likely to provide a representative picture of the health workforce pre-registration. The weaknesses of the study include that it does not include all health professional programmes, and only half of the nursing programmes. There were considerable differences between the sociodemographic profiles of students enrolled in different health professional programmes that are not reported in this paper and will be a priority for future analyses. This study reports cross-sectional data for the 5-year period 2016–2020 inclusive, and therefore we cannot report longer-term trends in enrolment patterns. We note that the practise of recording up to three ethnic groups within NZ tertiary institutional data does not align with best practice or recommended protocols to allow for as many ethnic groups to be identified as required. The Asian ethnic category is very broad and there would be considerable benefit if level 2 ethnicity groupings were routinely used. We recommend that a standard ethnicity data collection protocol be adopted by all tertiary education institutions.²⁸ In addition, we were not able to report data on gender diversity as there were only 33 gender diverse students listed in the dataset (almost certainly a significant undercount reflective of institutional coding practices), and 'gender diverse' was not included as a category in any denominator datasets.

We conclude that NZ's health workforce pre-registration students do not reflect the different communities they need to serve in several important dimensions, and this in turn has material impacts on the ability of the workforce to effectively respond to the health needs of the country's diverse communities. As previously noted, the workforce pre-registration is not Treaty of Waitangi compliant.

and is failing to reflect Māori indigenous rights to access health professional programmes of study. We recommend that: (1) there should be a nationally coordinated system for collecting and reporting on the numbers and sociodemographic characteristics of the health workforce pre-registration; (2) mechanisms be developed to allow the agencies that fund tertiary education to base their funding decisions directly on the projected health workforce needs of the health system and (3) tertiary education funding decisions be based on Te Tiriti o Waitangi and have a strong pro-equity focus.

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REFERENCES

- 1 Rees GH, Crampton P, Gauld R, *et al*. New Zealand's health workforce planning should embrace complexity and uncertainty. *N Z Med J* 2018;131:109–15.
- 2 Rees GH, Crampton P, Gauld R, *et al*. The promise of complementarity: using the methods of foresight for health workforce planning. *Health Serv Manage Res* 2018;31:97–105.
- 3 Rees GH. The evolution of new Zealand's health workforce policy and planning system: a study of workforce governance and health reform. *Hum Resour Health* 2019;17:51.
- 4 Rees GH, Crampton P, Gauld R, *et al*. Health workforce planning under conditions of uncertainty: identifying supportive integrated care policies using scenario analysis. *JICA* 2020;29:153–69.
- 5 Seleq S, Jo E, Poole P, *et al*. The employment gap: the relationship between medical student career choices and the future needs of the new Zealand medical workforce. *N Z Med J* 2019;132:52–9.
- 6 Poole PJ, Wilkinson TJ, Bagg W, *et al*. Developing new Zealand's medical workforce: realising the potential of longitudinal career tracking. *N Z Med J* 2019;132:65–73.
- 7 Nazroo JY. The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism. *Am J Public Health* 2003;93:277–84.
- 8 Kamran SC, Winkfield KM, Reede JY, *et al*. Intersectional analysis of U.S. medical faculty diversity over four decades. *N Engl J Med* 2022;386:1363–71.
- 9 O'Malley V. *The New Zealand wars, ngā pakanga o aotearoa*. Wellington: Bridget Williams Books, 2019.
- 10 Stats NZ. Census ethnic group summaries wellington stats NZ. 2020. Available: <https://www.stats.govt.nz/tools/2018-census-ethnic-group-summaries/> [Accessed 12 Jan 2022].
- 11 Crampton P, Weaver N, Howard A. Holding a mirror to society? progression towards achieving better sociodemographic representation among the University of Otago's health professional students. *N Z Med J* 2018;131:59–69.
- 12 Crampton P, Baxter J, Bristowe Z. Selection of Māori students into medicine: re-imagining merit. exploring some of the sociological reasons that might explain the exclusion of Māori from the medical workforce. *N Z Med J* 2021;134:59–68.
- 13 Curtis E, Wikaire E, Jiang Y, *et al*. Examining the predictors of academic outcomes for Indigenous Māori, Pacific and rural students admitted into medicine via two equity pathways: a retrospective observational study at the University of Auckland, aotearoa New Zealand. *BMJ Open* 2017;7:e017276.
- 14 Grainger B, Yelder J, Reid P, *et al*. Predictors of medical student remediation and their underlying causes: early lessons from a curriculum change in the University of Auckland medical programme. *N Z Med J* 2017;130:73–82.
- 15 Hotu S, Hotu C, Adair D, *et al*. Letter on an iceberg. *N Z Med J* 2021;134:134–5.
- 16 Matthews C, Bagg W, Yelder J, *et al*. Does pukawakawa (the regional-rural programme at the University of Auckland) influence workforce choice? *N Z Med J* 2015;128:35–43.
- 17 Webster CS, McKillop A, Bennett W, *et al*. A qualitative and semiquantitative exploration of the experience of a rural and regional clinical placement programme. *Med Sci Educ* 2020;30:783–9.
- 18 Poole P, Van Lier D, Verstappen A, *et al*. How rural is rural? the relationship between rural background of medical students and their career location intentions. *Aust J Rural Health* 2021;29:363–72.
- 19 Abid Y, Connell CJW, Sijnja B, *et al*. National study of the impact of rural immersion programs on intended location of medical practice in New Zealand. *Rural Remote Health* 2020;20:5785.
- 20 Reid P. Structural reform or a cultural reform? moving the health and disability sector to be pro-equity, culturally safe, tiriti compliant and anti-racist. *N Z Med J* 2021;134:7–10.
- 21 World Health Organization. *Global strategy on human resources for health: workforce 2030*. Geneva: World Health Organization, 2016.
- 22 Durie M. *Te mana, te kawanatanga, the politics of maori self-determination*. Auckland: Auckland University Press, 1998.
- 23 Reid P, Cormack D, Paine SJ. Colonial histories, racism and health—the experience of Māori and indigenous peoples. *Public Health* 2019;172:119–24.
- 24 Kapeli SA, Manuela S, Sibley CG. UNDERSTANDING pasifika mental health in new Zealand: a review of the literature. *MAI Journal* 2020;9:249–71.
- 25 Ministry of Health. *Responsible authorities under the act*. Wellington: Ministry of Health, 2020. Available: <https://www.health.govt.nz/our-work/regulation-health-and-disability-system/health-practitioners-competence-assurance-act/responsible-authorities-under-act> [accessed Aug 2021].
- 26 Stats NZ. Census wellington: stats NZ. 2020. Available: <https://www.stats.govt.nz/2018-census/> [Accessed 11 Jan 2022].

- 27 Perham ER. Citizenship laws in the realm of New Zealand. *The New Zealand Yearbook of International Law* 2011;9:219–40.
- 28 Ministry of Health. *Ethnicity data protocols HISO 10001:2017*. Wellington: Ministry of Health, 2017.
- 29 Stats NZ. *Urban accessibility – methodology and classification*. Wellington: Stats NZ, 2020. Available: <https://www.stats.govt.nz/methods/urban-accessibility-methodology-and-classification>
- 30 Whitehead J, Davie G, de Graaf B, *et al*. Defining rural in aotearoa New Zealand: a novel geographic classification for health purposes. *N Z Med J* 2022;135:24–40.
- 31 Atkinson J, Salmond C, Crampton P. NZDep2018 index of deprivation user's manual. 2019. Available: <https://www.otago.ac.nz/wellington/departments/publichealth/research/hirp/otago020194.html>
- 32 R Core Team. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing, 2013. Available: <http://www.R-project.org/>
- 33 Crampton P. Oh my. *N Z Med J* 2020;133:8–10.
- 34 Birch S, Kephart G, Murphy GT, *et al*. Health human resources planning and the production of health: development of an extended analytical framework for needs-based health human resources planning. *J Public Health Manag Pract* 2009;15:S56–61.
- 35 van Ryn M. Research on the provider contribution to race/ethnicity disparities in medical care. *Med Care* 2002;40:1140–51.
- 36 van Ryn M, Fu SS. Paved with good intentions: do public health and human service providers contribute to racial/ethnic disparities in health? *Am J Public Health* 2003;93:248–55.
- 37 Cooper LA, Beach MC, Johnson RL, *et al*. Delving below the surface. understanding how race and ethnicity influence relationships in health care. *J Gen Intern Med* 2006;21 Suppl 1:S21–7.
- 38 Burgess DJ, Fu SS, van Ryn M. Why do providers contribute to disparities and what can be done about it? *J Gen Intern Med* 2004;19:1154–9.
- 39 Ministry of Health. *Health and disability workforce strategic priorities and action plan*. Wellington: Ministry of Health, 2019. Available: <https://www.health.govt.nz/our-work/health-workforce/health-and-disability-workforce-strategic-priorities-and-action-plan>
- 40 Ministry of Health. *Whakamaui Māori health action plan 2020–2025*. Wellington: Ministry of Health, 2020.
- 41 Cormack D, Harris R. *Issues in monitoring Māori health and ethnic disparities: an update*. Wellington: Te Rōpū Rangahau Hauora a Eru Pōmare, University of Otago, Wellington, 2009.
- 42 Taylor O, Rapsey CM, Trehan GJ. Sexuality and gender identity teaching within preclinical medical training in New Zealand: content, attitudes and barriers. *N Z Med J* 2018;131:35–44.