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The enrolment gap and the COVID-19 pandemic: an exploration of routinely collected primary care enrolment data from 2016 to 2023 in Aotearoa New Zealand

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ABSTRACT

Introduction. For many countries, primary health care (PHC) serves as the gateway for individuals to access healthcare services. It has been shown to not only improve health but also health equity. To maximise this benefit, a substantial proportion of the population needs to be connected with PHC. The aim here was to assess the degree and evolution of enrolment in light of the coronavirus disease 2019 (COVID-19) pandemic in Aotearoa New Zealand. **Methods.** We examined data on the enrolment of people in PHC organisations between 2016 and 2023. This analysis included breakdowns by sex, age groups, ethnicity, and socio-economic deprivation levels. Poisson regression models were used to explore whether enrolment changed because of the COVID-19 pandemic. **Results.** In 2016, Māori, young people and the most deprived had lower enrolment rates relative to their peers. Although young people's enrolment rate increased over time, especially during the COVID-19 pandemic, the Māori enrolment rate declined, as did the rate for Pacific people, and those who were the most deprived. The groups who had increases in enrolment rates were those with the lowest levels of socioeconomic deprivation and those in the 'Other' ethnic category, predominantly made up of European New Zealanders. **Conclusion.** Enrolment statistics reveal disparities across socio-demographic lines. The COVID-19 pandemic was associated with changed patterns of enrolment that appear to have consequences for population health.

Keywords: Aotearoa New Zealand, COVID-19, ethnic disparities, general practice, health equity, patient enrolment, primary health care, primary health organisation.

Introduction

Primary health care (PHC), as declared by the World Health Organization (WHO), '… is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process.'[1]

This means that PHC not only provides health care, but acts to appropriately direct people to further health and social care. PHC fosters enhanced patient outcomes through its emphasis on early intervention and continuous, comprehensive care.[2,3] By prioritising accessibility and preventive measures, it significantly contributes to the overall efficiency and effectiveness of health services, alleviating the burden on tertiary care.[2,3] As well as improving health, PHC has been shown to improve health equity by offering accessible and comprehensive care.[4] Therefore, these benefits will be maximised, at a population level, by encouraging the greatest proportion of people to connect with PHC.[4] This connection has been organised in a number of different ways across countries,[5] but in Aotearoa New Zealand (NZ), it was envisioned through the 2001 PHC Strategy that all the eligible population would be enrolled through a Primary Health Organisation (PHO).[6]

In NZ, people visiting a general practice are encouraged to enrol with a PHO. This registration provides benefits for the patient, such as lower consultation fees and greater

WHAT GAP THIS FILLS

What is already known: Māori, young people and those who are more socioeconomically deprived are less likely to be enrolled in a primary health organisation.

What this study adds: This study refines the enrolment rate statistics to get more accurate estimates of access to primary healthcare enrolment. It looks at trends over time in enrolment and any changes that have occurred between the pre-COVID-19 era and the COVID-19 era.

continuity of care, and for the general practice by gaining government funding for each patient enrolled.[7,8] There are also benefits seen at the population level. An analysis of deaths between 2008 and 2017 in NZ found that those who died from an amenable death were less likely to be enrolled, after adjusting for age, sex, ethnicity and socioeconomic deprivation.[9]

Enrolment lasts for 3 years, but this term is reset when an enrollee has a consultation or the provider receives information from the enrollee during that period that they wish to remain enrolled.[10] Patients can only be enrolled at one service provider at a time and if they enrol at a new provider, then they are disenrolled from the previous provider.[10] Enrolment is not universal; some new migrants and people in New Zealand on certain visa types (eg diplomatic and short-term work visas) are ineligible to enrol and prisoners are disenrolled while they are on remand or serve their sentence.[10] There are also differences between eligible groups, in particular, lower enrolment is seen in Māori, younger people and those who are most deprived.[7]

The first case of coronavirus disease 2019 (COVID-19) in New Zealand was reported on 28 February 2020, and this heralded a raft of changes in health care, including how and where it was accessed. The number of face-to-face general practitioner (GP) consultations was reduced due to the COVID-19-related restrictions.[11] We suspect the COVID-19 pandemic might have changed enrolment patterns – people catching COVID-19 who were not enrolled might have enrolled to get COVID-19-related health care, particularly for young people who had the highest rates of catching COVID-19 and the lowest enrolment rates compared to other age groups. In contrast, infants needing routine preventative primary health care might have been kept away from general practices to reduce the risk of catching COVID-19 or the perception of others needing care more.[12]

Prior research has revealed inadequacies in the existing enrolment rate statistics.[7,13] Te Whatu Ora Health New Zealand (TWO/HNZ) provides a statistic called 'access to enrolment', which they release quarterly.[14] The statistic is the number of people enrolled divided by the resident population multiplied by 100 and reported as a percent (it can be thought of as the enrolment rate per 100 population). The count of the number of people enrolled is calculated from data submitted by PHOs to the TWO/HNZ for funding purposes. The resident population is estimated using population *projections,* which are calculated by Statistics New Zealand based on census data and *assumptions* about births, deaths and migrations.[15] At the time when the access to enrolment statistic is calculated, the projected population is the best available estimate of the resident population. However, the projected population estimates are less reliable as time moves further away from the census. Also, new population projections are calculated whenever a new census occurs (ie after the 2013, 2018 and 2023 censuses). This means that this population data series can introduce biases in the trends of the access to enrolment statistics.

Marked changes have been observed in the access to the enrolment statistic produced by the TWO/HNZ, most notably during the COVID-19 pandemic era (eg in the July quarter 2019, the access to enrolment statistic for Māori was 90% whereas in the July quarter 2023, it was 83%). To put this in perspective, 7% of the Māori population in the July quarter 2023 was approximately 63 000 people.[14] We were interested in: (1) studying trends in enrolment between 2016 and 2023 using a new enrolment rate indicator, improving on the one reported by TWO/HNZ; and (2) studying how COVID-19 might have affected enrolment patterns.

Methods

Enrolment counts and the access to enrolment statistics were accessed from the TWO/HNZ website by gender, age group, prioritised ethnicity and the NZ Deprivation index (NZDep) for the July quarter of each year from 2016 to 2023.[14] Age group was reported in funding bands as defined by the TWO/HNZ. Prioritised ethnicity is a method of assigning people to one ethnicity based on the priority ordering Māori, Pacific peoples, Asian, New Zealand European/'Other' and reported by the TWO/HNZ in three categories as Māori, Pacific peoples and 'Other' (the non-Māori, non-Pacific population). The NZDep is an area-based measure of socioeconomic deprivation based on information obtained from responses to census questions and assigned to people based on their home address. From 2019, enrolment counts could be accessed in finer detail.[14]

We created our own access to enrolment statistic by using the enrolment counts as the numerator but using the TWO/HNZ's 'best population' as the denominator and multiplying by 100.[16] The best population data are a mixture of the estimated resident population and the projected population.[15,17] The estimated resident population used here is based solely on the 2018 census and uses *observed counts* of births, deaths and migrations to estimate the resident population in other years and is reported as at the 31 June each year. When the estimated resident population was not

available, because the relevant information has not been observed and/or compiled, then the best population uses the projected population based on the 2018 census instead. For sex, age group and NZDep, the projected population was used for 2023. For ethnicity, the projected population was used for 2019–2023.

Modelling of enrolment counts was conducted using Poisson regression with a log link function. The four explanatory variables, sex, age group, prioritised ethnicity and NZDep were entered into the model as categorical variables. An offset was included in the model, the log of the best population divided by 100, so that the coefficients of the model, when exponentiated, would be on the same scale as the access to enrolment statistics. For the four variables of interest, three models were created. The first model contained the variable of interest plus an indicator variable, which was 0 before 2020, the start of the COVID-19 pandemic era and 1 from then on; that is,

$$\log(\text{enrolment count}_{i,j}) = \alpha + \beta_i \times \text{var}_i + \gamma \times \text{COVID}_{j>2019} + \log(\text{population}_{i,j}/100)$$

where $i = 1 \ldots$ number of levels in var and $j = 2016 \ldots 2023$, and where α, β_i, and γ are estimated by the modelling software.

The second model added an interaction term between the variable of interest and the COVID-19 indicator variable. This model was used to test whether this more complex model was an improvement over the previous model; that is,

$$\log(\text{enrolment count}_{i,j}) = \alpha + \beta_i \times \text{var}_i + \gamma \times \text{COVID}_{j>2019} + \delta_i \times \text{var}_i \times \text{COVID}_{j>2019} + \log(\text{population}_{i,j}/100)$$

where α, β_i, γ and δ_i are estimated by the modelling software.

The third model was the second model re-parameterised so that the parameters of interest could be estimated directly (ie whether there was a difference in the access to enrolment statistic in the two time periods for each level of the specified variable); that is,

$$\log(\text{enrolment count}_{i,j}) = \beta_i \times \text{var}_i + \delta_i \times \text{var}_i \times \text{COVID}_{j>2019} + \log(\text{population}_{i,j}/100)$$

where β_i and δ_i are estimated by the modelling software.

Using the mathematical properties of the log function and for the *i*th level of the variable of interest, this model can be written on the natural scale as enrolment $\text{count}_{i,j}/\text{population}_{i,j} \times 100 = \exp(\beta_i)$ before 2020 and enrolment $\text{count}_{i,j}/\text{population}_{i,j} \times 100 = \exp(\beta_i + \delta_i)$ from 2020. Thus, $\exp(\beta_i)$ estimates the access to enrolment percentage prior to 2020 and $\exp(\beta_i + \delta_i)$ from 2020.

As the counts were very large, some coefficients could be statistically significant without being practically significant. After asking a colleague with expertise who was blinded to the results, a two percentage-point difference between the pre-COVID-19 era and the COVID-19 era was taken to be the level at which a difference was considered policy relevant.

Ethics

No ethics approval was sought for this study as this was a secondary analysis of administrative data analysed at the group level.

Results

The overall access to enrolment statistic was 93.5 in 2016 and 95.4 in 2023 (see Supplementary Table S1). From observation (see Fig. 1*a*), the statistic was greater for females than males and slightly increased for both between 2016 and 2023. Most age groups were stable over this time period; however, the 15- to 24 and 25- to 44-year age groups appeared to have a slight increase that was more marked after 2019 (Fig. 1*b*).

Māori had the lowest access to enrolment in 2016 and Pacific peoples the highest, but both groups showed a decrease from 2016 to 2023, which was more marked for Pacific peoples. There was an increase in the remaining population (Fig. 1*c*). In 2016, those who were in the less deprived quintiles had greater access to enrolment, although those in deciles 7–8 and 9–10 were similar to each other. From 2019, there was a decline among those in NZDep 9–10, whereas the remaining socioeconomic deprivation groups showed a widening increase.

Analysis of variance tests were used to compare model 1 with model 2 for each variable of interest. In each case, the interaction model (model 2) was preferred. Table 1 presents the results from model 3, the re-parameterised version of model 2. In all cases, except for those aged 45–64 years ($P = 0.0541$), the δ_i coefficient was significant at the 5% level indicating that there was a statistically significant difference in enrolment rates between the two time periods. However, taking a rate difference of 2 percentage points as the threshold for practical significance, Pacific people showed the greatest decrease (difference = −5.1%) with Māori (−1.7%) and NZDep level 9–10 (−1.9%) being close to the threshold.

In contrast, the greatest increase was shown for those aged 15–24 (3.2%) years and 25–44 (2.2%) years, NZDep 1–2 (2.7%) and the 'Other' ethnic category (2.2%), which was predominantly made up of European New Zealanders.

The Māori and Pacific ethnic groups were examined by age group to see which age groups were showing the biggest changes using the data available from 2019, the first year when enrolment numbers could be analysed at this level of detail. The graphs of these data are presented in Fig. 2,

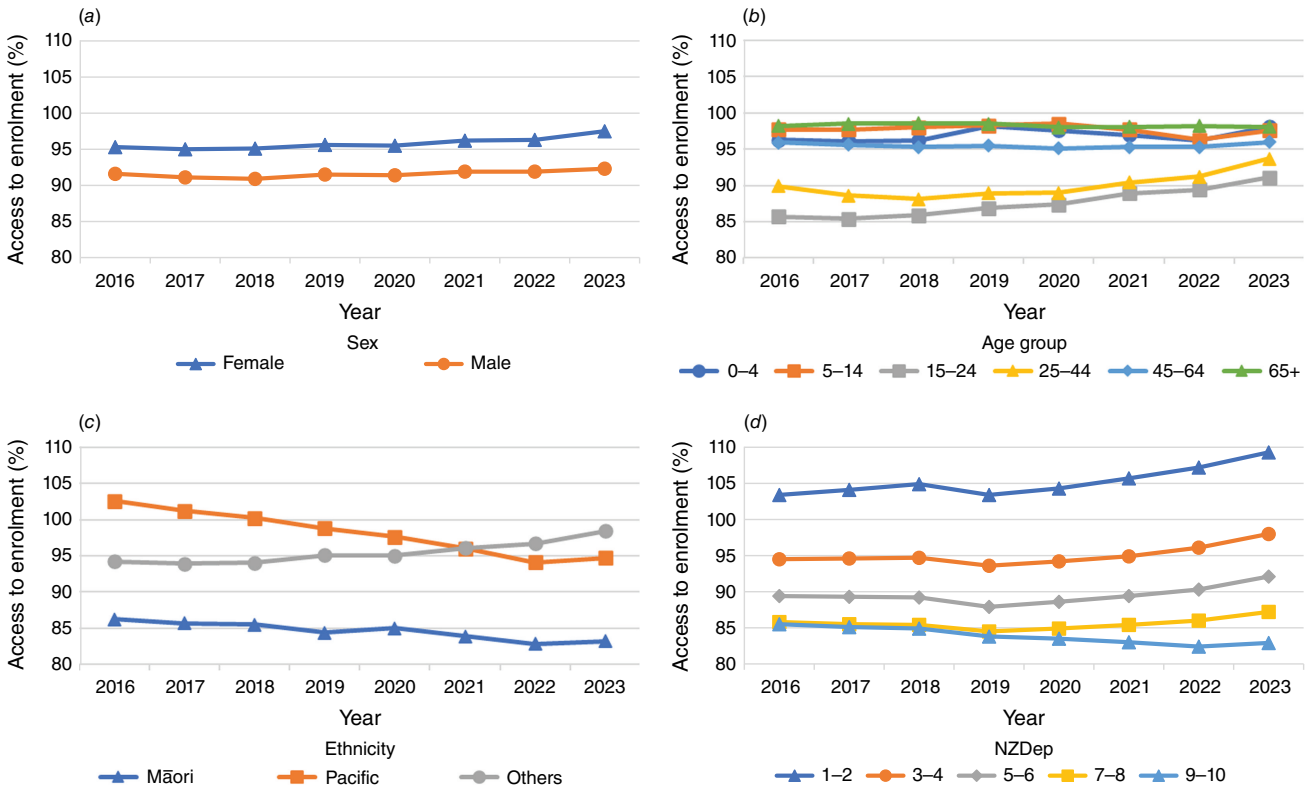

Fig. 1. Access to enrolment by (*a*) sex, (*b*) age group, (*c*) prioritised ethnicity, and (*d*) NZDep deciles (1 is least deprived, 10 is most deprived).

where the age groups that show a difference of more than 2 percentage points are highlighted with a dashed line. For the Māori data, the age group 0–4 years has a strong decline, but is masked by a concurrent rise in the 65 + year age group. For Pacific people, the decline has been more wide ranging: for children (5–14 years) and teens and younger adults (15–24 years, 25–44 years).

The strong decline for Māori in the 0- to 4-year age group necessitated some way of confirming that the result seen was accurate rather than some artefact of the population data used. For this group, the count of live births for the 0- to 4-year cohort was substituted for the population statistics, for each year, and the pattern remained similar.

A further way to check whether this decline in enrolment is real is to check whether indicators of enrolment-related care also declined. Lack of enrolment means that caregivers of these children will not get reminders about getting vaccinations through their primary care provider. The statistic 'Immunisations rates at 24 months' is used as a monitoring statistic for system performance and is reported online.[18] This statistic was plotted by ethnicity from 2018 to 2023 (see Fig. 3). For the 'Other' population, 'Immunisations rates at 24 months' has stayed relatively stable, but the change in rates between the start and end of the series have been substantial for Māori (change = 18 percentage points) and Pacific people (change = 13 percentage points).

Discussion

Overall, there has been a rise in access to enrolment, from 93.5% in 2016 to 95.4% in 2023. This rise primarily benefits the least deprived and the 'Other' ethnic group, which predominantly consists of European New Zealanders, who already had high enrolment rates. In contrast, it has also increased for young people. Conversely, disadvantaged populations with higher needs, such as the more socioeconomically deprived and Māori and Pacific peoples, have experienced declining enrolment rates.

This paper has improved the access to enrolment statistic by using population data that are based on one source (the 2018 census) and using the estimated population over the projected population where possible. The difference this has made to the estimates is particularly apparent for Māori where a substantial decline seen in the TWO/HNZ access to enrolment statistics was clearly an artefact of using different census-based sources of projected population data (see Fig. 3*b*). This reveals the tension between TWO/HNZ obligation to produce the best estimate at each time point with the best available data to hand and with our purpose of trying to produce a coherent time series to make sense of changes over time. The methodological refinements we have made here have increased our confidence that the changes we see are real.[7]

Table 1. Model 3 coefficients and estimates of access to enrolment for sex, age group, prioritised ethnicity and NZDep deciles.

	Model 3 results[A]							
	Pre-COVID-19 coefficient	COVID-19 era change	*P*-value for the change	Pre-COVID-19 enrolment rate	95% Confidence Interval	COVID-19 era enrolment rate	95% Confidence Interval	Difference $\exp(\beta_i + \delta_i) - \exp(\beta_i)$
	β_i	$\delta_i \times 100$[B]		$\exp(\beta_i)$		$\exp(\beta_i + \delta_i)$		
All	4.5357	1.03	<0.0001	93.29	93.25–93.34	94.26	94.22–94.30	0.9
Sex								
Female	4.557	1.1	<0.0001	95.3	95.2–95.3	96.4	96.3–96.4	1.1
Male	4.514	0.9	<0.0001	91.3	91.2–91.3	92.1	92.1–92.2	0.9
Funding age groups (years)								
0–4	4.572	0.5	<0.0001	96.7	96.5–96.9	97.2	97.1–97.4	0.5
5–14	4.584	−0.4	<0.0001	98.0	97.8–98.1	97.6	97.4–97.7	−0.4
15–24	4.454	3.7	<0.0001	86.0	85.9–86.1	89.2	89.1–89.3	**3.2**[C]
25–44	4.487	2.4	<0.0001	88.9	88.8–89.0	91.1	91.0–91.1	**2.2**
45–64	4.560	−0.1	0.0541	95.6	95.5–95.7	95.4	95.4–95.5	−0.1
65+	4.590	−0.4	<0.0001	98.5	98.4–98.6	98.1	98.0–98.2	−0.4
Prioritised ethnicity (in priority order)								
Māori	4.448	−2.1	<0.0001	85.4	85.3–85.5	83.7	83.6–83.8	**−1.7**
Pacific	4.612	−5.2	<0.0001	100.7	100.5–100.8	95.6	95.4–96.7	**−5.1**
Others	4.547	2.3	<0.0001	94.3	94.3–94.4	96.5	96.5–96.6	**2.2**
New Zealand deprivation index (NZDep) deciles								
1–2	4.644	2.6	<0.0001	104.0	103.9–104.1	106.6	106.5–106.7	**2.7**
3–4	4.555	1.5	<0.0001	94.3	94.2–94.4	95.8	95.7–95.9	1.5
5–6	4.488	1.3	<0.0001	89.0	88.9–89.1	90.1	90.0–90.2	1.1
7–8	4.446	0.7	<0.0001	85.3	85.2–85.4	85.9	85.8–86.0	0.6
9–10	4.441	−2.2	<0.0001	84.8	84.7–84.9	83.0	82.9–83.0	**−1.9**

[A]Model 3 results are for all variables except 'All'.
[B]The COVID-19 era enrolment rate for females is calculated as $\exp(\beta_i + \delta_i) = \exp(4.557 + 0.011) = 96.4$.
[C]Bolded data show results that are close to or are practically significant.

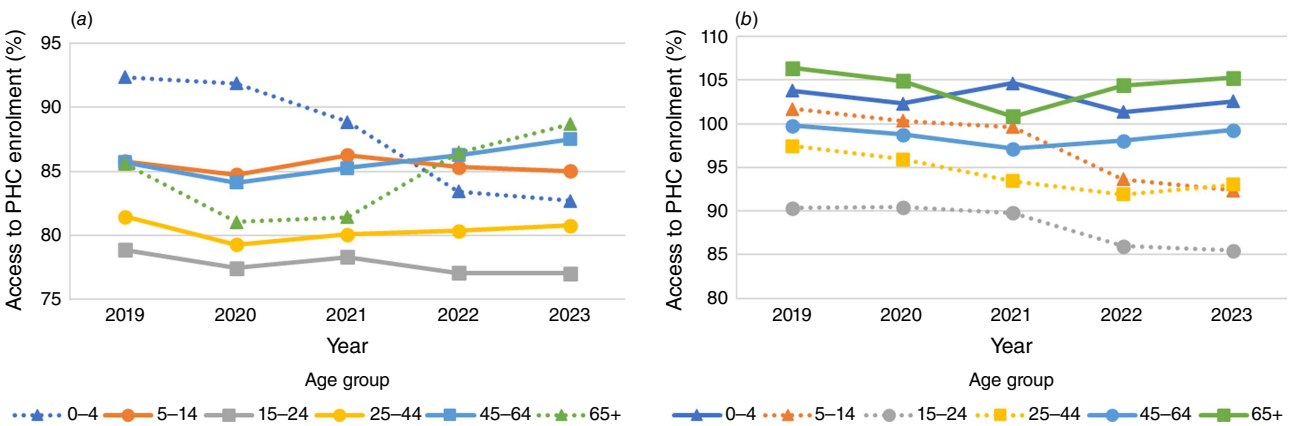

Fig. 2. Access to PHC enrolment for (*a*) Māori, and (*b*) Pacific people by funding age groups for June in each year. Dashed lines indicate an access to enrolment difference of ±2 percentage points or more between 2019 and 2023.

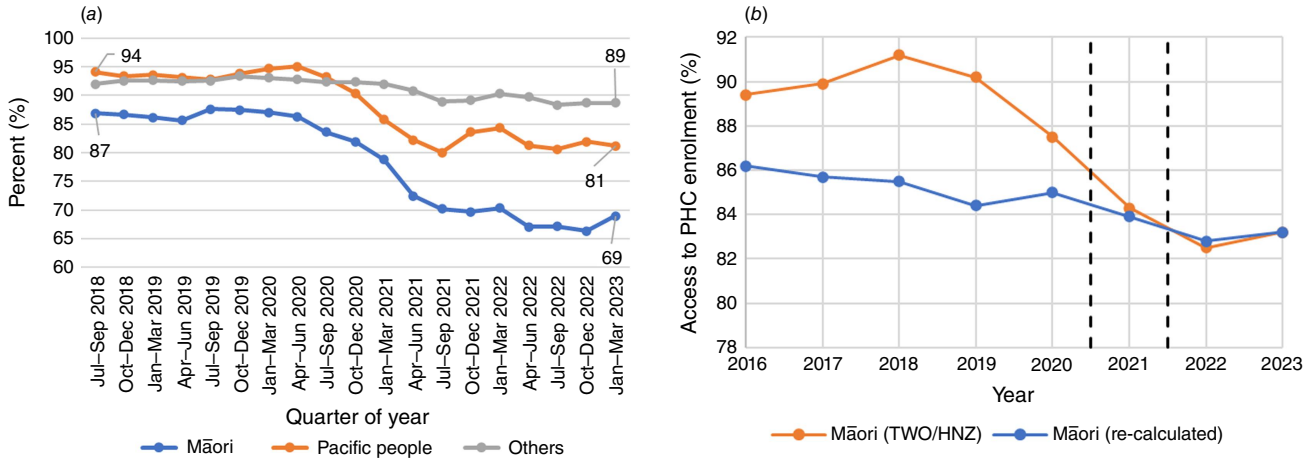

Fig. 3. (*a*) Immunisation rates for children at 24 months, and (*b*) access to enrolment statistics published by TWO/HNZ using projected population data available at the time (dashed lines indicate changes in the population series used) versus our recalculated figures for Māori.

The most obvious limitation in this analysis is that the access to enrolment statistics relies on information from two different sources. The numerator, the counts of enrolments, comes from PHO reports to the TWO/HNZ and the PHOs get their information from data collected at the point of enrolment by self-report of enrollees. Current addresses are usually checked at each visit to the general practice. The denominator data, the population, both estimated and projected, comes from Statistics New Zealand and is based on information from the census. Although age and sex are most likely to be consistent between these data sets over time, ethnicity and NZDep data are less likely to be consistent.

People report their ethnicity differently in different contexts according to who is asking, how it is asked and the use to which the information will be put.[19,20] In a study comparing ethnicity, as recorded in Ministry of Health (MoH) data with census data, around 80% of people who reported Māori as their sole ethnicity in the census were recorded as Māori in the MoH data, with the corresponding figure for those who reported sole Pacific ethnicity being around 85%.[19] For those reporting multiple ethnicities, less than 40% of those reporting multiple ethnicities in the census had the same ethnic profile recorded in MoH data.[19] This might partly explain why Pacific people's access to enrolment is over 100% at some timepoints and why young Pacific people, who are more likely to have multiple ethnicities, might appear to have decreasing enrolment rates at a time when the rate for 'Other' young people is increasing. It might be worth investigating if young Pacific people are choosing not to declare their Pacific ethnicity, and why, or if the question on ethnicity that is given to young Pacific people is unable to correctly capture their identity.

The enrolment rate for those in NZDep 1–2 is also above 100%. A comparison of which age groups show the greatest relative difference between the enrolment data and the MoH best population found that older people (75+ years) and those aged 15–24 years were more likely to be overestimated in the enrolment data as being in NZDep 1–2. These age groups are generally periods of transition in people's lives when young people move from their family home for education, work or a new relationship and older people move from the family home to more easily managed housing or a care home. In both cases, the new addresses are likely to be in areas of greater socioeconomic deprivation. These new addresses might not be updated with the general practice/PHO, either by choice or indifference, and so not get updated in the enrolment data set.

The rise in enrolment among young people during the COVID-19 pandemic offers a glimpse of a potentially positive outcome amid a challenging period. However, it seems likely that this rise will not be sustained in this cohort once the influence of the COVID-19 pandemic wanes, and without this impetus, the next cohort of young people are not likely to show these higher enrolment rates. There are very few general practices aimed at young people, the only exception being in large urban areas and at tertiary education centres. In a study on 'closed books', a survey respondent reported the difficulty of keeping young people connected to primary health care when they left tertiary education after observing the number of people who never had their medical records transferred to a new provider.[21]

One of the 'silent consequences' of the COVID-19 pandemic has been the drop in vaccination rates for many diseases around the globe.[22–24] This has been mainly due to governments needing to re-orient their services to meet the demands of the COVID-19 pandemic, as well as people's concerns about interacting with health services during a pandemic.[12,23] However, there were also other forces at work. Politicisation of the COVID-19 vaccines has had spill-over affects to other vaccines, with decreased trust in the people and institutions dispensing vaccines.[23]

This drop in vaccination rates has also been seen in New Zealand in some groups, with the greatest drop being seen in the Māori community alongside a drop in access to enrolment for those Māori aged 0–4 years. The drop in vaccination rates has also been observed in the Pacific population, but not to the same extent and not with a drop in access to enrolment for those aged 0–4 years. This lowered rate of vaccination rates is of particular concern, as in 2019, the Pacific region,[25] including New Zealand,[26] had multiple outbreaks of measles. The current immunisation rates fall far short of the necessary rate of 95% to have herd immunity from measles. This runs the risk of another outbreak that will put Māori and Pacific peoples particularly at risk.[23,27]

In conclusion, the paper highlights the nuanced landscape of PHC enrolment access in NZ from 2016 to 2023. Despite an overall increase in enrolment access, the benefits are unequally distributed, and Māori and Pacific communities are experiencing a decline, pointing towards a widening gap in healthcare access. The COVID-19 pandemic has temporarily bolstered enrolment among young individuals, a trend speculated to be short-lived post-pandemic. Alarmingly, the pandemic era has also seen a drop in vaccination rates, exacerbating the vulnerability of already at-risk communities, such as the Māori and Pacific populations, raising concerns about potential future outbreaks of diseases like measles. The inconsistencies in data sources and the potential unreliability of self-reported information add another layer of complexity to understanding and addressing these issues. The paper emphasises the critical need for addressing these disparities and enhancing the accuracy and consistency of data collection, where possible, for a more equitable healthcare landscape in New Zealand.

Supplementary material

Supplementary material is available online.

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