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The Natural and Built Environments where Pacific Children and Young People in Aotearoa New Zealand Live: A Nationwide Cross-Sectional Geospatial Study

Ngā Taiao Tūturu me ngā Taiao Hanga e Noho Ana ngā Tamariki me ngā Taiohi Moananui-a-Kiwa i Aotearoa He Rangahau Mokowā ā-Nuku Motuhanga ā-Motu

TROY RUHE,[*] LUKÁŠ MAREK,[†] NICK BOWDEN,[‡] JESSE WIKI,[§] REREMOANA THEODORE,[**] MATT HOBBS,[††] HIRAN THABREW,[‡‡] ROSALINA RICHARDS,[§§] BARRY MILNE,[***] SARAH HETRICK,[†††] JOSEPH BODEN,[‡‡‡] AND JESSE KOKAUA[§§§]

[*] Troy Ruhe is a research fellow at Va'a o Tautai | Centre for Pacific Health at the University of Otago | Ōtākou Whakaihu Waka.
Corresponding author: troy.ruhe@otago.ac.nz

[†] Lukas Marek is a post-doctoral fellow at the Geospatial Research Institute, University of Canterbury | Te Whare Wānanga o Waitaha.

‡ Nick Bowden is a senior research fellow at the Department of Women's and Children's Health, University of Otago | Ōtākou Whakaihu Waka.

§ Jesse Wiki is a post-doctoral fellow at the School of Population Health, Faculty of Medical and Health Sciences, University of Auckland | Waipapa Taumata Rau.

[**] Reremoana Theodore is the director of the Dunedin Multidisciplinary Health and Development Study, University of Otago | Ōtākou Whakaihu Waka.

[††]Matt Hobbs is a senior lecturer at the School of Health Sciences, Faculty of Health, University of Canterbury | Te Whare Wānanga o Waitaha.

‡‡ Hiran Thabrew is a child psychiatrist and paediatrician at Starship Children's Hospital and the director of Te Ara Hāro, Centre for Infant, Child and Adolescent Mental Health, University of Auckland | Waipapa Taumata Rau.

§§ Rosalina Richards is a co-director of the Coastal Peoples: Southern Skies, Centre of Research Excellence, University of Otago| Ōtākou Whakaihu Waka.

[***] Barry Milne is the director of the Centre of Methods and Policy Application in the Social Sciences (COMPASS) and an associate professor in the School of Social Sciences, University of Auckland | Waipapa Taumata Rau.

††† Sarah Hetrick is an associate professor in the Department of Psychological Medicine, University of Auckland | Waipapa Taumata Rau.

‡‡‡ Joseph Boden is the director of the Christchurch Health and Development Study and a professor in the Department of Psychological Medicine, University of Otago | Ōtākou Whakaihu Waka.

§§§ Jesse Kokaua is a senior research fellow at Va'a o Tautai | Centre for Pacific Health, University of Otago | Te Ōtākou Whakaihu Waka.

Abstract

The environment, whether natural or built, is central to the health of Pacific Peoples, especially children and young people. However, little is known about health-promoting and health-constraining features of the environments where Pacific children (0–14 years) and young people (15–24 years) live in Aotearoa New Zealand. Using linked data from population-level databases, the Integrated Data Infrastructure (IDI) and the Healthy Location Index (HLI), this national cross-sectional study was undertaken to address this knowledge gap. Pacific children and young people were found to predominantly live in urban and high-deprivation areas. They were simultaneously closer to health-promoting and health-constraining features than non-Māori/non-Pacific (NMNP) children and young people. The findings from this study provide an opportunity for structural change that can help reduce inequities and improve the health and wellbeing of Pacific communities.

Keywords: geospatial, Pacific, youth and children, environment, New Zealand

Whakarāpopotonga

He mea taketake te taiao, ahakoa hanga, ahakoa tūturu, ki te hauora o ngā Iwi o Te Moananui-a-Kiwa, ina koa ki ngā tamariki me ngā rangatahi. Heoi, he iti te mōhio ki ngā āhuatanga whakatairanga hauora, whakatiki hauora rānei o ngā taiao e noho nei ngā tamariki (0–14 tau), me ngā rangatahi (15–24 tau) Moana-nui-a-Kiwa kei Aotearoa. He mea whakahaere tēnei rangahau topenga ā-motu, e whakamahi ana i ngā raraunga hono mai i ngā pātengi raraunga taumata-taupori, te Tūāhanga Raraunga Kōmitimiti (IDI) me te Tauine Tauwāhi Hauora (HLI), ki te whakatika i taua āputa mōhiotanga. I kitea e noho ana te nuinga o ngā tamariki me ngā rangatahi Moananui-a-Kiwa i ngā wāhi tāone he nui te pakukore. I taua wā anō he tūtata atu tō rātou noho ki ngā āhuahira whakatairanga me te whakatiki hauora i ngā tamariki me ngā rangatahi ehara i te Māori/Moananui-a-Kiwa (NMMP). Mā aua kitenga i tēnei rangahau e whakarato arawātea ki ngā panoni hangahanga ka āwhina pea ki te whakaiti tautika-kore me te whakapiki i te hauora me te toiora o ngā hapori Moananui-a-Kiwa.

Ngā kupu matua: mokowā ā-nuku, Te Moananui-a-Kiwa, ngā rangatahi me ngā tamariki, taiao, Aotearoa.

Disclaimer

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI, please visit https://www.stats.govt.nz/integrated-data/

The association between the built and natural environment and its impact on the health of communities is becoming increasingly recognised (Marek et al., 2021). Environments can influence health outcomes through myriad means that can have an impact on positive development of young people. Positive health outcomes have been observed in environments conducive to greater accessibility to transport and availability of health care services (Huang et al., 2023). Further examples include distance to greenspaces, which has been associated with decreases in all-cause mortality (Kua et al., 2021), healthier body mass index (BMI) (Saenen et al., 2023), and increased cognition in children (Bell et al., 2008). Higher levels of greenness has also been associated with better air quality and bacterial diversity (Styles et al., 2023), while air quality and level of pollution have been associated with a range of health measures (Dzhambov et al., 2017; Kim et al., 2019; Warembourg et al., 2021). Air quality and distance to greenspaces, as well as neighbourhood infrastructure, may increase levels of physical activity, which has a range of benefits across mental, physical and physiological spectrums of wellness (Mavoa et al., 2019; Mitra et al., 2020; Utter et al., 2010).

The environment has been identified as a social determinant of health with quality of neighbourhoods as a large contributor to health inequities in population health outcomes in Aotearoa New Zealand (hereafter, Aotearoa) (Chin et al., 2018). The presence of health-constraining environmental features is associated with higher BMI and higher waist circumferences, type II diabetes, and tobacco smoking and vaping (Hobbs et al., 2022). In contrast, exposure to greater health-promoting environmental features has been associated with a significant reduction in odds of adverse mental health conditions, both self-reported and diagnosed (Hobbs et al., 2023; Hobbs, Kingham, et al., 2021), while access to fruit and vegetable outlets is associated with a protective effect for type II diabetes (Wiki et al., 2021).

Unfortunately, in Aotearoa there has been noted increasing geographical inequalities (Pearce et al., 2006). Areas characterised by deprivation in Aotearoa often have a high density of health-constraining environmental features (Marek et al., 2021). An analysis of the geographical change over a 10-year period suggests a decrease in distance and time to both fast-food outlets and supermarkets, with the biggest decrease in distance to supermarkets seen in the most-deprived areas (Hobbs,

Mackenbach, et al., 2021). Compared with the least-deprived areas, schools in areas of high deprivation were reportedly surrounded by three times the number of food outlets (Day et al., 2011). This underscores the importance of understanding the environments that communities are exposed to, particularly because Pacific communities are most likely to reside in areas of higher area-level deprivation (Pearce et al., 2007).

Pacific Peoples in Aotearoa are a vibrant and resilient group who made up 8 per cent of the country's population in 2018 (Ministry for Pacific Peoples, 2020). They are a young, fast-growing, highly diverse community from over 20 distinct countries and territories throughout the South Pacific (Ministry for Pacific Peoples, 2020). In communities where Pacific Peoples live, the environment cannot be separated from influences of Pacific culture and identity, with an overwhelming association between having a personal connection with the natural environment and their welfare (Nunn et al., 2016). Pragmatically, the environment dictates certain practices and culturally the environment connects generations through local knowledge and practice (Yates et al., 2022). This connectivity between wellbeing and the built and social environment is also acknowledged for Pacific Peoples in Aotearoa New Zealand as made evident in Pacific health models such as the Fonofale (Pulotu-Endemann et al., 2009) and Te Vaka Atafaga (Kupa, 2009), with the environment being a prominent feature of both models. Unsurprisingly, a community so intertwined with their environment is also the most burdened by living conditions. Pacific Peoples are most affected by inequities in the distribution of the socio-economic determinants of health (Howden-Chapman et al., 2023; Ministry of Health, 2020; Robertson et al., 2021; Stats NZ, 2023). Results from the census and other studies show that, compared with all other ethnic groups, Pacific Peoples are more likely to live in large urban areas (Stats NZ, 2023) characterised by areas of high area-level deprivation with the highest rates of household crowding (Ryan et al., 2019). However, little is known about the interaction between Pacific children and young people and various features of the environment where they live.

In-depth knowledge of the environment communities live in provides context for mitigating barriers and enhancing environmental facilitators to positive health outcomes. Environments in Aotearoa can be classified according to their health-constraining (e.g., takeaway and alcohol outlets), and health-promoting (e.g., greenspaces and access to opportunities for

physical activity) features (Marek et al., 2021); for example, as classified by the novel Healthy Location Index (HLI). An opportunity presents itself to use data to understand where Pacific children and young people in Aotearoa are living. This study asks two questions:

1) What are the environmental features that characterise the environments where Pacific children and young people live and do these environments differ between children and young people?
2) How does access to environmental features differ between Pacific and the wider population of Aotearoa?

A goal of Te Whatu Ora | Health New Zealand is to ensure Pacific families have safe and comfortable social and physical environments as well as overall health and wellbeing, or *Ola Manuia* (Ministry of Health, 2020). However, the only metric for monitoring and evaluation of environments and social determinants of health is the number of Pacific being admitted to hospital due to unhealthy and unsafe housing (Ministry of Health, 2020). This paper explores the environmental contexts where Pacific children and young people live to assist in effective urban planning and development for *Ola Manuia* of Pacific communities.

Methods

This is a national cross-sectional geospatial study using descriptive and spatial analyses to describe the environments where Pacific children and young people in Aotearoa live, by age groups.

Socio-demographics

Individual-level data was derived from Stats NZ | Tatauranga Aotearoa's Integrated Data Infrastructure (IDI). The IDI captures and links data collected from a range of government agencies, surveys (including the 2013 and 2018 censuses), and some non-government organisations (Milne et al., 2019; Stats NZ, 2017). The participant population was a national cohort of people aged 0–24 years old on 30 June 2023. This population was subdivided into two categories: children aged 0–4 and 5–14 years, and young people aged 15–24 years. The data were extracted from the administrative population 2022 Census data. Sex (male/female) and ethnicity, derived using the total ethnicity definition, were extracted from the personal details table

in the IDI. The total ethnicity definition meant they were included in Pacific or Māori (the Indigenous peoples of Aotearoa), using the New Zealand Standard Classification, 2005V2.0.0, regardless of whether they were also counted in another ethnicity. For comparison purposes, those who were neither Pacific nor Māori were assigned to a composite non-Māori/non-Pacific (NMNP) group. A separate complementary paper for Māori is under submission (Wiki et al., in press)

Environmental and socio-economic data

The IDI also contains residential address information which was used to link individuals to aspects of the environments where they live, based on their last known residential meshblock as of 30 June 2023. Area-level deprivation was defined using the New Zealand Deprivation Index 2018 (NZDep2018), which is an area-based socio-economic measure of deprivation based on the meshblock where individuals live (Atkinson et al., 2019). Each meshblock was assigned a deprivation score, which was then collapsed into 10 deciles and 5 quintiles. Decile 1 represents the 10 per cent of the population who live in the least-deprived areas (areas with the lowest NZDep scores), through to decile 10 which represents the 10 per cent of the population who live in the most-deprived areas (areas with the highest NZDep scores). Likewise, quintile 1 represents the 20 per cent of the population who live in the least-deprived areas, through to quintile 5 which represents the 20 per cent of the population who live in the most-deprived areas. A measure of urbanicity and rurality was derived using the urban/rural profile of residence (Stats NZ, 2020) which is based on residents, population density, and coverage of built physical structures. This metric was collapsed into a six-level categorical variable: major urban, large urban, medium urban, small urban, rural settlement, and rural other.

Data on the location of health-constraining environmental features (fast-food outlets, takeaway outlets, dairy outlets and convenience stores, alcohol outlets and gaming venues) and health-promoting environmental features (greenspaces, bluespaces, physical activity facilities, fruit and vegetable outlets, and supermarkets) were combined into a nationwide area-based HLI. The HLI is available at the meshblock level (2018) for the whole of Aotearoa. The distance from population-weighted centroids of the meshblock was calculated for each domain of health-promoting and health-

constraining environmental features and ranked. These ranks were summed, categorised by deciles, and then combined to provide the final HLI.

The individual domain aspect of the HLI is used to measure the distance from each young person's direct neighbourhood to each environmental feature. The HLI is used to measure if the direct environment (meshblock of residence) that a young person lives in is classified as either health-promoting or health-constraining (deciles: D1 = best access; D10 = worst access), when considering all environmental features together, or access to each environmental feature separately as individual domains. To assess co-occurrence, three levels of the HLI were used: category one indicates health-promoting environments where access to health-promoting features outweigh the access to health-constraining features (zones 1–2, 1–3 and 1–3); category two indicates health-constraining environments where access to health-constraining features outweigh the access to health-promoting features (zones 2–1, 3–1 and 3–2); and category three indicates environments that are neither health-promoting nor health-constraining (zones 1–1, 2–2 and 3–3). A detailed description of the methodology together with the characteristics of the HLI has been previously provided (Marek et al., 2021) and the data set is publicly available online (Marek et al., 2020).

Statistical analyses

All descriptive and statistical analysis and graphic outputs were created using R v4.3 (R Core Team, 2017). All Stats NZ confidentiality requirements were adhered to including random rounding to base three of all counts and suppression of data for counts less than six. Descriptive and spatial analyses were used to describe the environments where Pacific children and young people live after linking individual-level data with environmental features and area-level deprivation. First, we extracted population counts by age, ethnicity, socio-economic deprivation and urbanicity of the area. Then, we used a lognormal linear regression to understand associations between distance to individual domains and individual- and area-level characteristics. The distances were log-transformed due to their skewed distribution. The logarithm of distance to the nearest feature in individual domains served as the dependent variable, while ethnicity (Pacific versus NMNP), age and their interaction were independent variables. The interaction term of ethnicity and age was included because two-way ANOVA

used in modelling preparation stages identified the importance of both variables and their combination. Models were further adjusted for socio-economic deprivation. We did not adjust for urbanicity in our models as the majority of the Pacific population in Aotearoa lives in urban environments.

In addition, the Tivaivai research framework (Kokaua et al., 2020) was applied to ensure the validity of the findings were responsive to Pacific understandings and world views; the framework also allows for a strengths-based approach to future solutions and interventions using these data.

Results

The total identified cohort of Pacific children and young people was N= 222,384 with more than 80 per cent being older than 4 years of age with almost equal distribution in the 5–14 years and 15–24 years categories (39.1 per cent and 41.4 per cent, respectively). Table 1 shows that most Pacific children and young people (84 per cent) live in either major or large urban areas and more than half live in the areas where 20 per cent of the population live with the highest deprivation (quintile 5 or decile 10).

As displayed in Figure 1, compared with NMNP, Pacific children and young people were over-represented in areas of high area-level deprivation with over half of the cohort (52 per cent) residing in the areas with the highest area-level deprivation (deciles 9 and 10) compared with NMNP (13 per cent). Additionally, around 5 per cent reside in the areas of least deprivation, which was constant across the age categories for Pacific children and young people, where NMNP children are at least four times more likely to live in least-deprived areas (deciles 1 and 2).

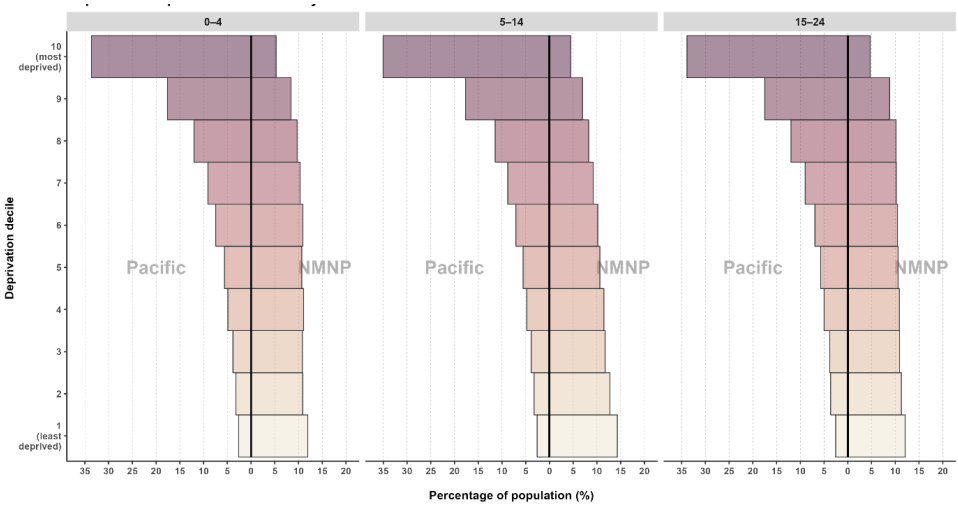
Figure 2 depicts a comparison of Pacific and NMNP children and young people and their access to health-promoting and health-constraining environmental features by decile. Fewer Pacific children and young people live in the three deciles with least accessibility to health-constraining features (deciles 8, 9 and 10); likewise, fewer live in the three deciles with least accessibility to health-promoting features (deciles 8, 9 and 10). This finding is particularly pronounced for children under 15 years of age. A consequence of these two findings are that Pacific children and young people are mostly found in deciles 4 to 7 for both health-constraining and health-promoting areas.

Table 1: Demographic structure of Pacific children and young people in Aotearoa by deprivation and urban rural indicators

			Ages (year)					
			0–4		5–14		15–24	
			n	%	*n*	%	*n*	%
	Quintile	Decile	43,404	19.5%	86,973	39.1%	92,007	41.4%
NZDep2018	Q1	1	1,134	2.6%	2,217	2.5%	2,403	2.6%
		2	1,398	3.2%	3,132	3.6%	2,970	3.2%
	Q2	3	1,665	3.8%	3,312	3.8%	3,519	3.8%
		4	2,124	4.9%	4,353	5.0%	4,419	4.8%
	Q3	5	2,433	5.6%	4,986	5.7%	5,106	5.5%
		6	3,225	7.4%	6,042	6.9%	6,486	7.0%
	Q4	7	3,954	9.1%	7,827	9.0%	8,076	8.8%
		8	5,223	12.0%	10,410	12.0%	10,524	11.4%
	Q5	9	7,644	17.6%	15,228	17.5%	16,245	17.7%
		10	14,601	33.6%	29,448	33.9%	32,259	35.1%
Rural/Urban	Major urban		30,870	71.1%	64,893	74.6%	65,421	71.1%
	Large urban		5,382	12.4%	9,837	11.3%	11,469	12.5%
	Medium urban		2,478	5.7%	3,924	4.5%	5,031	5.5%
	Small urban		2,364	5.4%	3,708	4.3%	4,962	5.4%
	Rural settlement		570	1.3%	1,032	1.2%	1,251	1.4%
	Rural other		1,737	4.0%	3,576	4.1%	3,879	4.2%

Notes:
1. Decile was missing for fewer than six 0–4 year-olds and eighteen 15–24 year-olds.
2. Rural/urban was missing for fewer than six individuals in each age group.
3. Total group counts may not add up to the same number due to random rounding of data.

Figure 1: Distribution of children and young people in Aotearoa New Zealand, by NZDep2018 decile and ethnicity



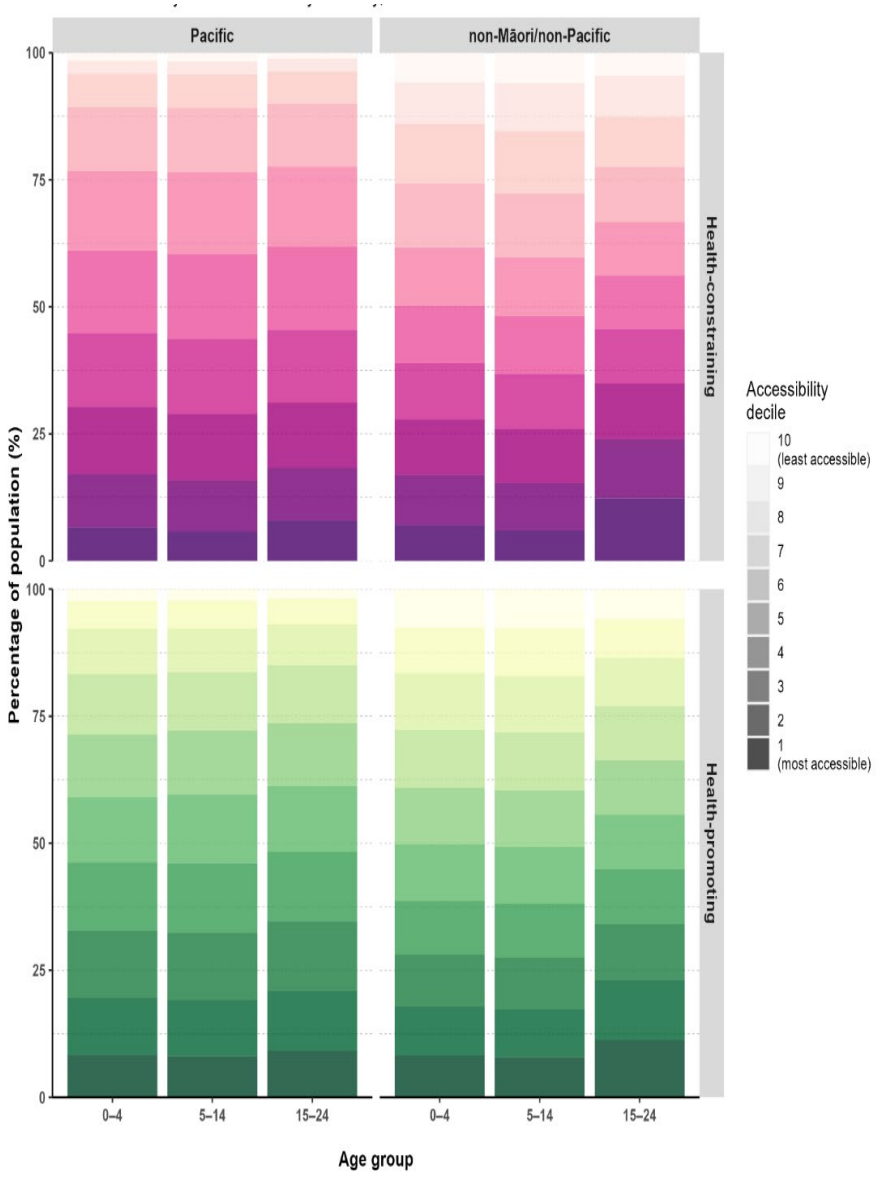
Note: Deprivation deciles based on deprivation scores from the IDI.

Figure 3 identifies co-occurrence of environmental features in the HLI. Pacific children and young people live in areas with high accessibility to health-promoting *and* health-constraining environments. However, when compared with NMNP, a high proportion of Pacific children and young people live in areas of neutral risk.

Figure 4 shows results of lognormal regressions of distance to the nearest environmental feature by individual HLI domains as the dependent variable. Models included interaction of ethnicity and age and are adjusted for NZDep and sex. The findings show the comparative percentage differences in distance to the nearest environmental feature of interest. Findings show Pacific children (aged 0–4 and 5–14 years) are simultaneously closer to all health-promoting environmental features (11 per cent closer to fruit and vegetable outlets and greenspaces; 13 per cent closer to bluespaces; 6 per cent to physical activity and 1 per cent to supermarkets) and health-constraining environmental features (17 per cent closer to fast-food outlets; 3–4 per cent closer to alcohol and gaming venues, < 2 per cent closer to dairies and takeaways) compared with NMNP. However, this relationship changes for NMNP young people (aged 15–24 years), who are closer to all health-promoting environmental features,

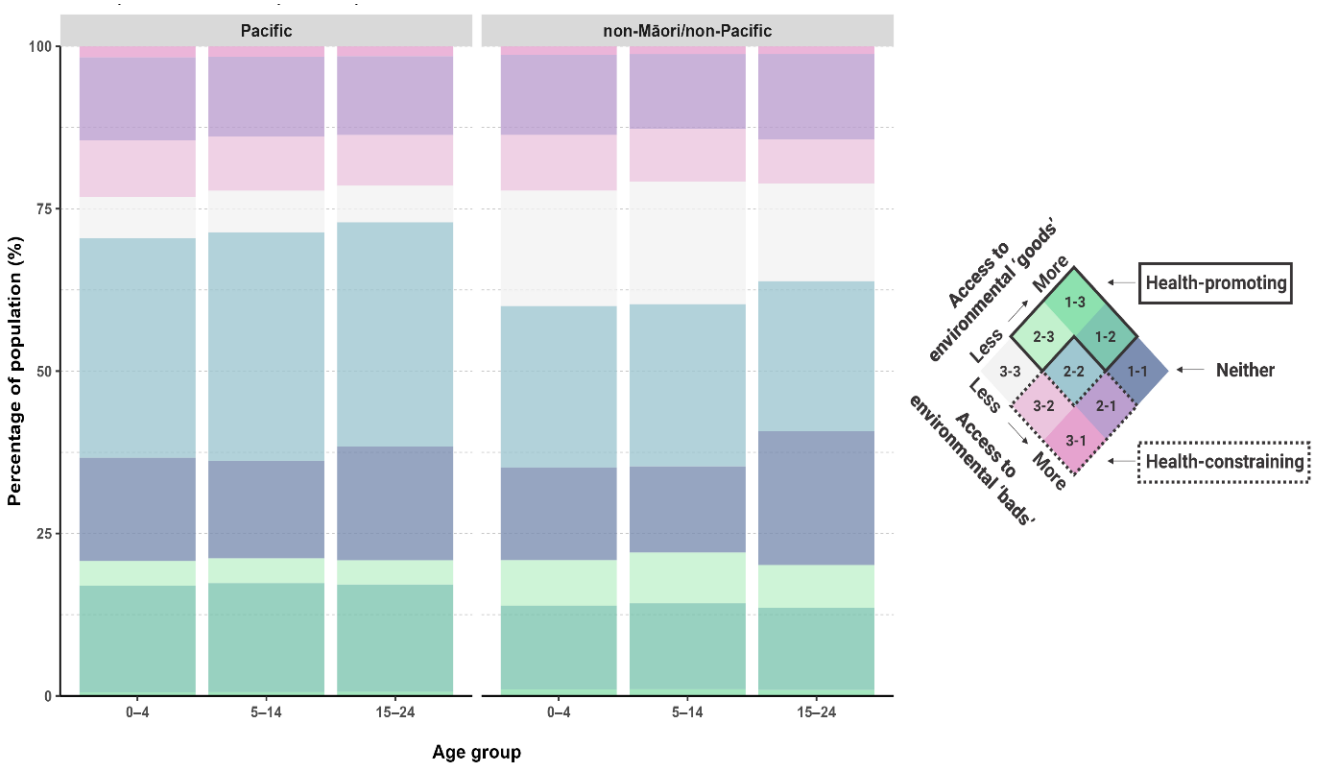
besides bluespaces, and closer to all health-constraining environmental features. (Additional information can be found in the Supplementary Note.)[1]

Figure 2: Accessibility of children and young people in Aotearoa New Zealand to health-promoting and health-constraining environments, by NZDep2018 decile, ethnicity and age group



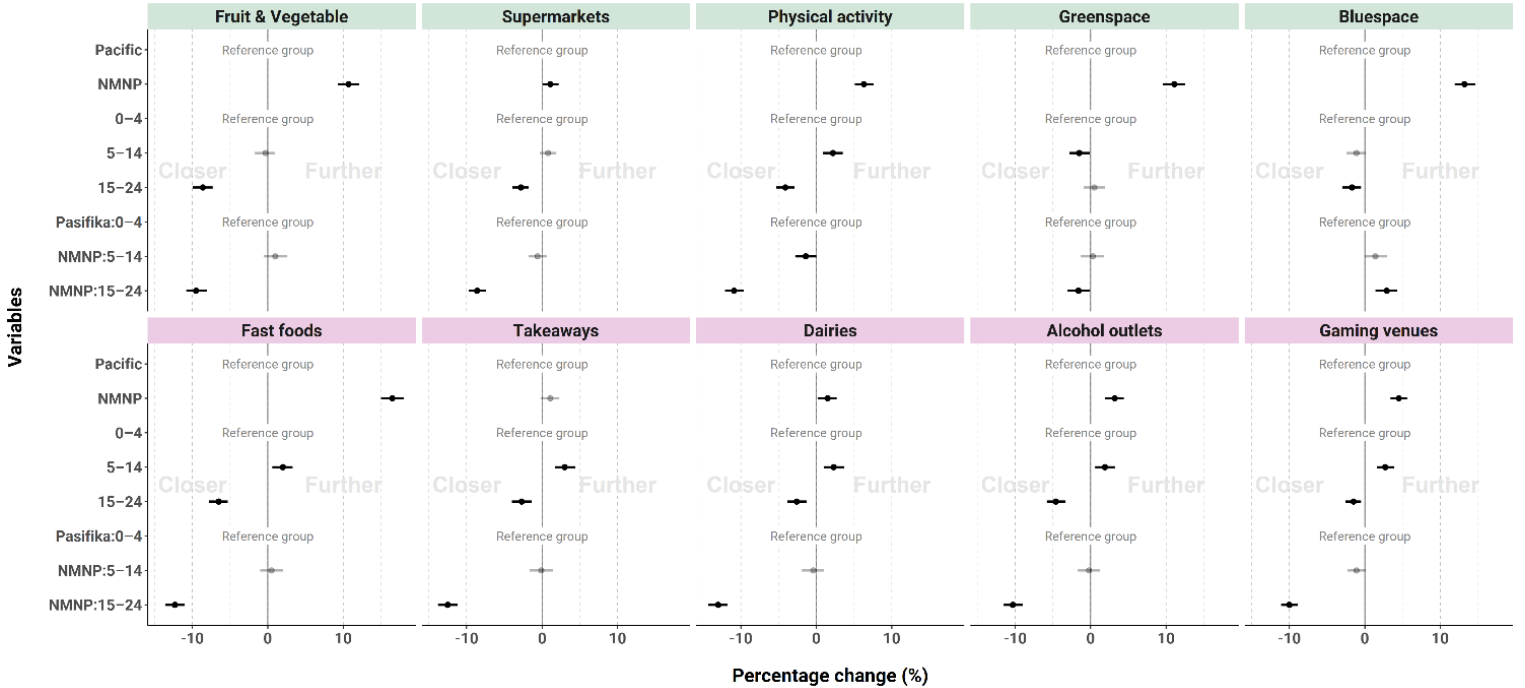
Notes:
1. Percentages calculated from the Healthy Location Index.
2. Pink are health-constraining environments and green are health-promoting environments.

Figure 3: How healthy is the (built) environment where children and young people in Aotearoa New Zealand live, by ethnicity and age group?



Note: Percentage of population calculated from the Healthy Location Index.

Figure 4: Lognormal model of accessibility of children and young people in Aotearoa New Zealand to health-promoting and health-constraining environmental features, by ethnicity and age group



Notes:
1. Health-promoting environmental features are shaded green; health-constraining environmental features are shaded pink.
2. The environmental features are based on the domains of the Healthy Living Index.
3. Transparent lines and points show variables with *p*-value $\geq$ 0.05.
4. Models adjusted for deprivation and urban-rural classification.

Discussion

The current study uses a nationwide measure of access to health-promoting and health-constraining environmental features to characterise the environment where Pacific children and young people are living. The majority of Pacific children and young people live in major or large urban areas with more than half living in neighbourhoods characterised by high area-level deprivation. A novel finding of this study is the identification that Pacific children and young people live in areas with moderate accessibility to both health-promoting and health-constraining environmental features, and when compared with NMNP children, Pacific children and young people are more likely to live in areas with co-occurring health-constraining and health-promoting environmental features. When considering deprivation, a linear relationship exists between deprivation gradient and accessibility to health-constraining environmental features while an inverse relationship exists for health-promoting environmental features, meaning that as area-level deprivation increases, access to health-promoting environmental features decreases.

A novel finding from the present study is the distances from health-promoting and health-constraining environmental features for Pacific children and young people. This finding is contrary to previous hypotheses based on previous literature as well as the understandings of inequitable access to health care in Pacific communities (Ministry of Health, 2020). Previous literature discussing the HLI and access to health-constraining and health-promoting environmental features would suggest that areas of high deprivation would be mainly health constraining with low accessibility to health-promoting environmental features (Hobbs et al., 2023; Marek et al., 2021). The finding is positive for Pacific communities as previous literature has demonstrated exposure to greater health-promoting environmental features has been associated with a significant reduction in odds of adverse mental health conditions and access to fresh produce (Hobbs et al., 2023; Hobbs, Kingham, et al., 2021; Wiki et al., 2021). Similar findings were demonstrated in single provinces in Aotearoa where there was a reported strong inverse relationship between access (measured by drive distance) and deprivation for all types of community resources such as GPs, pharmacies and schools (Field et al., 2004; Pearce et al., 2007). Cultural

factors must also be considered, as previous qualitative studies have suggested Pacific families will travel long distances to access health care services that they feel can cater to their specific cultural needs; however, the distance travelled was also a barrier to regular attendance (Galewski, 2023; Neville et al., 2022).

The present study identified that Pacific children and young people reside in environments with higher accessibility to all five health-promoting domains of the HLI (fruit and vegetable shops, supermarkets, opportunities for physical activity, greenspaces and bluespaces) compared with NMNP children and young people. Although seemingly counterintuitive, the distance to health-promoting and health-constraining environmental features is probably primarily explained by the fact that most of the Pacific population identified live in urban areas, which tend to have a high co-occurrence of all environmental features (Marek et al., 2021). It is important to understand the interactions and usability of certain environments, such as how an environment can be conducive to certain activities, and how context differs specific to Pacific communities, such as perceived neighbourhood safety, accessibility to transport, and availability of culturally appropriate health care services. An in-depth understanding of barriers to Pacific communites accessing health-promoting environments is essential for increasing positive health behaviours. For example, in Aotearoa, children attending higher-decile schools (higher socio-economic status) are more likely to participate in formal activities such as organised sports; conversely, children at low-decile schools journeyed to participate in informal physical activity (e.g., play in local streets) almost twice as often as the other groups (Ikeda et al., 2018). Further research is required to understand the relationship between Pacific communities' access to health-promoting participation and behaviours as a function of distance to each environmental feature.

Compared with NMNP children and youth, Pacific children and youth generally live closer to all five health-constraining domains of the HLI (fast-food outlets, takeaway shops, dairies, alcohol outlets and gaming venues) in Aotearoa. Previous literature has identified negative health outcomes for Pacific communities in each domain through modified health behaviours. Dairies have been reported as the most frequented location for Pacific youth purchasing cigarettes illegally (Teevale et al., 2013), so the closeness of dairies must be a consideration when assessing health-

constraining environmental features. The closeness to alcohol outlets and gaming venues for Pacific communities is unfortunately expected as operators of these businesses, when deciding where to locate their businesses, unfairly target areas of high area-level deprivation with limited socio-economic leverage (Boden et al., 2022; Hetrick et al., 2023; Hobbs et al., 2020; Nosa et al., 2021; Wheeler et al., 2006). Gambling and alcohol consumption in Pacific communities is associated with increased crime and hazardous drinking behaviours as well as negative societal impacts on communal relationships (Walker et al., 2012). However, although this study highlights moderate accessibility to health-promoting environments, Pacific communities perceive urban design and planning as a barrier to easy accessibility to healthy foods and notice a high concentration of fast-food outlets in their neighbourhoods (Tapera et al., 2017). Additionally, another finding suggests distance to food outlets was not a barrier as some Pacific youth purchased food that was cheaper and in larger portion sizes from outlets further from home (Tupai-Firestone et al., 2016).

As expected, this study has found that Pacific children and young people generally live in neighbourhoods characterised by high area-level deprivation, a finding consistent with previous research describing Pacific communities in Aotearoa (Howden-Chapman et al., 2023; Ministry of Health, 2020; Stats NZ, 2023). Unfortunately, for Pacific Peoples, living in areas of high area-level deprivation is associated with negative health outcomes and behaviours. Living in highly deprived neighbourhoods is significantly associated with increases in exposure to pollution (Pearce et al., 2008), higher mean BMI and waist circumference (Utter et al., 2010), increasing mental health needs (Sutcliffe et al., 2023), and a higher likelihood of binge drinking and smoking (Teevale et al., 2013; Teevale et al., 2012). The magnitude of effect was highest in Pacific children and young people living in high area-level deprivation, further suggesting the greatest impact of deprivation on Pacific communities (Howden-Chapman et al., 2023; Teevale et al., 2013; Teevale et al., 2012; Utter et al., 2010). Considering the wellbeing of Pacific children and young people, intergenerational flow-on effects have been reported whereby Pacific children and young people with mothers reporting symptoms of psychological disorder were more likely to display internalising behaviours (Gao et al., 2007; Low et al., 2021), while Pacific youth identify secure housing as a fundamental element for wellbeing (Goodman et al., 2019). The

wellbeing of those who reside in areas of higher area-level deprivation is also lower (Abbott et al., 2006; Carter et al., 2009; Wiki, Marek et al., 2023), which may be further exacerbated by lower accesibility to mental health services and unsuitable living conditions associated with increasing deprivation for Pacific young people (Ruhe et al., 2022; Stats NZ, 2023).

Furthermore, past studies have highlighted that those who live in relatively deprived areas of Aotearoa, and particularly areas of higher deprivation, are more likely to move to areas with either the same or very similar levels of deprivation, and that living in relatively deprived areas has a higher effect on stress levels in Pacific migrants than for other cohorts (Marek et al., 2023; Robertson et al., 2021; Sin et al., 2019). While a third of the Pacific population are foreign-born, two-thirds are not, and so Pacific communities' experiences of discrimination in accessing housing and relocation to state housing in peripheral suburbs suggests the persistence of socio-economic disadvantage beyond the immigrant generation. This discrimination and socio-economic disadvantage may also explain the relatively consistent levels of deprivation across the age range as well as the low levels of social mobility in the lowest areas of deprivation when compared with NMNP (Ishizawa et al., 2014).

Despite generally living in areas of high deprivation, Pacific communities continue to be resilient as a collective. Pacific Peoples are a highly socially connected peoples with communitarianism and collectivism as cornerstone values (Ataera-Minster et al., 2018). The concept of Pacific Peoples (re)-creating village structures in the diaspora is a strengths-based approach to maintain resilience in different environments, and is seen through Pacific Peoples being more likely to move to locations in Aotearoa where family already live (McLeod, 2010). Previous analyses have demonstrated this social connectivity with Pacific Peoples living in communities densely populated with other Pacific families (Maré et al., 2012), and with Pacific children and young people in lower-income neighbourhoods more likely to have extended family living close by (Maré et al., 2012; Carroll et al., 2015). This may potentially reflect child-rearing practices in some Pacific communities with grandparents being carers to maintain cultural values and language (Boon-Nanai et al., 2022; Tapera et al., 2017). Traditional cultural values are further highlighted as Pacific youth identified church as an important destination in their neighbourhoods (Carroll et al., 2015; Goodman et al., 2019).

Social connections in a Pacific world view extend beyond the nuclear family and include extended family, which includes community connections connected by culture (Capstick et al., 2009). In the context of Aotearoa, the cultural importance of family and community may potentially provide a rationale for Pacific communities clustering in areas, a practice that maintains social cohesion. Pacific children and young people perceive healthy urban communities as public spaces that afford positive social interaction (Goodman et al., 2019) and important aspects of thriving neighbourhoods were distance to family and friends, while 'good' schools were the schools that their friends attended (Freeman et al., 2015). Students living in neighbourhoods characterised by higher levels of social cohesion and membership in community organisations reported higher levels of wellbeing. The association between student self-reported wellbeing and neighbourhood membership in community organisations showed a stronger protective effect for students who were more socioeconomically deprived (Aminzadeh et al., 2013). Membership in community organisations, however, is not an element that is considered in the HLI, which highlights potential limitations of the HLI for use with Pacific communities.

Strengths, limitations and future considerations

To our knowledge, this is the first nationwide study in Aotearoa to look at the environments and the features that those environments consist of for Pacific children and young people. A key strength of the study is its use of individual linked data to the HLI, which provides a large sample size and so makes comparisons between different population groups possible. However, the limitations of the study must also be mentioned. The study is cross-sectional in design, which provides only a glimpse of the locality of the population of Pacific children and young people at the point that the data were collected. Another potential interaction that may be valuable to explore is an understanding of the HLI congruence with Pacific understandings of environmental features that are constraining to or promoting of health. For example, inclusion of community resources that provide cultural, familial and spiritual support in each neighbourhood is missing in the current iteration of the HLI. Additionally, the perceived accessibility of certain amenities must also be considered. This would involve understanding the relationships between different types of bluespaces and greenspaces and a

range of cultural practices associated with each. For example, coastal waters and recreational parks facilitate different activities compared with inland waters and forest. However, measuring different greenspaces and bluespaces would require appropriate data, which would require a lot of work. Another inherent limitation of the study is that the 2018 Census data used in the analysis underrepresented Pacific children, which may have resulted in undercounts of Pacific children. In contrast, the use of the estimated residential population in the IDI is a strength of the study, as the IDI uses multiple sources of data (Ministry for Pacific Peoples, 2021). A further limitation is that the study considered only Pacific as an amalgamated group in terms of ethnicity identification; future studies should consider specific Pacific ethnic breakdowns or highlight the other ethnic groups that make up the individual. Finally, it is known that Pacific Peoples are likely to cluster in areas where family members have migrated; thus some areas have higher representation of certain Pacific ethnic groups, which may alter the interaction between health outcomes and exposure to a certain environment.

Conclusion

The environment is central to Pacific health through the cultural and spiritual connections to place as well as the environment's direct influence on lifestyle factors. This is one of the first studies to describe the environments where Pacific children and young people in Aotearoa live, and in so doing, the study provides meaningful evidence for policymakers to consider the holistic impact of co-occurring environmental features on Pacific health. Despite Pacific communities and NMNP populations recording similar distances from health-promoting environmental features in the HLI, persistent health inequities for Pacific communities remain compared with the NMNP population. This suggests inequities in Pacific communities' access to health-promoting environmental features.

Note

1 The Supplementary Note is available from the corresponding author on request.

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