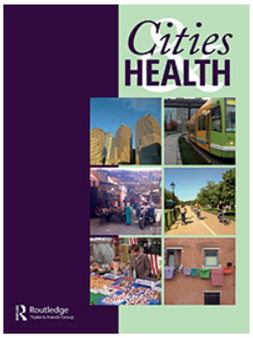

Cities & Health

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rcah20

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To cite this article: Julie Spray , Karen Witten , Janine Wiles , Anneka Anderson , Dolly Paul , Julie Wade & Shanthi Ameratunga , on behalf of the Inclusive Streetscapes Project Team (2020): Inequitable mobilities: intersections of diversity with urban infrastructure influence mobility, health and wellbeing, Cities & Health, DOI: 10.1080/23748834.2020.1827881

To link to this article: https://doi.org/10.1080/23748834.2020.1827881

Published online: 20 Oct 2020.

CITIES & HEALTH
https://doi.org/10.1080/23748834.2020.1827881

Routledge
Taylor & Francis Group

ORIGINAL SCHOLARSHIP

Inequitable mobilities: intersections of diversity with urban infrastructure influence mobility, health and wellbeing

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ABSTRACT

Transport infrastructure critically influences how people live their lives, structuring mobility and mediating access to the resources central to health and wellbeing. While the links between infrastructure, mobility and wellbeing are well established, much less is known about how these relationships are contingent on socio-economic, cultural, and bodily diversity, and the characteristics of local ecologies. Here, we firstly ask, how does transport infrastructure shape mobility opportunities for people living in diverse circumstances? Secondly, what are the impacts of inequitable access to mobility for wellbeing? Drawing from research across four sites in Tāmaki Makaurau (Auckland), Aotearoa New Zealand, we consider the experiences of older- and disabled- or bodily-diverse people from varied ethnic groups living across a range of socio-economic circumstances. We use community-based participatory research methods, including 'go-along' interviews, focus groups and interactive workshops, to engage communities least heard at policy or strategic levels. Their experiences illustrate firstly, that urban infrastructure tends to further marginalise the already marginalised, and secondly, that people draw on different and unequal resources to negotiate infrastructural marginalisation, resulting in unequally patterned vulnerabilities and a system that entrenches the status quo. Our findings indicate the need to consider intersectionality in transport consultation and design.

ARTICLE HISTORY
Received 15 June 2020
Accepted 21 September 2020

KEYWORDS
Wellbeing; health; older people; disability; transport infrastructure

Introduction

Transport infrastructure – the assemblages of roads, pathways, public transport, and the technical, material and human systems and apparatus that organise, support, and operate them – constitutes a powerful determinant of differential mobility (Gardner 2014). As part of a wider built environment, transport systems structure how people move across space and time, shaping mobility, or the potential for movement across distance (Nordbakke and Schwanen 2014). Yet, as a key mode of social organisation, transport infrastructure is also rooted in the political, economic, and socio-cultural values and priorities of society, which influence *what kinds* of infrastructure are developed *where* and for *whom*. Scholars have noted that urban transport systems are often designed to prioritise commuter travel to major centres. Designers tend to assume a standard, economically-stable, white, male, able-bodied worker making a direct route from home to the workplace and back, while marginalising the needs of low-income, disabled,[1] or older travellers (Imrie and Wells 1993, Sánchez 2008, Lubitow *et al.* 2017). Infrastructure is therefore highly implicated in social inequalities (Winner 1980, Raerino *et al.* 2013), both reflecting and reinforcing social stratification along socioeconomic and ethnic lines and structuring the various bodies that are and are not permitted physical mobility.

In reinforcing social stratification, infrastructure also unequally distributes opportunities for wellbeing by privileging accessibility for some people while leaving others vulnerable to risk, immobility, and social exclusion. A growing body of literature documents the mutually constituting relationship between inequities in access to mobility and wellbeing, which can support each other and regress together in a feedback loop (Ziegler and Schwanen 2011). While engagement with the world is not necessarily tied to physical mobility, movement across distance allows people to access 'spaces of wellbeing' (Fleuret and Atkinson 2007), meet social, emotional, and spiritual needs, obtain foods of nutritional, personal, social, or cultural importance, access health services, and be physically active. Conversely, restricted mobility outside the home can reduce contact with friends, relatives, neighbours, and wider communities, and lead to isolation, loneliness, and depression (Ziegler and Schwanen

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2011). Urban environments can enhance or constrict what people can do with their bodies, and these 'embodied capacities' (Schwanen and Ziegler 2011, p. 724) in turn shape the potential for mobility.

By mediating mobility, local infrastructure design can therefore powerfully influence how health inequities are produced and reproduced. Yet scholars note a dearth of studies attending to the interplay of institutional, temporal, social and cultural dimensions that form the contexts in which people negotiate infrastructure towards wellbeing (e.g. Schwanen and Páez 2010, Nordbakke and Schwanen 2014). Furthermore, people most socially marginalised are also those least likely to be heard by regional governments or transport industries in community consultations, their invisibility contributing to a 'no data, no problem' phenomenon (Krieger 1992). Yet groups such as indigenous or ethnic minorities, people with disabilities or chronic illness, older people, or the economically disadvantaged are also those most likely to benefit from inclusive transport design as they already experience worse health and more accessibility constraints (Ministry of Health 2015).

These forms of marginalisation are not independent, but cluster together and intersect to amplify mobility constraints. For example, those who are socio-economically disadvantaged are more likely to develop health issues due to poorer access to health care, housing, and nutrition (Poulton *et al.* 2002, Nguyen and Peschard 2003). Those in poor health have less ability to produce financial resources, due to differences in embodied capacity or to the discriminating effects of employment norms and structures (Kawachi *et al.* 2010). Transport is implicated with economic disadvantage in a feedback loop, for example, car ownership is a determinant of access to employment opportunities in Aotearoa NZ (Parker 1997), while access to income is required to own and maintain a roadworthy vehicle (Raerino *et al.* 2013).

In Aotearoa NZ, Indigenous Māori experience disproportionately higher rates of disease and disability with an average life expectancy at birth that is about seven years lower than for non-Māori (Ministry of Health 2015). Due to the ongoing effects of colonisation, Māori and Pacific populations in Aotearoa NZ are systematically disadvantaged across indicators of socio-economic status (Fahy *et al.* 2017), with some inequities worsening over time (Marriott and Sim 2015). These historical and structural disadvantages are amplified by infrastructure design that is predicated foremost not on equity but on transporting the already-privileged. Raerino *et al.* (2013) argue that existing concepts of transport disadvantage and transport-related social exclusion (Delbosc and Currie 2011) only partially explain inequitable impacts of transport infrastructure on Indigenous communities. Normative assessments of transport and health can overlook important domains for wellbeing of non-dominant groups (Sánchez, Stolz, and Ma, 2003); for Māori, this includes the ability to travel to places of spiritual, cultural, or social importance, to maintain connections or fulfil obligations (Raerino *et al.* 2013).

Such exclusion may reflect unconscious biases and values that render neglect, or represent deliberate attempts to segregate by ethnicity, gender, age, or class, as in Winner's (1980) classic example of the New York city planner who purposefully designed bridges too low for buses to pass underneath in order to prevent poor or black people from accessing Long Island suburbs. Its enduring nature makes infrastructure far less immutable than the social values originating its construction (Rodgers and O'Neill 2012); generations later, those bridges still scaffold New York transport systems, structuring mobility in the city with the vestiges of past values and inequities. Writ large-scale, as Star (1999) notes, infrastructure is comprised of millions of tiny metaphorical (if not literal) bridges, with millions of buses that cannot pass them.

These nuances of historical and ecological context and difference are often overlooked in urban mobilities transformation policy but represent important dynamics to be accounted for in universally inclusive design principles. Drawing on qualitative interviews with 62 older, disabled, or bodily-diverse participants across four sites in Tāmaki Makaurau (Auckland), Aotearoa NZ, our paper addresses two questions. First, how does transport infrastructure shape opportunities for mobility for people living in diverse circumstances? Second, what are the impacts of inequitable access to mobility for wellbeing? We suggest that attending to these questions points transport policy and planning towards inclusive streetscapes that promote mobility, health, and wellbeing for all.

Socio-ecological perspectives on infrastructure

To examine how opportunities for mobility become unevenly distributed, we consider relationships between individual- and group-level diversity and infrastructure through a socio-ecological framework. As evident in other studies at the intersection of transport infrastructure, mobility and health (Pikora *et al.* 2003, Saelens *et al.* 2003, Götschi *et al.* 2017), socio-ecological models are necessarily multi-layered and multi-scalar, locating individuals within social communities, and local built and natural environments within wider regional and national political and economic systems, all of which are influenced by hegemonic cultural values (Sallis *et al.* 2006). Recognising that environments shape behaviour, including modes of travel such as walking (Pikora *et al.* 2003), these studies suggest that changing social and physical environments may have greater influence over

population health outcomes than targeting only individual behaviours (Stokols 1992, Sallis *et al.* 2006, Giles-Corti 2006, Ogilvie *et al.* 2011).

Previous quantitative research drawing on socio-ecological models has enhanced understandings of the health benefits of walking or cycling at a population level (Saelens *et al.* 2003, Ogilvie *et al.* 2011, Goodman *et al.* 2014). These studies have identified important urban design attributes for neighbourhood walkability, including street connectivity, destination accessibility, dwelling density, distance to public transport, and pedestrian-friendly movement networks (Giles-Corti *et al.* 2016). While these attributes are also fundamental to the mobility opportunities of disabled people, the quality of pedestrian infrastructure has particular salience. A poorly maintained footpath can confine someone to their home, while streets and crossings designed to be accessible can extend mobility. Identifying the social and structural impediments to easy mobility for a person with a disability requires more finely grained analyses of infrastructure provision than is common in the literature discussed above.

Furthermore, a range of factors other than those related to transport networks and urban design can present mobility challenges to diverse groups. For example, health sector provision of mobility aids or the availability of assistance could determine whether a trip outside the home is taken. Socio-ecological models, used flexibly, can help understand the multi-layered, multi-scalar, cross-sectoral and relational factors that influence the mobility constraints and opportunities of people with disabilities and older people living in different places and contexts. Furthermore, the wellbeing outcomes measured in quantitative studies may not reflect the variety of cultural, social, physical and emotional facets of health that most support wellbeing for different communities. We therefore take a comparative approach to examine how bodily and cultural diversity, social marginalisation, and socio-economic circumstances intersect with transport provision, exposing inequitably distributed opportunities for mobility, and impacting personally and culturally-valued dimensions of wellbeing.

Participants and methods

Location

Auckland's suburban areas were developed in the era of the automobile and remain a low-density sprawl, rendering public transport a low-efficiency and expensive option, and leaving contemporary residents largely car-dependent. The city's location over a narrow isthmus geographically constrains road infrastructure, resulting in high levels of traffic congestion. Like Aotearoa NZ more generally, Auckland transport infrastructure is predominantly shaped by economic values, prioritising commuter access to central hubs and main arterial routes for efficient freight. There are some legislative provisions for people with disabilities, including subsidised taxis, disability parking, and some accessibility requirements for public transport and new buildings. People aged over 65 benefit from a SuperGold Card which enables free public transport with some time and service restrictions.

This research involved interviews with 62 people who are 'differently' challenged by the built environment, including older people and people with a range of disabilities, chronic illnesses or impairments. The participants, recruited from four study areas in Auckland, represented a diverse range of urban geographies, ethnic groups, and socio-economic circumstances (Figure 1):

- Glen Innes, a low socio-economic, culturally diverse (50% Pacific peoples, 20% Māori, 20% Asian, 10% European/Other) suburb in East Auckland. We partnered with Rākau Tautoko (a community organisation), who recruited and interviewed participants to reflect this cultural diversity.
- Howick, a high socio-economic suburb in East Auckland (74% NZ European, 12% Asian, predominantly Chinese). We intentionally recruited NZ European and Chinese participants.
- West Auckland – Henderson and surrounding suburbs: A low socio-economic region with a large Pacific migrant population. We particularly focussed on Tongan, Samoan, Tuvaluan, Tokelauan, and Kiribati communities attending local churches.
- Māngere, a low socio-economic suburb in South Auckland with high proportions of Māori (18%) and Pacific (62%) people. We centre on kaumātua (older Māori people) living in a block of flats associated with Te Puea Marae (a communal site of cultural significance, including a meeting house, other buildings and grounds).

Participants

We aimed to recruit a heterogenous mix of older people and disabled people but recognised the loss of contextual diversity when research employs exclusive definitions prioritising Western or biomedical standards. Specifically, age can have different meanings and implications for different communities, and 'disability' is a biomedical term and social identity that is differently understood across cultural groups (Ingstad and Whyte 1995). For example, given their shorter life spans and higher rates of morbidity compared with NZ Europeans, many Māori and Pacific participants in their 50s were considered kaumātua, or respected elders, in their communities. Acknowledging cultural nuances and concerns

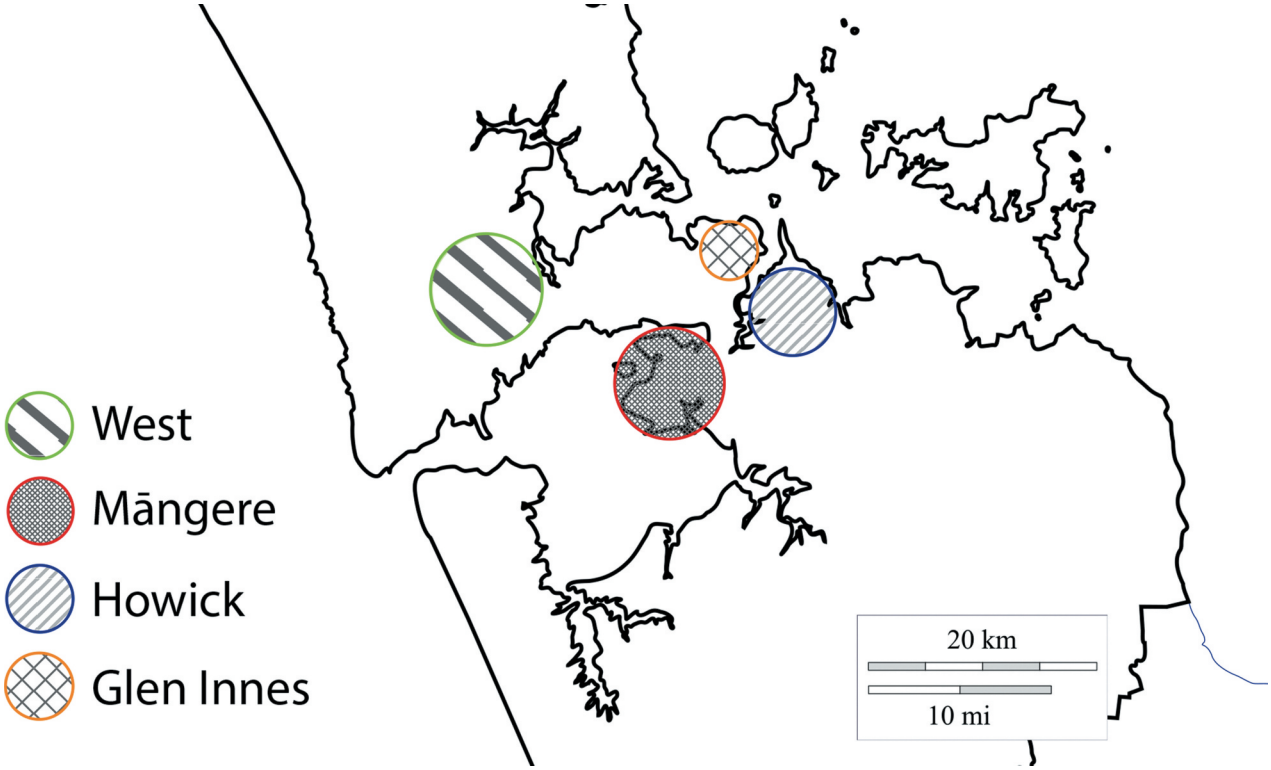

Figure 1. Map of Tāmaki Makaurau (Auckland) indicating the four study sites.

relating to stigma, we avoided the word 'disability' and referred to long-term conditions and limitations when recruiting Chinese participants. In the absence of a direct translation of the word 'disability' in Pacific languages, we used broader concepts that encompassed chronic illnesses (in Samoan, 'gase-gase', meaning 'sick'; in Tongan, 'faingata'a'ia faka e sino', meaning 'difficulties of the body'). Few participants spoke of themselves as disabled, but more referred to 'leg problems' or a 'weak arm' that had persisted for some time. Despite their arguable biomedical recognition, these terms capture the mosaic realities of adapting a body into an environment, and vice versa. Acknowledging the socio-political dimensions of the word 'disability' for us meant shifting towards a more inclusive framing which explored how bodily, socio-economic, cultural, and linguistic diversity influenced experiences of infrastructure. Our sample therefore included a range of people differently challenged by the built environment, including older people or those living with chronic conditions such as diabetes or heart disease, people affected by agoraphobia, anxiety, chronic fatigue, broken bones, hearing loss, or cognitive impairment. One participant was a community mental health worker supporting clients with accessibility issues.

Methods

Following approval from the University of Auckland Human Ethics Committee, we engaged nine research assistants from local communities in the four study sites to recruit an appropriately diverse range of participants and collect data. They represented six different ethnic groups, collectively spoke nine languages, and recruited participants through their networks, including community groups and family members (Table 1).

Table 1. Participants' demographic characteristics.

Study Site	N	Gender		Age*		Self-reported ethnicity**
Glen Innes	15	F	12	Mean	57.9	European (n = 10); Māori (n = 7); Pacific (n = 2)
		M	3	Range	26–77	
Howick	17	F	11	Mean	76.5	European (n = 10); Chinese (n = 8)
		M	6	Range	62–92	
West	16	F	9	Mean	66.9	Pacific (n = 16); European (n = 1)
		M	7	Range	26–82	
Māngere	14	F	12	Mean	59.7	Māori (n = 12); Pacific (n = 1); European (n = 1)
		M	2	Range	26–82	

*The mean and range were estimated from age reported in five-year groups.
**Participants could report multiple ethnicities. Pacific ethnicity included Samoan, Tongan, Cook Islands, Niue, Tokelauan, Kiribati, and Tuvaluan. European ethnicity included New Zealand European, Pākehā, Italian, Scottish, Irish.

After gaining informed consent, we engaged participants in semi-structured interviews, beginning with a sit-down conversation followed, where possible, with a 'go-along' interview using photovoice techniques to document the journey with a digital camera (Harper 2002, Whitzman *et al.* 2013). Some participants were interviewed together as they were spouses or friends. We invited participants to take us on journeys they would typically take or journeys that presented challenges. We asked questions exploring their personal history, relationships, destinations, modes of travel and experiences of taking journeys in their community. A few participants had difficulties engaging in the 'go-along' component of the interviews; for some the destination was their mailbox or the journey had to be taken by car. We also undertook a kaumātua hui (meeting) in the Māngere site prior to individual interviews, as a culturally appropriate introduction to the research. Interviews were transcribed verbatim and data analysed as noted below. We then engaged participants in community workshops at each site where we presented preliminary findings and solicited feedback for further refining.

The research team included co-investigators, research assistants and advisors from diverse backgrounds, representing a range of ages, ethnic groups including Māori, and disabled people. Synthesizing this range of perspectives was instrumental to an analysis that considered multiple ways of knowing. After reading an initial subset of transcripts, and with input from all co-investigators, we developed an initial group of codes with detailed descriptions, which we continued to develop, question, and refine in discussion with investigators and ongoing reading of transcripts. We coded data with a sample of transcripts cross-checked for consistency and cultural interpretation, using NVivo 12 to support this process. We used a reflexive thematic analysis (Braun and Clarke 2020) to identify our main themes. The individual stories and examples presented here were selected to reflect the range of participant experiences within each of the four sites more generally, as well as to illustrate the intersecting dimensions of advantage and disadvantage that we identified across sites. All names are pseudonyms, and we have been careful to protect identity.

Findings

We present our findings below arranged under six key themes to illustrate how transport infrastructure shapes mobility opportunities for our participants and the impacts of inequitable access on their wellbeing. Each theme is named to reflect the core ideas identified from our participants' experiences and narratives.

Wellbeing is supported through opportunities to make places of belonging and joy

Mario is a NZ European man in his early 60s awaiting surgery to alleviate chronic hip pain following an injury sustained several years ago. The pain immobilises him several days a month, and so he deeply values his ability to go out when possible but cannot walk nor climb into a car. Before he got a mobility scooter he had been housebound for a year, only sometimes taking car trips with his sister by crawling into the vehicle. Fortunately, a visiting nurse helped him apply for a funded mobility scooter, which he described as life changing.

Now he makes the 1 km journey by scooter into Glen Innes centre every day he can, both to prevent isolation and to manage his pain. He plans his journeys in advance, forestalling loneliness with pleasant things to anticipate. He took our research assistant to a local second-hand store (op-shop) which he visits regularly because it is one of the few shops he can enter in his bulky mobility scooter, and because he takes joy in searching for 'special' things: books, videos, a picture from Bali. 'Even if I go in the op-shop makes my spirit already lift up, distract from the pain,' he tells us. 'So you are doing things that distract you from your suffering, and if you are mobile, it is easier, it is easier than reading books. That is why I like to go out, get more distraction, distraction from … it is not suffering, but it is.'

The benefits for Mario of being able to access the Glen Innes town centre independently cannot be underestimated, most importantly, *because* he is already physically suffering and socio-economically limited. Yet Glen Innes is an unusual site given its substantial provision for state housing close by the town centre. This accessibility means that despite experiencing financial hardships, the relationship that Mario had to Glen Innes was shared by many other participants who travelled by foot or scooter to the centre to find and make their own places of belonging and joy. Claiming their belonging through relationships and shared activity, Rawiri (Māori, 70s) and Grace (Māori, 50s) walk to the Glen Innes marae to sing and be in community with other local kaumātua, while Eleanor (Niuean, 40s) parks her scooter amongst Harley Davidsons at the pub and feels welcomed with her walker. Meilani (Cook Island, 50s) encourages others to join her in exercise at the stage in the town square. Although access is more difficult for those who live further away, people like Nora (Māori, 60s) enjoy opportunities to meet people and make friends while travelling on the bus. Glen Innes is not without its challenges, including a gap between the train and platform which means Mario cannot board from the Glen Innes station, but the town design facilitates social interaction and

relationships within a low socio-economic community. In turn, the strong sense of community pride fosters the recursive relationship between people and places, leading, for example, to the creation of a popular music and arts centre. Significantly, the Glen Innes example shows the value gained when the people who need them most are able to access the resources and relationships they need to pursue wellbeing.

Infrastructure further marginalises the marginalised

Participants at other sites, however, do not necessarily have this level of access to places of belonging and joy, with subsequent effects on wellbeing. Living in the block of kaumātua flats, Marama, a Māori woman in her 80s, does not have the option of accessing the nearby township of Māngere Bridge. Marama cannot walk more than short distances due to arthritis, she cannot drive, and there are no bus routes near the kaumātua flats. She is therefore completely dependent on her caregiver Ngaio's brief daily visits. Ngaio sometimes breaks the 10-kilometre rule in her employment conditions to drive Marama to clinic appointments.

Marama described her situation:

> I'd like to make a lot of journeys. But I depend on other people because there's no buses. No way out. Some people, not like me you know. They walk up to, because they're capable of walking up to the bridge. To catch a bus to go all over. You know, wherever the pension card takes you. And if you're not in like, if you're, not capable of doing that, then, it's look outside the window. See the big world then. Hello, here I am!

Marama's isolation is not by choice. The block of flats where she lives was founded as housing for aging kaumātua, who also served as spiritual leaders and custodians to the land, sea, marae and local urupā [cemetery]. However, in 1982 the main state highway to the airport was extended through Māngere, amputating the road where the kaumātua flats were located and cutting off kaumātua from access to the Māngere Bridge village, Māngere mountain, and the urupā. Over subsequent decades, the area around the kaumātua flats has been developed as an industrial area where farmland and orchards were replaced with factories, leaving the marae an island of green pasture ringed by roads congested with heavy traffic, while pollution turned the residents' clothes black. Bus routes to the industrial area around the marae have been reconfigured to operate around worker hours, leaving kaumātua without bus access. Only one of the kaumātua had a car. For everyone else, the only way to independently leave their home is via a kilometre-long walk next to the busy motorway onramp where frequent crashes have damaged the road signs and barriers (Figure 2).

Some of the younger kaumātua are healthy enough to manage a trek to catch a bus to the Māngere township once a week to browse shops. Most, however, are like Marama, dependent on caregivers or family members to take them out of the flats, and this minimises the number of trips taken; Raewyn, for example, is taken by a family member to Māngere Bridge only once a fortnight to do her shopping.

Reflecting dialectical relationships between 'embodied capacities' and mobility, the kaumātua with limited ability to walk have the least opportunity for mobility, while those who have the least opportunity for mobility become those who are most limited in their ability to walk. Before the motorway was built, kaumātua at Te Puea flats regularly made journeys of particular social, spiritual and cultural importance in their roles as kaumātua, walking up the road to the village and the urupā, or across the road to the moana [sea] to collect kaimoana [seafood] and harakeke [flax] for weaving and other cultural functions. Since then, however, kaumātua have experienced the gradual constriction of their mobility, and with it, their health and wellbeing. Marama shuffles in and out of her caregiver's car because of her arthritis, but her poor health is likely due, at least partially, to her limited opportunities to access places of cultural and spiritual significance.

Many of the kaumātua recall the protests local Māori made to the motorway's intrusion, and how they were silenced by urban planning that prioritised moving the country's commuters over protecting the mobility of kaumātua. When asked what transport planners could do to improve their situation, Marama bitterly repeats, 'put the road back how you got it.' A bypass reconnecting the severed road would have offered a compromise, valuing the foundational role of kaumātua in Māori community development. This would have also increased their opportunities for mobility and better supported kaumātua physical, social, and spiritual wellbeing. Instead, the effect of this infrastructure is to marginalise the already marginalised.

Transport design discriminates

Opportunities for mobility are also inequitably distributed through public transport design. A recent shift to a 'frequent transit network' in Auckland with hub and spoke designs connecting residential areas to town centres help those living close to main routes to access destinations but is less beneficial for those who do not fit the 'ideal' rider: those who do not work a 'normal' 9am-5pm weekday job; those who live further away and are required to catch a less frequent 'feeder' bus; those who cannot walk longer distances to bus stops placed further apart; those who wish to travel to another part of the area. Importantly, these variable

Figure 2. Clockwise from top left: The amputated road cutting kaumātua off from the village; damage on Māngere bridge from traffic accidents; the busy road preventing access to the sea; the motorway cutting kaumātua off from the village and the mountain.

user needs are not evenly distributed across social groups. In Auckland, like many other places, people who use wheels to facilitate mobility are particularly disadvantaged by urban transport designs. As accessible as Glen Innes is, for example, participants who use scooters and wheelchairs had the greatest challenges, especially those living further from the township.

Lester is a Pacific man in his 20s who, like others we talked with, values his community engagement in Glen Innes, journeying in his wheelchair to build relationships as part of his work role and for social connection. His medical needs are partially supported by the Ministry of Health (MoH), but he does not qualify for more substantial support from New Zealand's Accident Compensation Corporation (ACC) as the injury that caused his paralysis occurred overseas. While he is waitlisted for a better chair, he uses a manual wheelchair with limited functionality which is missing a wheel grip and is poorly aligned. The built environment does not facilitate his mobility in this chair as he cannot push himself up inclines, forcing reliance on caregivers.

His journeys to Glen Innes are fundamental to Lester's livelihood and wellbeing but involve negotiating sequential challenges. He must first take a taxi from his home in a neighbouring suburb to the train station, because the journey requires navigating a steep hill, uneven footpaths and roads, and construction blocking the paths. Like Mario, Lester worries that the gap between the train and platform at Glen Innes risks flipping his wheelchair forward if he attempted the manoeuvre alone (Figure 3).

Lester acknowledges that the recently introduced electric trains have improved accessibility because they are fast, stable to ride on, and easier to embark and disembark. However, the surrounding infrastructure imposes many other difficulties. Lester worries about crossing the railway lines as his wheels can get stuck, trapping him or flipping the chair forward, leaving him vulnerable to oncoming trains. When the train is crowded, he declines to board because 'having to back in and get everyone to move and all that just for me, it's hard.' Returning home, he cannot take the stairs in the train station so must navigate an unreliable elevator that frequently breaks down, requiring him to turn around and catch another train to a different station and take a longer taxi ride home. Lester made a conscious decision to stop using the bus because the ramps are too steep to push up, the seating is not secure, and because of bad experiences with

Figure 3. The gap between the train and Glen Innes station (left) and the train tracks that threaten wheelchair stability.

impatient bus drivers or drivers not stopping to pick him up, all compounding his feeling that 'I'm a burden to society.'

His inadequate chair and the series of infrastructural challenges therefore conspire to exclude Lester from community by requiring extraordinary effort to access mobility. Consequently, there are many places in Auckland where Lester simply avoids. The outcome for Lester, like for Mario, is a world that becomes very small and where access carries a disproportionate labour and financial cost – the result of infrastructural decision-making that does not prioritise inclusivity.

Socio-economic position influences mobility

Lester's story also demonstrates how economic status, and the bureaucratic apparatus which structures access to resources, are implicated in inequitable mobilities. Being ineligible for ACC services, Lester acquires medical supplies from friends who stockpile excess equipment through their ACC coverage, and relies on his family's support with mobility. Lester would like to buy a mobility van if he had more financial aid, but even an electric wheelchair would allow him independence he currently lacks. His discounted taxi rides and train journeys to and from Glen Innes are expenses he can ill-afford. As he puts it, 'it costs us too much just to be disabled.' This sentiment was shared by many other participants. While several accessed government funding for wheelchairs or mobility scooters, and discounted taxi fares offered by Auckland Transport, many noted the costs of transport as prohibitive, especially as disability pensions are modest, and users are responsible for paying the costs of wheelchair or scooter maintenance and repair. A common problem for wheeled travellers was broken glass on pavements which punctured tyres, resulting in high fees for rescue and repair.

The travel discount also makes little difference when the base cost of mobility van hire is high. For example, Mele is a Tongan woman in her 60s living in West Auckland who uses an electric wheelchair due to an amputated foot. She cannot get into cars, as her heel became so bruised during transfers that it required further surgery. Aside from short journeys in her electric wheelchair provided by the MoH, the only way Mele can travel any distance is by hiring a mobility van with a hoist. The MoH pays for transport to her dialysis clinic, but for Mele the 50% subsidy for personal travel leaves most journeys still too expensive. She has only been able to use the personal travel option three times, missing out on many important social occasions, including family gatherings and funerals.

Fortunately, Mele lives about ten minutes' walk from Te Atatu shopping centre to which she travels independently nearly every day in her wheelchair. Every Friday, she meets with a group of wheelchair users for tea at the shopping centre, stopping to talk with two Tongans working in the supermarket. On Saturdays she goes to

Figure 4. Naama to research assistant: 'I can feel the heaviness on my legs and that is a sign of enough. Can we continue another time?' Her closest bus stop is another 240 metres down this road.

the flea market. She says, 'the happiest time for me is when I meet others who also use electrical wheelchairs like me. We have coffee with them and we talk for hours before I come back.' Mele's experience suggests that designs distributing many small community hubs throughout neighbourhoods, rather than separating residential and commercial areas, may better support equitable access to wellbeing for disabled and socio-economically disadvantaged people.

Intersections of health with socio-economic status further shapes mobility

Their age and disabilities notwithstanding, the more affluent participants were typically in better health and had greater access to transport resources and options, even when they lived further away from the community or bus stop. For example, many Chinese participants in the Howick site did not drive but made many independent journeys by foot or by bus. Some reframed their 20-minute walk to the bus stop as an opportunity for exercise. This was less possible for many Pacific participants in the Henderson site. For example, Naama is a Tuvaluan woman in her 80s who struggles with walking but tries to take short walks every day to her mailbox for her health, as her doctor advised. She explains, 'If I feel good and healthy, not running out of breath, I can walk to the mailbox every day. If I do not feel good I may only be able to take the journey two or three times a week.'

Our research assistant accompanied her on her walk to the mailbox, which took one minute and left her with, as he described it, 'just enough for her to breathe properly.' The nearest bus stop, however, is another 300 metres down the road, a 20-minute walk for Naama. On a good day, Naama might take the bus to the shops or doctor, pausing to rest during the walk to the bus stop. On her walk with our research assistant, however, she only managed 60 metres (Figure 4).

A distance to a bus stop, then, becomes a significant barrier for those who already have limited mobility that cannot be overcome with financial means. Auckland Transport's re-designed routes with increased distances between some stops perpetuate the marginalisation of those who most need public transport – those who are financially or physically constrained with limited alternative options.

The relationship between socio-economic status and health also intersects with ethnicity, as Māori and Pacific people are both more likely to be economically disadvantaged and suffer poor health at younger ages. This is a problem when services for older people are

based on a Pākehā (New Zealand European) standard of health and age. Since 2006, New Zealand residents aged over 65 (also the age of eligibility for superannuation or government pension) can obtain a SuperGold Card which provides free public transport on most services. Many of our participants benefited from and appreciated their SuperGold cards. However, we also had participants who were not yet eligible for the SuperGold Card, including some who had retired early for health reasons, who therefore struggled with the cost of transport. As Māori and Pacific people in Aotearoa NZ have younger populations with shorter life-expectancies than Pākehā, the universal eligibility for retirement benefits further disadvantages these groups who most need the support to begin with. Participants in the Henderson site commonly noted insufficient money for bus fare, bills, or petrol. For example, Tomasi, a Tuvaluan man in his early 60s who has chronic heart disease and cannot walk long distances, described difficulty with covering the cost of the bus. Similarly, in her early 60s, Nora, a Māori woman, does not yet qualify for a SuperGold Card. Recovering from major surgery, she also has chronic obstructive pulmonary disease, arthritis, and diabetes. She sometimes needs to ask family or friends for rides when she runs out of money for public transport.

People draw upon different financial, social, and cultural resources to negotiate mobility

Being of higher socio-economic status facilitates greater mobility through several mechanisms, as was evident in participant narratives from the Howick site. Firstly, although they were the oldest group and reported similar infrastructural problems with pavements and public transport design as other sites, they were in better health and had the financial means to access more transport options. Secondly, these participants had acquired a range of skills, resources, and a sense of entitlement that holds currency when navigating transport systems and overcoming barriers to a higher quality of infrastructure (e.g., footpaths) and services (buses, trains). Many Howick participants had long histories in the area and institutional ties to local schools and universities, reflecting a high level of social capital (Bourdieu 1986). Many Chinese and NZ European participants were embedded in transnational social networks and used technology and frequent overseas travel to maintain these relationships. High levels of education, computer literacy, and systems knowledge meant that even participants who only occasionally used public transport were generally confident in navigating the systems.

Participants can be confident in using their social power and systems knowledge both to access mobility and to advocate for themselves. For example, Patricia, a NZ European woman in her 70s, uses the bus stop right outside her retirement complex almost every day, using her laptop to plan her routes. She is involved in many community organisations and makes submissions to Auckland Transport through her Probus group (a social club for professional, business and retired seniors). She regularly calls the local council to have broken pavements fixed, and showed us where they recently made a repair following her notification (Figure 5).

Patricia told us about a recent complaint she made to Auckland Transport:

> I wanted to get off there, and the driver wasn't stopping there, and he went another, you know, for 10 more metres up the road. And I said, 'the bus stop's back there.'
>
> As I got off the bus, he said, 'fussy old lady.'
>
> I said, 'I heard that.' Came, came storming home, and sent off a, complaint. Got a reply back the next day which is most unusual for Auckland Transport. Saying we will talk to, interview the driver and if necessary, he will be sent off for more customer service training!

Most participants in other sites did not have Patricia's confidence with navigating systems or the social capital to advocate for themselves, or worse, when they did raise issues they did not have the privilege of being heard due to ongoing systemic racism and othering. Auckland's transport systems are increasingly incorporating new technologies, such as electronic 'HOP cards' to pay for trips or online journey planning or bus tracking tools, which inadvertently privilege those with access to technology or skills in its use – typically those who are already most socio-economically advantaged and with higher education and connections to institutions and organisations, like Patricia. Participants without Internet access found it difficult to top up their HOP card or find information about bus routes and timetables. Francine, a Samoan woman in her 50s who had to retire early due to stress and an undiagnosed 'weak' left arm, points out, 'not everybody has Internet on their blooming phone, they run out of data.' She described how she often calls to find out the next bus, but 'it costs me money as well to call.' As she cannot top-up her HOP card online without internet access, she – ironically – must take an extra bus ride to the nearest outlet offering top-up facilities.

The increasing complexity of digital transport infrastructure leaves behind people with less experience navigating new technologies, or without English language skills. Several participants found transport systems too challenging to decipher. Angela, a Māori woman in her 50s who indicated some mental health or cognitive issues, found navigating transport systems overwhelming and therefore avoided routes or modes she was unfamiliar with. Although she uses a HOP card on buses, she found the system daunting

Figure 5. Patricia shows the research assistant where the council repaired the path following her complaint.

on the train, and so she buys paper tickets which are more expensive. As she describes her uncertainty:

> I'm not quite sure how to do the swiping. And what's involved in that. I don't know what, whether I have seen people waiting for a certain sound um, a certain sound off the, the um, swipe, the swipe cards, as you swipe them as they come in. [...] But I don't use it because I, I'm on the train and, pretty useless when it comes to, to swiping. But I have seen it. I have seen it done and I know I can do it but, I just go and do, prefer, prefer to get a train ticket.

Participants were often eager for help with learning, however. On their go-along interview, our research assistant showed Angela where the card reader was at the train station, to which Angela said, 'Great. Now I know where to swipe on and swipe off is.' Valeri, another Māori participant who did not use public transport because she did not know how, expressed a desire for support with learning the system, saying:

> Even if there was someone, even at a, local community centre or the library. And you could pick a pamphlet up and read it, and if there's someone, if you weren't sure, you could actually ask them because things do change. And I did take myself and my friend [...] And managed to just make the deadline [for activation], to swipe it on the bus. But I'm, quite unsure.

Other participants faced language barriers to navigating the transport system. For example, Pelenike, a woman in her 70s who teaches her grandchildren to write and speak Tuvaluan, said she could not take public transport because 'I can't communicate with people because of language problems and therefore I can't go on the train.'

The relationship between socio-economic status and mobility is therefore not only about financial disadvantage, but the diversity of knowledge and a system that privileges holders of specific, classed kinds of knowledge, or connections to other people and places from whom this knowledge can be acquired. Patricia is confident using online systems in her 70s because she has the means to afford a laptop and a home in a retirement complex with a good Wi-Fi connection, but also because her personal history involves speaking English as a first language, working in schools, and volunteering for the Citizens Advice Bureau, where she has opportunities to learn how to find information online. This knowledge gives her the power to use the system to advocate for herself; she knows how to make a complaint and expects to see action taken as a result. By contrast, this kind of knowledge was much less common among socio-economically disadvantaged participants, with important consequences for mobility. These participants often relied on younger family members to drive them or advocate for them. For example, Mele, the Tongan woman who liked to visit the flea market in her electric wheelchair, had trouble getting to the market when the unmaintained footpath caused her wheels to become stuck. On that instance, it was her son who saw and rescued her. After cars had been parked on the footpath near Mele's house for several weeks, blocking her from leaving, her daughter came over to take photographs and call the council on Mele's behalf.

Families could therefore be an important resource for mitigating challenges but even they may be unaware of what is considered unacceptable, and what could be addressed. Mele described another occasion where she was trapped in her house for two weeks, waiting for the footpath to be fixed. As she described her experience:

> I'm usually mad when I'm saw that the footpath is still not yet fixed. One week goes by going on two weeks, and still no concrete. So I stayed home that whole week, that whole two weeks until I hear the news that it's been fixed and then finally, I get to go.

She wished that pieces of flat metal could be placed over broken footpaths while they are being repaired, and that the repairs would not take so long. In this case, it appears that no one in the family was aware that this was a violation of construction guidelines – perhaps because disability guidelines are often deprioritized – and that another call to council may have quickly resolved the situation.

Understanding the way diversity shapes wellbeing through mobility therefore requires recognition of how people draw on different and unequal resources to negotiate infrastructural marginalisation. When systems place the responsibility on individuals to report problems, then only those who have the 'right' kind of knowledge will see their problems solved. Patricia has the financial and social resources and technological knowledge favoured by transport design, and subsequently can independently journey over distance and use the system to solve her transport

challenges. Mele is well-resourced with a supportive family who can rescue her wheels from an uneven path, but her knowledge – which includes embodied knowledge of disability – is less valued by a system predicated on other forms of knowledge. She knows this system is not designed for her, telling us, 'the construction of our traffics and footpath to me is entirely to help the healthy population and not the disabled ones.' However, without the right resources and knowledge to speak to the right people, her situation is invisible to transport-planners, who mainly hear from those with the social capital and resources to make themselves heard.

Concluding discussion

Urban environments play critical roles in shaping population health, but the nature of the relationships between individuals and environments are complex, contingent, and multi-factorial. We use a socio-ecological framework to interpret the multi-layered nature of transport disadvantage, examining the relationships between personal, relational, and structural influences at the juncture of mobility and health. By using fine-grained analyses, we located individual diversity within community, regional and national political-ecological, historical and cultural contexts to unpack the way environments intersect with age, ethnic, economic and bodily diversity to distribute opportunities for mobility. We observed the disabling power of the many 'tiny metaphorical bridges' as they layered one upon the other to undermine mobility: platform gaps; uneven pavements; the need for digital and language fluency; a public transport network designed for commuters; subsidy caps on disability-specific transport; a car dependent urban form.

We also found that transport infrastructure reflects and reinforces social inequities, influencing who has opportunities for mobility and where. Auckland's built environment is not value-neutral, but accommodates geographical constraints through infrastructure designed in accordance with historical and contemporary cultural values. The enduring nature of infrastructure means that the vestiges of past cultural values scaffold the mobility of the present traveller; Auckland's suburban areas were developed in an era that anticipated near-universal car ownership and large family homes set within wide outdoor sections. All our sites were in low density, largely car-dependent suburban areas and only Glen Innes was located near a retail hub. Auckland's sprawling urban form represents an important layer of the socio-ecological system, exacerbating mobility exclusion for older people and those with disabilities compared to contemporaries in higher density cities with more integrated public transport services.

Historically as well as currently, Auckland's infrastructure has privileged economic needs at the expense of social and cultural wellbeing, with infrastructure that prioritises roads for moving freight and private vehicles. More particularly, the needs of Indigenous peoples have been historically overridden by infrastructure developed foremost on economic principles, with colonial conceptions misaligned with lived contexts and cultural values. The institutionalised privileging of Western paradigms in decision-making and the enduring nature of infrastructure converge to perpetuate an 'infrastructural violence' (Rodgers and O'Neill 2012) upon Aotearoa's Māori peoples, inflicting harms that include inequitable mobility, greater exposure to risky or mobility-constrained environments, and barriers to cultural engagement and wellbeing that persist across generations. When Marama called for planners to 'put the road back,' she said so knowing that motorways, once built, do not change within lifetimes.

Prevailing economic values also privilege the needs of a 'standard' traveller with a 'standard' body, culture, language, economic status, and set of social aspirations (Lubitow *et al.* 2017). Our research reinforces that these values are implicit in public transport designs that prioritise commuter access to economic hubs and increasingly rely upon digital literacy with and access to technologies. As those with stable employment in standard hours and access to technology tend to be those who are already advantaged, infrastructure designed on economic principles and culturally-normative assumptions further marginalises the already marginalised. With people drawing on different and unequal resources to negotiate mobility, this results in unequally patterned vulnerabilities and a system that entrenches the status quo.

How does transport infrastructure shape mobility opportunities for people living in diverse circumstances?

While previous studies have focused on individual factors such as indigeneity, socio-economic status, or age (Sánchez 2008, Raerino *et al.* 2013, Nordbakke and Schwanen 2014), here we particularly consider how intersecting forms of diversity mediate transport access to impact health. This is critical because intersectionality scholars have demonstrated how the structures of society often produce disadvantage in packages (Crenshaw 1989): disability or chronic illness coincides with under-employment (Hughes and Avoke 2010); Indigenous peoples are both culturally and economically marginalised (Raerino *et al.* 2013); culturally or linguistically marginalised groups are more likely to suffer ill health (Sherwood and Edwards 2006). Globally, older people and people with disabilities living in socio-economically deprived

areas are much more likely than those living in affluent areas to have non-communicable diseases, mobility difficulties, and multiple risks of exclusion (Barrett *et al.* 2006, Lang *et al.* 2008, Beard *et al.* 2009, Buffel *et al.* 2013). Over and above the challenges that many older people and those with disabilities face accessing all form of transport, our study highlights how these challenges intersect with additional layers of transport disadvantage based on ethnicity, economic hardship, or residential location. For example, by not considering the needs of wheeled-users as essential requirements of public transport designs and services, the cost of mobility is shifted to different-bodied users; yet alternatives like taxis or mobility vans, even at discounted rates, are prohibitive for those who are both disabled and financially constrained.

While environments built for a 'standard' person can compound challenges for people with multiple 'non-standard' identities, our research also shows where infrastructure can more equitability distribute access to mobility. Mario, who is disabled, in pain, and economically disadvantaged, was also resourced: with a nurse who helped him navigate bureaucratic system to acquire a scooter, and with a state house located a short distance from the thriving town centre of Glen Innes. As for many other participants who lived nearby, the accessibility of Glen Innes was critical to facilitating Mario's personal self-care routine. When systems were not designed for them, our participants drew on personal resources to enable mobility: financial; family connections; community networks. In some cases, like Mele's, community design features can help to mitigate the effects of disadvantage and still allow for opportunities to make such places of belonging and joy. However, systems that supply easiest mobility to those already most advantaged while requiring the disadvantaged to draw upon their own limited resources to enable mobility are not equitably designed.

What are the impacts of this inequitable access to mobility for wellbeing?

Mobility and wellbeing are mutually constituting, meaning that inequitable infrastructure could buffer or amplify the health impacts of intersecting forms of marginalisation. Where economic disadvantage intersected with disability, indigeneity with age, or ethnic identity with geography, opportunities for mobility could have significant implications for wellbeing. Some of our participants demonstrate the health benefits of infrastructure that supports mobility. Being able to access Glen Innes township in his scooter alleviates Mario's loneliness and supports his mental and spiritual wellbeing. The social benefits that Mele gains from the nearby shops demonstrate how small community hubs in neighbourhoods create places of belonging and joy that foster wellbeing.

Most of our participants had limited, if any, access to such places, however. This lack of opportunity powerfully impacted health and wellbeing; and this manifested unequally across different communities. The challenges of negotiating multiple barriers to mobility caused stress, as for Lester, or accelerated declining health, further reducing capacity for mobility, as for Marama. Meanwhile, socioeconomically affluent participants tended to be healthier, so even those who did not drive had the privilege of being able to walk to the bus stop and reframe the journey as 'exercise,' transforming distance into an opportunity for self-care. For those whose health precluded walking such distances, however, inaccessible mobility become another barrier to wellbeing.

This study fills a critical gap in the literature by enhancing population-level socio-ecological associations between infrastructure, mobility, and health with rich understandings of how interacting dimensions of privilege and disadvantage mediate these relationships at individual- and community-levels. While we situate this study in the local historic, socio-cultural and political context of Tāmaki-Makaurau in Aotearoa, the findings illustrate broadly generalisable processes through which layers of privilege and disadvantage can determine mobility opportunities. This study includes a relatively small number of participants, however, our in-depth and culturally-congruent methods of documenting the mobility experiences of marginalised groups, using participants' own language, yielded nuance that is difficult to attain in larger studies. Studies in future could seek to establish objectively the material difference in streetscapes and public transport access between areas.

In summary, our research highlights how transport infrastructure and practices produce, reproduce, and amplify inequities in mobility, health and wellbeing. More specifically, our findings indicate the need to consider intersectionality in transport consultation and design, acknowledging that some forms of marginalisation (age, socio-economic status, ethnic minority status, illness and disability) are not discrete and independent, but tend to coalesce and intensify with social stratification. It is therefore not sufficient to consult with older, disabled, *or* non-Pākehā ethnic groups; consultation must meaningfully engage people who are impacted in multiple dimensions and yet least enabled to make themselves heard.

Note

1. We use this term in line with the current consensus in the New Zealand Disability Strategy (Ministry of Social Development n.d.).

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Health Research Council of New Zealand [16/289].

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