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Creating and applying public transport indicators to test pathways of behaviours and health through an urban transport framework

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ABSTRACT

Access to public transport is an important social determinant of health, and influences congestion and economic capacity of cities. For these reasons public transport access is gaining attention in urban planning and policy. Yet, pathways for how public transport access influences behaviours and health outcomes remain largely unknown, and little work has tested public transport access policy recommendations with health and well-being behaviours and outcomes. As such, we sought to: 1) create and test policy-relevant measures of access to public transport stops with hypothesised travel behaviour and health pathways in Melbourne, Victoria; and 2) examine whether public transport infrastructure is distributed and / or delivered according to current state-specific urban planning policies. Overall 9495 adults living in urban Melbourne participated in the study. Living outside the recommended catchments of bus (> 400 m), tram (> 600 m), or train (> 800 m) stops were associated with higher levels of neighbourhood-level car ownership and greater road traffic exposure (tram and train only). Higher levels of car ownership and road traffic exposure were associated with longer commuting times; longer commuting time was positively associated with longer overall sitting time; and longer overall sitting time was associated with poorer self-rated health. Overall, 75% of the sample lived within the recommended catchment of a bus stop, compared with 19.8% and 18.0% for trams and trains, respectively. Developing and applying context-specific policy-relevant indicators likely has relevance for helping policy-makers and planners assess and monitor how diverse urban environments support various transport modes, and in turn, health behaviours and outcomes.

1. Introduction

Access to public transport and its associated infrastructure are important social determinants of health, and affect health and wellbeing in a variety of ways. Those living in more walkable and public transport-oriented neighbourhoods are more likely to walk for transport and less likely to be overweight or obese (Badland and Schofield, 2005; Papas et al., 2007). More broadly, traffic volumes and congestion contribute to both traffic incidents and pollution exposure (Dumbaugh and Rae, 2009;

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OECD, 2010; Ewing et al., 2003). Indeed, morbidity and mortality from air pollution exposure in OECD countries was estimated to cost US$1.7 trillion in 2010 (OECD, 2010). The environmental benefits of using active transport modes, including public transport, potentially extend to reduced vehicle kilometres travelled, traffic congestion, and green house gas emission, leading to improved air quality, less money spent on road infrastructure, and less impact on climate (Haines et al., 2009).

Adequate access to diverse transport modes not only supports individual health and creates a more sustainable environment, but it also enables a broader range of people to travel to employment, education, food, health and social services, and to recreate and socialise (Badland et al., 2014a). For example, having public transport stops accessible near home not only supports active transport (i.e. walking or cycling for travel purposes), but also increases mobility to destinations outside of the neighbourhood; thereby reducing area-level inequity by increasing productivity, engagement, and social inclusion (Strategic Review of Health Inequalities in England post-2010, 2010; Leyden, 2003). Conversely, neighbourhoods designed predominantly for private motor vehicles (as often seen on the urban fringe of cities), tend to have poor access to public transport, employment and shops and services, resulting in longer commute distances between home and destinations required for daily living (Jacobsen et al., 2009; Ewing and Cervero, 2001). In these motor vehicle-dependent neighbourhoods residents must purchase and maintain one or more vehicles to maintain mobility (i.e. forced car ownership). Otherwise, living in these neighbourhoods limits employment and social engagement opportunities, potentially leading to cycles of debt and entrapment (Dodson and Sipe, 2008).

Access to transport infrastructure and the related behaviours it supports, directly and indirectly modifies the risk of non-communicable diseases and environmental impacts, and is an important social determinant of health. Together with land use planning, access to public transport influences levels of traffic congestion and the productivity of a city (United Nations Department of Economic & Social Affairs, 2014). This is becoming a significant issue, in the face of population growth and rapid urbanisation (United Nations Development Program, 2011). Access to multi-modal transport systems is therefore gaining considerable attention in urban policy and planning discourse internationally (Department of Infrastructure and Transport, 2013; International Transport Forum, 2011).

To deliver accessible public transport in developed countries many urban design and transport planning policies recommend specific catchment areas for access to different public transport modes. For example, Australia is one of the most highly urbanised countries in the world and Melbourne, Victoria (where this study was undertaken) has one of the largest urban footprints internationally. Melbourne's more recent urban planning strategies support '20 min neighbourhoods', which encourage higher urban population densities located close to public transport within a polycentric city layout (State Government Victoria, 2014). In addition to buses and a large suburban rail network radiating from the city centre, Melbourne has one of the world's largest streetcar and light rail systems, hereafter referred to as 'trams'. In Victoria, it is recommended most residents should have access to a bus, tram and/or train stop within 400 m, 600 m, and 800 m respectively of their home (Department for Planning and Community Development, 2006). Yet, it is unknown whether these policy recommendations are delivered, and if so, the extent their delivery is associated with travel behaviour or health impacts.

To date, the pathways through which area-level measures of public transport influence health behaviours and outcomes are largely unknown (Badland et al., 2015). The primary aims of this paper were to create and test local spatial measures of access to public transport stops with hypothesised pathways associated with travel behaviours and health in the Australian urban context. For the purposes of this paper, access to public transport refers to the residential accessibility to public transport stops. Once tested and confirmed, our intention is to use these findings to develop a series of policy-relevant urban transport indicators that can be applied to measure and compare public transport infrastructure access within and between Australian metropolitan cities. Our secondary aim was to examine whether public transport infrastructure is distributed and / or delivered according to current state-specific urban planning policies. In combination, this work will examine the current delivery of public transport services and provide insights into specific types of public transport infrastructure investment required to support health behaviours and outcomes.

2. Methods

Ethics approval for the use of the VicHealth Indicators Survey was granted by the (then) Victorian Department of Health and The University of Melbourne Human Ethics Advisory Group. Informed consent was obtained from all study participants. Data were collected in 2011.

2.1. Conceptual framework

An urban transport conceptual framework was developed using a social determinants of health perspective (Badland et al., 2015). Potential upstream (i.e. neighbourhood attributes) and downstream (i.e. travel behaviours) determinants of urban transport were identified and pathways mapped in relation to long-term individual-level health outcomes based on existing evidence and variables commonly collected in population health or routine surveys. The neighbourhood attributes identified as being likely to influence transport and health behaviours and outcomes included access to public transport stops, cycling, and walking infrastructure. In this paper, we investigated the relationship between access to public transport stops with travel behaviours and health outcomes. The abridged framework and pathway analysis investigated in this paper is presented in Fig. 1.

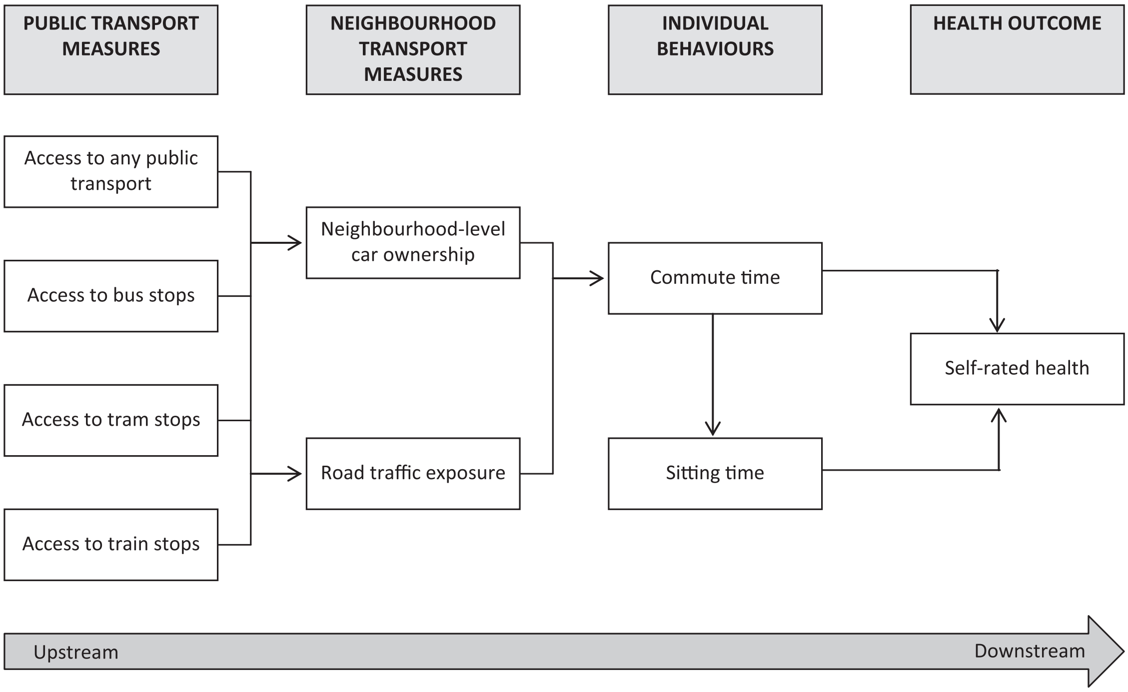

Fig. 1. Conceptual and analytic framework for assessing selected pathways for how public transport impacts neighbourhood transport, individual behaviours, and health outcome of interest (modified version of framework published elsewhere (Department for Planning and Community Development, 2006)).

2.2. *Area-level measures*

2.2.1. *Public transport measures*

2.2.1.1. Access to specific types of public transport stops. 2006 Victorian state transport policies state that 95% of residents living within a Statistical Area 1 (SA1) should have access to a: bus stop ≤400 m, tram stop ≤600 m, and train stop ≤800 m (Department for Planning and Community Development, 2006). SA1s are the smallest routine geographic area made available through the Australian Bureau of Statistics, and represent ~400 persons domiciled/area (Australian Bureau of Statistics, 2011a). Accordingly, road network distances from each participant's residential address to the nearest bus, tram, and train stop were calculated using an OD Cost-Matrix performed in ArcGIS 10.2 (ESRI, Redlands CA) geographic information systems (GIS) software. Participants located ≤400 m along a road network to a bus stop, ≤600 m along a road network to a tram stop, or ≤800 m along a road network to a train stop were classified as living 'inside the recommended catchment' for the respective public transport mode. Those located >400 m along a road network from a bus stop, >600 m along a road network from a tram stop, or >800 m along a road network from a train stop were classified as living 'outside the recommended catchment' for the respective public transport mode (Department for Planning and Community Development, 2006).

2.2.1.2. Access to any public transport stops. To be classified as 'inside the recommended catchment', participants were required to have access to at least one public transport mode within the policy-recommended catchments (i.e. a bus stop ≤400 m, or a tram stop ≤600 m, or a train stop ≤800 m). Participants were classified as 'outside the recommended catchment' if no public transport mode stops were available to them within the recommended distances. This formed the 'combined' transport measure.

2.2.2. *Neighbourhood transport measures*

Although numerous neighbourhood transport measures were identified through our earlier conceptual framework (Badland et al., 2015), we focused our current investigation on those measures that could be created using readily available national data sets, as well as relating to the behaviours that could be tested.

2.2.2.1. Neighbourhood-level car ownership. Neighbourhood-level car ownership was used as a proxy measure for individual-level car ownership. Participant residential addresses (geocodes) were assigned to SA1s. Mean 'neighbourhood-level' car ownership values were generated for each participant's SA1 using 2011 Census data (Australian Bureau of Statistics, 2011b) and created using ArcGIS 10.2 GIS software. A binary measure of 'lower' and 'higher' neighbourhood-level car ownership was created based on the sample median split of 1.68 cars per household.

2.2.2.2. Road traffic exposure. An index of road traffic exposure was created based on road hierarchies following an approach similar to Giles-Corti et al. (2011). Kilometres of each road type (i.e. arterial, sub-arterial, collector, local) within a 1600 m road network of a participant's address were generated using GIS software. The ratio of kilometres of arterial+sub-arterial+collector to kilometres of local roads was estimated to generate the exposure measure. A binary measure of 'lower' and 'higher' road traffic exposure was created based on the sample median split of 0.31 ratio value.

2.3. Individual-level measures

Demographic, behaviour, and outcome data were sourced from the 2011 VicHealth Indicators Survey. This self-report population health survey assessed a range of social determinants of health and community wellbeing factors in adults (≥18 years) residing in Victoria, Australia. The survey was conducted across the 79 Local Government Authorities in Victoria using computer assisted telephone interviews. Overall, there were 25,075 participants with geo-coded address data drawn across Victoria (overall response rate 53.5%). As this study focuses on urban transport, we applied a combined measure of the Sections of State (Australian Bureau of Statistics, 2011c) and Metropolitan Boundary (State Government Victoria, 2014) classifications to identify and select participants who lived in urban metropolitan areas of Melbourne. Those living in non-urban, non-metropolitan areas were excluded (n=15,580).

2.3.1. Behaviours

Commute time and sitting time were measured in the VicHealth Indicators Survey, as well as mapping onto our conceptual framework. Other behaviours likely related to transport, such as physical activity, were not assessed in the survey, therefore could not be examined in this sample.

2.3.1.1. Commute time. For those who were employed, the total number of minutes taken on a typical weekday to travel to and from work by any mode was self-reported. A binary measure of 'shorter' and 'longer' commute time was created based on the sample median split of 45 min.

2.3.1.2. Sitting time. Sitting time was assessed by the self-reported number of minutes spent sitting for all purposes on a typical weekday. This included time spent sitting while driving, working at a desk or computer, reading, watching television, and playing computer games. A binary measure of 'shorter' and 'longer' sitting time was created based on the sample median split of 300 min.

2.3.2. Outcome

2.3.2.1. Self-rated health. Overall health was assessed by using a self-rated health 5-point Likert scale of 1=excellent, 5=poor health. Participants were recoded into a binary measure of better (good + very good + excellent) and poorer (poor+fair) self-rated health. 'Self-rated health' encompasses both physical and mental health, and is a stable measure that is associated with morbidity and mortality outcomes across the socioeconomic spectrum (Burström and Fredlund, 2001).

Table 1
Demographic profile of urban VicHealth Indicators Survey participants.

		n	%
Sex			
	Male	3,729	*39.3*
	Female	5,766	*60.7*
Age (years)			
	Mean *(SD)*	50.7	*(29.0)*
Household income (AUD)			
	<$40,000	2,426	*27.5*
	$40,000–$79,999	1,970	*22.4*
	$80,000–$119,999	1,381	*15.7*
	≥$120,000	1,274	*14.5*
	Missing	1,758	*20.0*
Household composition			
	Children in household	4,380	*46.1*
	No children in household	4,863	*51.2*
	Missing	252	*2.7*
Self-rated health			
	Better	7,648	*80.7*
	Poorer	1,830	*19.3*

Key: AUD=Australian dollars; SD=standard deviation.

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2.4. Statistical approach

Multilevel multivariate logistic regression models were used to compare exposure and outcome measures. The primary aim of this research was to test each of the hypothesized pathways identified in Fig. 1. The spatial public transport measures were compared with the odds of reporting higher neighbourhood-level car ownership and higher road traffic exposure (based on median splits). In turn, these neighbourhood transport measures were compared with the odds of longer commuting time (employed adults only). Commuting time was then compared with the odds of poorer self-rated health and longer sitting time, and longer sitting time was compared with the odds of poorer self-rated health. All analyses were adjusted for sex, age, household income, and household composition. Analyses were conducted using Stata IC v.13.1, and statistical significance was $\alpha=0.05$.

3. Results

Table 1 presents the demographic and self-rated health profile for the urban study participants. There were more women (61%) than men, and a mean age of 50 years. Over half the participants had children living in the household, and the vast majority (81%) reported better self-rated health.

Table 2 presents the distribution of access to public transport stops, and odds of neighbourhood-level car ownership and road traffic exposure. Three quarters of participants lived within the recommended distance to bus stops, where as might be expected, access within the recommended distances to trams and trains was less common (19.8% and 18.0%, respectively). In Melbourne, tram services tend only to be offered in inner-middle suburbs and trains are limited to 15 lines radiating from the city. Those who lived outside of the recommended catchments for the specific public transport travel modes all had greater odds of living in a neighbourhood with higher car ownership compared with those living within the recommended public transport catchments (i.e. ranging from OR=1.30 for trams to OR=4.79 for trains). When road traffic exposure was considered, significant associations were also shown with access to trams and trains, but not buses. Compared with those who lived within the recommended catchment for tram and train stops, respondents who lived outside the catchments had much greater odds of being exposed to higher road traffic volume as determined by the road hierarchy (i.e. OR=8.64 for trains and OR=65.7 for trams). The large effect for trams reflects the fact that trams are limited to an inner suburb service network. The 'combined' access to public transport stops measure showed that 81% of participants lived within recommended distances to one or more public transport stops, but was not associated with area-level car ownership or traffic exposure.

The next pathways investigated were associations between neighbourhood transport measures and individual behaviours (Table 3). The odds of a longer time spent commuting to work was approximately 22% and 15% higher in those who lived in neighbourhoods with higher car ownership and road traffic exposure, respectively, when compared with those living in neighbourhoods with lower car ownership and road traffic exposure.

Table 4 examines the association between time spent commuting and time spent sitting; and Table 5 presents

Table 2
Adjusted multilevel regression models examining the odds of higher car ownership and road traffic exposure by access to public transport stops.

Public transport measures	n	%	**Odds of higher neighbourhood-level car ownership**			**Odds of higher road traffic exposure**		
			OR	*95% CI*	*p-value*	*OR*	*95% CI*	*p-value*
Access to bus stop ≤ 400 m								
Inside recommended catchment	7161	*75.4*	1.00	ref.	–	1.00	ref.	–
Outside recommended catchment	2334	*25.6*	**3.25**	**1.42–7.44**	≤ 0.01	0.79	0.56–1.11	0.17
Access to tram stop ≤ 600 m								
Inside recommended catchment	1876	*19.8*	1.00	ref.	–	1.00	ref.	–
Outside recommended catchment	7619	*80.2*	**1.30**	**1.16–1.46**	≤ 0.001	**65.70**	**37.63–114.71**	≤ 0.001
Access to train stop ≤ 800 m								
Inside recommended catchment	1706	*18.0*	1.00	ref.	–	1.00	ref.	–
Outside recommended catchment	7789	*82.0*	**4.79**	**3.60–9.23**	≤ 0.001	**8.64**	**5.32–14.05**	≤ 0.001
Access to any public transport stop								
Inside recommended catchment	7698	*81.1*	1.00	ref.	–	1.00	ref.	–
Outside recommended catchment	1797	*18.9*	1.07	0.51–2.25	0.86	0.93	0.68–1.28	0.65

Key: CI=confidence interval; m=metre; OR=odds ratio; ref=reference group.
Bolded text indicates association p-value ≤ 0.05.
Models adjusted for sex, age, household income, and household composition.

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Table 3
Adjusted multilevel regression models examining the odds of longer transport commute time by car ownership and road traffic exposure.

Neighbourhood transport measures			Odds of longer transport commute time		
*Neighbourhood-level car ownership**	n	*%*	*OR*	*95% CI*	*p-value*
Lower (< 1.68 cars)	4802	*50.6*	1.00	ref.	–
Higher (≥ 1.68 cars)	4693	*49.4*	**1.22**	**1.07–1.38**	≤ 0.01
Road traffic exposure⌘*					
Lower (< 0.31)	4843	*51.0*	1.00	ref.	–
Higher (≥ 0.31)	4652	*49.0*	**1.15**	**1.02–1.31**	≤ 0.05

Key: *=based on median split; ⌘=ratio of local roads carrying less traffic to more heavily trafficked roads; CI=confidence interval; OR=odds ratio; ref=reference group
Bolded text indicates association p-value ≤ 0.05.
Models adjusted for sex, age, household income, and household composition.

associations between sitting time and self-rated health. Those who spent longer than 45 minutes commuting to and from work had approximately 50% greater odds of being classified as sitting for longer for all purposes during the day. In turn, Table 5 showed that those who sat longer than 300 minutes daily had 30% greater odds of reporting poorer self-rated health, compared with respondents who sat for 300 minutes or less daily. No significant associations existed for the independent effect of commuting time with poorer self-rated health.

4. Discussion

The primary aim of this paper was to investigate hypothesised pathways (illustrated in Fig. 1) through which neighbourhood access to public transport stops and neighbourhood travel, impacts individual behaviours, and long-term health. Our hypothesised pathways were, for the most part, supported with significant associations in the anticipated direction. Together these findings add to the evidence base that greater provision of local public transport infrastructure positively impacts behaviours and health. Moreover, we have attempted to add to the literature by considering a limited number of pathways through which this might occur.

A secondary focus was to investigate whether public transport infrastructure was being implemented in accordance with current state-level urban planning policies. We found that bus stops were widely distributed across Melbourne, and 75% of our urban sample lived in areas that adequately (≤ 400 m) met the policy. This was not the case for tram and train stops (~20% and 18%, respectively). This is perhaps not surprising because in Melbourne, tram services are located in inner-middle suburbs only and there are 15 train lines. Future analyses could isolate areas where tram and train services were available to examine household travel behaviours, as well as identifying other areas where adequate densities exist required to support public transport services; however these are beyond the scope of the current study.

Furthermore, our findings highlight the importance of measuring the specific type of public transport provided in the neighbourhoods, as the 'combined' access to public transport stops measure appeared not as useful as the specific public transport mode indicators. This is primarily because of the differential distribution of services across the city; the aggregated 'combined' measure is diluted by ubiquitous distribution of bus stops across Melbourne, whereas tram services are limited to the inner city and trains to 15 metropolitan service lines. Not achieving recommended access to trams and trains in this urban sample show much stronger effects than buses for higher levels of neighbourhood-level car ownership and road traffic exposure. This may be because buses are generally regarded as lower-quality public transport compared with trams and trains, and the latter tend to have more direct and quicker routes and enforced timetabled services (Anderson et al., 2013).

Given the benefits of high quality transport infrastructure, it was anticipated that individuals with good access to public transport, and with lower commuting and sitting time would report better self-rated health. Individuals who lack access to public transport are more likely to experience 'transport disadvantage', which is the inability to travel when and where one needs without difficulty (Denmark, 1998). Individuals who experience transport disadvantage are more likely to experience social exclusion (Currie and Delbosc, 2010; Hine, 2004), and further socioeconomic disadvantage (Australia Bureau of

Table 4
Adjusted multilevel regression model examining the odds of longer daily sitting time by transport commute time.

Commute time			Odds of longer daily sitting time for all purposes		
Transport commute time §*	n	*%*	*OR*	*95% CI*	*p-value*
Shorter (< 45 mins)	2791	53.9	1.00	ref.	–
Longer (≥ 45 mins)	2366	46.1	**1.51**	**1.33–1.71**	≤ 0.001

Key: *=based on median split; §=employed adults only; CI=confidence interval; OR=odds ratio; ref=reference group.
Bolded text indicates association p-value ≤ 0.05.
Model adjusted for sex, age, household income, and household composition.

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Table 5
Adjusted multilevel regression model examining the odds of poorer self-rated health by transport commute time and daily sitting time.

Sitting time			**Odds of poorer self-rated health**		
*Transport commute time** §	n	%	*OR*	*95% CI*	*p-value*
Shorter (< 45 mins)	2791	53.9	1.00	ref.	–
Longer (≥ 45 mins)	2366	46.1	0.89	0.74–1.07	0.22
*Daily sitting time for all purposes**					
Shorter (< 300 mins)	4226	46.2	1.00	ref.	–
Longer (≥ 300 mins)	4916	53.8	**1.30**	**1.16–1.46**	≤ 0.001

Key: *=based on median split; §=employed adults only; CI=confidence interval; OR=odds ratio; ref=reference group.
Bolded text indicates association p-value ≤ 0.05.
Models adjusted for sex, age, household income, and household composition.

Statistics, 2006) due to the forced ownership and maintenance of two or more private motor vehicles (Currie et al., 2009). They are also more vulnerable to increases in fuel prices and mortgage stress (Dodson and Sipe, 2008). Indeed, lower income households in outer Melbourne that have no or very low public transport service levels available to them have been found to spend as much as 50% or more of their total income operating two or more cars (Currie et al., 2009). Hence those living in low-density developments with limited public transport infrastructure on the urban fringe are potentially doubly disadvantaged, as many have lower incomes and often experience transport disadvantage. Indeed, one of the main strategies to overcome transport-related social exclusion in the State of Victoria has been through funding increased public transport service levels, with a focus on fringe urban and rural contexts (Loader and Stanley, 2009; Lucas, 2012).

Evidence-informed indicators and frameworks provide useful tools for policy-makers and planners to design environments that support health behaviours and outcomes, and reduce inequity. Generating indicators using spatial data provide tools for objectively comparing and contrasting neighbourhoods and regions to gain a better understanding of the social patterning of infrastructure availability, and are replicable over time (Badland et al., 2014a). Our paper identified potentially useful urban spatially-derived policy-relevant transport indicators: i.e. access to bus stops within 400 m, tram stops within 600 m, and train stops within 800 m. We have confirmed that those living outside recommended catchments have higher neighbourhood-level car ownership and in most cases, higher traffic exposures; these are associated with more time spent commuting which is associated with more sitting time, which in turn is associated with poorer self-rated health. Although we have conceptualised these indicators from an Australian urban perspective, similarities exist between these and catchment distance measures used in other countries (Anderson et al., 2013; Ice, 2012). Accordingly, developing and applying context-specific policy-relevant indicators likely has relevance for helping policy-makers and planners assess and monitor how diverse urban environments support various transport modes, and in turn, selected behaviours and health outcomes.

There are some limitations to this work. First, the original conceptual framework identified public transport, cycling, and walking infrastructure attributes that were hypothesised as being important for health and wellbeing (Badland et al., 2015), yet we were only able to examine the pathways for access to public transport stops. It was beyond the scope of this study to examine walking and cycling, largely because cycling- and walking-specific spatial infrastructure data were incomplete and we lacked the resources to collect and develop these measures. Second, the road traffic exposure measure is likely less relevant for tram access. In Victoria, trams only run predominantly on sub-arterial and arterial streets and have a limited inner-middle suburb service network compared with trains and buses. Therefore, participants who live in areas with access to trams tend to reside more centrally, and likely have lower exposure to major motor vehicle arterial routes. Third, we only examined access to public transport stops, and the frequency of services was not considered in our analysis. A body of evidence suggests the frequency of a public transport service is an important predictor of its use (Anderson et al., 2013; Yigitcanlar et al., 2007). Fourth, we only examined access to public transport stops around the residence. It is likely public transport stop accessibility at both origin (e.g. residence) and destination (e.g. place of employment or education), as well as service frequency, are important predictors of use (Adams et al., 2016; Badland et al., 2014b). Future research needs to understand the network (e.g. jobs, goods and services) that can be accessed using public transport. Fifth, we relied on cross-sectional data and forced the direction of analysis based on the evidence. Future research needs to model these indicators with longitudinal data to test if our relationships hold in other cities and if other urban planning policy recommendations for public transport delivery are associated with health and wellbeing outcomes. Other limitations include the self-report nature of the VicHealth Indicators Survey and the limited range of behaviours and outcomes that could be assessed.

To conclude, a series of spatially derived urban public transport indicators were identified and mapped to study plausible pathways for their influence on behaviours and health. These proposed indicators were based on current Victorian urban planning policy, and accordingly, in this context could be applied by policy-makers and planners to examine the spatial distribution of the delivery of specific types of public transport stops across the urban Victorian region. As it currently stands, bus stops are more widely distributed across the Victorian urban region than trams or trains, and having adequate access to public transport modes is, for the most part, associated with positive health behaviours and outcomes.

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