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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.

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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

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broadly, traffic volumes and congestion contribute to both traffic incidents and pollution exposure (Dumbaugh and Rae, 2009; 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.

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