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# 4 Optimising Low Carbon Mobility for Health and Equity

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### Introduction

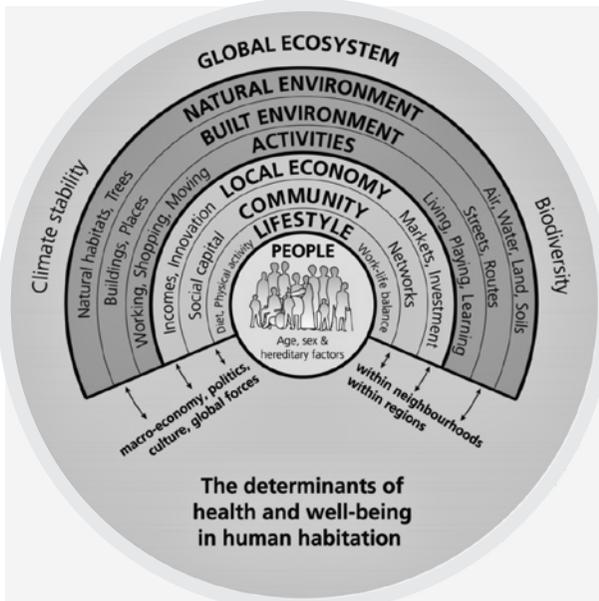
Climate change has urgent and profound implications for humans and our quality of life (Watts *et al.*, 2015). Transport systems have complex links with health and well-being, not only through the contribution of transport to climate change (Reardon & Abdallah, 2013). In modern human habitats, the places people reside and the goods, services and people that contribute to their wellbeing are often separated geographically, and transport options confer a health benefit by enabling access. These benefits must be weighed against the negative impacts of different transport options on health, wellbeing and equity across a range of domains: physical, mental, cultural and spiritual, environmental and economic (Reardon & Abdallah, 2013). Direct effects include air pollution, road traffic injuries and levels of daily exercise. There are also important indirect impacts: the ease with which people can fairly access health-promoting goods and services (including work); contact with neighbours, friends and family; access to sites of cultural significance; and connection with nature. The notion that access for equitable human wellbeing is the purpose of a transport system challenges the current neoliberal transport policy discourse, dominated by a perceived need to move goods, capital and labour for economic growth.

Cities are increasingly the context for these transport and health relationships. Urban transport transitions therefore matter very much to public health and will be increasingly important as global rural to urban migration continues (United Nations, 2014). The complex links between the social and the technical aspects of transport require new approaches to urban transport policy-making to optimise

co-benefits for health and fairness. In this chapter, we focus on low carbon transitions for land transport in cities, especially cities that are currently dominated by the use of private motor vehicles for most trips. We critically review the links between land transport and health using a broad public health framework. We demonstrate that transport policy-making needs to enable transport planners to understand future implications of policy choices, include a wider range of outcomes in analysis of costs and benefits, and involve the communities whose transport patterns are expected to change. We then provide two real world examples of these principles in action. The setting for both examples is Auckland, New Zealand, a city with 60 years of urban planning predicated on universal car ownership and use (Mees & Dodson, 2006, also see Chapter 7).

### Transport, health, equity and climate change

In describing the links between land transport systems and human health and well-being, we combine a public health lens with current psychological knowledge about human behaviour change. A public health lens assumes that individual health is not just the absence of disease but a state of complete physical, mental, and social well-being (World Health Organisation, 1948) and takes an evidence-based view that the most important influences on health lie outside the health sector, as well as outside the control of individuals (Marmot & Bell, 2012). This means that changing policy and infrastructure systems at global, national, regional and local levels are often more effective than attempting to change the behaviour of individuals, or even directly attempting to shift social norms (Marmot & Bell, 2012).



**Figure 4.1:** Map of the social and environmental determinants of human wellbeing and equity. Reproduced with permission Barton & Grant (2006).

Figure 4.1 illustrates a combined public health and psychological understanding of how individual health and wellbeing is nested in social and environmental influences.

Much research about the links between transport and health has focused on the impacts on physical wellbeing through air pollution, injury and physical activity. However, there are broader implications of transport patterns on mental, social, environmental and economic aspects of wellbeing, as well as the unequal distribution of wellbeing by gender, socioeconomic status, and ethnicity. The evidence for these complex links between transport and health is summarised briefly below.

## Physical health

Injury is the most comprehensively studied health impact of transport, and features prominently in prevention programmes and policy. Traffic injuries are among the leading causes of mortality and morbidity worldwide, responsible for a stable 3% of the global years of life lost (Institute for Health Metrics and Evaluation, 2016). The risk of road traffic injury is greatest for motorcyclists, cyclists and pedestrians, while public transport is the safest way to travel (World Health Organisation, 2010, 2015). Perceived risk of injury is also an important barrier for people to use active transport, especially cycling (Parkin *et al.*, 2007). Inequities in road traffic injury exist by income, education and ethnicity (see for example Camilloni *et al.*, 2013; Hosking *et al.*, 2013). Effective policies for reducing road traffic injury include lowering vehicle speeds and reducing the number of motor vehicles on the road, which also have the potential to reduce transport related carbon emissions. Both are especially important for reducing injury to people walking and cycling (Bhalla *et al.*, 2007; Elvik & Bjørnskau, 2016).

Vehicle-related air pollution is responsible for a growing burden of lung and heart disease and cancer, driven by increases in South and East Asia (Global Road Safety Facility & Evaluation, 2014). Exposure to vehicle exhaust pollutants varies by mode of transport. Although levels of pollutants may be higher within vehicles than outside, higher breathing rates and longer trips for walking and cycling can mean exposures are greater (de Hartog *et al.*, 2010). Socio-economic and ethnic gradients also exist for exposure to vehicular air pollution (Briggs *et al.*, 2008; Jacobson, Hengartner, & Louis, 2005).

To date, many policies to address transport air pollution have responded to the introduction of standards for specific pollutants with technological improvements, sometimes decreasing one pollutant while increasing the emission of others (HEI Panel, 2010), also a potential consequence of a single-focused technical standard for carbon emissions. Electric vehicles hold promise for reducing carbon and other air pollutants, but rely on clean, renewable sources of electricity and a rapid fleet turnover to achieve health and climate targets.

Transport and land use policies that reduce the number of vehicle kilometres travelled can also reduce air pollution impacts. For example, the London Congestion

Charge, has reduced air pollution deaths and illness, with air quality improvements greatest in areas of high deprivation (Tonne *et al.*, 2008).

Replacing motor vehicle trips with more active modes has the potential to benefit health through physical activity (Martin *et al.*, 2015), even in the most polluted cities (Tainio *et al.*, 2016). Urban planning over the past half century has built physical activity out of our daily lives, so that extra time and expense is often needed to achieve the levels of activity that can prevent heart disease, stroke, diabetes, cancer, depression and loss of bone density (Warburton, Nicol & Bredin, 2006). Even 2.5 hours of brisk walking per week can reduce mortality by about 10% (Woodcock *et al.*, 2011). Individual encouragement to be more physically active has achieved little sustained success (Ogilvie *et al.*, 2007), while building some walking and cycling into habitual trips like commuting can more successfully reduce mortality (Hamer & Chida, 2008), even as part of a public transport trip (Rissel *et al.*, 2012). Policies that improve safe, convenient accessibility of destinations are needed to achieve the benefits of more walking and cycling for transport. When such policies lead to successful substitution of motor vehicle trips by walking and cycling they also reduce transport carbon emissions (Macmillan *et al.*, 2014).

## **Mental wellbeing**

Regular physical activity also benefits mental wellbeing, reducing the risk of depression. When daily transport trips are congested, unpredictable and perceived as having a high opportunity cost, then perceived stress is higher, with implications for mental and physical health (Gottholmseder *et al.*, 2009). This stress can manifest itself in more harmful behaviours when it leads to expressions of anger to other road users (Asbridge *et al.*, 2006). The opportunity cost of the time spent travelling and people's ability to manage other responsibilities is a further cause of stress, particularly for women, who are still mainly responsible for multiple care obligations (Schwanen, 2011).

Road traffic noise has further negative impacts on mental wellbeing. It is estimated that about 100,000 years of life are lost annually in Europe due to environmental noise, much of which is attributable to road traffic noise (Jantunen *et al.*, 2011), through cumulative impacts on stress and sleep disturbance. Railway noise has also been implicated in annoyance and sleep disturbance, especially in Japan (Lim *et al.*, 2006).

## **Social participation and economic wellbeing**

Much research has assumed transport time is lost to other activities or opportunities (for example Mokhtarian & Chen, 2004). However, active transport can provide a 'double dividend' in the form of time saved on physical activity undertaken for fitness during leisure time. People may also use time on public transport for relaxation and social connection (Letherby & Reynolds, 2003), while walking provides opportunistic social and nature connection within neighbourhoods (Lund, 2003). In