TRANSPORT, URBAN REGENERATION AND HEALTH

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Introduction

Transport is the means by which people—or goods—travel from one place to another. This straightforward definition disguises the range and complexity of relationships between transport, urban environments and the health and wellbeing of populations. This chapter explores the multiple connections between transport and urban development, demonstrating their impacts on health at different scales, from city- and regional-level regeneration to neighbourhood interventions.

Transport is often described as a derived demand, in that it is the demand for other activities that generates the demand for transport (Hanson 2004). Spatial separation, time and cost all create a ‘friction of distance’, which transport helps us to overcome, connecting people to place (Rodrigue et al. 2006). Yet to think about transport as only a mechanism for connecting point A and point B is to overlook the symbiotic nature of transport and urban development. The evolution of transport technology has been crucial in influencing the size and form of the city, allowing greater distances to be travelled in a shorter time. For example, the characteristic small size and relative density of many European cities is a function of their evolution during a time when scale was largely a product of walking distance. Along with changing transport options come changing levels of mobility. Transitions from walking, through early forms of powered transport, to the car as the dominant means of travel have fundamentally influenced the character of urban areas in a variety of ways (Schaeffer and Scalar 1975; Muller 2004). The importance of central city locations was reinforced by the advent of fixed-route trams and railways, as important nodes clustered around the accessible central district. In an early attempt to theorise the spatial patterning of urban land use, Burgess’s concentric ring model conceptualised distance from a central business district as a determining factor in the desirability of locations for different socio-economic functions (Rodrique et al. 2006). Following this, Hoyt’s sectoral model of urban development identified rail and road links as driving urban growth along radial transport axes, more explicitly recognising the influence of transport on land use (Bruegmann 2006). Around this time, Christaller developed central place theory, which aimed to gauge an optimal size and distribution of settlements in order to minimise travel time (Gregory et al. 2009).

As well as physically shaping urban development, transport shapes the social world. An effective public transport network can support social mixing, opening up the opportunities and amenities offered in large urban areas to a wider range of people (Docherty et al. 2008). The growth of rail networks supported the development of suburban neighbourhoods and offered people the opportunity to physically separate work from home—a trend which grew further with widespread car
ownership. However, at the same time as allowing greater personal mobility, increased car ownership has facilitated urban sprawl. This separation of home from work, social and leisure activities can result in a polarisation between those possessing and those lacking access to private transport (Adams 2000). Lack of private transport can perpetuate health inequalities, by limiting access to employment, education, healthcare and recreational activities (UN-Habitat 2013). This is a particular problem when locational decisions about public services are made on the assumption that people have access to private road transport. From this perspective, transport is a key dimension in the making of place, offering access to some but segregating others.

Within public health, there has been a shift from a focus on disease and ill-health towards health promotion, and the role of urban environments in shaping health outcomes has become a focus of attention. Regeneration is widely understood as ‘a holistic process of reversing economic, social and physical decay in areas where it has reached a stage when market forces alone will not suffice’ (ODPM 2004, p. 55). Thus, several regeneration programmes have sought to address health outcomes and inequalities (Droomers et al. 2014; Egan et al. 2016; Ruijsbroek et al. 2017). There has also been growing interest in promoting healthy travel behaviours (WHO 2011). Nevertheless, the inter-dependence of transport and urban development can easily be overlooked in regeneration—in particular, the role of transport in urban regeneration programmes that seek to promote health is, to date, less well covered in the literature (McCartney et al. 2017).

The following section maps the conceptual links between transport and health, based on a social determinants of health model (see Figure 33.1), highlighting in particular the role of urban form. Thereafter, the health implications of making urban space are profiled: four themed sub-sections explore new towns and new development, the evolution of ‘New Urbanism’ and transit-oriented development (TOD), redevelopment on a city scale, and neighbourhood regeneration, in order to illustrate the range of health impacts arising from the different ways in which transport and urban development can interact at different scales. The chapter concludes by reflecting on the need to evaluate the health impacts of transport at all scales of urban development.

**Transport and Health: The Conceptual Links**

The World Health Organization (WHO 1948) defines health as ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’. Over and above medical care, social factors exert a powerful influence on health, at both individual and population levels, with the most disadvantaged members of society experiencing the poorest outcomes (Braveman and Gottlieb 2014). These social determinants of health—the circumstances in which people are born, grow up, live, work and age (WHO 2017)—are spatially patterned and, so, amenable to urban regeneration interventions. Transport, understood broadly as all modes of travel from human-powered to mass transit and freight, is a significant social determinant of health, having both positive and negative health impacts through a broad range of exposures and practices (Khreis et al. 2016).

Conceptual models of the social determinants of health offer a useful entry point for understanding the multiple scales at which transport and the urban environment influence health outcomes (see Figure 33.1). The visualisation of the relationships between health and human settlement in Figure 33.1 was developed as part of the WHO Healthy Cities agenda (Barton and Grant 2006). Although no explicit mention of the transport system is made in the figure, the relevance of transport to urban development is evident at every level, from individual and lifestyle factors to the global ecosystem. In the following three sub-sections we map the relationships between transport, urban environments and health on to the conceptual diagram shown in Figure 33.1. Starting with the global ecosystem, we then discuss the physical context (natural environment, built environment and activities), followed by the social context (local economy, community and lifestyle). Finally we consider the intersection with individual demographic factors.
Although the existential threat posed by climate change and loss of biodiversity is beyond the scope of this chapter, minimising the negative health impacts of transport at the urban scale will also have global impacts. Transport is responsible for nearly a quarter of CO$_2$ emissions, with over two-thirds of emissions coming from only ten countries, including China (28%) and the USA (16%) (IEA 2016). In the UK, transport is currently the largest source of emissions (26%), ahead of industry, building and energy (Castres 2017). Furthermore, the transport and urban development choices made in the rapidly expanding cities of the global south will have major implications for greenhouse gas emissions (Satterthwaite and Mittlin 2012). Globally, air travel, shipping and rail all release damaging pollutants, which have serious health impacts at local levels. Air pollution is a trans-boundary issue, associated with respiratory difficulties, heart attacks and asthma. Urban outdoor air pollution

![Image of the social determinants of health.](image)

*Figure 33.1 The social determinants of health.*


**The Global Ecosystem**

Although the existential threat posed by climate change and loss of biodiversity is beyond the scope of this chapter, minimising the negative health impacts of transport at the urban scale will also have global impacts. Transport is responsible for nearly a quarter of CO$_2$ emissions, with over two-thirds of emissions coming from only ten countries, including China (28%) and the USA (16%) (IEA 2016). In the UK, transport is currently the largest source of emissions (26%), ahead of industry, building and energy (Castres 2017). Furthermore, the transport and urban development choices made in the rapidly expanding cities of the global south will have major implications for greenhouse gas emissions (Satterthwaite and Mittlin 2012). Globally, air travel, shipping and rail all release damaging pollutants, which have serious health impacts at local levels. Air pollution is a trans-boundary issue, associated with respiratory difficulties, heart attacks and asthma. Urban outdoor air pollution
is responsible for around 8% of lung cancer deaths, 5% of cardiopulmonary deaths and 3% of respiratory infection deaths throughout the world (WHO 2009). Even in Europe, where emissions standards have led to significant reductions in the level of air pollution, there are around 400,000 additional deaths a year, with road transport the biggest contributor to the problem (EEA 2016). In light of this evidence, transport significantly contributes to existential risks to human health, through climate change impacts relating to extreme weather and the spread of disease, as well as more immediate excess mortality arising from air pollution (Workman et al. 2016). Regeneration interventions that focus on integrated urban planning and transport can produce co-benefits for health and climate mitigation strategies, reducing greenhouse gases and improving air quality through a modal shift towards healthier, low-carbon forms of travel (WHO 2011; UNECE 2016).

The Physical Context

Nested within the global ecosystem, the next tier of the social determinants of health highlights the physical context within which people live, considering the natural environment, the built environment and the range of activities people undertake.

From one perspective, the natural environment can be seen as a constraint on transport, limiting the feasibility of road links and sometimes necessitating water or air routes to connect urban areas. In terms of human health, these limitations can restrict the availability of goods and services, additionally isolating individuals and communities, particularly those with limited financial resources. Interventions to connect isolated communities may therefore have indirect health benefits. Transport also serves a beneficial health function in connecting people with health-promoting destinations. There is strong evidence that access to natural environments, such as woods, wetlands and meadows (‘greenspace’), rivers, lakes and the sea (‘bluespace’) can promote mental wellbeing and reduce levels of stress (Croucher et al. 2008; Völker and Kistemann 2011; Ward Thompson and Silveirinha de Oliveira 2016). As well as relieving depression and improving mental wellbeing (Chen et al. 2012; Richards et al. 2015; Ward Thompson et al. 2016), access to natural environments also offers opportunities for exercise and recreation with direct physical benefits (Mytton et al. 2012; Pretty et al. 2005).

Along with initiatives to support health by connecting urban areas with natural environments, opportunities for active travel and green exercise can be integrated into the built environment. The main United Nations framework for moving towards sustainable development lists the availability, accessibility, quality and security of urban greenspace as key health indicators for sustainable cities (WHO 2012). Regeneration provides an opportunity to integrate existing greenspaces into the urban environment, preferably connected by walking and cycling corridors, and to include greenspace in new urban developments. Such initiatives can support physical and mental wellbeing by facilitating active travel and exercise, as well as social interaction (Nutsford et al. 2013). The role of the built environment in promoting health behaviours such as active travel is achieving increasing attention (Rao et al. 2007).

Streets and routes form the fundamental character of the built environment, as building design, the form of buildings, transport networks and other interconnecting corridors influence choice of travel mode (Saelens et al. 2003). For health, walking is one of the most important forms of travel, yet from a transport planning perspective it is under-recognised (Gwilliam 2002). More ‘walk-able’ neighbourhoods combine high connectivity, density, and diversity of land uses (Saelens et al. 2003). Conversely, dispersed housing with dedicated parking, in single-zoned areas, poorly served by public transport, is more ‘car-friendly’. Death and injury from traffic accidents, like other health outcomes, run on a social gradient, with the poorest members of society likely to suffer most—a relationship that holds true in developing and more affluent countries (Nantulya and Reich 2002; Morency et al. 2012). Noise pollution is an additional widespread problem associated with traffic.
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In Europe, for example, it affects more than one in four people, and associated long-term sleep disturbance is a risk factor for heart disease and increased blood pressure (EEA 2016). Although concern over air pollution may discourage active travel in busier urban environments, recent research has indicated that the health benefits from exercise outweigh the risks from exposure to air pollution ‘in the vast majority of settings worldwide’ (Tainio et al. 2016, p. 235).

Nevertheless, the car offers excellent personal mobility, especially for households that must undertake spatially dispersed activities such as managing work, shopping, healthcare, leisure and education. The introduction of shared transport initiatives, such as bicycle share schemes and car clubs, can be seen as a means of reducing car ownership and encouraging healthier, more sustainable modes, although these projects will not necessarily reach those most at risk of transport exclusion (Clark and Curl 2016). However, there are many health problems associated with the urban sprawl facilitated by transport technology and infrastructure (Khreis et al. 2016). Planning systems that encourage out-of-town developments and support the disparate location of activities foster reliance on the private car and, consequently, health issues such as obesity, respiratory conditions and physical inactivity (Douglas et al. 2011; WHO 2011). Accessibility planning is a vital function, coordinating land use and transport to combat social exclusion and ensure all have access to destinations essential for participation in society, guaranteeing that services are available near their users (UN-Habitat 2013; Lucas et al. 2015). Effective, attractive and affordable public transport systems have the potential to improve health and reduce health inequalities by facilitating access to important destinations and reducing inequalities in accessibility and, thereby, health inequalities (Lucas 2012).

The Social Context

Having outlined relationships within the global and physical context, we now consider health-related regeneration interventions as they affect the social context within which people live, looking at the local economy, community and lifestyles. Economic growth is often a major focus of regeneration programmes, which aim to attract investment to disadvantaged areas. This can happen at the expense of the environmental and social justice consequences of development; in particular, contemporary transport developments tend to prioritise motorised transport, thereby serving the interests of the more affluent (Gössling 2016). While it is difficult to quantify the links between transport and a local economy (Banister and Berechman 2001; Shaw, J. and Docherty 2014), transport policies, such as access to wider networks, parking or provision of pedestrian infrastructure, can be a significant factor in the success of local economies (Couch et al. 2011). Although insecure employment and particularly stressful or physical work can be damaging to health (Benach et al. 2016), employment is widely recognised as a determinant of health behaviours and health inequalities (WHO 2008; Braveman and Gottlieb 2014). However, in cases of spatial mismatch between the skills of people in relatively disadvantaged communities and the location of available appropriate work, the lack of adequate transport can be a barrier to taking up employment opportunities that might offer improved income and, in some cases, health insurance (DCLG 2008; Lucas et al. 2008; Titheridge et al. 2014).

As well as supporting access to work, at the community level, transport influences the extent to which people can build and maintain social networks across different scales. Crime and perceptions of neighbourhood safety play a role here. Well-lit, properly maintained paths and pavements, designed so that they are safe and overlooked with ‘eyes on the street’, rather than those that are isolated, are an important aspect of urban design (Jacobs 1961). Active travel and safe, frequent public transport support physical and mental wellbeing by encouraging physical activity and social interaction, allowing people full social participation (Sinclair and Sinclair 2001; SEU 2003). However, even in relatively well-served urban areas, there is evidence that people in disadvantaged communities may be forced into car ownership, despite already suffering from financial stress, because public transport is not always fit for purpose, perhaps because of timetabling, safety or trip complexity (Curl et al. 2018).
In car-dominated communities, traffic creates an uncongenial environment that discourages everyday exercise and limits opportunities to build social capital at the local level, since it reduces interaction between friends and neighbours (Appleyard et al. 1981). Further, community severance can occur when transport infrastructure, such as major roads, cuts one part of a community off from neighbours and access to services or public transport (Khreis et al. 2016); this phenomenon can be physical, where there is no provision for crossing, psychological, where traffic levels are a perceived threat, and social, inhibiting interactions that might otherwise have taken place (Titheridge et al. 2014).

Lifestyle factors, including physical activity and work–life balance, are all relevant to physical and mental wellbeing. One report cited delayed and congested public transport as a source of daily stress (Royal Society for Public Health 2016). However, people who commute to work by cycling, walking and, to a lesser extent, public transport, rather than travelling by car, tend to have a lower body mass index (BMI) and lower levels of body fat by mid-life (Martin et al. 2015; Flint, E. and Cummins 2016). Considering work–life balance, lengthy commutes are known to contribute to stress and reduced time for other activities, including spending time with family and doing physical activity, which are both related to positive wellbeing (Hilbrecht et al. 2014). Driving can enhance work–life balance in cases where it offers a shorter commute time than alternative modes, but time spent commuting can also have a positive value for the traveller. Drivers gain psychosocial wellbeing benefits in terms of mastery, autonomy and prestige (Ellaway et al. 2003). However, there are also psychosocial wellbeing benefits to travel by other modes. Anable and Gatersleben (2005) found that people who commute using public transport and active travel modes evaluated their journeys more positively than car drivers along a range of dimensions, including relaxation, stress and freedom, and that cycling also outperformed driving in terms of excitement. Furthermore, as well as affording the opportunity to undertake useful and enjoyable activities while commuting on public transport, such as reading, working, playing games or listening to music, the journey itself can be enjoyable, even if people are only gazing out of the window or decompressing between work and home (Mokhtarian and Salomon 2001; Lyons et al. 2007; Jain and Lyons 2008).

**Demographic Factors**

Although there are health problems associated with, particularly, personal motorised transport, mobility is crucial for the health and wellbeing of people, making demographic factors a concern in transport-related regeneration. A driving licence can offer opportunity and independence (Scheaffer and Scalar 1975); however, designing places without planning suitable alternatives to driving restricts the young, and older people who no longer drive for reasons of age, medical advice or loss of confidence (McNamara et al. 2013). Gender is an additional concern, with women tending to have less access to private motorised transport (UN-Habitat 2013), as well as having greater exposure with regard to safety and security issues (Gwilliam 2002). Despite their more complex travel requirements, there is a pattern of women having lower levels of car access (Peters 2001; Civitas 2013), as well as fewer financial resources for public transport fares (World Bank 2012). Demographic factors not highlighted in Figure 33.1, such as ethnicity, are also important considerations when thinking about how health inequalities are affected by transport and regeneration (see Currie and Delbosc 2011; Lecompte and Bocajero 2017; Shrestha et al. 2017). Indeed, the under-representation of minority groups in transport research is a particular concern (Steinbach et al. 2011; Rajé 2016), particularly given they may have different transport needs. It is important to recognise the diversity of transport needs and health responses. For example, while walking is widely held to be a health-promoting form of transport, it may be that health benefits are not evenly felt, especially where walking is a necessity rather than a choice. Similarly, bicycle share schemes have been criticised for not being culturally responsive to community needs.
Health Implications in Making Urban Space

Urban development, whether in areas of new construction or the regeneration of existing neighbourhoods, is always facilitated by transport, which connects the development to other places. The following four sub-sections highlight spaces in which transport and development typically interact, illustrated with potential health impacts. Relationships between transport, regeneration and health differ spatially and temporally. The examples discussed draw attention to issues of complexity and diversity. As such, they are also, necessarily, contextual and specific to place—not least in that they are drawn predominantly from the minority world—rather than being broadly generalisable.

New Towns and New Developments: England’s ‘Garden Cities’ and Beyond

This sub-section discusses the relationships between transport and health in the context of new urban developments and the building of new towns. There are precedents for including health promotion as an explicit outcome in new developments. In early 20th century England, Ebenezer Howard’s ‘garden cities’ were designed in response to squalid and unhygienic urban living conditions. These were planned suburban towns, structured with the objective of improving public health by allowing people to escape the city and live in more pleasant environments, surrounded by nature.

Without transport to connect new towns and developments to existing settlements, new urban projects like this would not be viable. Many new urban areas were facilitated through growth of suburban railway lines, including the London Underground, which promoted a more pleasant lifestyle out of the city, while still being within commuting range. Post-war new town developments in Britain following the 1946 New Towns Act were facilitated through the expansion of suburban road networks and motorways. Although these new towns were generally intended to be self-contained towns with jobs and housing in close proximity, concurrent transport developments have meant that in many cases new towns have become satellite towns of larger settlements (Kafkoula 2009). Transport developments have reduced journey times and allowed people to live further away from employment centres without increasing their commute times. However, the resulting suburbs or satellite towns have become dormitory towns, with a population which predominantly commutes to larger settlements. This process leads to places that are devoid of key services, sense of place and social connectivity, where the needs of non-commuters such as older people, children and stay-at-home parents are ignored.

In many new developments, non-motorised transport is not considered critical. Roads are the prerequisite for new developments, but the provision of high-quality public transport, walking and cycling networks can have important implications for supporting health as well as social and economic wellbeing. New developments that incorporate high-quality public transport, walking and cycling infrastructure have the potential to influence and change travel habits towards more sustainable and healthy modes. While development contributions can include a requirement for provision of transport, this can be temporary provision, unsuitable to local needs or added after other travel habits have taken root.

Barton Park is a new housing development in suburban Oxford, England, which is currently being built in stages. The time lag between the first homes becoming available and the development being ‘complete’, with amenities and transport connections, means that the first new residents will rely on car ownership as a means of accessing amenities outside of the development. Instead, if the requirement were established for transport connections and amenities to be in place before any homes were occupied then the development could support health through facilitating non-car travel and influencing those people who are at a stage where they are susceptible to behavioural change (Müggenburg et al. 2015).

The Pegasus development north of Christchurch, New Zealand is a ‘new town’ that has been marketed as aligning with the principles of New Urbanism (Swaffield 2012). However, the
development generated a substantial increase in commuter traffic; the population grew from 33 in 2006 to 1,050 in 2013, and a third of these new arrivals commute into the city (Statistics New Zealand 2013). With no connection to the public transport network (Swaffield 2012) and a distance of 25 kilometres (15.5 miles) from the city, most of these will be private car commuters. Therefore, while the development itself may be walkable, connected and to some extent aligned with urbanist principles, the high reliance on Christchurch for employment means that the development does not promote car-free sustainable and healthy urban living. Further demonstrating instead the need for housing developments to consider transport connections and accessibility at the outset, Wigram, a high-density housing estate in a Christchurch suburb, has struggled to attract buyers. While some consider that this suggests a cultural distaste for dense housing, the development is disconnected from the city, does not provide all essential services, and relies on use of the car.

Although there are examples of ‘car-free’ developments, particularly in continental Europe (Melia et al. 2013), these are the exception rather than the norm. Such examples expose the tensions between the short-term economic gains of private developers and the long-term health and wellbeing potential of transport and urban environments.

**New Urbanism and Transit-Oriented Development: US Origins and Translation to Chinese Development**

Transit-oriented development is a planning strategy developed alongside the broader concept of New Urbanism. TOD is focused around public transport corridors or stations. The underlying idea is that, by (re)developing high-density, mixed-use areas around transport hubs, the interaction between transport and land use can be shifted to favour public transport and active modes of travel, rather than the car-based travel that has both driven and emerged from urban sprawl.

The potential of transport systems to facilitate development, increase the value of property and enable a better quality of life has long been recognised. While the construction of suburban rail ways, followed by motorways, prompted the growth of suburbs, TOD more specifically relates to redevelopment or regeneration in an attempt to encourage and revitalise urban areas and promote sustainable development.

TOD emerged in the 1970s, predominantly to address problems associated with car use and associated urban sprawl, such as pollution and congestion (Shaw, S.L. 2009). In an attempt to meet challenges associated with a lack of coordination in urban and regional planning, as well as changing demographic and lifestyle trends that have reignited a preference for city living, TOD gained considerable traction with architects, urban planners and academics in the United States (Calthorpe 1993; Ditmar and Ohland 2004; Cervero and Sullivan 2011). Amidst concerns about pollution, congestion and car dependence, environmental sustainability was one of the key drivers of TOD (Newman and Kenworthy 1999). Evidently, there are clear associations between urban sprawl, pollution, congestion, physical health and mental wellbeing. Nevertheless, an explicit focus on how health is related to TOD has only more recently emerged; Loo and du Verle frame TOD as a ‘community development model that seeks to build healthier communities and stronger economies while reducing their carbon footprint’ (2017, p. 56). However, even now, research into the specific health impacts of TOD is limited.

Accessibility may be considered as offering a potential health benefit. Alongside the boost to land values that comes from transport investment, improved accessibility to a range of destinations with healthy food, employment, education and recreational facilities could support positive health outcomes. However, there is limited research to support a link between TOD, improved accessibility and health. Furthermore, if the effects of TOD or regeneration are not evenly distributed, health benefits may not be so either, resulting in greater health inequalities. For example, the displacement
of populations following TOD can occur as a result of increased property prices. This phenomenon of ‘transit-induced gentrification’ (Dawkins and Moeckel 2016) can mean that those who are most in need of improved access are forced out of an area as a result of increased living costs, and accessibility-related health benefits from the investment do not reach those most in need. Accessibility at local level may prove a more secure pathway to improved public health in relation to transport development. The TOD emphasis on mixed-use development, serving multiple functions by affording a range of residential, employment, recreational and commercial opportunities, promotes walking, which is highly correlated with diversity, intersection density and number of destinations within walking distance (Ewing and Cervero 2010).

Given the focus on a shift away from car to other forms of transport, one of the key benefits of TOD is to facilitate multi-modality, whereby people are not reliant on one mode, usually the car, but can instead use a range, including more active modes. TOD has been shown to promote modal shift. Evidence from the USA shows that TOD has the potential to reduce car dependence by focusing on making communities more pleasant for using other modes of transport, and evaluations have shown that per capita car use can decrease by up to half (UN-Habitat 2013). Bearing in mind the philosophy of TOD, structuring compact, mixed-use urban development around transport hubs, attention to the quality of the walking environment is also a means of encouraging people to walk to transport links rather than drive (Litman 2003). For this reason, in a meta-analysis of travel and the built environment, Ewing and Cervero (2010) classify transit use as a form of active travel supportive of public health. The health benefits associated with reduced pollution, reduced congestion and use of non-motorised transport suggest there is potential for positive health effects related to TOD. Congestion, which is associated with stress (van Wee and Ettema 2016), can be mitigated by the introduction of light rail, bus rapid transit and supporting active travel for shorter journeys.

Driven by rapid urbanisation and increasing levels of congestion, the concept of TOD has been translated from the US context to the Chinese one in recent decades (Xu et al. 2017). China has developed its high-speed rail (HSR) infrastructure at a phenomenal rate since 2004, rapidly creating the most extensive network in the world, which is seen by many local governments as a mechanism for promoting municipal urban development (Diao et al. 2017). Many cities have implemented subway or bus rapid transit in efforts to facilitate sustainable urban development around mass transport systems. In contrast to the case with New Urbanism and TOD in the USA, the relatively low levels of car ownership in China mean that this implementation of mass transit has emerged as a reaction to rising demand for mobility in a system where most people rely on public transport rather than in response to concerns about car dependence or low-density sprawl (Delpirou et al. 2016). The aim is to relieve traffic congestion by reducing the quantity of ‘access commuting trips’ (Xu et al. 2017, p. 746).

Rapidly growing car use, with levels of personal car ownership increasing over six-fold in the decade from 2005 (He and Qiu 2016), has raised the profile of sustainable urban development and environmental impacts in China (Xu et al. 2017). Nevertheless, health does not seem to be an explicit concern of TOD so much as are facilitating new development, expansion of urban areas and economic growth. This does not mean that there are not health impacts, but rather that, in this context, they are not a driver or a key outcome of development facilitated by transport.

Redevelopment on a City Scale: Christchurch, New Zealand

In respect of city-scale regeneration projects, transport-related investment tends to be in large, major schemes such as new road building, new railway stations or bus infrastructure. Health outcomes from this investment can be both positive and negative and affect distinct populations differently, which makes it very difficult to evaluate the health outcomes associated with development. Despite the potential health implications of some city-wide regeneration and transport policies, including
road building, the main focus is economic, and it is often unclear whether, or by whom, any health benefits are realised: ex-post evaluations of health outcomes are rare. A longitudinal evaluation of a motorway extension project in Scotland drew attention to the potential for negative physical health impacts and perpetuating inequalities (Ogilvie et al. 2016). Health impacts were complex. At an aggregate level, increased car usage and poorer mental wellbeing were found; however, the same study noted some positive effects on wellbeing arising from increased car use, including improved connectivity, particularly to dispersed social networks. Nevertheless, returning to health inequalities and the distribution of benefits, this applies only to those people with access to a car.

Christchurch, New Zealand provides an example of recent city-wide redevelopment, following extensive damage to the city from the earthquake sequence in 2010 and 2011. Approximately 12,000 houses and 1,500 commercial buildings have since been demolished (Brand and Nicholson 2016), with a substantial change in the urban structure of the central city, as shown in Figure 33.2.

This scale of reconstruction offers the opportunity to promote healthy communities, and the role of transport and rebuilding of transport networks is a key aspect of both the physical and the community redevelopment. Health already formed a key part of the pre-quake Christchurch Urban Development Strategy as a result of the work undertaken by the Canterbury District Health Board’s Health in All Policies Team (Stevenson and Brinsdon 2017). However, in the immediate aftermath and during subsequent construction, disrupted transport networks were linked to possible social isolation, particularly for those without reliable access to a private vehicle (Annear et al. 2014).

In the post-quake redevelopment, there has been an emphasis on building healthy, resilient and sustainable communities (Stevenson and Brinsdon 2017), including community-led, grassroots initiatives. Health and wellbeing have been central in discussions around community-led transitional uses of spaces in the city (Brand and Nicholson 2016). As well as physical rebuilding, social and community regeneration has been stressed, with an emphasis on people and places, as part of the city-wide redevelopment (Dionisio et al. 2016). Physical infrastructure is seen as supporting the rebuilding of communities and the social fabric of the city, as well as economic development. Streets and the built environment have played a crucial role in facilitating social interactions, supporting community resilience in the recovery phase (Banwell 2017).

The council ran a public engagement campaign called ‘Share an Idea’ to stimulate public participation and development of ideas about what citizens wanted the rebuilt central city to be like. Transport featured strongly among the outcomes of this process, with reference made to affordable public transport, cycling, parking, buses, rail/tram, pedestrians, laneways, separate cycle lanes and
fewer cars. In the draft Central City Plan, the role of transport and the urban environment in the redevelopment of the city was considered, with high-density, mixed-use development, green spaces, light rail and a cycle network mentioned (Brand and Nicholson 2016).

The Christchurch Transport Strategic Plan (Christchurch City Council 2012) includes a goal to ‘create safe, healthy and liveable communities’, demonstrating a clear policy link between transport investment in rebuilding the city and health outcomes. There has been a particular focus on cycling, with NZ$156 million (a little over US$100 million) being invested in 13 cycleways across the city. There are strong relationships between physical activity associated with cycling and health outcomes. The Strategic Plan also mentions cycling as a more equitable choice, and social interaction and community resilience as supporting reasons for investing in cycleways.

Other transport interventions include a city centre rebuilt around the idea of ‘an accessible city’ designed to ‘provide a compact, people-friendly core and about supporting the economic, social and environmental recovery of the Central City’ (Christchurch City Council 2017). Emerging from the ‘Share an Idea’ consultation, the accessible city concept is based on providing more resilient transport options and a more people-friendly transport system (Cheesebrough et al. 2015, demonstrating the expectation of a link between transport, regeneration and health outcomes. New motorways have also formed part of the redevelopment, but, other than a new bus interchange, there has not been significant investment in public transport infrastructure, despite ongoing discussion of light or heavy rail. Of course, transport does not operate in isolation, and another part of the recovery plan has been to promote higher-density housing. In fact, this policy had been in place before the earthquake in the form of the Christchurch Urban Development Plan (Vallance 2015), which aimed to provide an urban form more supportive of public transport, walking and cycling.

However, this commitment to promoting higher-density central city living to support liveable, healthy urban redevelopment occurs in conjunction with a decision to rebuild low-rise, in response to the earthquake risk, which can be seen to be at odds with promoting high density. Additionally there has been a widespread retreat from the city, to the greater Christchurch region. Nearby districts Selwyn and Waimakariri have experienced considerable population growth (33% and 17% respectively by 2013), leading to increased commuting into the city and greater pressure on transport networks (Statistics New Zealand 2015). This population sprawl also challenges attempts to rebuild a city and community that are healthy, sustainable and resilient. Despite best intentions and the central role of health and wellbeing in the discourse of the redevelopment of the city, beyond the apparent success of the cycleway network, the role that transport will play in facilitating sustainable and healthy development remains unclear.

Neighbourhood Regeneration: A Holistic Approach in Glasgow, Scotland

The patterning of poor health and deprivation at neighbourhood level occurs for many reasons: as a product of housing markets, loss of employment opportunities, disinvestment and stigma, amongst others. Neighbourhoods, as the smallest unit of social territory, can be seen as the ‘blocks upon which the economic, social, political, and cultural elements of the city are built’ (Flint, J. 2009, p. 354), and the contrasting fortunes of sometimes adjacent neighbourhoods throws the spatial dimension of health inequalities into relief. Area-based interventions, designed to transform disadvantaged neighbourhoods into thriving communities, are a well-established policy approach intended to alleviate poor conditions and compensate for market failures with government support (Adair et al. 2000; DCLG 2009).

Europe and the USA have a history of area-based interventions in the form of neighbourhood-level regeneration (Couch et al. 2011). Many of these initiatives have attempted to address public health concerns in relation to overcrowding and insanitary conditions through slum clearance and the creation of peripheral estates (Flint, J. 2009; Couch et al. 2011). However, with a focus on
housing and little or no regard to the wider determinants of health, including mobility and accessibility, many regeneration interventions have been cyclical, repeatedly subjecting impoverished communities to disruption with no long-term alleviation of disadvantage (Robertson 2014).

The UK saw a burgeoning of interest in the role of transport in social exclusion during the early 2000s (DETR 2000; Sinclair and Sinclair 2001; SEU 2003). Simultaneously, ambitions for an urban renaissance were marked by the New Deal for Communities (NDC), which advocated a neighbourhood-based approach to regeneration, in partnership with disadvantaged communities (Tiesdell and Allmendinger 2001). However, as a result of the widespread privatisation agenda preceding this, achieving integration between transport modes or operational integration of fares, timetables, ticketing and interchanges had become highly problematic for most cities in the UK (Hull 2005). In addition to such challenges, Glasgow has high levels of excess mortality and striking health inequalities, exemplified by a 15-year gap in male life expectancy between the most and the least deprived neighbourhoods (Whyte 2016).

Following the adoption of a widespread urban regeneration programme in 2003, the GoWell Research and Learning Programme was set up in 2006 to monitor the health impacts of regeneration over the next decade (GoWell 2007, 2010). While the study confirms improvements to wellbeing and mental health from active travel and leisure-based physical activity (Mason et al. 2016), as has been typical in the UK and USA (Couch et al. 2011), the regeneration and research programmes predominantly focus on housing. However, later investment associated with the city’s successful bid to host the 2014 Commonwealth Games offered opportunities to investigate a more holistic approach to regeneration, which was principally delivered by the Clyde Gateway regeneration partnership (see www.clydegateway.com).

In addition to new and improved sports facilities and the athletes’ village constructed in and around the impoverished inner East End of the city, several key developments associated with the Commonwealth Games regeneration have implications for urban mobility and health. These included a new road (later named the ‘Clyde Gateway’, after the developing organisation), a refurbished local railway station, an urban forest park, new and improved cycle paths connecting to the city centre, and improvements to aspects of the urban realm including pathways and lighting.

The regeneration partnership has a remit to bring about social and economic change through the process of neighbourhood regeneration, improving the physical fabric, and transport infrastructure forms a major part of that strategy. The extent to which the new amenities and infrastructure associated with the regeneration are desirable or affordable for the host community is also open to challenge (Kidd et al. 2017). The ‘Clyde Gateway’ road development has a contentious status, given the negative impacts of car traffic on health and the small proportion of households in the neighbourhood with access to a vehicle. The road development is one of the most expensive capital investments undertaken as part of the regeneration and, while flanked by cycle paths and broad pavements, it is likely of more benefit to relatively affluent populations visiting or passing through the area. However, the partnership argues vigorously that it has helped to bring employment to the area and can demonstrate a track record of linking local people to new jobs (Clark and Kearns 2016). Indeed, in-depth interviews in the host community show broad support for the new infrastructure, and improved perceptions of safety have been accompanied by significant increases in active travel and walking in the local neighbourhood (Clark and Kearns 2015; Gannon et al. 2018).

The interplay between urban development and transport is critical in TOD, and this is especially evident at the ‘micro’ neighbourhood level. Writing in 2010, Ewing and Cervero extend the classic ‘three Ds’ of urban planning from density, diversity and design to include destination accessibility and distance to transit. Better transport services and new sports facilities can encourage flows of people into and out of the neighbourhood, potentially supporting wellbeing by increasing activity and social interaction. However, diversity, considered in terms of mixed use, remains under question. There is still a shortage of local retail and non-sport leisure amenities around
the host community site, as well as persistent and widespread dissatisfaction with the bus service, which is one of the most important modes of transport in disadvantaged communities (Clark and Kearns 2016, 2017).

In places where people have limited resources to pay for recreation, improved urban quality, greenspace and increased opportunities for walking and cycling offer valuable pathways to mitigate wider health inequalities and support improved population health (Mitchell and Popham 2008; Clark and Kearns 2016). However, as well as illustrating the role of transport interventions in neighbourhood regeneration, this example shows the extent to which the potential for successful health improvement is dependent upon the wider governance context. In this case, national and local government came together to form a long-term urban regeneration partnership, and a mega-sports event was used to leverage funding. Nevertheless, holistic regeneration also needs to consider diversity, in terms of the diverse and sometimes divergent needs of different members of the urban community. For less affluent citizens, including some older people or those who are not so physically mobile, inexpensive and frequent bus services, along with local shops, can do more to support physical activity and social interaction than large capital investment in roads, rail stations and sports facilities. Attracting private-sector investment to generate more desirable retail and leisure destinations and to improve de-regulated bus services remains a challenge.

Conclusion

Transport innovations have always influenced the built environment but, along with the transition from urban spaces based on walking to those based on public transport and cars, their implications for population health have also changed. Although transport forms a crucial part of development and regeneration, the health impacts of transport infrastructure—or of its absence—can easily be overlooked. To some extent this occurs because of siloed decision making, rather than holistic thinking across transport, health and urban development. Recent developments in place-based strategies offer the potential for more joined-up outcomes-based policy making.

Health is multi-faceted, encompassing positive social, economic and physical dimensions, as well as negative consequences (WHO 1948). Taking the social determinants of health as a starting point for exploring the conceptual links between transport and health exposes the pivotal roles of transport and the urban environment. The transport options associated with urban development are complex: policy and planning must balance the benefits brought by mobility and connectivity with damaging transport externalities, considering global impacts, the physical environment, the social sphere and diverse demographic factors.

The nature of urban form influences both why and how people travel and, at the same time, how new transport technologies influence urban form and development. Urban development and regeneration programmes offer a key intervention point where transport planning can support positive physical and mental health and reduce risks, including those of accidents and of damage from air and noise pollution. The four examples explored in the chapter demonstrate some of the different ways in which transport and urban regeneration or urban development takes place and the scope for positive and negative health impacts. Many of the health problems faced in cities today have, to some extent, been caused by suburban development designed to address historical health problems. Retrofitting sustainable and healthy development using New Urbanism approaches in general or, more specifically, through TOD is one way to address these legacy health problems, but economic rather than health concerns often drive development, especially at the city scale. Neighbourhood-level interventions, incorporating high-quality greenspace and well-maintained paths and cycle tracks, can be an effective means of supporting health, encouraging active travel and reducing car dependence. However, micro-level changes must be nested within a larger-scale strategic framework, removing car dependence at more than just the neighbourhood scale. Closer integration of transport and
development governance across scales would help achieve more desirable health outcomes and mitigate the negative health impacts associated with transport, ensuring these are distributed fairly across the population.

Maintaining a focus on the ways in which transport and the urban environment are mutually constitutive is crucial for the success of urban regeneration and development in both health and economic terms. Treating transport as an integral component of place-based regeneration planning at different scales can, potentially, deliver walkable neighbourhoods where people want to exercise and interact, and provide an efficient and inexpensive means of accessing greater economic, social and leisure opportunities. Perhaps most importantly for the urban health agenda, considering transport and regeneration holistically should provide a means of diminishing, rather than perpetuating, health inequalities.

More evidence is needed about the health implications of transport investments within urban regeneration programmes. Relationships are not straightforward and, as demonstrated by Ogilvie et al. (2016), positive and negative pathways may both be associated with the same intervention. With any intervention, it is important to evaluate who benefits and who is disadvantaged, bearing in mind the differences between the implications for individuals and for populations. Latency, in terms of how long health impacts take to manifest themselves, is a further obstacle to demonstrating benefits, especially as short-term economic gains can often be prioritised over long-term public health benefits. In this sense, scale is important temporally as well as spatially.

Looking to the future, emerging technologies, such as ride-sharing services and autonomous vehicles, raise the possibility of another transformation of the urban transport landscape, which could shift the locations of development and have considerable effects on health. Realising positive impacts and mitigating negative ones are a challenge for planners in this new landscape, which is often dominated by the private interests of information technology companies. Prioritisation of short-term economic gain over long-term public health or social interest threatens the potential of such technologies to have positive long-term impacts. Ensuring that social and environmental considerations are a key part of any urban development or regeneration will help to limit the negative consequences for health and to reduce health inequalities.

Notes
1 www.ccc.govt.nz/transport/cycling/major-cycle-routes

References
Transport, Urban Regeneration and Health


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UN-Habitat. 2013.


