

Scottish Health and Inequality
Impact Assessment Network (SHIAN)

Report

Health and Transport: A Guide

2018

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About This Guide

This guide has been written to help people involved in public health, health promotion and health improvement work who are engaging with transport issues. It can support health impact assessment of a transport proposal, health needs assessment or a more general focus on transport projects as part of a health in all policies approach. It may also be of use to transport planners. The guide:

- provides some background information on transport in Scotland and the policy context
- summarises evidence on links between transport and health
- summarises evidence on health impacts of selected transport policies
- discusses how to use the evidence to inform a specific proposal.

Development of the guide

This guide updates the previous *Health Impact Assessment of Transport Initiatives: A Guide* which was published in 2007.[1] Chapter 3 is based on the systematic review [2] that formed the basis of the previous guide. To update this, we re-ran the previous searches, looking for evidence that added to or changed the key points. We also carried out a hand search of the *Journal of Transport and Health* and carried out focused searches to identify best available evidence relating to the transport policies in chapter 4.

There is a spectrum of evidence referred to in the guide, from systematic reviews to observational studies. An extensive literature exists relating to the strength of evidence for policymaking.[3-9] Our approach tries to identify the best available evidence while acknowledging the limitations of different study designs. The focus of the guide is on transport for access rather than transport as a leisure pursuit in itself (e.g. cycling or walking as a sport or leisure activity).

Contributors

Margaret Douglas and Martin Higgins drafted this updated guide and take overall responsibility for the final document. Martin Higgins also hand searched the *Journal of Transport and Health* and reviewed evidence for the policies discussed in Chapter 4. Ruth Jepson, Hilary Thomson and Fintan Hurley drafted the 2007 review. Gillian Armour ran the searches and Hannah Austin reviewed the new literature thus identified.

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Chapter 01: Transport in Scotland

Scotland has a few large built up urban centres, a number of smaller towns and vast remote and rural areas. Transport needs vary with a high dependency on private vehicles in remote and rural areas which have few, if any, local public transport services. Even in urban areas, access to main public transport routes for some groups, such as older people or people with a disability, can be limited. The range of transport options available in Scotland include air, ferry, train, motor vehicle (car, bus, coach, motor cycles), bicycle, walking, or a combination of these. As the figures below demonstrate, the dominant mode continues to be private car travel.

Car ownership

In 2016 the Scottish Household Survey[10] found that 71% of Scottish households had one or more motor vehicles available for private use (so more than a quarter of households have no car available for private use). Twenty nine percent of households had two or more cars.

There is considerable variation according to the area in which people live. Car ownership in 2016 was greater in remote and rural areas (85%) than large urban areas (60%). In areas classified as most deprived, 50% of households had access to a car compared with 85% of households in the least deprived areas. There are also gender differences, as 75% of men have a driving licence compared with 63% of women.

Modal share

Scottish Transport Statistics for 2016[11] show that cars are the most common transport mode. There has been a 12% increase in bicycle traffic volume over the last five years [2] but cycling still accounts for a small minority of journeys. Table 1 shows modal share for all journeys and usual mode of travel to work and school.

Table 1: Modal share – all journeys, usual travel to work and usual travel to school, Scotland, 2016

Mode	Share of all journeys	Usual travel to work	Usual travel to school
Car	64%	67% - 62% as driver, 5% as passenger	26%
Walking	24%	12%	52%
Bus	8%	10%	19%
Cycling	1%	2%	1%
Train	2%	5%	
Other	2%		

When measured by distance, about 76% of the total distance travelled in 2016 was by car.[11]

Trends

The refresh of the National Transport Strategy reported that between 2006 and 2014 there was a 2% increase in traffic on the roads in Scotland. Although the volume of car traffic remained very similar, the volume of light goods vehicle traffic increased by 16%. Public transport passenger journeys declined by 6% over that time. Although bus travel remains the dominant form of public transport, and accounts for 77% of public transport journeys, the number of bus passenger journeys has declined while rail journeys have increased. The costs of private motoring rose very slightly but bus and rail costs increased by 14% and 16% respectively between 2006 and 2013.[12]

Determinants of transport mode

Decisions about mode of transport are complex and will often take into account a number of factors.

Individual characteristics are important influences on transport choices. Active travel rates have been found to be higher among younger people, people in owner occupied accommodation, people who live near their workplaces and those who do not have access to a car.[13]

Specific barriers to and facilitators of active travel were outlined in a review by Glasgow Centre for Population Health (GCPH). [14] This review identified convenience, reliability and time-efficiency as key considerations. The relative cost of different modes is an important determinant. Lack of information about timetables and routes can be a barrier to public transport, particularly when there are competing operators. The perceived meaning of travel choices and 'fit' with individuals' identities are also important, and decisions may be simply a matter of habit. The dominance of car culture is a key obstacle to active travel.[15]

The GCPH review noted that one person's barrier may be viewed more positively by others. For example, while some people are concerned that other passengers on public transport may pose a risk of anti-social behaviour, others welcome the opportunity for social contact.

Features of the neighbourhood environment can also impact on active travel. In particular, higher rates of walking are found in 'walkable' neighbourhoods that have good pedestrian connectivity, land use mix and proximity to key destinations.[16, 17] Although qualitative studies find that personal safety fears and fear of crime may deter people from walking, cycling or using public transport,[18] quantitative studies find inconsistent associations between crime and active travel.[19, 20]

Although there are many promising interventions being tested to improve uptake of active travel modes among adults and among children, overall there is a lack of evidence that these interventions lead to long-term modal shift.[21-26] Measures recommended to promote a modal shift from car use to walking, cycling or public transport include those that make car travel less attractive and improvements to alternative forms of transport such as better infrastructure, information and reliability.[27, 28] A recurrent theme in research about active travel is the importance of strong civic leadership and significant investment for both infrastructure and

promotional interventions. Whole system approaches to active travel are needed to achieve change.[29, 30]

People with fewer transport options may be excluded from services and amenities as a result. Impediments to travel include cost, lack of information, community severance and psychological barriers.[31-33]

Chapter 02: Transport Policy in Scotland

This chapter outlines recent transport policy in Scotland, and some of the influences on this area of policy. Transport is one of the areas of government devolved to the Holyrood parliament. Over the last 20 years a series of national, regional and local transport strategies and policies have evolved along with associated government departments and agencies.

Transport planning and delivery structures in Scotland

Transport Scotland is the national transport agency for Scotland. Its purpose is 'to support and advise the Scottish Government on strategy and policy options for transport in Scotland, and increase sustainable economic growth through the development of national transport projects'. Among other areas of responsibility it leads on the **National Transport Strategy**, strategic infrastructure, trunk roads, and runs concessionary travel schemes, Traffic Scotland and Traveline Scotland.

There are seven Regional Transport Partnerships that are responsible for **Regional Transport Strategies**. They also develop, deliver and fund projects, do regional transport modelling, are a key agency for development planning and operate some services.

Local Authorities are responsible to develop and implement **Local Transport Strategies**. They have a range of transport responsibilities including local roads maintenance, other local infrastructure, bus subsidy schemes and other bus service influence or management, local road safety, environmental management, traffic management and funding of voluntary sector transport initiatives.

Other key transport partners include private sector operators, relevant academic departments and voluntary sector organisations which provide community transport schemes and/or volunteer drivers for accessing health and other key service locations.

National Transport Strategy

Scotland's National Transport Strategy (NTS) was first published in 2006 and refreshed in 2016.[12] It presents a vision of:

An accessible Scotland with safe, integrated and reliable transport that supports economic growth, provides opportunities for all and is easy to use; a transport system that meets everyone's needs, respects our environment and contributes to health; services recognised internationally for quality, technology and innovation, and for effective and well-maintained networks; a culture where transport providers and planners respond to the changing needs of businesses, communities and users, and where one ticket will get you anywhere.

The strategy sets out five high level objectives and three key strategic outcomes, which are listed below:

High level objectives

- Promote economic growth
- Promote social inclusion
- Protect our environment and improve health
- Improve safety of journeys
- Improve integration

Strategic outcomes

- Improve journey times and connections
- Reduce emissions
- Improve quality, accessibility and affordability

The 2016 refresh identified changes in the broader economic and political landscape and changes in transport patterns. These include Scotland's Economic Strategy, the National Planning Framework, the Climate Change Act, the Community Empowerment Act and opportunities relating to digital innovation and connectivity. All of these have implications for transport priorities. The refresh recognised that since the original NTS there has been significant investment in transport infrastructure, declining bus but increasing rail patronage, uptake of electric vehicles, but private car transport continues to be the dominant transport mode. It recommended that further work should be done to understand these trends and their implications. Transport Scotland is now working on a fuller, collaborative review of the NTS that aims to 'set out an updated vision for what kind of transport we want for the whole of Scotland in 20 years' time and how we plan to get there.'^[12]

The NTS Review team invited submissions for evidence to inform the new strategy during 2017. Extensive public and stakeholder engagement is scheduled for 2018 with publication of the new strategy planned for Summer 2019.

Figure 1 shows how the National Transport Strategy fits with other key national strategies and shows the national and local plans that have been developed to implement elements of the overall strategy. These relate to strategic infrastructure projects, policy relating to specific transport modes and/or thematic topics like road safety, transportation noise and active travel. Some of these set objectives that are closely linked to health. The complex, interconnected nature of transport policy, which requires linkages across border, nationally, regionally and locally, as well as links to different areas of government such as housing and planning, is evident from this diagram.

Strategic Projects

The Strategic Transport Projects Review sets out 29 investment priorities to 2032.^[34] The four priority projects are the Queensferry Crossing, completed in 2017, and three rail improvement projects on the Edinburgh to Glasgow line, the Highland main line and the Aberdeen to Inverness line.

National Active Travel Strategies

Transport Scotland has published the *Long Term Vision for Active Travel in Scotland*.^[35] Linked to this are key strategies to promote walking and cycling. The *Cycling Action Plan for Scotland* (CAPS) sets the target of 10% modal share for cycling

by 2020.[36] *Let's get Scotland walking: The National Walking Strategy* aims to achieve 'A Scotland where everyone benefits from walking as part of their everyday journeys, enjoys walking in the outdoors and where places are well designed to encourage walking'. [37] Implementation of these includes funding for both building infrastructure and behaviour change interventions.

Scottish Government will be consulting on a new Active Scotland Delivery Plan during 2018 which will include links and opportunities for active travel policymaking.

Figure 1: National Transport Strategy Policy Framework[12]

Strategy and overarching references	UN Convention on the Rights of Persons with Disabilities, UN Sustainable Development Goals for 2030, EU Transport White Paper, Transport (Scotland) Act 2005, Climate Change (Scotland) Act 2009, Equality Act 2010, Children and Young People (Scotland) Act 2014, Community Empowerment (Scotland) Act 2015, Scotland’s Economic Strategy, Community Planning, National Performance Framework, Single Outcome Agreements													
SG Purpose	To focus government and public services on creating a more successful country, with opportunities for all to flourish, through increasing sustainable economic growth													
SG National Outcomes	Transport contributes to 9 National Outcomes: We live in a Scotland that is the most attractive place for doing business in Europe; We realise our full economic potential with more and better employment opportunities for our people; We live longer, healthier lives; We have tackled the significant inequalities in Scottish society; We live our lives safe from crime, disorder and danger; We live in well-designed, sustainable places where we are able to access the amenities and services we need; We value and enjoy our built and natural environment and protect it and enhance it for future generations; We reduce the local and global environmental impact of our consumption and production; Our public services are high quality, continually improving, efficient and responsive to local people’s needs													
SG National Plans, Policies and Outcomes	Scotland’s Digital Future: a Strategy for Scotland	Ready Scotland Scottish Climate Change Adaptation Programme	Land Use Strategy and Scottish Biodiversity Strategy	Scotland’s International Framework	Scotland’s Cities: Delivering for Scotland	Scottish Planning Policy	Public Bodies Climate Change Duties	National Transport Strategy	National Planning Framework	Low Carbon Scotland: Report of Proposals and Policies	SG Delivery Plan 2016-2020 on UNCRPD	Preventing Overweight and Obesity in Scotland	Cleaner Air for Scotland	Regeneration Strategy and Labour Market Strategy (to be published in 2016)
	Infrastructure Investment Plan													
Transport Vision High Level Objectives Key Strategic Outcomes	An accessible Scotland with safe, integrated and reliable transport that supports economic growth, provides opportunities for all and is easy to use; a transport system that meets everyone’s needs, respects our environment and contributes to health; services recognised internationally for quality, technology and innovation, and for effective and well-maintained networks; a culture where transport providers and planners respond to the changing needs of businesses, communities and users, and where one ticket will get you anywhere.													
	Promote economic growth		Promote social inclusion			Protect our environment and improve health			Improve safety of journeys			Improve integration		
	Improved journey times and connections				Reduced emissions				Improved quality, accessibility and affordability					
National Transport Plans, Policies and Strategies	An Action Plan for Buses (2006)		Freight Action Plan (2006)		Scotland’s Railways (2006)			Strategic Transport Projects Review (2008)			Scotland’s Road Safety Framework to 2020 (2009)		Strategic Road Safety Plan (2007)	
	Carbon Account for Transport (2015)		Cycling Action Plan for Scotland (2013)		National Walking Strategy (2014)			Active Travel in Scotland (2014)			Long Term Vision for Switched On Scotland: A Roadmap to Widespread Adoption of Plug-in Vehicles (2013)		Scottish Ferry Services – Ferries Plan (2013-2022)	
	Roads for All: Good Practice Guide for Roads (2013)		Final Report National Roads Maintenance Review (2012)		Delivery Strategy – Smart & Integrated Ticketing (2012)			Making the Most of Scotland’s Canals (2013)			Transportation Noise Action Plan		SG/RTP/COSLA Working Group report	
Regional Transport Plans, Policies & Strategies	Regional Transport Plans, Policies and Strategies													
Local Transport Plans, Policies & Strategies	Community Planning Partnerships Local Outcomes Improvement Plans													
	Local Transport Strategies, Local Transport Plans, Local Development Plans, City Deals													

Chapter 03: Why Does Transport Matter for Health?

The transport system facilitates access to jobs, education, shops, leisure and other essential services for example health services. As well as having a key role in the wider economy, access to these daily essentials is of central importance to an individual's socio-economic status and levels of neighbourhood social inclusion and exclusion. Therefore availability of accessible, affordable transport may also, in itself, be regarded as a determinant of health.[38]

Different modes of transport may also affect health through a range of other determinants. Individual travel choices can have health impacts not just on that individual but on the wider community through externalities including pollution, risk of injury to others and community severance. But equally, individuals' travel choices are often determined by the availability, affordability and practicality of different transport modes in their communities.

It is important to consider the range of outcomes, and effects on different populations, to understand the overall health impacts of transport policies and interventions. This section contains a brief summary of the links between transport and the health outcomes and health determinants listed below, then uses this evidence to identify features of a 'healthy' transport system. The statements below are based on a comprehensive search for and assessment of the best available evidence. Further details of the selection and assessment of the evidence are available from the authors.

1. General health and wellbeing
2. Stress
3. Injuries
4. Physical activity
5. Air pollution
6. Noise pollution
7. Placemaking and community severance
8. Climate change
9. Health inequalities

1. Transport, general health and wellbeing

- Access to a car is associated with improved self-reported physical and mental health. This link is not fully explained by social class, income or feelings of self-esteem linked to car ownership.[39] It may reflect greater access to other services and amenities.
- Positive experiences of travel may contribute to wellbeing. This can apply to both active and other travel modes.[40]

2. Transport and stress

- Possible sources of transport related stress include overcrowding, congestion and delays.

- There is little available research on the subject of road rage or public transport related stress.
- Post-traumatic stress disorder may occur after a road traffic crash though estimates of prevalence vary.[41]

3. Transport related injury

- In 2016, 191 people were killed as a result of road crashes in Scotland. 10,901 people were injured, of whom 1,697 were seriously injured.[42]
- These numbers have fallen substantially since the 1970s and continued to fall over the past decade. In 2016, there were 35% fewer fatalities than the average for 2004-2008.[42] These numbers reflect incidents routinely recorded by the police in the Stats 19 database. Other injuries, notably pedestrian falls, are not recorded by police.
- The most common reported contributory factor in reported crashes was 'driver error', which contributed to 64% of all reported crashes and 80% of fatal crashes in 2016. The most common errors were failing to look or loss of control of the vehicle.[43]
- Travelling too fast for the conditions or exceeding the speed limit was reported in 10% of all crashes and 23% of fatal crashes in 2016.[43]
- WHO estimates an increased risk of accident between 2% and 9% for people using mobile phones while driving.[44, 45]
- Several prescription medications have been shown to impact on driving performance and subsequent risk of road traffic crashes.[46, 47]
- Driving and pedestrian fatality rates are generally higher in England for males than females. Age is a stronger predictor of fatality than travel mode.[48]
- Non-collision accidents on public transport and while pedestrians are more common among older people.[49, 50]
- There is also some evidence to suggest that the number of passengers in cars with young drivers is a risk factor. More young passengers increases the likelihood of accidents.[51]
- Vulnerable road users at highest risk of being killed or seriously injured by a collision are cyclists and pedestrians.[48]
- Safety in numbers refers to the idea that the risk of being hit by motor vehicles reduces if there are more cyclists or pedestrians.[52, 53]
- Travel by rail and plane has the lowest rate of fatality or serious injury.[54]
- Some observational studies outline potential risks associated with trams, including risks to cyclists whose wheels become trapped in tram tracks. There is no comprehensive review of health issues associated with this mode of transport.[55-59]
- Legislative, engineering and educational measures may all be effective in reducing crashes and associated injuries.[1]

4. Transport and physical activity

- Regular physical activity has many benefits to health. It reduces the risk of chronic conditions including cardiovascular disease, type 2 diabetes, cancer, obesity, musculoskeletal conditions, and mental health problems and improves

mood. There is a clear relationship between physical inactivity and all cause mortality.[60]

- The current recommendation for adults to achieve health benefits is to accumulate 75 minutes of vigorous activity or 150 minutes of moderate-intensity activity each week.[60]
- Walking and cycling are physically active forms of transport, whereas car travel is a sedentary activity. Physically active transport may lead to increases in overall levels of physical activity.[61]
- Active transport to work is associated with improved cardiovascular health and lower body weight.[24]
- Active transport among children may result in increased physical activity levels (but not reduced sedentarism).[26, 62, 63]

5. Transport, air pollution and health

- Outdoor air pollution is a complex mixture of pollutants which comes from a mixture of sources - some local, some distant.[64]
- In most urban areas road transport is the main contributing source of Particulate Matter (PM) and Nitrogen oxides (NO_x). NO_x are emitted from car engines and concentrations decay with distance from the road. PM is emitted from engine combustion and also from friction from brakes and tyres. Small particles can be transported over long distances and regional emissions play an important role in PM concentrations.[65]
- Increased outdoor air pollution is associated with increased cardio-respiratory mortality and morbidity. Some effects are more-or-less immediate and affect vulnerable groups in particular whereas the effects of long-term exposure are more widespread.[66-69]
- The strongest evidence of greatest health effects relates to PM. Smaller particles cause more harm than larger particles. There is no known safe level of PM pollution.
- There is an estimated 3% increase in all cause mortality in adults per 5µg/m³ increase in PM_{2.5}. [70]
- In Scotland it is estimated that long-term exposure to PM_{2.5} air pollution leads to about 1,500 early deaths per year, about 2.8% of annual mortality.[70]
- NO₂ or something related to it, has adverse health effects that are additional to the effects of PM or ozone. Also NO_x are a precursor of other harmful pollutants, including ozone.[70]
- There are 'triggering' effects of short-term exposure to ground level ozone affecting respiratory morbidity and mortality.[71, 72] There may be additional effects of long term ozone exposure.
- People living near major roads have increased risk of mortality and childhood asthma though it is unclear how much of this can be attributed to transport related air pollution.[73]
- Generally, in-vehicle concentrations are higher than background levels, the extent varying by pollutant.

6. Transport related noise pollution and health

- Motorised transport is a common form of noise pollution.
- Links between transport noise and health are inconclusive.[74]
- Transport noise is unlikely to result in long term hearing problems.
- Aircraft noise may lead to sleep disturbance and reduced quality of sleep. There is less clear evidence about the link between living near to an airport and other health outcomes.[75, 76]

7. Transport, placemaking and community severance

- New transport routes and high levels of traffic running through a community may disrupt social networks and cause community severance.[77-79]
- Good social networks and social participation benefit physical and mental health.[80]
- Car dominated environments discourage active travel and active play.[15] The physical and social characteristics of a place have an important influence on health and wellbeing.[81, 82]
- Transport infrastructure may replace greenspace. Access to greenspace is associated with improved health. [83]

8. Transport and climate change

- There is wide scientific consensus that the global climate is changing and that most of this change is attributable to human activity since the pre-industrial era.
- A range of detrimental health impacts is predicted to arise from continued climate change, with lower income populations, predominantly within tropical/subtropical countries, likely to be the most seriously affected.[84]
- Transport accounted for 28% of Scotland's greenhouse gas emissions in 2014. Forty four percent of these were from private cars, 25% heavy goods vehicles, 15% air travel and 11% ferries. The lowest emitters per passenger kilometre are national coaches and national rail.[85]

9. Transport and health inequalities

- The above impacts on health determinants and health outcomes are not distributed equally.
- Transport resources and availability, and the benefits and dis-benefits associated with transport are not shared equitably across the population, which can result in transport exclusion.[31]
- Access to private transport is heavily skewed in favour of richer people.
- Financial penalties and costs of car use, e.g. fuel tax, will inevitably have a disproportionate effect on people living on low incomes, thus increasing the negative aspects of living in a car dependent society.[33, 86]
- Externalities associated with transport are also not evenly shared. The burden of air and noise pollution is not spread evenly nor are the impacts of pollution

the same for the whole population. People in low income communities are at higher risk of injury from road crashes.[48]

Elements of a healthy transport system

Pulling all the evidence together, how can transport policy contribute to better health? This needs to address the range of health determinants identified in this chapter, and consider impacts not only on the individual traveller but also on fellow travellers and the wider community.

It may seem a paradox that, at an individual level, the evidence consistently shows that having access to a car associated with better physical and mental health, although regular travel to work by active modes is associated with improved health. But car access differs from regular car use. It is likely that the association of car access with better health is because it allows access to services and amenities that would otherwise be inaccessible. This reflects a transport system that prioritises private motorised travel, to the extent that people without access to a car are excluded. Most of the adverse health effects of transport, to both individual travellers and wider communities, are associated with motorised transport, and are exacerbated by the predominance of private cars.

The evidence suggests that overall, a healthy transport system should:

- Provide an inclusive transport system that enables all groups of people to have easy and affordable access to employment, services and amenities. This includes people who are not able to use a car, for example people in poverty, young people and people with a disability.
- Ensure transport decisions consider externalities and balance the needs of the individual traveller with the wider impacts on other travellers and communities.
- Avoid being dominated by the needs of car users and give genuine priority to alternative modes including active modes and public transport. Current transport policy states that pedestrians, cycling and public transport should be prioritised, in that order, above private car travel. However this hierarchy is not reflected in, for example, the proportion of the transport budget that supports the infrastructure for each of these. Transport decisions should not be based on an assumption that most people will travel by car.
- Encourage, promote and support active modes of travel wherever possible. Active travel brings benefits for both the individuals who are supported to walk or cycle and the wider community. The individual traveller gains health benefits from regular physical activity and the wider community is exposed to less air pollution, noise, severance and lower risk of injury to others.
- Continue to improve safety, particularly for vulnerable road users. This should involve a mix of legislative, engineering and educational measures.

Finally, it is important to recognise the important influence of land use policy on the transport system. Land use planning affects the proportion of land given to roads, rail, parking, cycle ways, pavements and other infrastructure needed for different modes, which clearly affects the transport options available. Even more significant are decisions about the location of employment, services, amenities and retail in relation to each other and to residential areas, which affect how far people need to travel.

Chapter 04: Health Impacts of Selected Transport Policy Options

This section presents very brief reviews of available research on some specific transport policies and interventions that are currently being considered and/or implemented in Scotland. More detailed summaries of evidence of health impacts related to transport interventions are included in the original SHIAN *Guide to HIA of Transport Initiatives* and associated literature review,[2, 87] *Health on the Move 2*[38], the review of the Glasgow Centre for Population Health work on active travel[88] and in guidance by Khreis and colleagues.[89]

Research on transport policies and interventions tends to study a very small range of outcomes and often focuses solely on one intended outcome, but as noted in the previous chapter, transport can affect a broad range of health determinants. In a health impact assessment, or other work to improve the health impacts of transport policies, it is important to consider the range of potential health impacts. It is also important to consider how the local context will affect impacts and how impacts will be distributed among different population groups. The uptake and effects of any intervention may vary across different socio-economic groups and across the lifecourse.[90, 91] The possible differential impacts of a transport intervention across different social groups should be considered.

New Transport Infrastructure

Some UK research programmes have investigated the impacts of new transport infrastructure on active travel patterns. Although these studies vary in terms of intervention – a guided busway near Cambridge, three different active travel infrastructure projects for the i-Connect studies, Cycling Towns, and a motorway extension that was predicted to increase active travel opportunities in the vicinity – they provide some common findings.

The Cambridge Guided Busway evaluation found that new public transport and dedicated cycleways and footpaths resulted in higher rates of active commuting to work by people living in close proximity to the new infrastructure. These studies could not ascertain whether total activity increased as a result of the new infrastructure. [92-94]

The i-Connect studies investigated the impacts of active travel investments in three English towns. The evaluation suggests that new infrastructure is associated with increases in walking and cycling for local residents two years after investment.[95]

The Cycling Towns evaluation showed that investment in cycling infrastructure led to an increase in commuter cycling in the intervention towns compared with control locations.[96] Variation in outcomes between intervention towns means that it is difficult to estimate potential impacts of investment.

The Traffic and Health in Glasgow study (known as the M74 study) investigated changes to the urban environment as a result of motorway construction in deprived neighbourhoods in Glasgow. The study used quantitative and qualitative research methods to evaluate both individual- and population-level changes in health and health-related behaviour and to develop an in-depth understanding of how these

changes were experienced and brought about. Part of the M74 evaluation investigated the hypothesis that active travel would increase in the vicinity of the new motorway due to displacement of traffic from nearby streets onto the motorway. The evaluation showed no impact on active travel.[97, 98] On balance the new motorway seemed to promote car use. There was also no evidence of an impact on rates of road traffic collisions, as the trend in collision rates in the area around the motorway was the same as in other parts of Greater Glasgow. [99] The motorway helped some residents connect with amenities and people in other places, but had negative impacts on mental wellbeing for those who lived nearest to it.[100]

A systematic review summarising the evidence of the impact of structural road interventions on risk of injury to cyclists states that there is no compelling evidence that any type of cycling infrastructure reduces rates of cycle collisions. Narrative data suggests that the use of 20mph speed restrictions in urban areas may be effective at reducing cyclist collisions and that redesigning specific parts of cycle routes that may be particularly busy or complex may be beneficial to cyclists. The review suggests that there is insufficient evidence to draw any robust conclusions concerning the effect of cycling infrastructure on the severity of injury, age, sex or level of social deprivation of cyclists involved in collisions. Overall the review concluded that there is a lack of rigorous evaluation of cycling infrastructure and therefore a lack of high quality evidence to be able to draw any firm conclusions as to the effect of this infrastructure on cyclists.[101] Another recent systematic review also investigated cyclists' preferences regarding separated cycle lanes and concluded that 'Riders across all cyclist types prefer dedicated cycling facilities and are opposed to high speed traffic'.[102]

Other research has suggested that car sharing should be viewed on the spectrum of active travel because of the potential to reduce overall traffic volumes.[23] As stated earlier, however, evidence suggest that active travel interventions need to be across a whole policy frame rather than only addressing single aspects such as infrastructure or individual behaviours.[29]

Low emission zones

Low Emission Zones (LEZ) are local areas where access by selected highly polluting vehicles is restricted. Previous studies have shown both modelled and observed health benefits arising from short term traffic restrictions such as those introduced for the 1996 Atlanta Olympics[103] and the 2008 Beijing Olympics[104] and from local restrictions in other settings.[105] However there is limited empirical evidence on the health impacts of LEZs.[100]

Within the London LEZ, larger diesel vehicles that do not meet EU emission standards are required to pay a penalty charge. A health impact assessment carried out before its implementation suggested that the most important health impacts would result from improved air quality, with potential small impacts on noise and safety due to replacement of older vehicles, and possible impacts on access to services and employment.[106] However, an evaluation after implementation found that the London LEZ had had no significant effect on air quality or (as a result) on respiratory symptoms.[107, 108] Overall, the health effects of LEZs will depend most on their effectiveness in improving air quality, and will vary according to the nature of the fleet,

vehicles affected and effectiveness of measures taken to restrict them, displacement effects and also the overall impact on travel behaviour and access. The HIA of the London LEZ suggested that it could have greater benefits if it were extended to other types of vehicle and integrated with other policies, for example to promote active travel.

Road pricing

Road pricing shows promise as a way of reducing traffic volumes and increasing levels of physical activity.[109] A major review highlights a number of potential health benefits associated with pricing interventions including vehicle taxation, parking charges, road user charging, fare charge subsidies to increase public transport uptake and integrated ticketing. The authors suggest that benefits may:

Slightly increase active travel and physical activity, reduce levels of air pollution, noise, heat island effect, climate change effects, motor vehicle crashes and community severance. Further positive impacts can occur if inequalities are reduced by for example decreasing fares for public transport which may improve the mobility and accessibility of vulnerable and low socioeconomic groups.[89]

20 mph zones

An umbrella review found that 20mph zones are an effective way of reducing vehicle speeds.[110] As a result, injury and death rates in 20mph areas are lower. The authors suggest that as road traffic injuries and fatalities are more common among deprived groups, 20mph zones may be an effective intervention for reducing inequalities.

Graduated and restricted licensing

Young drivers are at highest risk of road traffic collisions.[48] A Cochrane review suggests that graduated driver licensing programmes may have a positive impact on accident rates; young people who attend these courses have lower accident rates although there is some uncertainty about the most effective components of these schemes.[111]

Although visual and cognitive impairment and physical disability is likely to affect older people's driving ability, as a population they are least likely to have road traffic collisions. There is no strong evidence that screening drivers by age has a positive impact on road safety.[112-115] It seems likely that preventing older people from driving will have a negative impact by limiting their mobility and social interaction.[112]

Free or subsidised public transport

Research into the provision of free bus passes for young people suggests that this policy leads to greater use of buses for short journeys with no detrimental impact on overall levels of walking, but may reduce cycling levels.[116, 117]

There is also evidence to suggest that concessionary bus passes for older people can increase physical activity levels, sense of belonging and reduce social exclusion. It is unclear if these schemes are cost-effective.[118]

Potential future policies

This section outlines a few of the policy interventions that are currently being considered or implemented. As in all policy areas, transport research and policy are continually evolving. New research findings may suggest potential future policies that would improve health and other outcomes. Examples of interventions that researchers have suggested, but not evaluated, include:

- Routinely collecting data on Stat 19 reports about mobile phone usage.[44]
- Increasing time allowed at pedestrian crossings, to respond to the finding that only 10% of people aged over 60 years can walk fast enough to cross the road in the time given.[119]
- Discouraging or prohibiting young drivers from carrying other young people as passengers, as more young passengers increases the likelihood of crashes.[51]

Motorised bicycles, electric cars and increased provision of segregated active travel corridors are other examples of transport interventions that might have significant impacts on health. The health impacts of these and other transport interventions should be researched so that future transport policy can contribute to better health outcomes.

Chapter 05: Using the Evidence to Inform Transport Policy and Planning

The evidence summarised in this guide may be used to inform transport policy, by helping to identify ways in which proposed transport policies and plans could impact on health. This can facilitate a 'Health in All Policies' approach to transport planning.

Health in All Policies and Health Impact Assessment

Health in all policies (HiAP) is 'an approach to public policies across sectors that systematically takes into account the health and health systems implications of decisions, seeks synergies and avoids harmful health impacts, in order to improve population health and health equity'. [120, 121] HiAP is preventative and aims to create the social, physical and economic environment in which people can have the best health outcomes. It involves partnership between public health and other sectors. It aims to develop a holistic understanding of how policies affect health and influence those policies in a way that improves the health consequences. [122, 123]

There are several ways in which HiAP can be applied in practice. [124, 125] These range from using a formal approach like Health Impact Assessment to assess the health impacts of a specific policy proposal, to a more fluid approach that focuses on building relationships between health and other policy areas – being 'at the table' when decisions are made to ensure the health issues are considered. In each of these, it is important to have a good understanding of the evidence on the links with health.

Health Impact Assessment (HIA) offers a recognised, structured way to identify and assesses impacts before a proposal is implemented. It is defined as 'a combination of procedures, methods and tools that systematically judges the potential, and sometimes unintended, effects of a policy, program or project on the health of a population, and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects'. [126] A practical guide to HIA is available on the SHIAN website at: <http://scotphn.quantumitdigital.com/wp-content/uploads/2016/09/Health-Impact-Assessment-Guidance-for-Practitioners-SHIAN-2016.pdf>

Sometimes a full HIA of a proposal is not possible or not necessary, but it is still useful to consider, formally or informally, the range of ways that a proposal may impact on health and use this to inform policy development. A group exercise using a health impact checklist is a relatively quick way to identify the potential areas of impact and help determine whether a fuller HIA would be useful. The practical guide to HIA noted above provides guidance on how to do this.

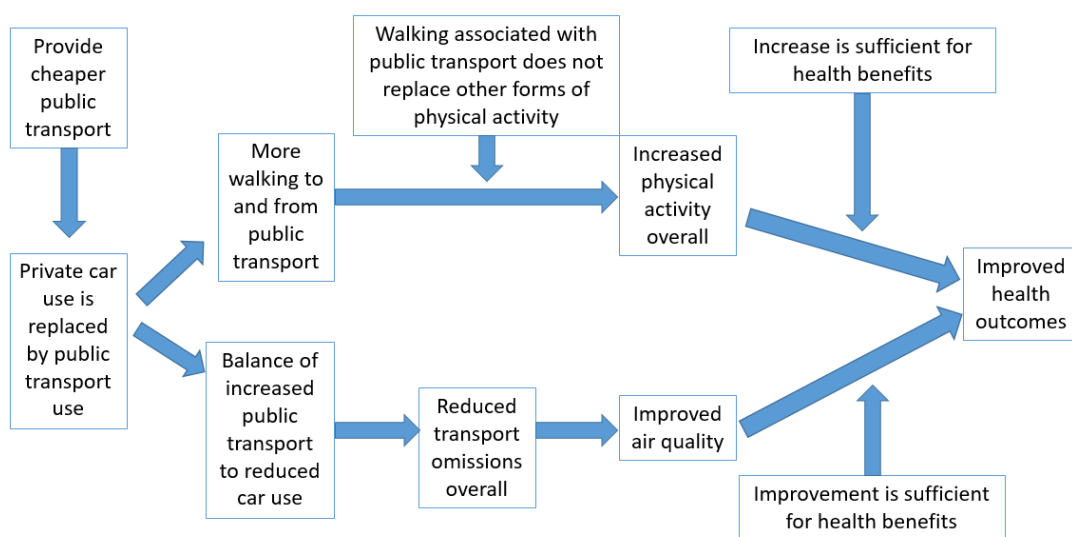
Applying evidence to a specific proposal

When applying research evidence from another setting it is important to consider how relevant findings may be to the local context. Other forms of evidence such as a local profile and qualitative evidence from key informants often give an insight into characteristics of the local context that may influence whether, and in what ways, impacts may arise.

There are still many gaps in the research evidence, particularly in the research evidence of the health impacts of non-road transport. Absent or insufficient research evidence does not mean there is no link between transport and health. When evidence is lacking it may be recommended that prospective monitoring or research be carried out to identify how the proposal affects health once implemented.

Often it is helpful to map (either using a diagram or in words) the pathways between a proposed policy and health outcomes. This can help in several ways. It can make it explicit when some links in the pathway are underpinned by research evidence but others are not. It can also help identify links that are likely to be influenced by local context. Finally, it may identify links in the pathway that could be either strengthened or reduced, and this can help identify recommendations to ensure positive impacts are realised and negative impacts mitigated. Figure 2 shows selected links between a policy to provide cheaper public transport and improved health outcomes.

Figure 2: Map of selected links between cheaper public transport provision and health outcomes



Questions to ask of a transport proposal

The questions below are based on the research review and are designed to help understand how a specific transport proposal may affect health.

Define nature and extent of intervention or policy being assessed

- What are the specific transport-related changes proposed?
- What is/are the overall aim(s) and objectives of the transport changes proposed?
- What is the research evidence that this intervention is effective in achieving its stated aims?
- How will the changes be implemented?
- What phases of implementation are there - consultation, implementation/construction, and maintenance?

Define features of the local area

- What is/are the geographical area(s) covered by the intervention?
- What are the key features of the area?
 - Is it urban or rural?
 - What transport infrastructure currently exists?
 - What facilities and amenities are there that people need to access?

Changes in travel and traffic patterns

- How will traffic levels or speed change? If appropriate, consider different parts of the affected area separately.
- Will there be any part of the affected area where traffic levels, speed, or infrastructure, will change to the extent that severance effects may occur?
- How will these changes affect access to services, facilities and amenities for those living in or travelling through the affected area?
- What will be the effect on individuals' travel patterns? Consider levels of driving, walking, cycling, and public transport use. Consider travel patterns of those both living in and travelling through the affected area(s).
- Will there be displacement of traffic and related impacts to or from surrounding areas? For example, traffic calming may reduce traffic in one area but displace it to a peripheral area. *If displacement is expected consider impacts on both areas.*

Economic implications

- What are the predicted effects of the proposal on the local economy?
- How will travel costs be affected for individuals?

Define populations

- What populations will be affected by the changes?
 - Note any vulnerable population groups.
 - For each impact identified who will be affected positively.
 - For each impact identified who will be affected negatively.
- Will the impacts be distributed equally in difference socio-economic groups?

Health impacts of the intervention

Does the intervention have stated health objectives? If so, what is the research evidence of effectiveness to support this?

- What is the research evidence that the intervention has unintended health related impacts (positive or negative)?
- How will the expected changes affect safety for vehicle drivers or other transport users?
- How will the expected changes affect safety and perceptions of safety for other vulnerable road users, e.g. pedestrians?
- How will the expected changes affect air quality in the affected area?
- How will the expected changes affect noise levels in the affected area?
- Will there be a shift to more or less physically active forms of transport? (Walking, cycling or public transport use)
 - Will this shift affect individuals' levels of physical activity overall?
 - Will this change in physical activity be sufficient to affect health?
 - Will changed levels of physical activity be seen in the general population of the affected area or in a minority of motivated individuals?

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For further information contact:

SHIAN (via ScotPHN)
c/o NHS Health Scotland
Meridien Court
5 Cadogan Street
Glasgow
G2 6QE

Email: nhs.healthscotland-scotphn@nhs.net

Twitter: @NHS_ScotPHN

Web: www.scotphn.net

(<https://www.scotphn.net/networks/scottish-health-and-inequalities-impact-assessment-network-shian/introduction/>)