Walking and cycling and socio-economic status in Scotland: analysis of statistical data and rapid review of the literature

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Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>HEPS</td>
<td>Health Education Population Survey</td>
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<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>NPARE</td>
<td>National Physical Activity Research and Evaluation Group</td>
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<tr>
<td>NS-SEC</td>
<td>National Statistics Socio-Economic Classification</td>
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<tr>
<td>NTS</td>
<td>National Travel Survey</td>
</tr>
<tr>
<td>ScRS</td>
<td>Scottish Recreation Survey</td>
</tr>
<tr>
<td>SCSP</td>
<td>Smarter Choices Smarter Places</td>
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<tr>
<td>SEABS</td>
<td>Scottish Environment Attitudes and Behaviours Survey</td>
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<td>SHS</td>
<td>Scottish Household Survey</td>
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<tr>
<td>SHeS</td>
<td>Scottish Health Survey</td>
</tr>
<tr>
<td>SIMD</td>
<td>Scottish Index of Multiple Deprivation</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for the Social Sciences</td>
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Executive Summary

Introduction
This is a study commissioned by NHS Health Scotland in conjunction with the National Physical Activity Research and Evaluation Group (NPARE) in order to examine the level of participation in walking and cycling for active travel and sport or recreation across different socio-economic groups in Scotland. This research uses data from surveys already collected, together with published and grey literature in order to:

- review what is known about levels of walking and cycling undertaken for travel or recreational activity across different socio-demographic groups and different locations in Scotland
- pay particular attention to low income or the most deprived socio-economic groups in the analysis to identify the patterns of behaviour, barriers and motivations of this group
- identify important mediating factors that influence the relationship between socio-economic status and walking and cycling behaviour
- discuss interventions that are aimed at encouraging people to walk or cycle more often, with a focus on interventions aimed at encouraging more deprived groups in particular to walk and cycle more often
- identify knowledge gaps in the literature and suggest directions for future research.

Methodology
This study was carried out in three phases:
1. a rapid but systematic review of published and unpublished evidence sources most relevant to the Scottish situation
2. a ‘data mapping’ exercise which systematically identified data sets and documented their content and suitability for secondary analysis of walking and cycling for active travel and recreation in Scotland across socio-economic groups
3. secondary analysis was undertaken on key data sets using multivariate analysis as appropriate.

Walking and cycling and socio-economic status
Comparing the results from various surveys allows more reliable statements about population trends to be made. Secondary analysis was undertaken of four major Scottish datasets: The Scottish Household Survey (SHS), The Scottish Health Survey (SHeS), The Scottish Recreation Survey (ScRS) and the Smarter Choices, Smarter Places baseline (SCSP).

A summary of the basic comparative results from each dataset is presented in Table 1.
Table 1 Summary of the results from each dataset on the relationship between walking and cycling and socio-economic status

<table>
<thead>
<tr>
<th>Dataset</th>
<th>For transport</th>
<th>For recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>Cycling</td>
<td>Walking</td>
</tr>
<tr>
<td>SHeS</td>
<td>lowest among most deprived (frequency of 5 min or 15 min trips + total time spent travelling)</td>
<td>no difference</td>
</tr>
<tr>
<td>SHS</td>
<td>highest among most deprived (total no. of trips; ave. length of trips + trips as a % of total trips)</td>
<td>lowest among most deprived cycling trips as a proportion of total trips is declining in the most deprived areas and increasing in the least deprived</td>
</tr>
<tr>
<td>SCSP</td>
<td>highest among most deprived (frequency)</td>
<td>lowest among most deprived</td>
</tr>
<tr>
<td>ScRS</td>
<td>highest among most deprived for travel to leisure destinations</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*AB Managerial and Professional; C1 Supervisory and Clerical, C2 Skilled Manual, DE Unskilled Manual and Unemployed

For walking, it can be concluded that:
- walking as a way of getting around is highest where deprivation is highest. This is the case in terms of walking frequency, distance travelled and time taken, particularly for work, shopping and trips to leisure destinations
- even for those who have access to a car, there is still a tendency for walking to be higher in areas with higher deprivation. However, for those without a car, there is no longer a significant difference
- there is also a tendency for those with a disability to still walk more in areas with higher deprivation, although the results are not as conclusive
- across deprivation levels, higher education is associated with more walking and has an effect independent of employment status
- walking for recreation is highest where deprivation is highest when time is spent outdoors. However, because outdoor recreation trips are undertaken less frequently overall, walking for recreation may be lower in absolute terms
- whilst walking is declining in all deprivation quintiles in Scotland, the rate of decline is greatest in the most deprived areas. However, walking to get to and from leisure destinations (such as leisure/sport centres, parks, cinemas) is declining at the slowest rate.

For cycling it can be concluded that:

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1 There are 6505 datazones across Scotland and these can be ranked from the most (1) to the least deprived (6505). From these 6505 datazones, five equal groupings can be created to form a spectrum from the most deprived (0-20%) to the least deprived (80-100%).
• cycling for getting around and for recreation is highest where deprivation is lowest
• across deprivation levels, higher education is associated with more cycling and has an effect independent of employment status
• it seems as though cycling trips as a proportion of total trips is declining in the most deprived areas but the opposite is true in the least deprived, particularly for trips to get to and from leisure destinations.

The contribution of walking and cycling to daily physical activity
The majority of people living in Scotland do not meet recommended physical activity levels, particularly those living in deprived areas. On average, 46% of men and 39% of women in the least deprived areas meet the recommended target, this falls to 35% and 28% in the most deprived areas.

With respect to the contribution of walking and cycling to levels of physical activity, walking is an important contributor across all social groups, but less so in the more deprived areas compared to sport and home-based activities. On the basis of current activity levels, cycling makes a negligible contribution overall, but a potentially large impact for the minority who do undertake it on a regular basis.

On the other hand, children in the most deprived areas tend to be slightly more physically active with respect to walking and active play (girls) and sport (boys).

The determinants of walking in different social groups
The figures outlined above show a strong relationship between socio-economic status and walking and cycling activity. Realising there is a link does not, however, help us to understand why it should exist and the factors leading to the different behaviour patterns. The datasets needed examining in more detail to understand the extent to which the underlying factors which are associated with higher deprivation such as unemployment, low car ownership or poor neighbourhood perceptions have a role to play in influencing walking and cycling.

The data analysis revealed that the factors which influence walking are different for different levels of income or deprivation. The things influencing walking in deprived areas (such as disability and work status) make less difference in the least deprived areas. For instance:
• in the most deprived areas, young men walk more frequently than women, as do those with children at home and those not in work - yet none of these factors, including work status, make a difference in the least deprived areas
• for those who have access to a car, there is still a tendency for walking to be higher in areas with higher deprivation but for those without a car, there is no longer a significant difference between deprivation levels.

Similarly, those who are healthy are likely to walk more, but only in areas of high deprivation. However, of particular relevance to the NHS and NPARE, people who live in deprived areas perceive fewer health benefits from cycling.
and walking than people in less deprived areas. Nevertheless, regardless of which social group they belong to, the more someone walks already, the more they believe they should walk more and those with the poorest health have the least compulsion to walk more for fitness.

Settlement type is a strong determinant of walking, even once deprivation is controlled for. Walking is highest in small remote towns, consistently low in remote rural areas and lowest of all in the least deprived neighbourhoods of accessible rural areas. However, if we only look at large urban areas, we can see the influence that location-specific factors have over and above levels of deprivation. Residents in the most deprived neighbourhoods in Glasgow and Edinburgh walk less frequently than their counterparts in Aberdeen and Dundee. We can speculate whether this might be due to public transport being a more popular option in the former cities instead of walking.

Perceptions of the walking environment deteriorate as deprivation increases. Nevertheless, within each deprivation quintile, individuals who have the most positive opinion of walking facilities in their area, particularly low crime levels during the daytime and pedestrian safety, walk the most. Respondents in both the highest and the lowest deprivation categories are more likely than the middle ranking areas to perceive their neighbourhood as congested but this only impacts on walking levels in the more deprived areas where perhaps public transport may be used instead.

Although less of a factor in the most deprived groups, those who say the environment is important to them are more likely to walk in all social groups.

For children, at the area level, the degree of deprivation does not seem to be related to the extent to which children in Scotland walk to school: 55% of the children in the most and least deprived areas walked to school. We can only speculate that factors other than area-level deprivation are important for determining the frequency with which children walk to school, such as the distance between home and school, or the lack of alternative modes of transport, potentially even the existence of a travel plan and Safe Routes to School. However, data quality on children’s journey to school is either too poor (e.g. sample sizes for children’s travel in the Scottish Household Survey) or has not been collected alongside individual socio-economic (e.g. school ‘hands-up’ surveys) or has not been collected alongside other contextual information such as public transport provision (e.g. ‘Hands-up’ data or SHS) to investigate these determinants in any detail.

**The determinants of cycling in different social groups**

With respect to cycling, any differences between socio-economic group is dependent on settlement type - average numbers of daily cycling trips are indeed highest in the least deprived areas of large and medium towns but also in the most deprived neighbourhoods in small accessible towns, though shorter distances are travelled here. In the least deprived groups, cycling activity is more evenly spread across demographic characteristics. In the most deprived groups, cycling is more frequent among younger people, particularly males. In the medium deprived groups only, cycling is more frequent in households with children.
Overall, cycling is most frequent in households with a car regardless of deprivation level. This is the opposite to walking. Cycling plays an important role in the journey to work regardless of deprivation level. However, it may also be an important mode for students and those out of work, particularly in less deprived groups.

In deprived areas, the perceived level of traffic was found to hinder cycling uptake, but community spirit was a positive influence, unlike for their more affluent counterparts. Perceptions of whether cycling is safe are most negative in the most deprived areas, but there are fewer differences between areas as to whether cycle facilities are perceived to be adequate.

Those who cycle most frequently are most likely to agree that the environment is important to them as a person, though the association is weaker in deprived areas.

**What does this mean for the role of walking and cycling in physical activity?**

Given the findings above, this study highlights a number of reasons why we should continue to invest in walking and cycling interventions as a means of reducing inactivity and health inequalities in low income groups and in deprived neighbourhoods.

With respect to walking, there is a tendency for those who already walk more frequently than average to believe they should walk more for fitness. In addition, there are extremely low and declining numbers of cyclists in the most deprived areas and apparent cultural barriers towards this mode. However, the relative disengagement with the health benefits of active travel amongst those who would benefit the most, and their rapid decline in the most deprived areas, does not mean there is no basis for promoting walking as a way of reducing health inequalities for the following reasons:

*The lack of evidence can be attributed to a lack of targeted interventions aimed at motivating the most deprived groups* - any lack of evidence on the potential for walking and cycling interventions to reduce physical inactivity among low income groups or in deprived areas could be attributable to the fact that such interventions are rarely targeted towards these groups, rather than any suggestion that they are not successful when they are. To the contrary, the most recent evidence from the Cycling Demonstration Towns (CDT) and the Sustainable Travel Towns in England suggests a town-wide approach can increase cycling levels *in all social groups* and even lead to the *greatest* reduction in levels of inactivity among those in the lowest social grades (Sloman et al., 2009; Cavill, 2009). Such interventions have applied key ingredients such as galvanising community support through inclusive, town-wide branding exercises, consumer surveys and media campaigns, investment in infrastructure improvements and a gradual cultural shift.

*Interventions can be successful regardless of the target group, so long as targeting takes place* - this study revealed engagement with the health benefits of walking for those who are currently inactive to be very similar
regardless of the level of deprivation. This shows that relatively speaking, there is better engagement with health in more affluent areas but that the segments who most need to become active are hard to reach regardless of deprivation.

Although town-wide interventions appear to have had some success, it is clear from the literature that targeted interventions are best placed to deliver improvements in active travel behaviour. Although the most motivated groups are likely to respond to interventions, the evidence presented in the literature also suggests that interventions can be successful regardless of the target group, so long as targeting takes place.

Higher levels of walking and cycling are clustered within different subgroups of the population in different levels of deprivation. In areas of highest deprivation, the people who walk the most are young men, those not at work and those with children at home. This is all important information to inform targeted interventions.

**Locational and individual factors can have a stronger impact than deprivation** - there are certain individual, social and structural factors which are stronger determinants of walking and cycling behaviour than deprivation *per se*. For instance, there is strong evidence from within the SHS and SCSP datasets and elsewhere that where, on an individual basis, people think most positively about walking and cycling, they are most likely to undertake these activities. This suggests that, within any given deprivation level, it is still worth improving the environment and the infrastructure in order to foster more positive opinions about these modes.

We also saw that, compared to area level deprivation, perceptions of travel time and the compulsion to get fit are stronger determinants of walking. Perceptions of health and perceived safety are stronger determinants of cycling. This suggests that there are factors at the individual level which are worth influencing which have the potential to mitigate any underlying barriers related to socio-economic status at the area level.

Likewise, by controlling for deprivation across different cities in Scotland, we saw there was no longer a consistent pattern between deprivation and walking and cycling levels. There is strong evidence that factors at the local level - likely to be a combination of the quality of the built environment and infrastructure, accessibility and cultural factors - are worth influencing in order to increase levels of walking and cycling even in the most deprived neighbourhoods.

**There are potential big wins in the area of recreation travel** - walking is a popular activity for recreational trips across all social groups. The evidence whether walking for recreation is undertaken more or less frequently in the most deprived groups is currently mixed. It is clear that around a third of those in the lowest social grades DE$^2$ do not participate at all in outdoor activities.

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$^2$ AB Managerial and Professional; C1 Supervisory and Clerical, C2 Skilled Manual, DE Unskilled Manual and Unemployed.
Little is known about this group, but given the lack of stigma attached to walking in general among this group, there is great potential to target inactivity through recreation. This ties in with the Scottish Natural Heritage’s current focus on increasing the number of new participants to the outdoors (SNH, undated).

**Walking is a particularly important contributor to physical activity among girls in deprived areas and working with children could be the key to future success** - children in the most deprived areas tend to be slightly more physically active and especially for girls, walking plays an important role in levels of physical activity. Nurturing this activity at a young age could be a key ingredient in future activity levels.

**Interventions are necessary to at least stem the decline in walking in deprived areas** - given that walking and cycling frequencies are declining at the fastest rate in the most deprived areas, there is an argument to suggest that investment is needed to at least maintain current levels of activity.

**Efforts should not be confined to improving walking and cycling infrastructure but also to discourage car use** - walking frequencies are reducing the fastest in the same areas that car ownership is increasing the fastest. Nevertheless, even when cars are owned, people walk more in the more deprived areas than their less deprived counterparts. This suggests that factors such as affordability and accessibility dampen car use in these areas. It follows that further measures to increase the cost or reduce the accessibility of car use would stem the decline in walking. In addition, the analysis revealed that for car owners in particular, there is a greater tendency for cycling to be used in order to overcome difficulties in using the car such as parking or congestion constraints. This also suggests that measures to discourage car use could be an important ingredient to encourage cycle use.

From the above recommendations and the data analysis undertaken for this study, it can be concluded that the following would be important in the most deprived areas:

- **Individual factors**: interventions which alter perceptions of the relative travel time, safety and health benefits of walking and cycling; promotions targeted at those out of work and the most inactive groups
- **Social factors**: promotional campaigns based on local research into specific attitudes and barriers and which aim to get the community on board
- **Structural and environmental factors**: investment in good quality and safe infrastructure including traffic calming and interventions to ‘reclaim the streets’ in order to encourage active travel especially by children; planning which supports equal access by disadvantaged groups to jobs and essential services by identifying local accessibility problems and solutions.
Suggestions for further action

Understanding the ‘why’ in addition to the ‘what’ – it is necessary to identify the specific barriers and motivations to walking or cycling (affordability, social norms, cycling cultures) for the target groups and design tailored pilot programmes to apply this knowledge before scaling up.

Road safety – there is a lack of information on the relationship between people’s perceptions of safety of walking and cycling, objective measures of safety and actual walking and cycling behaviour. This needs to be examined in a Scottish context and differences between socio-economic groups and settlement types understood.

Neighbourhood characteristics - more needs to be understood about the neighbourhood factors which have any influence on walking and cycling and the interplay between the perceptions people have about their neighbourhood (e.g. in relation to congestion) and the reality. This includes measures of accessibility whereby the objective measures (such as the time it takes to walk to nearest GP or primary schools) needs to be compared with subjective measures (such as people’s perceptions of travel time by these modes). This would involve the collection of detailed individual travel data and perceptions of the neighbourhood and travel times to be correlated with objectively defined measurements using Geographic Information Systems (GIS). It may be that objective measures of the built environment have stronger associations with walking and cycling than subjective measures and should help to unpick why, when deprivation is controlled for, levels of cycling and walking can be very different in similar types of settlement.

Recreation - there is a specific lack of evidence on cycling and walking undertaken as activities for their own sakes. The dedicated ‘travel’ surveys (SHS, SCSP) generally do not distinguish well between travelling to get around or for recreation and have difficulties in documenting very short trips. The dedicated recreation survey (ScRS) places much emphasis on the respondent’s previous visit to the outdoors, which has the potential to miss many casual activities and makes it difficult to measure total activity. There is the potential to improve question wording on both the SHS and the ScRS to rectify this gap in the evidence.

Children - it is unclear how much of walking is discretionary leisure time walking versus visits to shops or to school. This lack of detail means that it is difficult to understand what the net impact on physical activity levels might be if such walking activity were to be reduced. It would also be useful to understand the age at which children become independent travellers (i.e. tend to go out alone) and how this might vary across socio-economic groups, genders and settlement types. With respect to the journey to school, there are unanswered questions about why walking does not vary at the aggregate level between the most and the least deprived areas, but there is considerable variation between schools in the same local authority areas. This could be usefully addressed through a combination of Sustrans data which records the journey to school and objective measurements of the structural, institutional and environmental factors at each school.
Monitoring - particular emphasis needs to be placed on adopting appropriate methods to collect data. Quantitative and qualitative surveys need to be designed to collect data across a broad enough range of socio-economic cohorts to allow sub-group analysis in addition to before and after studies with control groups. Finally, it is necessary to understand the longer term effects of interventions and the degree to which any behaviour change is sustained over the longer term.
1. Introduction

This is a study commissioned by NHS Health Scotland in conjunction with the National Physical Activity Research and Evaluation Group (NPARE) in order to examine the level of participation in walking and cycling for active travel and sport or recreation across different socio-economic groups in Scotland. This research utilises data from surveys already collected, together with published and grey literature, to undertake a comprehensive analysis of who is walking and cycling in Scotland, how often, for what purpose and in which locations.

1.1 Background

It is widely recognised that an increase in transport related physical activity in the form of walking and cycling for travel or recreation could significantly promote improved personal health, reduce traffic congestion, improve the quality of the urban environment, and contribute to a reduction in carbon emissions (Woodcock et al., 2007; Chief Medical Officer, 2004). This is demonstrated by a wide range of policy initiatives by national and local governments, by health authorities and a variety of non-governmental organisations. There is also a wealth of research literature on the health impacts of walking and cycling, on travel choices and on the impacts of environmental interventions to promote sustainable travel. Many of these have been examined in a series of recent systematic reviews and bibliographies (Handy, 2005; NICE, 2006; DfT, 2006; Ogilvie et al., 2004, 2007; Cavill and Davis, 2007).

In addition, it is also widely recognised that socio-economic status is a strong and consistent correlate with physical activity and is a major source of health inequalities (e.g. Scottish Executive, 2005; Inchley et al., 2005; Estabrooks, 2008). However, despite recent attention to walking and cycling in the literature and policy, the relationship between socio-economic status and engagement in these activities for travel or for recreation remains unclear. This means that policies and interventions to promote walking and cycling are being developed without full understanding of their likely impacts across the population which may lead to unintended effects and limited success.

However, NHS Health Scotland, in conjunction with NPARE, are keen to fill the gap in understanding the different levels of participation in walking and cycling for active travel and sport or recreation across different socio-economic groups in Scotland. The purpose of this study is to make use of the considerable wealth of information contained in existing Scotland-specific and UK-wide datasets, which, hitherto, has been largely confined to aggregated results or the examination of relatively simple, univariate relationships in the data. Indeed, much of the analysis of this data concentrates on identifying and characterising who does walk or cycle, particularly for the journey to work or other ‘utility’ journeys, and provides little insight about those who walk or cycle infrequently, possibly only as a recreational activity, or not at all.

1.2 Aims and objectives

People in more deprived groups in particular tend to experience poorer health than people in less deprived groups, which has been at least partially
attributed to lower participation in physical activities such as walking and cycling levels in deprived areas. However, the relationship between walking and cycling and socio-economic status is unclear, and evidence is sometimes contrary. This is particularly the case when trying to understand the differences between walking and cycling as a mode of transport as opposed to recreational activities and when trying to gain a more sophisticated understanding of any mediating factors, such as the quality of the built environment, which may have an important influence on behaviour independently of socio-economic status.

These gaps in understanding gave rise to the objectives of this study as follows:

- review what is known about levels of walking and cycling undertaken for travel or recreational activity across different socio-demographic groups and different locations in Scotland
- pay particular attention to low income or the most deprived socio-economic groups in the analysis to identify the patterns of behaviour, barriers and motivations of this group
- identify important mediating factors that influence the relationship between socio-economic status and walking and cycling behaviour
- discuss interventions that are aimed at encouraging people to walk and/or cycle more often, with a focus on interventions aimed at encouraging lower socio-economic groups in particular to walk and cycle more often
- identify knowledge gaps in the literature and suggest directions for future research.

1.3 Structure of the review
This research report consists of eight sections. In the next section, the methodology used to conduct the rapid evidence review and secondary data analysis is explained, with commentary on the robustness of the evidence base. The following three sections examine the contribution of cycling and walking to daily physical activity (Section 3), as a way of getting around (Section 4) or for recreational purposes (Section 5). These sections start with a summary of the key findings relating to these sections. In addition, each section contains ‘feature boxes’ in which key information is given about the main datasets being most relied upon in that section of the analysis.

In Section 6, determinants of walking and cycling behaviour, such as individual, social and physical factors are elaborated upon by bringing together the findings of the data analysis and augmenting these findings with key elements of the literature review, and in Section 7, interventions to promote walking and cycling are discussed. These Sections also start with a summary of the key findings. Conclusions, policy recommendations and ideas for further research are presented in Section 8.
2. Methodology

This study was carried out in three phases:

1. a rapid but systematic review of published and unpublished evidence sources most relevant to the Scottish situation
2. a ‘data mapping’ exercise which systematically identified data sets and documented their content and suitability for secondary analysis of walking and cycling for active travel and recreation in Scotland across socio-economic groups
3. secondary analysis on key data sets using descriptive and multivariate analysis as appropriate.

Before outlining these three phases of the research, we start with some key definitions in order to set the boundaries of this study.

2.1 Key issues and definitions

2.1.1 Walking and cycling
In some studies and subsequent policy applications, walking and cycling is united under one common banner, such as ‘active travel’, ‘physical activity’ or ‘non-motorised transport’. However, there are at least two reasons why walking and cycling behaviour should be examined separately.

First, most journeys require a walking component and it is therefore an activity in which almost all of the Scottish population participate to some degree (See Section 4). By contrast, cycling is undertaken by a much smaller proportion of the population. It is clear from this that walking and cycling have different determinants and therefore require distinct analysis in order to understand the potential to influence this behaviour.

Second, cycling and walking in themselves are not homogenous activities. Each can be undertaken either as a discrete mode of travel or in combination with other modes for the purpose of travelling from A to B (often termed ‘utility’ travel) or can comprise part or all of a leisure activity in its own right (often called sport or recreational travel). Whilst each of these motivations for walking or cycling can contribute to the same goals (e.g. reaching a destination or increasing levels of physical activity), the motivations for and barriers to participation are likely to be different in each case and for different sub-groups in the population.

Consequently, literature that referred to walking and cycling as a single concept were considered to be of less importance for the evidence review part of this study. In the secondary analysis and interpretation, we have examined walking and cycling separately but have drawn common conclusions where appropriate.

2.1.2 Socio-economic status
Socio-economic status is a complex concept which is meant to capture a person’s relative position in a hierarchy such as social class based on ‘their capacity to create or consume goods that are valued in our society’ (Miech &
As such, it can be measured in a number of ways on an individual or an area-level basis.

The most common proxy’s of socio-economic status on an individual level are:

- income (individual and household, sometimes relating to the ‘chief household earner’)
- socio-economic classification (NS SEC). This is a classification of social position that was introduced in the 2001 Census and has been subsequently revised. People are assigned to a category based on the current or former occupation of the household reference person
- social grade is the socio-economic classification used by the market research and the marketing industries. It is not possible to allocate social grade precisely from the NS SEC Census classifications, but it is a good approximation. Output is for a household reference person based on occupation and resulting in grades AB Managerial and Professional; C1 Supervisory and Clerical, C2 Skilled Manual, DE Unskilled Manual and Unemployed. See Technical Annex, Appendix E for a breakdown of these categories
- employment status
- educational attainment.

And on a spatial/area level:

- the Scottish Index of Multiple Deprivation (SIMD) is the Scottish Government’s official measure of area based multiple deprivation. The 2009 indices encapsulate 37 different indicators in seven domains including income, employment, health, education, skills and training, accessibility and crime. In combination or individually, these indices provide a *relative* measure of deprivation for each data zone (Scottish Government, 2009c)
- median level household income (e.g. from Census output areas).

In the secondary analysis undertaken for this study, the area level measure of deprivation (SIMD) was used most frequently as a proxy for socio-economic status (usually by contrasting the most deprived quintile and the least deprived quintile). Consequently, the term ‘most deprived’ and ‘higher deprivation’ is used to refer to people living in areas belonging to the most deprived ‘quintile’. We talk about the ‘least deprived’, ‘lowest deprivation’ or ‘more affluent’ as those in the least deprived ‘quintile’.

There are two main reasons for concentrating on SIMD. Firstly, without exception, each data set examined had achieved high levels of non response on the income variable ranging from 40 – 70% missing data. Secondly, where income data is available, measurement is not standardised with variation in whether this is provided at individual or household level, as well as differences in the time period it applies to (weekly, monthly, yearly) or whether it is net or gross. This contributes to the uncertainty in using this metric.

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3 There are 6505 datazones across Scotland and these can be ranked from the most (1) to the least deprived (6505). From these 6505 datazones, five equal groupings can be created to form a spectrum from the most deprived (0-20%) to the least deprived (80-100%).
Nevertheless, the reliance on SIMD has some disadvantages. Firstly, it is not a one dimensional variable and its composite nature can mean that some important differences in area level characteristics such as accessibility or crime levels can be ‘smoothed’ out and undetected in the analysis. It was beyond the scope of this study to look at the various SIMD indices separately. Secondly, SIMD measures area deprivation and not affluence and so all that can be said about the higher ranking areas is that they are not deprived. Whilst there is a very strong relationship between area-level and individual level indicators, especially income, not all deprived people live in deprived areas and not everyone living in a deprived area is deprived. Consequently, it is still important to use individual level measures where possible in order to understand the relationship between walking and cycling and socio-economic status within deprived or non-deprived neighbourhoods. To do this, we have examined income, education and work status where these add something to our understanding.

2.2 Rapid Evidence Review

2.2.1 Searching, scoping and screening of literature

The search for relevant literature started with identifying relevant search terms. All search terms were related to walking, cycling and socio-economic status, and were used with and without the search term ‘Scotland’ (see Table 2.1). These were used to search five databases, namely, MetaLib, psycINFO, ScienceDirect, Google Scholar and NHS Scotland e-library. Studies could be qualitative, quantitative, theoretical or review articles. They could also be peer reviewed academic sources as well as published or unpublished reports. To find ‘grey’ literature, the archives of the research team were searched in addition to websites of relevant Scottish organisations using the same search terms. These organisations were: The Scottish Government, Transport Scotland, Sustrans, Living Streets, Cycling Scotland, NHS Health Scotland, Scottish Natural Heritage, Glasgow Centre for Population Health, Scottish Physical Activity Research Collaboration (SPARColl), Cycling England and The Department for Transport.

One of the aims of the rapid evidence review was to provide input for the secondary data-analyses. Parallel to the literature search, relevant datasets were identified. All existing reports based on these datasets were also specifically collated for the literature review.
2.2.2 Synthesizing the evidence and creating a Proforma

Almost 100 relevant articles were identified from an international research literature many times that size. The identification of titles on this long list was undertaken in the first instance by one member of the team to ensure both consistency in the selection criteria but also to maintain an overview of coverage including duplicates and data gaps. The former was a particular issue as there was a tendency for many of the sources to be based on the same core data-sets such as the Scottish Health Survey and the Scottish Household Survey.

The selection of the final list involved three members of the study team. The titles and abstracts of all papers and reports were used to make the selection using the following selection criteria:

- walking and/or cycling behaviour for adults and children in Scotland was studied or reviewed
- walking and/ or cycling as a way of getting around and/or for the purposes of sport or recreation in Scotland was studied or reviewed
- socio-economic status was studied in relation to walking and/or cycling
- an evaluation of an intervention related to walking and/or cycling behaviour was studied or reviewed.

The lack of evidence on socio-economic status in relation to walking and cycling both within and outside of Scotland meant that papers in which one or more of the proxy’s for socio-economic status mentioned above were measured alongside walking and cycling were given highest priority in the literature review.

From this process, 26 papers and reports were identified as having a high priority. These were read in detail by one member of the team, producing a summary of content and a common set of descriptive data using a proforma. These 26 references resulted in 22 proformas as studies based on the same survey data were amalgamated.

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4 These 26 references resulted in 22 proformas as studies based on the same survey data were amalgamated.
Particular attention was paid to the methodology used and the quality of the evidence reported in each piece of literature in order that conclusions could be drawn as to the quality of the evidence base. These conclusions are reported in Section 2.5 below.

The sources used are included in the reference list to this report and a separate list also and all the proformas are included as Appendix A of the Technical Annex. The results of the literature review are reported alongside the secondary analysis in each of the appropriate Sections of the report in order to give a balanced account of the evidence base.

2.3 Data mapping and evaluation
This stage was about scoping, collating and assessing the data sets that contain information on walking and cycling in Scotland. A Data Inventory was developed which records the key information from each data set in relation to sample size, methodology and coverage and evaluates this content in relation to the study objectives. Tables 2.2 and 2.3 summarise this inventory and includes a synopsis of the reasons for using or rejecting each data set in the subsequent secondary analysis. We note that there are some data sources due to become available in the near future which could usefully be analysed further.
Table 2.2 Overview of data sets used in the analysis

<table>
<thead>
<tr>
<th>Data set</th>
<th>Year(s)</th>
<th>Sample</th>
<th>Survey Type</th>
<th>Coverage</th>
<th>Social Status</th>
<th>Strengths and Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scottish Household Survey (SHS)</td>
<td>From 1999</td>
<td>~15,000 p.a.</td>
<td>Multi-stage stratified clustered random probability</td>
<td>One adult in household (aged 16+) + one schoolchild</td>
<td>Face to face (CAPI) + 1 day travel diary</td>
<td>Scotland • general interview: modes normally used for each journey purpose; frequency in past 7 days • travel diary: day before the interview • SIMD • income • education • work status • comprehensive coverage of travel patterns • some attitudinal data • very short walks excluded before 2007 • 1 day travel diary only</td>
</tr>
<tr>
<td>Scottish Health Survey (SHeS)</td>
<td>1995, 1998, 2003, 2008</td>
<td>~6000-20000 adults + ~2000 children p.a.</td>
<td>Multi-stage stratified clustered random probability</td>
<td>From 2003: all adults in household (aged 16+) and up to 2 children (+ child boost)</td>
<td>Face to face (CAPI)</td>
<td>Scotland • sports and exercise, DIY/ gardening/ housework, walking • cycling included in sports • how often, how long and intensity (over 15 minutes in 2003 and 10 minutes in 2008) • separate question on walks over 5 minute duration • children activities included • SIMD • income • NS-SEC • in time for this study, only 2003 data was available (not 2008) • lower response rate in 2003 (60%) • cycling treated as a sport activity • adult weighting factor used • very low response rate on income (9%)</td>
</tr>
<tr>
<td>Smarter Choices, Smarter Places (SCSP)</td>
<td>2009</td>
<td>~12,500</td>
<td>Random probability</td>
<td>One adult in household (aged 16+)</td>
<td>Self-completion</td>
<td>10 locations in Scotland • walking and cycling frequency, physical activity, attitudes • SIMD • income • education • work status • large sample • comprehensive coverage of attitudes • 1 day 1 person travel diary only with much missing data • sample not Scotland wide • weighting scheme possibly not adequate to compensate for non-response • household survey does not include information on journey purpose</td>
</tr>
<tr>
<td>Scottish Recreation Survey (ScRS)</td>
<td>From 2003</td>
<td>~12,000 p.a.</td>
<td>Quota (based on sex, age, working status and work status)</td>
<td>One adult in household</td>
<td>Face to face (CAPI)</td>
<td>Scotland • participation in walking and other open air activity • main mode of transport used on last visit • social Grade (AB, C1, C2, DE) • large sample over many years • comprehensive coverage of recreational activity • emphasis on last trip may misrepresent both infrequent and frequent behaviour • quota sample • basic measurement of walking/cycling • grades A/B and D/E have been merged</td>
</tr>
<tr>
<td>National Travel Survey (NTS)</td>
<td>From 2002</td>
<td>~16,000 p.a. (10% Scotland)</td>
<td>Stratified two-stage random probability</td>
<td>All adults in household</td>
<td>Face to face (CAPI) + 7 day travel dairy</td>
<td>UK (except Scottish Isles and Isles of Scilly) • detailed coverage of seven days-worth of trips • SIMD • income • education • work status • very comprehensive coverage of travel • 7 day travel diary (+ young respondents diaries) • very short walks excluded • small Scottish sample</td>
</tr>
</tbody>
</table>
## Table 2.3 Overview of data sets not used in the analysis*

<table>
<thead>
<tr>
<th>Data set</th>
<th>Year(s)</th>
<th>Sample</th>
<th>Survey Type</th>
<th>Coverage</th>
<th>Strengths and Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Education Population Survey (HEPS)</td>
<td>1996-2007</td>
<td>~1800 p.a. Adults aged 16-74 in private households</td>
<td>Face to face (CAPI)</td>
<td>Scotland</td>
<td>income, Depcat, social grade, education, work status</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>question format does not allow adequate discrimination or interpretation (e.g. ‘In the past year how frequently have you walked/cycled instead of taking the car’ – always, sometimes, never, don’t know). There are many flaws in the question: it is unlikely to detect variation in behaviour; very few people can answer ‘always’; it seems to only apply to those who own a car; we are not only interested in walking or cycling when it substitutes for car travel.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>small sample size</td>
</tr>
<tr>
<td>Scottish Environmental Attitudes and Behaviours Survey (SEABS)</td>
<td>2008</td>
<td>3,054 Quota (based on sex, age, working status, car ownership) Adults (16+)</td>
<td>Face to face (CAPI)</td>
<td>Scotland</td>
<td>income, Social grade, education, work status</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>limited coverage of walking and cycling, no attitudes to walking and cycling, quota sample</td>
</tr>
<tr>
<td>Scottish Social Attitudes (SSA)</td>
<td>From 1999</td>
<td>~1500 Stratified random probability Adults (16+)</td>
<td>Face to face + self completion supplement</td>
<td>Scotland</td>
<td>SIMD, income, education, work status</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>new module in 2009 on sustainable places with some relevance to walking and cycling environment (not available in time for this study)</td>
</tr>
<tr>
<td>Sustrans Hands Up</td>
<td>From 2008</td>
<td>~1800 schools (400,000 children) All local authorities, all schools Primary and secondary school pupils Hands up survey</td>
<td>Scotland</td>
<td></td>
<td>very crude measurement of travel, no social status information, postcodes not included in the file (although Sustrans could supply these)</td>
</tr>
</tbody>
</table>

* Although new secondary data analysis was not carried out on these data sets, reports relating to them were used in the review of the evidence and cited as appropriate.
2.4 Data analysis
The main effort for the secondary data analysis was applied to the Scottish Household Survey (SHS) (1999/00 - 2005/06), the Scottish Health Survey (SHeS) (2003) and the Scottish Recreation Survey (ScRS) (2003-08). In each case, the most up to date data set was used although more recent data has been published for the SHS and the SHeS since this study began. In parallel, analysis was performed as part of the Smarter Choices Smarter Places (SCSP) baseline study in order to investigate the relationship between walking, cycling and socio-economic status to inform the design of this programme. This was published as Anable (2010) and the results are interwoven into this report as appropriate.

In the first instance, the official reports underpinning each survey were reviewed and any pre-existing analysis on walking, cycling and economic status was distilled in a proforma. An analysis plan was then drafted to plot how the remaining questions might be answered using each data set. Statistical analysis was then performed using the following approach.

Firstly, in each data set (SHS, SHeS, SCSP, ScRS), we started by undertaking a descriptive analysis of current walking and cycling patterns in Scotland according to demographic, socio-economic and geographical indices using cross-tabulations and bivariate statistics to test for significant associations between variables. Where possible, trend analysis was undertaken (specifically from the SHS dataset going back to 1999).

Secondly, the mediating effects of socio-economic status on walking and cycling activity were examined across sub-populations to understand whether the relationship with socio-economic status is indeed different in different groups. For instance, income may have a strong association with walking and cycling behaviour in younger age groups, but have less of an impact as age increases; or the associations may be stronger or weaker in different locations across Scotland. In both cases, tests of independence were applied to understand whether any differences between the observed frequencies (e.g. frequency of walking for a number of people in a specific socio-demographic group) and the expected frequencies based on probability calculations are statistically significant. For most cross-tabulations the test statistic is the Chi square ($X^2$) and to test differences in the mean scores of two or more groups on one or more variables, the Analysis of Variance (ANOVA) was used.

Thirdly, to understand in more detail the propensity of an individual to choose a certain mode and how this has changed over time for different sub-groups, descriptive analysis as well as binary logit modelling was applied to the Scottish Household Survey (SHS). This identified which factors tend to increase the propensity of an individual to cycle and walk and which factors act as a barrier to behaviour. Given that the SHS has information on utility cycling and recreation walking and cycling, the findings from this analysis are reported in each Section as appropriate. More detailed tabulations arising from this analysis are included as Appendix C in the Technical Annex.

Finally, on the basis of the preceding analysis, regression analysis was used to explore the relationship between a wide range of factors identified as being associated
with walking and cycling frequency (Section 6). Stepwise models were used for car owning and non-car owners separately. The relative contribution that socio-economic status makes to explaining walking and cycling behaviour vis a vis other factors is presented.

Due to the wide range of variables available, including attitudinal data, the regression analysis was carried out for the Smarter Choices, Smarter Places (SCSP) dataset (first reported in Anable, 2010). The SCSP survey had collected the travel mode ‘frequency’ variables in a way that usefully distinguished across the population. Instead of asking whether walking and cycling had been undertaken at least once in the past week/month or year (as is for example the case in the SHeS), restricting this to the past seven days (as with the SHS) or avoiding the measurement of short walking journeys (as is the case in the SHS), the SCSP was able to capture a wide variation in behaviour by asking for frequency of use over the past 12 months on a six point scale (5 or more days a week, 2-4 times a week, about once a week, less than once a week but at least once a month, less often than once a month, never). In addition, specific attitudes to the walking and cycling environment, perceived safety and health benefits had been included in the survey and these were all relevant to the topic being studied. However, it should be noted that this data was collected from 10 locations in Scotland and does not represent a random sample of the whole of the Scottish population. The weighting scheme undertaken on this dataset is also under review to potentially better account for non-response. Nevertheless, it is a large dataset covering a wide variety of respondent characteristics so as to allow robust analysis of associations within the data. More detail is provided in Appendix B of the Technical Annex.

All statistical analysis was undertaken using SPSS Version 17.0.

As with the literature review, the results of these various analyses from each dataset are not reported separately but instead are used to investigate the issue pertinent to each Section in the report as appropriate.

2.5 Robustness of the evidence base
The two strands of data synthesis in this study (the evidence review and the secondary data analysis) have identified some important gaps in the evidence base due to either an almost complete lack of coverage of certain aspects of this topic, or due to poor quality of the underlying methodology or data sources. The main observations on the robustness of the evidence base with respect to the available data can be summarised as follows:

2.5.1 Poor measurement of socio-economic status
- income is an unreliable indicator due to: non response (at least 30% missing data on all datasets); inconsistent measurement (individual versus household; highest income householder; gross versus net; monthly versus weekly); social response bias (some respondents may purposely overstate or understate their income); inaccuracy (information is provided ‘off the top of the head’)
- social grade based on current or previous occupation is a complex measure and is not available in all data sets
• education is consistently available but there can be inconsistencies in measurement and it does not map exactly on to income or deprivation
• SIMD is more consistently available but is an area level index with its own simplifications and does not help determine relationships at the individual or household level (see Section 2.1.2 above).

2.5.2 The measurement of walking and cycling
• inconsistency in measurement between surveys: depending on how ‘fine grained’ the measurement of travel activity is, very different modelling results can be achieved. In general, where respondents are able to give a detailed picture of their frequency of use of a certain mode and also in terms of distance and time and by journey purpose, the more variation will exist between respondents and the more robust the relationships with explanatory variables will be
• inconsistency in measurement on the same surveys over time: e.g. the SHeS has changed its measurement of physical activity (from bouts of 15 minutes to bouts of 10 minutes); the SHS has changed its definition of short walking journeys (until 2007, only those over ¼ mile or over 5 minutes were measured)
• short trips are very poorly measured on surveys. Even where they are measured, it is likely that respondents under-record these journeys
• there is a lack of objective walking and cycling data (from ‘traffic counters’) to help us understand the number of people walking and cycling on local streets and footpaths.

2.5.3 The measurement of recreational journeys
• ‘leisure’ or ‘recreation’ journeys or walking and cycling ‘for their own sake’ are often mixed together with journeys to and from a leisure destination. We make the distinction in this report between ‘recreational’ travel and travel ‘to get to and from’ a destination.

2.5.4 Response rates, sample sizes
• large sample sizes (e.g. SHeS, SHS and SCSP) generates precise estimates but low response rates are a risk to the representativeness, especially of more recent surveys (e.g. SHeS)
• small response rates for cycling means that sub-group analysis can be unreliable
• small (or no) response rates for children
• although difficult to prove, there is likely to be low response rates and underrepresentation by those who are least engaged in the variables of interest (such as those with self reported poor health or a lack of motivation to walk for fitness).

2.5.5 Objective measures of accessibility, transport infrastructure and the built environment
• SCSP and SHS have good information on perceived built environment quality and accessibility. However, these are still perceived measurements. The use of more objective measurement of built environment quality and accessibility,
including local transport infrastructure, would enable us to understand the interaction between individual travel behaviours with their environment. This would include GIS data defined objective measures of access to destinations to see whether measures of access are associated with walking used as a way of getting around.

The main observations on the robustness of the evidence base with respect to studies of walking and cycling and socio-economic status in the literature can be summarised as follows:

- there has been a lack of attention paid to the relationship between walking, cycling and socio-economic status, with emphasis on aggregate analysis or demographic (not-socio-economic) disaggregation
- there is a lack of qualitative data to understand motivations and ‘why’ travel patterns are as they are, as opposed to the information on ‘what’ is taking place which is generally captured in travel surveys
- walking and cycling is often treated together as ‘active travel’
- evaluation of interventions is somewhat skewed in favour of case studies that seem easier to evaluate, often studied in small, convenience, or volunteer samples without a control
- there are very few ‘before and after’ studies and information on the longer term impacts of interventions
- there is a reliance on ‘grey’ literature and a lack of peer reviewed academic studies
- there are areas which are almost completely absent from the literature. These include:
  - studies of perceptions of walking and travel times, infrastructure and the built environment versus objective measures of these factors
  - the relationship between the provision of greenspace and walking and cycling in deprived areas
  - issues around perceived and actual affordability of travel modes and the role that walking and cycling could play in addressing this issue.

Recommendations for further research based on these limitations will be outlined in Section 8.

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5 Although it should be noted that our search strategy did not include specific terms relating to greenspace and a dedicated search should be carried out to investigate this further
3. The contribution of walking and cycling to physical activity

**Summary of key findings**

**Adult walking levels**
- the majority of people living in Scotland do not meet recommended physical activity levels, particularly those living in deprived areas
- on average, 46% of men and 39% of women in the least deprived areas meet the recommended target, this falls to 35% and 28% in the most deprived areas
- the SHeS survey finds the frequency and time spent walking reduces as deprivation increases. This contradicts findings from the SHS and SCSP surveys (reported in Section 4)
- physical effort at work cannot explain the lower rates of walking in the most deprived areas
- housework is the greatest contributor to physical activity levels in the most deprived areas, whereas walking and sport are most important in the least deprived areas.

**Adult cycling levels**
- the SHeS finds no difference in cycling levels across deprivation levels or social grade. This contradicts findings from the SHS and SCSP surveys (reported in Section 4)
- there is some evidence that for the small minority who cycle this makes an important contribution to their activity levels.

**Children**
- children in the most deprived areas tend to be slightly more physically active with respect to walking and active play (including cycling) (girls) and sport (boys).

**The influence of disability and health motivations on walking and cycling**
- individuals from the most deprived areas with a physical disability or illness walk and cycle the same amount as their counterparts in more affluent areas according to the SHS, but are found to walk more according to the SCSP and less according to the SHeS
- in general, the more someone walks already, the more they believe they should walk more
- people who live in deprived areas perceive fewer benefits from cycling and walking than people in less deprived areas but engagement with the health benefits of walking for those who are currently inactive is very similar regardless of deprivation
- those in the lowest income brackets with poor health are significantly less engaged in the health benefits of walking or cycling than their more healthy counterparts, yet in the higher income groups (>£30k) there is no significant difference between healthy/ non healthy groups
- policy interventions would need to specifically target those with poor health in the lower income groups in order to convince them that walking would be beneficial to their health.
3.1 Walking and cycling’s contribution to physical activity among adults

In 2003, the Scottish Physical Activity Task Force set a recommendation that adults should accumulate at least 30 minutes of moderate activity on most days of the week (and this could be accumulated in shorter bouts of at least 10 minutes) (PATF 2003). This strategy set the target of 50% of adults over 16 meeting the recommended levels by the year 2022. The Scottish Health Survey (SHeS) is the main instrument by which progress towards physical activity targets are assessed (see Box 1) and shows that 46% of men and 35% of women met this target in 2008 (Bromley et al., 2009).

The SHeS measures a range of forms of activity including sports and structured exercise but also other forms of daily activity such as walking, cycling and home based activities (housework, gardening, building work and DIY). It also measures the degree of physical effort undertaken at work. The dimensions of activity measured are the time spent being active, the intensity of the activity undertaken and the frequency with which it is carried out.

According to findings from the 2008 SHeS, the extent to which people meet the recommended activity levels is related to deprivation and income (Bromley et al., 2009). With respect to income, 35% of men and 28% of women in the lowest income quintile households met the recommendations compared with 50% of men and 40% of women in the highest income quintile. With respect to deprivation, the age-standardised proportions meeting the recommendations in the most deprived quintile were 35% for men and 28% for women compared with 46% and 39% in the least deprived. Trend analysis has also found that there has been no significant change in the variation in physical activity by deprivation, demonstrating the persistence of health inequalities in physical activity (Catto et al., 2009).

However, this relationship is straightforward for women, whereas for men, the highest activity levels are actually found in the third deprivation quintile (Bromley et al., 2009). This lack of a strong pattern among men was also found in the Smarter Choices, Smarter Places survey (Anable, 2010). In addition, no clear pattern in varying activity levels by socio-economic classification (NS-SEC) was found in the SHeS.

In order to understand these variations and particularly the extent to which walking and cycling contributes to levels of physical activity, it was necessary to carry out our own analysis of the SHeS. This was particularly important for cycling as this is not reported separately in the main reports on the SHeS data, but is instead included under sports activity.

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6 Because of the differences in physical activity between age groups, the SHeS reports figures that account for the different age levels in different SIMD quintiles (‘age standardised figures’).
Box 1. Scottish Health Survey (SHeS)

**Background**

The SHeS provides a detailed picture of the health of the Scottish population. It has been undertaken in 1995, 1998, 2003 and a redesigned (continuous) survey began in 2008 using multi-stage stratified random probability design using first postcodes and then private addresses and face to face interviews using computer assisted personal interviewing (CAPI). Two samples are collected: general population (all adults in households (over 16 yrs) and up to two children) and a child boost. The 2003 data set was the latest data available for analysis for this study although the 2008 dataset was published in February 2010.

The achieved sample is around 6-9,000 adults and 2000 children each year. Its large sample size generates precise estimates, but low response presents a risk to the representativeness of more recent SHeS data. In 2003, the sampling design was altered from one adult per household to all adults per household, contributing to a fairly considerable decline in individual response: 81% in 1995, 76% in 1998, 60% in 2003 and 49% in 2008. Weighting corrects for under-representation in the sample.

**Measurement of variables**

*Physical activities*

In 1995 and 1998 physical activity levels were measured using the Allied Dunbar National Fitness Survey (see Sports Council and HEA, 1992) and, since 2003 were measured as ‘the participation in activities for a minimum duration of 15 minutes’. In 2008, this was changed to 10-14 minutes. Information is collected about:

- home-based activities (housework, gardening, building work and DIY)
- walking
- sports and exercise (broken down into many activities including cycling)
- activity at work.

Questions include how many days in the previous four weeks the activity had been undertaken (if undertaken for more than 15 minutes), the duration and typical intensity of the ‘typical’ activity. For each activity an intensity level (vigorous, moderate, light or inactive) is determined. To illustrate, for walking, participants were asked to assess their usual walking pace. Walks of 10 minutes or more at a ‘brisk’ or ‘fast pace’ were classified as ‘moderate’. Walks at a slow or steady average pace were classified as ‘light’. Additional questions ask about whether someone had undertaken at least one walk (either locally or away from here including country walks, walking to and from work and any other walks) lasting at least 5 minutes in the past 15 weeks (but the total number of days on which this was undertaken was not recorded).

*Socio-economic status*

The National Statistics Socio-Economic Classification (NS-SEC) was introduced in 2003, based on current/ last occupation of respondent and current/ last occupation of householder with highest income. Equivalised household income and SIMD are also reported. In 2003 the response rate for the income variable was extremely low at 9%.

Sources: Bromley et al., 2005a/b/c; Bromley et al., 2009; Dong & Erens, 1997; Shaw et al., 2000

Three things should be noted about the analysis of the SHeS data to follow. Firstly, it is based on the 2003 dataset due to the fact that the 2008 data was not released in time for this study. Secondly, in 2003, the survey only recorded
participation in an activity if at least 15 minutes (not 10 minutes as in 2008) had been spent on it. Thirdly, the SHeS data is weighted using the variable (int-wt) provided in the dataset that aims to correct for differences between responding and non-responding adult household members and cint_wt for children (see Bromley et al., 2005c).

Whether or not the overall frequency of walking is examined or the time spent walking is examined, the SHeS data reveals that walking is lower in the most deprived areas in absolute terms and as a proportion of total physical activity. For instance, 35% of those in the least deprived areas had walked continuously at least once for at least 15 minutes in the last 4 weeks compared to 22% of those in the most deprived areas\(^7\). Those in the least deprived areas spend an average of 2.1 hours per week on walks lasting more than 15 minutes compared to only 1.2 hours in the most deprived areas.

This is an important finding as it contrasts to results from the Scottish Household Survey, Smarter Choices Smarter Places survey and, to some extent, the Scottish Recreation surveys reported in Sections 4 and 5 which all suggest that walking is higher in the most deprived areas. The discrepancy may be due to the emphasis placed in the SHeS on trips of longer duration and of moderate or vigorous activity. However, even if the measurement of participation in walking journeys lasting only more than 5 minutes is used, the same pattern is found: 91% of those in the least deprived had undertaken at least one of these trips compared to 85% in the most deprived. Nevertheless, this is not a measure of total accumulated participation in these short trips (as frequency of these short trips was not measured) and it could be that those who do undertake short walking trips do so more frequently in deprived areas. We will explore this in Section 4.

Figure 3.1 shows the total number of hours spent on all activities on average per capita per week (where at least 15 minutes is spent on an activity) in each SIMD quintile. From this it can be seen that the total number of minutes spent undertaking all physical activity is highest in the middle deprivation quintiles but that the composition of this activity is different, especially in the most deprived areas. Housework is the activity to which the greatest number of hours is devoted in the most deprived areas, whereas walking and sport are the most important in the least deprived areas. Manual work, gardening or DIY was less often part of people’s daily activities in all areas.

Cycling is included here under the heading of ‘sport and exercise’ and is undertaken too infrequently to be able to include as a separate activity on this graph. When cycling was separated out and the total time spent cycling was compared across different deprivation quintiles (or NS SEG or income quintiles) reveals no statistically significant differences.

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\(^7\) Activities on a vigorous or moderate level were reported only.
In the Smarter Choices Smarter Places study (Halden et al., 2010; See also Box 3) self reported levels of physical activity were collected in addition to levels of walking and cycling. There was a clear correlation between those who exercised every day or 5-6 times a week and the average number of days per year spent walking or cycling. In addition, those with a bicycle were much more likely to exercise most days.

One hypothesis as to why people in the most deprived areas are the least active in their leisure time is because they are more active at work. The SHeS measures this by asking people whether they are 'very/ fairly or not very/not at all’ physically active in their job. Analysis shows that those in the most deprived areas are significantly more likely to be more physically active at work (with 76% of those in the most deprived quintile saying they are very or fairly physically active in their job compared to 51% in the least deprived).

Overall, those who are more physically active at work are slightly less likely to say they have walked (for more than 5 or 15 minutes) in the past 4 weeks. However, analysis shows that, overall, those who are most active at work actually spend more time walking (brisk or fast) in an average week suggesting that they spend longer time on the walking trips that they do make. However, when deprivation level is controlled for, the differences between those with different levels of physical effort involved at work largely disappear. In other words, activity at work makes no difference on walking levels within each deprivation level suggesting that there are other factors relating to deprivation which have a more important influence on walking frequency.

The conclusion from the analysis of physical activity in the SHeS data is that walking as a regular activity, but not cycling, makes an important contribution
to meeting recommended activity levels, although it seems to be less important in absolute and relative terms in the most deprived areas. Those in the most deprived areas are less likely to have undertaken at least one walking trip lasting more than 15 minutes and spend less time in total on such journeys. In addition, walking is less important here than housework as a contributor to levels of physical activity.

This conclusion contrasts somewhat to the patterns revealed in the Scottish Household Surveys and the Smarter Choices, Smarter Places survey which have looked at general travel patterns and recreational travel patterns. Here, walking is found to be more frequent in the most deprived areas and this is discussed further in Sections 4 and 5.

3.2 Walking and cycling’s contribution to physical activity among children
The SHeS also collects data on children aged 2-15 years in relation to sports and exercise, active play (including riding a bike), walking (for at least 5 minutes) and housework/gardening (for at least 15 minutes). The Scottish Government’s long-term target is for 80% of children under 17 to meet the recommended target of 60 minutes of moderate intensity activity every day by 2022.

With regard to physical activity taken place outside school hours, the proportion of children meeting the recommendations in 2008 was 72% for boys and 56% for girls. After having risen in the years before 2003, the activity levels for girls has fallen back seven percentage points since 2003 (Scottish Government, 2009f).

In the 2008 data, no clear socio-economic pattern was found in the proportion of children meeting physical activity recommendations even when school based activity is included (Scottish Government, 2009f). The highest proportions meeting the recommendations were found in both the least and most deprived quintiles for both boys and girls although it is notable that the sample sizes for certain sub-groups in the socio-economic analysis are fairly low and therefore care should be taken when drawing any conclusions.

The study team felt it was worth examining the SHeS (2003 dataset) further in order to get a more detailed picture of the types of activities undertaken by children in the different socio economic groups.

Looking only at walking, around 92% of children in all levels of deprivation consistently claim to have walked on at least one 5 minutes journey in the last week. However, if a finer analysis is undertaken to also gauge the frequency of walking trips it appears that there is indeed a difference between levels of deprivation, particularly among girls. The most commonly reported form of regular activity for boys was active play and for girls it was walking, the least common was housework/gardening for both sexes. In terms of time spent, the most time was spent on active play.

Boys’ activity levels were unrelated to household income and degree of area deprivation. The one exception to this is sports and exercise where boys in the
most deprived areas undertake more exercise (Table 3.1). Similarly, a
tendency was found for girls’ activity levels to increase as household income
decreased and as area deprivation increased. This trend can be illustrated by
the frequency with which girls engage in walking and active play on at least 5
days a week (Table 3.1):

- 73% of girls in the most deprived areas engaged in walking five days a
  week, whereas this was only 64% of girls in the least deprived areas
- 68% of girls in the most deprived areas engaged in active play at least
  five days a week, whereas this was 58% of girls in the least deprived
  areas.

Table 3.1 Proportion of children undertaking each type of activity for at
least 15 minutes, 5 or more times per week (%)

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Most deprived 20%</th>
<th>Least deprived 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housework</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Active play</td>
<td>74</td>
<td>71</td>
</tr>
<tr>
<td>Sport</td>
<td>38</td>
<td>24</td>
</tr>
<tr>
<td>Walking</td>
<td>70</td>
<td>69</td>
</tr>
<tr>
<td>Any physical activities</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>Girls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housework</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Active play</td>
<td>68</td>
<td>58</td>
</tr>
<tr>
<td>Sport</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td>Walking</td>
<td>73</td>
<td>64</td>
</tr>
<tr>
<td>Any physical activities</td>
<td>96</td>
<td>94</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bases (weighted)</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>311</td>
<td>279</td>
</tr>
<tr>
<td></td>
<td>308</td>
<td>287</td>
</tr>
</tbody>
</table>

Source: SHeS 2003 (Bromley et al., 2005b, Table 4.9)

With respect to the NS-SEC classification, analysis of the 2003 data concluded
there was no consistent relationship (Bromley et al., 2005b). The lowest
activity levels were observed among boys in small employer or own account
worker households and for girls among professional and managerial
households as well as small employer or own account worker households.

From this, it can be concluded that walking is an important contributor to
children’s physical activity levels across all socio-economic groups but that
children in the more deprived areas tend to be slightly more physically active
with respect to walking and active play (for girls) and sport (for boys).

3.3 Disability and health determinants of walking and cycling
We know from the wider literature that there is a direct relationship between
income and self reported health. The SCSP survey found that only 42% of
those in the lowest income band report themselves as having very good or
excellent health, compared to 83% of those belonging to the highest earning
households (Anable, 2010).
Being physically active is self-evidently more difficult for those with poor health and low fitness levels and can therefore lead to lower levels of walking and cycling. Missing from the literature, however, is the degree to which self-reported health, disability or illness is a psychological barrier to the uptake of walking or cycling. A qualitative study of attitudes towards active travel in and around Glasgow revealed that some regard cycling in particular as ‘difficult to adopt’, with specific reference to the need to have a certain level of physical fitness in order to start (JMP, 2009). This is confirmed in international studies: those who believed themselves to be most physically restricted to move were least likely to be physically active (Cerin & Leslie, 2008; Kloek et al., 2006). Thus, people are likely to end up in a vicious circle: those in poor health conditions and being physically unfit are least likely to walk and cycle but, because they are sedentary, their health and fitness diminishes and subsequently they are even less likely to become physically active.

Our own analysis of the SHS (1999/00-2005/06 datasets), SHeS (2003 dataset) and SCSP (2009 dataset - Anable, 2010) investigated whether socio-economic status can have an independent influence on walking and cycling over and above a long standing illness or disability or individual health perceptions. In other words, do those people with long term illnesses or disability still behave differently depending on the socio-economic group to which they belong? Unfortunately, no clear picture emerges as analysis of each data set gives a different result. Analysis of the 2005/06 SHS (see Box 2) indicates that the effects of deprivation disappear if disability or illness are held constant. Individuals from the most deprived locations (as determined by SIMD quintiles) with a physical disability or long term illness do not behave significantly differently in terms of walking and cycling compared to their counterparts in more wealthy areas. This suggests that the effects of deprivation are less important than physical disability as those with a physical impairment are likely to be equally inactive regardless of their deprivation level.

However, analysis of the SCSP (see Box 3) found that both disability and deprivation have an independent effect on levels of walking (Anable, 2010). Those who suffer from an illness or disability walk less frequently in more affluent areas. For example, 54% of those with an illness/disability in the most deprived areas say they walk at least twice a week compared to only 38% in the least deprived. The explanation is that those with disabilities in the areas with less deprivation use the car twice as much as a driver and three times as much as a passenger instead of walking.

Analysis of the SHeS also found that disability and deprivation have independent effects, but in the opposite direction to the SCSP survey. Overall the SHeS concludes that walking is higher in the more affluent areas even when disability or self-reported health is controlled for. ‘Healthy’ people in the more affluent areas walk 2.6 hours per week compared to 1.4 hours in the

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8 Cycling was not examined due to the low numbers of those who cycle with a disability in most deprivation/income categories
most deprived areas. This suggests that for walking, deprivation does have an effect over and above self-perceived health.

3.4 Health benefits of walking and cycling as motivators for behaviour

In general, if people think positively about walking and cycling, they are more likely to undertake this behaviour (Cerin & Leslie, 2008; Kloek et al., 2006). Studies confirm that people are more likely to walk when they have a positive attitude towards it and believe that walking will be of direct benefit to them. Ryley (2006) suggests that the exercise and associated health benefits derived from walking and cycling are the most commonly expressed reasons for choosing these modes above other transport options. Likewise, a recent qualitative study of attitudes to active travel (including bus travel) in and around Glasgow found a general tendency for the health impacts, particularly losing weight, to be much more widely recognised for walking than for cycling (JMP, 2009). Instead of being viewed as healthy, the effort required to cycle, and the perceived safety risks mean that cycling can be viewed as a ‘bad’ thing to do.

However, in their analysis of the Smarter Choices, Smarter Places (SCSP) Survey Halden et al. (2010) concluded that, given that the vast majority in Scotland believes that cycling is healthy for them and yet cycling levels are still very low, this would indicate that the health benefits are not the most important factor explaining cycling behaviour.
Box 2. Scottish Household Survey (SHS)

Background
The Scottish Household Survey is a continuous, large-scale social survey of the composition and characteristics of Scottish households, the attitudes and behaviour of adults, and to a lesser extent, of children within these households.

Data for the Scottish Household Survey is collected via structured interviews. One part of the questionnaire comprises a travel diary, in which respondents' travel patterns on the day before the interview were recorded.

Measurement of variables

Walking and cycling
- general interview: it was asked what modes are normally used for trips with different purposes (including children travelling to school). Also, the frequency of walking and cycling trips 'in the past 7 days before the interview' was measured. These journeys could have taken place from home or if the respondent had been staying away from home. A distinction was made for walking and cycling trips as a way of getting around (i.e. ‘going somewhere such as work, shopping or friends etc’) and walking trips for leisure (i.e. ‘just for pleasure of walking or to keep fit or to walk the dog’; jogging and running was also included) or for cycling (‘just for the pleasure of cycling or to keep fit’)
- travel diary: the number of trips made on the day before the interview was measured (e.g. how did you make trip x yesterday). Also, characteristics of the trips made were reported such as starting point, destination, trip length and purpose.

Walking trips were not consistently measured over the years and within the latest survey. In the travel diary, the measurement of trips by foot is changed since 2007: until 2007, walking trips over a ¼ mile or 5 minutes were recorded only, whereas since 2007 walking trips of all lengths were measured. However, this change was not made in the general interview: when the frequency of walking trips made in 7 days previous to the interview was asked, walking trips over a ¼ mile were recorded only. Similarly, only cycling trips longer than a ¼ mile were recorded as well.

Socio-economic status
- employment status
- annual net household income
- SIMD indicators
- Education (though this is not widely reported in the Scottish Government reports).

Sources: Hope, 2008; Hope & Hall, 2007

Studies in Australia show that people who live in deprived areas perceive fewer benefits from physical activities than people in less deprived areas (Cerin & Leslie 2008; Cerin et al., 2009). This suggests that people in deprived areas are less aware of the positive health effects that are associated with walking and cycling. Yet, people in lower socio-economic groups have lower self-reported levels of health (Bromley et al., 2005; Anable, 2010; Kloek et al., 2006; Poortinga, 2006). This suggests that people with lower socio-economic status realise that their health condition is not optimal, but tend not to be as aware as those of higher social status that their health can be improved by
walking or cycling. Therefore, interventions that aim to increase awareness of this link may be laying important foundations to increased uptake of walking and cycling activity.

Analysis was undertaken with the SCSP survey to investigate the extent to which lower income groups are less engaged in the health benefits of walking and cycling and whether those who are inactive have a greater or lesser compulsion to walk for fitness depending on the income group they belong to (Anable, 2010). The SCSP survey asked whether people felt they ought to walk more to keep fit. On average, 63% agreed with this statement, although the SCSP baseline analysis found that the compulsion to act varied across target areas with the least compulsion to act in Glasgow East End and Kirkintilloch/Lenzie and the most in Larbert/Stenhousemuir (Halden et al., 2010).

An important finding of the SCSP baseline analysis was that the more a respondent walks already, the more they believe they should walk more. Across the sample, 70% of those who walk at least 2 days a week believe they should walk more, compared to only 50% who currently walk rarely or never. Anable (2010) undertook further analysis to understand whether the ‘gap’ between behaviour and attitude with respect to walking is different for different social groups. In other words, in lower income groups or areas of greater deprivation, is there a greater or lesser tendency for those who already walk less or believe themselves to be less healthy to feel they should walk more? Do these social groups make more or less of a connection between walking and health and fitness?

Concurring with Leslie and Cerin’s research, those in the most deprived areas included in the SCSP baseline survey were less convinced that they should walk more for fitness with only 59% believing they should walk more compared to 68% in the least deprived (Anable, 2010). However, we know that there are some differences in the level of walking activity between these areas (those in the least deprived areas already walk more on average – see Section 4) and so it is necessary to see whether there is a difference between levels of deprivation among those people who already have a similar pattern of walking activity. In other words, do those who are inactive have a greater or lesser compulsion to walk for fitness if they belong to lower income groups?

In the most deprived areas, 13% of those who rarely walk (excluding those with disabilities) believe they should walk more compared to 16% of those in the least deprived areas. This shows that engagement with the health benefits of walking for those who are currently inactive is very similar regardless of the level of deprivation at the area level. The same is true at the individual level when household income is used for the comparison.

Another dimension is current self reported feelings of health and whether this has any relationship to how motivated people are to walk more. There is a tendency for those with the poorest health to have the least compulsion to walk more for fitness (Halden, 2010; Anable, 2010). Of those recording only fair or poor health, 48% feel they should walk more compared to 67% of those rating their health as excellent or very good. If those with a physical disability are
excluded, the gap narrows but still shows that those in poorer health are less inclined to walk more.

Does socio-economic status make any difference to the extent to which those with the poorest self-reported health are inclined to walk? Analysis from the SCSP data suggests that those in the lowest income brackets with poor health are significantly less engaged than their more healthy counterparts, yet in the higher income groups (>£30k) there is no significant difference between healthy/ non healthy groups. This implies that policy interventions need to specifically target those with poor health in the lower income groups in order to convince them that walking would be beneficial to their health.

SCSP survey respondents were also asked whether they felt cycling was a healthy way to travel around. Despite the low levels of cycling in the sample, 84% of respondents agreed that it was. However, this is higher where cycling is higher – around 90% of those in the highest income groups believe cycling is healthy but this drops to 81% in the lowest income groups. In the SCSP baseline report it was notable that Glasgow East End had a particularly negative perception of cycling with only 69% of respondents believing it to be a healthy way to travel. This is interesting as the Glasgow East End respondents fall almost exclusively in the most deprived SIMD quintile and yet the average score for this quintile on this question across all areas is 80%. This suggests that there is something other than deprivation per se in Glasgow which is contributing to the negative perception of cycling in the area. Other factors such as the built environment, satisfaction with the local neighbourhood and attitudes will be explored in the next section.
4. Walking and cycling as a way of getting around

Summary of key findings

The relationship between socio-economic status and cycling is much clearer than for walking, but overall lower income groups undertake more walking but less cycling than those on higher incomes. This relationship holds true whether household income is examined or whether the area level indicator of deprivation (SIMD) is used.

Walking - adults

- after driving a car, walking is the most frequently used mode of transport in Scotland (22% of all trips are made on foot)
- whilst walking is declining in all deprivation quintiles in Scotland, the rate of decline is greatest in the most deprived areas. However, walking to and from leisure destinations (e.g. cinemas, parks) is declining at the slowest rate
- those living in deprived areas make fewer trips in total, particularly by car, but make more and longer walk trips on average, particularly for work, shopping and leisure journeys
- the number of trips undertaken on foot as a proportion of total trips is also higher in the most deprived areas
- the factors influencing walking activity are different for each income or deprivation quintile
- in the more deprived areas, young men walk more frequently than women, as do those with children at home and those not in work - yet none of these factors, including work status, make a difference in less deprived areas
- for those who have access to a car, there is still a tendency for walking to be higher in areas with higher deprivation but for those without a car, there is no longer a statistically significant difference between deprivation levels
- across deprivation levels, higher education is associated with more walking and has an effect independent of employment status
- even once deprivation is controlled for, settlement type is a strong determinant of walking. The highest rates of walking are found in small remote towns regardless of deprivation level. The lowest rates are in the most affluent neighbourhoods of accessible rural areas
- residents in the most deprived neighbourhoods in Glasgow and Edinburgh walk less frequently than their counterparts in Aberdeen and Dundee. We can only speculate whether this might be due to public transport being the default option in the former cities instead of walking
- perceptions of the walking environment deteriorate as deprivation increases. Nevertheless, within each deprivation quintile, individuals who have the most positive opinion of walking facilities in their area, particularly crime during the daytime and pedestrian safety, walk the most
respondents in both the highest and the lowest deprivation categories are more likely than the middle ranking areas to perceive their neighbourhood as congested but this only impacts on walking levels in the more deprived areas (where public transport may be used instead)

although less of a factor in the most deprived areas, in general, those who say the environment is important to them are more likely to walk

in conclusion, there is a relationship between socio-economic status and walking. However, it is important to understand how walking activity is related to certain factors which are associated with deprivation, such as unemployment, low car ownership, disability and self-reported health as these each have an independent influence on behaviour.

Walking - children

at the aggregate level, the degree of deprivation does not affect the extent to which children in Scotland walk to school: 55% of the children in the most and least deprived areas walked to school

factors other than socio-economic status are important for determining the frequency of which children walk to school, such as the distance between home and school, or the lack of alternative modes of transport but there is a lack of data to investigate these determinants in any detail.

Cycling - adults

in 2008, 1% of all trips in Scotland were made by bicycle and around 5% cycle at least once a week

the pattern for cycling appears to be the opposite to that of walking: cycling is highest where deprivation is lowest

cycling trips as a proportion of total trips is declining in the most deprived areas and increasing in the least deprived, particularly for leisure trips

16% of households with incomes below £10,000 p.a. have access to a bicycle, compared to 69% of households with income over £40,000

just over a quarter of those in the highest income groups cycle at least once a month compared to only 7% in the lowest income groups. However, examination of those who cycle very frequently (5 days a week or more) shows less of a difference with 3% versus 2%

any differences between socio-economic group is dependent on settlement type - average numbers of daily cycling trips are indeed highest in the least deprived areas of large and medium towns but also in the most deprived neighbourhoods in small accessible towns (though shorter distances are travelled here)

in the most affluent areas, cycling activity is more evenly spread across demographic groups. In lower income groups, cycling is more frequent among younger people, particularly males. In the middle income groups only, cycling is more frequent in households with children

overall, cycling is most frequent in households with a car. This is the reverse of walking

cycling plays an important role in the journey to work regardless of deprivation level but it may also be an important mode for students and those out of work, particularly in higher income/ lower deprivation categories
those with higher educational attainment are likely to cycle more and, like walking, the effect is still present even when employment and deprivation levels are held constant

- in deprived areas, the perceived level of traffic was found to hinder cycling uptake, but community spirit was a positive influence, unlike for their more affluent counterparts
- perceptions of whether cycling is safe are most negative in the most deprived areas, but there are fewer differences between areas as to whether cycle facilities are perceived to be adequate
- those who cycle most frequently are also most likely to agree that the environment is important to them as a person, though the association is weaker in more deprived areas.

**Cycling - children**
- approximately 2% of children cycle to school in Scotland
- the low sample sizes and limited data collected on children’s journey patterns mean that it is not possible to conclude on the relationship between socio-economic status and children’s cycling patterns.

In this section, walking and cycling as a means of getting about is discussed as distinct from walking and cycling as a recreational activity. Walking and cycling will be discussed as distinct transport modes and patterns will be examined separately for adults and children/adolescents.

### 4.1 Trends in walking and cycling mode share in Scotland

Travel behaviour is measured as part of the Scottish Household Survey (SHS - see Box 2). Data from travel diaries indicate that, over time, walking and cycling as a proportion of all trips in Scotland have been reducing. In 1999/2000, walking accounted for 20% of trips and cycling 0.9%. In 2006 this had reduced to 14.5% and 0.8% respectively. During the same period, the proportion of trips undertaken by private car in Scotland increased from 65% to 69%, and public transport trips fell from 10% to 12%.

Up until 2007 the travel diary used in the SHS did not count trips shorter than a ¼ mile or 5 minutes on foot. The 2008 data does include these shorter trips and, in this case, walking accounted for 22% of all trips and bicycle 1% (Scottish Government, 2009e). Of the other trips, 63% of all trips were made by private car or van, 9% were made by bus, 2% by rail, 2% by taxi/minicab and 1% by another mode.

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9 The 2006 data set was the latest data available for analysis for this study.
Box 3. Smarter Choices, Smarter Places (SCSP)

Background
A programme of infrastructure, marketing and community-led initiatives called Smarter Choices, Smarter Places began in May 2009 in seven towns in Scotland: Barrhead, Dumfries, Dundee, Glasgow East End, Kirkintilloch/Lenzie, Kirkwall and Larbert/Stenhousemuir. A quantitative baseline survey was undertaken in these seven towns plus three towns (Arbroath, Bearsden and Dalkeith) from which synthesised control samples will be generated.

The quantitative survey comprised a random probability sample from the postcode address file for each locality. A random adult in each household filled out the self-completion survey and a one person, one-day travel diary. The achieved sample was 12,411 household surveys equating to a 48% response rate. However, only 35% of these completed a travel diary.

The large sample size is advantageous for precise estimates, but coverage of Scotland is restricted to the ten locations. The low response rate also presents a risk to its representativeness. Age/ gender weighting corrects for some under-representation in the household sample in relation to the survey locations but this weighting strategy is under review.

Measurement of variables
Walking and cycling
The SCSP baseline collects information on the frequency of use of different travel modes, the self-reported change in use of these modes over the past twelve months, attitudes towards transport modes and the local environment including views of the local neighbourhood; self-reported health; physical activity at home and work.

Some qualitative data was also collected in the seven target locations to provide more detailed evidence on perceptions of travel and transport.

Socio-economic status
Household income (62% response rate), SIMD, educational attainment and work status.

Sources: Halden et al., 2010; Anable, 2010

Interestingly, the National Travel Survey 2006 (NTS) (which covers England, Scotland and Wales) shows that the proportion of trips undertaken on foot in Scotland is higher than the average for Great Britain, but not for cycling. In Great Britain as a whole, in 2006 walking trips only accounted for 11% of trips compared to 12.5% for Scotland and the equivalent figures for cycling were 1.7% and 1%. However, whilst the proportion of walking trips is currently higher in Scotland than in Great Britain, walking in Scotland is declining overtime, whereas the opposite is true for Great Britain taken as a whole.

The vast majority (90%) of walking trips in Scotland are shorter than 2 miles (Scottish Government, 2009e). However, of all journeys shorter than 2 miles, only 40% were made on foot. This implies that people often choose not to make a trip on foot despite distances potentially being conducive to doing so. In the SCSP Survey, trips shorter than 400 metres were recorded (Halden et al., 2010). The majority of such short trips were made on foot (81%) in the
seven Scottish locations examined\textsuperscript{10}. For the 14% of these trips undertaken by car, the main reason was to go shopping: people indicated that shopping bags were too heavy to carry.

In the 2008 SHS, adults were asked how often they had made a trip on foot in the past 7 days\textsuperscript{11}. Just over half of the respondents indicated that they had made at least one walking trip over a quarter of a mile as a way of getting around in the past week (53%). Data from the seven locations examined in the SCSP project indicate that a larger majority (76%) of the population walks at least once a week (ranging from 70% in Kirkintilloch/Lenzie to 80% in Dundee) (Halden et al., 2010). The frequency may be higher than the SHS as the SCSP survey did not exclude journeys of less than a quarter of a mile and do not restrict the purpose to only those trips used for getting around. Although many people generally walk frequently, there is still a significant proportion of people who say they never walk (ranging from 15% in Dumfries, Kirkwall and Larbert/Stenhousemuir to 21% in Barrhead).

Overall, the frequency of cycling for adults is very low in Scotland, either for getting around or for recreational purposes (Halden et al., 2010; Scottish Government, 2009e; Ryley, 2006). In the 2008 Scottish Household Survey adults were asked how often they had cycled in the past seven days. Almost 5% of them reported cycling at least once in the past week as a means of transport, usually to go to work. Comparable results were found in the Smarter Choices, Smarter Places project: around 5% cycled at least once a week overall, although there was quite a contrast in cycling frequency between the seven communities: Glasgow East End (3%), Dundee (4%), Kirkintilloch/Lenzie (6%), Larbert/Stenhousemuir (7%), Barrhead (7%), Dumfries (11%) and Kirkwall (13%).

4.2 The relationship between walking and socio-economic status for adults

In general, the travel behaviour of people who live in deprived areas differs from that of people living in more affluent areas. Those living in deprived areas make fewer trips in general (Scottish Government, 2009e), particularly by car (Gray et al., 2001). This is clearly related to levels of car ownership which are reported in Section 4.4.2. Also, the car trips made by those living in deprived areas are generally shorter than car trips made in more affluent areas (Scottish Government, 2009e). According to Gray et al., (2001), greater affluence permits greater mobility, for example because higher income groups can afford to commute longer distances, and thus, choose to live further away from their work location. So, overall, people in deprived areas use their cars less than people in more affluent areas. We will examine the degree to which this is related to their walking and activity.

\textsuperscript{10} Barrhead, Dumfries, Dundee, Glasgow East End, Kirkintilloch/Lenzie, Kirkwall, Larbert/Stenhousemuir.

\textsuperscript{11} Based on the general interview where trips longer than a quarter of a mile were recorded only (see also Box 2).
Given the variety of ways in which walking and cycling activity can be measured it can be a challenge to ascertain the travel behavioural profiles of different social groups, let alone disentangle the relative influence that socio-economic status has vis-à-vis other influences on behaviour.

Across the three main data sets examined in detail in this study (SHS, SHeS and SCSP), three different conclusions can be drawn as to whether more walking activity is undertaken in the most deprived areas or not. We have seen in Section 3 that SHeS data shows walking to be lower in the most deprived areas. The 2008 SHS data suggests, on the other hand, there is no significant difference across deprivation quintiles in terms of the proportion of people who had walked for journeys over a quarter of a mile at least once in the previous week (Scottish Government, 2009e). It suggests that 55% of people had walked for journeys over a quarter of a mile at least once in the previous week and this was the same in the least and the most deprived areas. Indeed, both the least and most deprived areas demonstrate the highest levels of walking overall, with about half of people walking at least once in the previous week in the 2nd, 3rd and 4th quintiles.

However, the questions used to ascertain these results are based on rather crude measurements of walking. For instance, ‘at least once in the previous week’ (SHS) or ‘for at least 5 (or 15) minutes in the past month’ (SHeS) are questions which are likely to catch a large number of people and be relatively undiscriminating between groups.

Our own analysis of the travel diary element of the SHS and dedicated analysis by the SCSP team on this topic examined finer grained measurements of walking in terms of both frequency of travel, distance and time spent travelling and across journey purposes. Depending on which indicators are investigated, the degree to which behaviour differs across social groups can be very different. However, the overall conclusion is that adults in lower income groups or more deprived areas do walk more frequently and undertake more and longer trips, on average, than those of higher income and lower deprivation.

Exploring the distribution of walking trips from the SHS one-day travel diary we found that the proportion of walking trips as a proportion of total trips is higher in more deprived areas. In 2005/06, a fifth of journeys in the most deprived areas of Scotland were undertaken on foot compared to 12% of those in the least deprived (Table 4.1).

The SHS data indicates that, not only is the proportion of total trips undertaken on foot greater in the more deprived areas, the total number of trips and the average length of those trips is also greater as highlighted in Table 4.1 for all trip purposes combined. This is particularly notable given that the total number of trips across all modes and journey purposes is overall lower in the most deprived (2.5 trips per day compared to 2.8).
Examine the differences across income as opposed to area level deprivation, analysis of self reported frequencies of walking in the SCSP survey revealed that the proportion of people who walk at least 2-4 times per week is marginally greater in those with gross household income of less than £30K per year (Anable, 2010). Interestingly, the greatest difference is with those who claim they never walk, with a larger share of these people in the lower income groups.

Significantly, as Figure 4.1 shows, the rate of decline of walking trips is greatest in the most deprived areas. So, whilst walking is declining in all deprivation quintiles in Scotland, it has fallen by one third in the most deprived areas (from 30% to 20%) compared to only one quarter in the least deprived (from 16% to 12%) between 1999/00 and 2005/06. This is consistent with the evidence from the National Travel Survey that the greatest increases in car ownership and use are among the lowest income quintiles which more than offset any reductions in the use of other transport modes. Bayliss (2009) shows that the rate of ownership has increased from less than 5% in 1960 to 49% in 2008 – a near ten-fold increase. For the second lowest income quintile (Figure 4) the increase has been from under 10% to 54% - a more than fivefold increase (Bayliss, 2009; Lucas and Jones, 2009).
The fact that those in the deprived areas act differently to those in less deprived areas is corroborated by analysis of the SCSP data, but the SCSP study suggests that walking behaviour is on the increase in all areas, just not increasing as much in the most deprived neighbourhoods. The SCSP data asked respondents to record whether they had increased or decreased their travel by each mode over the last 12 months. Notwithstanding the fact that these results may be overestimates since people tend to report ‘aspirational’ change rather than actual change, net increases in walking were reported across all levels of deprivation. Overall, 16% of respondents across the 10 areas claimed to have increased their walking activity and 6% to have reduced it (i.e. a 10% net gain). However, it is true to say that the most deprived areas reported the lowest net gains (7% net gain) (Anable, 2010).

4.3 The relationship between walking and socio-economic status for adults travelling for different journey purposes

So far we have looked at walking trips as a proportion of overall trips and we can conclude that this share is higher in the most deprived areas and among the lowest income groups. However, further examination of the literature reveals that differences between walking behaviour across social groups are even more evident if different journey purposes are considered.

The literature revealed that the most common purposes when walking are to go shopping or to work (Gray et al., 2001; Halden et al., 2010). This is confirmed by data from the SHS in Table 4.2. The table also reveals that, as a
proportion of total trips, shopping journeys account for a higher share in the most deprived areas, but that journeys to work are more important in the least deprived areas.

Table 4.2 Proportion of walk trips undertaken for different journey purposes in Scotland by SIMD quintile in 2005/06 (%)

<table>
<thead>
<tr>
<th>Deprivation level</th>
<th>1 (0-20%)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (80-100%)</th>
<th>Least Deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most deprived</td>
<td>15.5</td>
<td>21.8</td>
<td>23.9</td>
<td>16.4</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>education trips</td>
<td>3.9</td>
<td>3.5</td>
<td>2.6</td>
<td>7.8</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>leisure trips</td>
<td>11.2</td>
<td>15.4</td>
<td>15.3</td>
<td>18.3</td>
<td>16.5</td>
<td></td>
</tr>
<tr>
<td>shopping trips</td>
<td>31.5</td>
<td>24.4</td>
<td>26.1</td>
<td>22.3</td>
<td>24.8</td>
<td></td>
</tr>
<tr>
<td>escort trips</td>
<td>8.1</td>
<td>7.2</td>
<td>7.4</td>
<td>6.9</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td>other</td>
<td>30.0</td>
<td>27.8</td>
<td>24.8</td>
<td>28.3</td>
<td>24.3</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Source: SHS 2005/06

There is a slightly different picture, however, if, instead of looking at what proportion of walking trips are ‘spent’ on which purposes, we examine instead the proportion of each journey purpose which is undertaken on foot (Table 4.3). Looked at this way we see that in deprived areas trips to work are more commonly made on foot than in more affluent areas. For instance, 13% of all work trips are undertaken on foot in the most deprived areas compared to 8% in the least deprived. The only trips which are equivalent (though not significantly higher) in the less deprived areas are education trips which are primarily trips to college and university by those over aged 16.

Table 4.3 Proportion trips for each journey purposes undertaken by walking in Scotland by SIMD quintile in 2005/06 (%)

<table>
<thead>
<tr>
<th>Deprivation level</th>
<th>1 (0-20%)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (80-100%)</th>
<th>Least Deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most deprived</td>
<td>12.7</td>
<td>13.4</td>
<td>10.4</td>
<td>5.7</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>% of education</td>
<td>29.9</td>
<td>23.7</td>
<td>18.3</td>
<td>28.0</td>
<td>31.9</td>
<td></td>
</tr>
<tr>
<td>% of leisure</td>
<td>21.6</td>
<td>23.2</td>
<td>15.9</td>
<td>14.1</td>
<td>15.1</td>
<td></td>
</tr>
<tr>
<td>% of shopping</td>
<td>24.1</td>
<td>19.9</td>
<td>16.6</td>
<td>11.1</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>% of escort</td>
<td>18.4</td>
<td>15.1</td>
<td>11.2</td>
<td>8.6</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>% of other</td>
<td>20.9</td>
<td>18.3</td>
<td>13.3</td>
<td>11.8</td>
<td>12.4</td>
<td></td>
</tr>
<tr>
<td>% all trips</td>
<td>19.8</td>
<td>17.7</td>
<td>13.4</td>
<td>10.3</td>
<td>12.3</td>
<td></td>
</tr>
</tbody>
</table>

Source: SHS 2005/06
This is in line with Scottish Government analysis of the 2008 SHS survey which looked at the proportion of people for whom walking is the main mode of transport to work (Scottish Government, 2009b): Nineteen percent of the employed adults living in deprived areas walked to work, whereas this was only 8% of those living in the least deprived areas. In line with this, 29% of those with a household income up to £10,000 and 6% of those with a household income over £40,000 walk to work. Later we will see that employment status is a strong determinant of walking and cycling activity.

There is a consistent picture across various models undertaken on the SHS survey which suggests that there is something distinctly different about travel to and from leisure destinations in lower income groups and more deprived areas ('leisure trips' as opposed to 'walking/cycling for leisure or recreation' which are discussed in Section 5 and reveal a slightly different picture). Analysis of the SHS data revealed that those on lower incomes (household net incomes less than £30k per annum) walk more for leisure purposes than higher income groups. The opposite would be true if we were talking about walking for recreation. In addition, although the participation rates of walking trips for leisure are also declining in line with the national trend for walking, walking is declining at a slower rate for this trip purpose.

Although these differences in behaviour are significant, the role that deprivation plays in shaping walking behaviour is less obvious. When the relationship between walking for different journey purposes and deprivation and income are combined in multivariate (logit and regression models) with a number of other factors such as employment status, car ownership, settlement type and attitudes, the relationship between socio-economic status and walking is found to be complex. We discuss this below and conclude that the many factors which contribute to or are a symptom of deprivation and low income (such as employment status, car ownership, health) each have specific influences on the amount of walking activity in either generally positive or negative directions and are therefore individually more or as important than deprivation per se.

4.4 The relative importance of socio-economic status as a determinant of adult walking behaviour

The trends across different deprivation and income groups outlined above are the result of the interplay between various socio-demographic, built environment and attitudinal differences which may themselves be closely related to socio-economic status or may act on behaviour independently from income or deprivation. In particular, individual travel patterns will be influenced by car ownership, employment status, accessibility and opportunity, age and presence of children, levels of disability and even local social norms - some of which will themselves be correlated with income and deprivation, but others may not be. It is therefore necessary to undertake multivariate analyses in order to disentangle the relative importance of these different factors.

12 Also based on general interview: trips longer than a quarter of a mile were recorded only (see also Box 2).
Once this more detailed multivariate analysis is undertaken, the relationship between socio-economic status and walking activity is less clear cut than would appear to be the case from the basic comparative figures presented above. We will first examine the impact of individual categories of influence before examining (in Section 6) their relative power to explain differences in walking behaviour.

4.4.1 The role of demographic factors
Before concentrating on the link between walking and cycling and social socio-economic variables, it is worth reporting on the effect of demographic characteristics as distinct from social status. Analysis of the SCSP baseline data (Halden et al., 2010; Anable, 2010) examined relationships between walking frequency and age, gender and presence of children in the household and noted that, overall, walking was unrelated to gender, which is surprising given the difference in car ownership noted below. However, there is an age difference as walking is more frequently undertaken by younger age groups and by those with children at home. Analysis was then undertaken to understand whether these relationships hold true across different income bands and levels of deprivation and found that the relationship with age was consistent. However, whilst in general there is no difference in frequency across gender, in lower income households (<£10k per annum (gross)), younger males (aged less than 34 years) walk more than females and the tendency for households with children to walk more is only significantly true in lower income households.

4.4.2 The role of car ownership
The proportion of households with at least one car varies significantly according to income and deprivation. In the SHS, 47% of the highest deprivation quintile have access to at least one car compared to 87% in the lowest (Table 4.4). In the SCSP study, 31% of households in the lowest household income band (<£10k per annum (gross)) own at least one car whereas this rises to 95-98% in the highest two income bands (>£30k and >£60k) (Anable, 2010). Driving license holding also varies strongly between areas, but tends to follow that of car ownership. In all areas, more men have a driving license than women, although this difference is narrowing (Scottish Government, 2009d).

Table 4.4 Car ownership and driving licence holding in 20% of most and least deprived areas in 2008, based on SIMD

<table>
<thead>
<tr>
<th></th>
<th>most deprived</th>
<th>least deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to 1 or more cars (%)</td>
<td>47</td>
<td>87</td>
</tr>
<tr>
<td>Driving Licence (%)</td>
<td>44</td>
<td>83</td>
</tr>
</tbody>
</table>

Source: Scottish Household Survey (Scottish Government 2009b, Tables 15 and 16)

In general, car access has increased in Scotland in the past ten years. Between 1999 and 2008, the average number of households with access to one or more private cars increased from 63% to 70%. However, whereas average car ownership stabilised between 2004 and 2008, a large increase in car access has occurred in deprived areas where access to one or more cars
has increased from 39% in 2004 to 47% in 2008 (Scottish Government, 2004; 2009b).

A similar trend is found when looking at the relationship between car access and household income. For lower income-households, car access has increased steadily during recent years. For example, 32% of households with a net income up to £5,000 and 35% of households with an income between £5,000 and £10,000 had access to one or more cars in 1999 (Scottish Government, 2002). This had grown to 38% for households with an income up to £10,000 by 2008. By contrast, in households with an income over £40,000, car ownership remained stable at the much higher rate of 98% (Scottish Government, 2002; 2009b).

Although car access and the number of people holding a driving license is relatively low in deprived areas, having access to a car is strongly valued in these areas. Low income households make considerable sacrifices to be able to drive a car, particularly in rural areas where car dependency is high (Gray et al., 2001). If a car is not replaced in a low income household, this is usually because they can simply not afford to do so, rather than that they believe they can live without a car.

The frequency of walking is strongly associated with the opportunity to use a car, that is, the more people have access to a car, the less often they walk (Gray et al., 2001; Ryley, 2006; Scottish Government, 2009b). A consistent result across surveys is that car owners walk less frequently than non car owners in all income groups and across all levels of deprivation. In the SCSP study, of those without a car, 71% walked at least twice a week, compared to 61% of those with a car. The same broad pattern is evident in each of the deprivation quintiles, although the difference in walking behaviour between those that have a car in the household and those who do not is greater in the less deprived areas (Anable, 2010).

As we know, car ownership is lower among lower income groups and higher deprivation. An interesting question is whether income/deprivation has any additional impact on walking once we control for car ownership. The answer is that, for those that do not own a car, there is no longer a statistically significant difference in the frequency of walking between SIMD quintiles so car ownership is the overriding factor. But, for those who have access car, there is still a tendency for walking to be higher in areas with higher deprivation. This is likely to be because in deprived areas, even where a car is owned, the average number of cars per household is lower and therefore individual access (as opposed to household access) is not as guaranteed. In the SCSP study the average number of cars per household in the most deprived areas is 0.67 and this increases to 0.75 in the least deprived (Anable, 2010).

4.4.3 The role of employment status
We have already seen that the journey to work consumes a significant portion of walking trips across all deprivation levels and a greater proportion of work journeys are undertaken on foot in deprived areas. The question is whether being employed or not employed is a strong determinant of walking behaviour regardless of socio-economic status.
Despite the fact that work journeys account for many walking trips, it is actually those out of work, and particularly those in education, who walk more on average. In both the SHS and the SCSP data, those who are not in work (full-time or part-time) walk more frequently than those in employment and those in part time employment walk more frequently than those in full time. However, in the SCSP analysis, the difference between those in and out of work was only significant in areas of higher deprivation (1st and 2nd quintiles) (Anable, 2010). Table 4.5 also highlights data from the SHS which shows that work status does not appear to be such an important influence on walk trips in the less deprived areas and that those over 16 years in education carry out the greatest proportion of their trips on foot in all areas.

### Table 4.5 Employment status and proportion of trips undertaken by walking in the most and least deprived SIMD quintiles (% of all trips)

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Most Deprived</th>
<th>Least Deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full time employed</td>
<td>11.3</td>
<td>9.4</td>
</tr>
<tr>
<td>Part time employed</td>
<td>19.3</td>
<td>9.9</td>
</tr>
<tr>
<td>Unemployed</td>
<td>25.9</td>
<td>15.9</td>
</tr>
<tr>
<td>In education</td>
<td>28.5</td>
<td>29.3</td>
</tr>
</tbody>
</table>

Source: SHS dataset 2005/06

4.4.4 **The role of educational attainment**

The SCSP data shows those with higher qualifications up to the point of Highers/A-levels or equivalent have a greater tendency to walk (although those with degree level qualifications had a tendency to walk slightly less than those with Highers/A-levels only). This is interesting as, broadly, this is the opposite pattern to employment status even though education and employment are themselves related. If employment is held constant (those in or out of work), the effect of education is still significant for those in and out of work (Anable, 2010). This pattern is consistent across deprivation levels and suggests that education has a greater role in explaining walking behaviour than deprivation per se and has an effect independent of employment status.

4.4.5 **The role of the built environment**

The SHS dataset allows us to look at different classifications of settlement size and type and understand whether, even if we only look at areas of high deprivation, there is a difference between and within settlement types. For instance, do people in the most deprived areas of Aberdeen tend to walk the same amount as those in the most deprived areas of Glasgow?

Overall, individuals who live in small remote towns (settlements of between 3000 and 10,000 people) undertake the most frequent walking journeys across all journey purposes including leisure and shopping trips. And, as expected, those who live in remote rural areas (<3000 people) are the ones who walk the least, especially for the journey to work and shopping activities. Figure 4.2

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shows that deprivation has a larger impact within some settlement types than others. Once deprivation is controlled for, small remote towns still exhibit the highest rates of walking, but walking is particularly high in the most deprived areas of these small towns. The smallest differential between most and least deprived is seen in remote rural areas where walking rates are consistently low. The greatest difference between levels of deprivation takes place within accessible rural areas where those in least deprived neighbourhoods exhibit the lowest rates of walking of all settlement types.

**Figure 4.2 Average number of walking trips per person per day in the most and least deprived areas and settlement types**

<table>
<thead>
<tr>
<th>Settlement Type</th>
<th>Most Deprived</th>
<th>Least Deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large urban areas</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Other (medium) urban areas</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Small accessible town</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Small remote town</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Accessible rural</td>
<td>0.1</td>
<td>0.08</td>
</tr>
<tr>
<td>Remote rural</td>
<td>0.08</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Source: SHS dataset 2005/06

Our analysis also examined the four largest cities in Scotland: Glasgow, Edinburgh, Dundee and Aberdeen. Interestingly, even when deprivation is held constant, there are significant differences in walking frequency between these cities. The largest number of average daily walking trips per person takes place in the most deprived areas of Aberdeen and Dundee and the least walking takes place in the least deprived areas of the same cities. In Edinburgh, those people living in the least deprived areas walk more and there is no difference between levels of deprivation at the area level and daily walking frequency in Glasgow. This suggests that there are location-specific factors other than deprivation which strongly affect walking activity. We can only speculate as to what these might be such as the differential provision of public transport, levels of traffic, the quality of the built environment and local culture. These factors can lead to comparatively wide disparities between deprivation levels in some areas.
4.4.6 Perceptions of the local neighbourhood

The degree to which a person may be willing to change their travel behaviour could be directly related to their perceptions of neighbourhood characteristics such as ‘friendliness’ and sense of community, quality of the built environment, concerns about congestion and access to goods and services. Questions relating to these issues are included on both the SHS and the SCSP surveys. Analysis of both SHS and SCSP confirms that neighbourhood satisfaction, perceived friendliness and views on the built environment worsen as deprivation worsens; although perceived accessibility increases (which concurs with the SIMD accessibility domain which suggests that access to local services is better in deprived areas).

Interestingly, respondents in both the highest and the lowest deprivation categories are more likely than the middle ranking areas to perceive their neighbourhood as congested. This was explored in the SCSP baseline report (Halden et al., 2010) which highlighted that concerns about congestion vary between towns and income group with no consistent pattern – sometimes those in least deprivation are the most concerned and sometimes they are the least concerned. For instance, the lowest income groups were more concerned in Barrhead, Kirkintilloch/Lenzie, Larbert/Stenhousemuir and Kirkwall but the same group was also the least concerned in Glasgow and Dumfries and relatively unconcerned in Dundee. From this it would be reasonable to conclude that some of the areas of least deprivation and/or high earners are ‘nice areas’ of towns but more heavily trafficked streets in cities.

Analysis of these factors in both the SHS and the SCSP datasets reveals a complex relationship between these perceptions and walking behaviour. For example, SCSP analysis revealed that, curiously, with respect to community spirit and quality of the built environment, there is a statistically significant tendency for those who walk more to have a more negative view of their

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**Figure 4.3 Average number of walking trips per person per day in the most and least deprived areas of the four major Scottish cities**

![Average number of walking trips per person per day in the most and least deprived areas of the four major Scottish cities](image.png)

Source: SHS dataset 2005/06

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49
neighbourhood. On the other hand, congestion is perceived to be less of a problem among those who walk the most and the relationship between walking and perceived access is not statistically significant.

It is not immediately apparent why those who walk more should have more negative views of some aspects of their community. It could be that those who are ‘out and about’ on foot pay more attention to their surroundings and therefore see many of the more negative aspects of where they live. This would fit with the fact that car owners, who perhaps engage less directly in their community and ‘see less’, rate their neighbourhood more positively, believe neighbours to be more friendly, and generally have a greater appreciation of the public spaces in their towns, although this does not hold true for all areas. However, it is equally plausible that the inverse relationship between walking levels and neighbourhood satisfaction is due to the fact that walking is higher in precisely those places where neighbourhood satisfaction is lower due to factors which are simply more influential than satisfaction, not because more walking causes negative attitudes.

To examine this, Anable (2010) looked at each level of deprivation separately to see whether those who walk more in those areas still have more negative opinions of where they live. The analysis revealed that, when controlling for deprivation, there was no statistically significant relationship between walking frequency and satisfaction with any of the neighbourhood attributes other than congestion. However, negative perceptions of congestion only significantly affect those in the most deprived areas. Those who strongly believe congestion to be a problem do tend to walk less in these areas, but makes no difference to those in less deprived communities. It is likely that in the most deprived areas with congestion problems, there is likely to be a greater choice to use public transport but less so in the least deprived areas.

Given that walking is higher in the deprived areas even though satisfaction with the neighbourhood is generally lower, this suggests that other factors related to deprivation such as income and lack of car ownership are stronger determinants of the level of walking.

4.4.7 Attitudes towards walking infrastructure

The SCSP survey included questions on whether pedestrians were believed to be able to make safe trips including crossing roads in the local area, whether there are good facilities (pavements, road crossings and pedestrian-only areas) and whether there are concerns about being a victim of crime either during the day or at night.

Figure 4.4 shows that the perceptions of the walking environment are least positive in the most deprived areas, particularly general safety of walking around and fear of crime in the evenings, but that those living in the least deprived areas don’t necessarily have the most positive attitudes. On each question, those areas in the top quintile (= least deprivation) have a slightly more negative view about their local pedestrian environment than the
preceding quintile\textsuperscript{14} so it would appear that the relationship between perceived pedestrian quality and deprivation is not linear.

**Figure 4.4 Perceptions of the walking environment in each SIMD quintile**

![Perceptions of the walking environment in each SIMD quintile](image)


Given that satisfaction with the pedestrian environment is lower in deprived areas, but walking is higher in these areas, can we conclude that perceptions of pedestrian safety and the quality of infrastructure provision is not relevant to walking behaviour? To examine this, Anable (2010) looked at each level of deprivation separately to see whether, if deprivation is held constant, there is a difference between those who walk more and their opinions of the pedestrian environment.

Almost without exception, within each deprivation quintile, those who have a greater opinion of walking facilities in their area, particularly crime during the daytime and safety, walk more often. However, from this type of analysis, we cannot conclude the direction of causality – i.e. do those who walk more do so because they have a better view of the walking conditions or do they have a better view because they walk more and have based their opinions on real experiences?

The survey also examined whether time pressure was a barrier to the uptake of walking. Encouragingly, more than half of the sample (60\%) disagree that they are put off walking short journeys because it takes too long. However,

\textsuperscript{14} Using cross tabulations and chi-squares allows examination of whether the differences across the groups as a whole are statistically significant, but does not tell us which groups are significantly different from each other. In this case, an ANOVA with post-hoc Sheffe test was also used and revealed that, on the question of whether there are believed to be good facilities for pedestrians in the local area, the 81-100\% quintile responded significantly more negatively than the preceding quintile. All other differences between this quintile and its preceding quintile are not statistically significant.
there is a very strong relationship between agreement or disagreement on this statement and walking frequency so that, for the fifth of people who do believe short journeys take too long, the majority walk only a few times a month or less. Respondents were more likely to believe there was a time penalty if they lived in either the most or the least deprived areas.

4.4.8 Attitudes towards the environment
Three questions on the SCSP survey elicited the degree to which environmental issues were important to the respondent. Halden et al. (2010) discovered that those who claim the environment is important to them are disproportionately likely to be older, female, in employment, more highly educated and healthier.

Crosstabulations with household income and SIMD also reveal that those on lower incomes say the environment is less important to them, are more inclined to believe that environmental threats have been exaggerated and less inclined to believe that car use should be restricted for environmental reasons.

With respect to walking and cycling behaviour, those who walk and cycle most frequently are also most likely to agree that the environment is important to them as a person and less likely to agree that people should be allowed to use their cars as much as they like. These relationships are even stronger if each deprivation quintile is looked at separately, although this analysis reveals there to be less of a relationship in the most deprived areas compared to elsewhere. This suggests that when the effect of deprivation is controlled for, environmental attitudes are strong correlates with walking.

4.5 The relationship between cycling and socio-economic status for adults
The pattern for cycling appears to be the opposite to that of walking: those in the most deprived areas travel less by bicycle. The 2008 Scottish Household Survey suggests that twice as many people cycle in the least deprived areas as cycle as in the most deprived (6% versus 3%). However, considering the generally low number of people cycling, it can be difficult to draw valid conclusions about the relationship between cycling and socio-economic status as we comment on as appropriate in the analysis to follow. In order to at least partially overcome this, our analysis of the SHS data has combined cycle trips from across 1999-2006 datasets.

Exploring the distribution of cycling trips from the Scottish Household Survey one day travel diary we found that the proportion of cycling trips as a proportion of total trips is higher in less deprived areas, albeit still a very small fraction of total trips. In 199/00-2005/06, 0.6% of journeys in the most deprived areas of Scotland were undertaken on foot compared to 1.3% of those in the least deprived (Table 4.6). The analysis also indicates that the total number of trips and the average time spent travelling is also greater as highlighted in Table 4.6 for all trip purposes combined.
Table 4.6 Cycling trips, average distance travelled and average travel
time per person per day by SIMD quintile in 1999/00 - 2005/06

<table>
<thead>
<tr>
<th>Deprivation levels</th>
<th>1 (0-20%)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of total trips</td>
<td>0.6</td>
<td>0.6</td>
<td>0.8</td>
<td>0.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Trips/person (trips/day)</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>Ave distance per trip/person (kms/day)</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Ave travel time per trip/person (mins/day)</td>
<td>0.37</td>
<td>0.39</td>
<td>0.59</td>
<td>0.54</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Source: SHS dataset 1999/00 - 2005/06 (combined)

The SCSP survey also found cycling to be more prevalent among those on higher incomes (Halden et al. 2010; Anable, 2010). This relationship holds true whether individual/household income is examined or whether the area level indicator of deprivation (SIMD) is used.

Over a quarter (27%) of those in the highest income groups (>£60k gross household income) cycle at least once a month compared to only 7% in the lowest income groups (<£10k). However, examination of those who cycle very frequently (5 days a week or more) shows less of a difference with 3% versus 2%.
There is an unclear pattern with respect to trends over time. From analysis of SHS datasets between 1999/00 to 2005/06, it seems as though cycling trips as a proportion of total trips is declining in the most deprived areas and increasing in the least deprived, particularly for leisure trips.

### 4.6 The relationship between cycling and socio-economic status for adults travelling for different journey purposes

Data from the SHS survey in Table 4.7 reveals that the most common purpose for cycling trips is to work.

#### Table 4.7 Proportion of cycle trips undertaken for different journey purposes in Scotland by SIMD quintile in 2005/06 (%)

<table>
<thead>
<tr>
<th>Deprivation levels</th>
<th>1 (0-20%)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>work trips</td>
<td>44.9</td>
<td>49.2</td>
<td>54.4</td>
<td>60.8</td>
<td>42.8</td>
</tr>
<tr>
<td>education trips</td>
<td>0.0</td>
<td>0.0</td>
<td>2.2</td>
<td>1.4</td>
<td>12.2</td>
</tr>
<tr>
<td>leisure trips</td>
<td>12.2</td>
<td>9.5</td>
<td>13.0</td>
<td>17.6</td>
<td>19.1</td>
</tr>
<tr>
<td>shopping trips</td>
<td>10.2</td>
<td>6.4</td>
<td>21.7</td>
<td>4.1</td>
<td>10.7</td>
</tr>
<tr>
<td>escort trips</td>
<td>4.1</td>
<td>6.4</td>
<td>2.2</td>
<td>4.1</td>
<td>5.3</td>
</tr>
<tr>
<td>other trip purposes</td>
<td>28.6</td>
<td>28.6</td>
<td>6.5</td>
<td>12.2</td>
<td>9.9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: SHS dataset 2005/06

Work journeys account for between 43 and 61% of cycle trips, with the lower (though not lowest) deprivation quintile putting most emphasis on the cycle commute. Leisure trips and shopping trips are the other most significant journey purposes. There is a clear relationship between deprivation and leisure...
trips whereby fewer cycling trips for leisure are undertaken in the most deprived areas. This is once again the opposite trend to walking.

There is a slightly different picture, however, if, instead of looking at what proportion of cycling trips are ‘spent’ on which purposes, we examine instead the proportion of each journey purpose which is undertaken by bicycle (Table 4.8). Looked at this way we see that in deprived areas there are no journey purposes which have a greater share of cycle journeys than the least deprived quintile.

Table 4.8 Proportion trips for each journey purposes undertaken by cycling in Scotland by SIMD quintile in 2005/06 (%)

<table>
<thead>
<tr>
<th>Deprivation levels</th>
<th>1 (0-20%)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most deprived</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Least Deprived</td>
</tr>
<tr>
<td>% work trips</td>
<td>1.1</td>
<td>1.1</td>
<td>1.5</td>
<td>1.4</td>
<td>1.9</td>
</tr>
<tr>
<td>% education trips</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.3</td>
<td>5.7</td>
</tr>
<tr>
<td>% leisure trips</td>
<td>0.7</td>
<td>0.5</td>
<td>0.9</td>
<td>0.9</td>
<td>1.9</td>
</tr>
<tr>
<td>% shopping trips</td>
<td>0.2</td>
<td>0.2</td>
<td>0.9</td>
<td>0.1</td>
<td>0.7</td>
</tr>
<tr>
<td>% escort trips</td>
<td>0.3</td>
<td>0.5</td>
<td>0.2</td>
<td>0.3</td>
<td>0.7</td>
</tr>
<tr>
<td>% other purposes</td>
<td>0.6</td>
<td>0.7</td>
<td>0.2</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>% all trips</td>
<td>0.6</td>
<td>0.6</td>
<td>0.8</td>
<td>0.7</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Source: SHS dataset 2005/06

4.7 The relative importance of socio-economic status as a determinant of adult cycling behaviour

To the extent that it is possible to look at subgroup differences among the small sample sizes involved in examining cycle behaviour in Scotland, the following analysis examines the degree to which socio-economic status is influential in cycle behaviour as distinct from a number of other socio-demographic, built environment and attitudinal differences.

4.7.1 The role of demographic factors

Analysis of the SCSP baseline data (Halden et al., 2010; Anable, 2010) examined relationships between cycling frequency and age, gender and presence of children in the household and noted that, overall, unlike walking, cycling was gender related, with men more likely to cycle. Like walking, cycling declines as age increases and those with children are more likely to cycle. However, these relationships are potentially different in different income bands. In higher income groups, cycling activity is more evenly spread across different age groups and is not the domain of younger people. In the lowest and the highest income groups, the presence of children does not effect the level of cycling. Analysis of the SHS data found that males from the most deprived areas are cycling significantly longer distances for leisure whereas no such gender impacts were found in areas with less deprivation.
4.7.2 The role of car ownership
According to analysis of the SCSP data, the relationship between car ownership and cycling activity is the reverse of walking - households with a car are much more likely to cycle overall. Of those with a car, 15% cycle at least once a month compared to 7% of those without. This fits with the figures reported above which show bicycle ownership increasing with income, as does car ownership. If we control for car ownership, however, we see that people in less deprived areas are still more likely to cycle even if they do not own a car. Only 3.8% of those without a car cycle at least two days a week in the most deprived areas compared to 8.4% in the least deprived.

4.7.3 The role of bicycle ownership
Given the lack of any strong tradition of cycle hire in Scotland, bicycle ownership is necessary to have access to cycling trips for most people. Bicycle ownership has somewhat increased over the past 10 years in Scotland: 32% of households had a bicycle in 1999, whereas this was 37% in 2008 (Scottish Government, 2009b). However, there seems to be a discrepancy between bicycle ownership and bicycle use: on average 37% of people in Scotland has access to a bicycle, whereas the number of trips made by bicycle has remained constant since 1999 at 1% of all trips made (Scottish Government, 2009e).

In Scotland, bicycle ownership is lowest in deprived areas (Scottish Government, 2009b). More specifically, 16% of households with incomes up to £10,000 annually have access to a bicycle, compared to 69% of households with an annual income over £40,000. Similar figures were found in the SCSP Baseline survey which showed that the figures on bicycle ownership corroborated the limited evidence that cycling seems to be lower in more deprived areas. This trend is clearly reflected in the pattern of bicycle ownership (Figure 4.6) with 73% of higher income households owning at least one adult bicycle (1.51 bicycles on average) compared to only 14% of lowest income households (owning 0.19 bicycles on average) (Anable, 2010).

The Smarter Choices, Smarter Places data found that, overall, the majority of bicycle owning households also own a car and the majority of non car-owning households do not own a bicycle (Halden et al., 2010). Figure 4.7 maps the frequency of respondents with car and bicycle availability across the SIMD quintiles and shows that in the areas with highest deprivation, more than 50% own neither a car nor a bike. From this point of view, it is not surprising that walking or public transport may be higher in these households.
Figure 4.6 Proportion of households owning at least one adult bicycle and average number of bicycles owned in each of the income bands

Source: SCSP 2009 (Base = 12,411, weighted) (Anable, 2010) (note: there was a 37% non response on the income question)

Figure 4.7 Household bicycle and car access in each SIMD quintile

Source: SCSP 2009 (Base = 12,411, weighted) (Anable, 2010)

Overall, the multivariate analysis on both the SHS datasets and the SCSP data indicates that, as would be expected, bicycle ownership is a very strong predictor of cycling behaviour. However, it also suggests that having access to
a bicycle plays a greater than average role for individuals who live in the most deprived areas.

4.7.4 The role of employment status
A study of cycling in Edinburgh identified two groups that have the highest propensity to cycle in this city (Ryley, 2006). The first group are students, who are characterized by low household income but a high educational level. Next, people who are in-between jobs have a high propensity to cycle in Edinburgh. Those in-between jobs are also characterised by a low household income and are unemployed and/or seeking for work. This is interesting as it suggests that there may be a tendency for cycling to be an attractive mode of transport for those on lower incomes which is the opposite to what has been suggested so far by our analysis. However, Ryley’s conclusion may be due to specific contextual (and as yet unobserved in the data) factors present in Edinburgh as, for example, our analysis of the SHS survey found that cycling levels in the most deprived areas in Edinburgh have a higher cycling frequency than the equivalent deprivation levels elsewhere in Scotland.

On the other hand, Ryley found a medium propensity to cycle was found for high-earners with children. They are characterized as being in full-time employment, high household income and having children.

Analysis of SHS data partly concurs with these findings in as much as the proportion of all trips undertaken by bicycle is largest for those in education or unemployed (Table 4.9) in the least deprived areas but for the most deprived areas, cycling is most important for those in full time employment. On the other hand, the SCSP data shows a tendency for those in employment to cycle more frequently than those who are out of work in all levels of deprivation areas. Of those in employment, 8% cycle at least once a month compared to 6% who are not.

Table 4.9 Employment status and proportion of trips undertaken by cycling in the most and least deprived SIMD quintiles (% of all trips)

<table>
<thead>
<tr>
<th>Proportion of all trips</th>
<th>most deprived</th>
<th>least deprived</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full time employed</td>
<td>1.0</td>
<td>1.6</td>
</tr>
<tr>
<td>Part time employed</td>
<td>0.0</td>
<td>1.3</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.5</td>
<td>5.8</td>
</tr>
<tr>
<td>In education</td>
<td>0.5</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Source: SHS dataset 1999/00 - 2005/06 (combined)

The mixed results illustrate the problem of dealing with small sample sizes and different measurement of ‘activity’ (e.g. proportion of trips or frequency) which leads to different results from different studies. In conclusion, the balance of evidence suggests that where cycling is undertaken, its role in the journey to work is clear regardless of deprivation level but that it may also be an important mode for students and those out of work, particularly in higher income/lower deprivation categories.
4.7.5 The role of education
There is consistent evidence across the SHS and SCSP datasets that those with higher educational attainment are likely to cycle more and, like walking, the effect is still present even when employment and deprivation levels are held constant (Anable, 2010). The relationship can be seen in Figure 4.8 as found in the SCSP baseline survey.

Figure 4.8 The relationship between cycling frequency and educational attainment

![Chart showing the relationship between cycling frequency and educational attainment](source)

Source: SCSP 2009 (Base = 12,411, weighted) (Anable, 2010)

4.7.6 The role of the built environment
Examining the distribution of cycling trips across different settlement types and levels of deprivation helps to clarify why many of the models find an inconclusive relationship between deprivation and cycling levels. Figure 4.9 reveals that average numbers of daily cycling trips are indeed highest in the least deprived areas of large and medium towns but also in the most deprived neighbourhoods in small accessible towns (though shorter distances are travelled here). Our analysis showed that Edinburgh goes against this trend with high cycling frequency in its most deprived areas, although still not as high as in its least deprived neighbourhoods. Those cycling in the small remote towns spend more time travelling for leisure than in the other locations.
4.7.7 Perceptions of the local neighbourhood
The SHS survey found some relationships between neighbourhood satisfaction and cycling activity. In deprived areas, the level of traffic was found to hinder cycling uptake, but community spirit was a positive influence in these neighbourhoods, unlike their less deprived counterparts. In addition, whilst good scenery in the most deprived areas encourages individuals to cycle more frequently, the residents of the least deprived areas are actually cycling less frequently than others where the scenery is rated good. This latter finding may reflect the fact that many with good scenery live in remote rural areas which we have seen encourage the least average daily rates of cycling.

The SCSP survey found no conclusive evidence that neighbourhood satisfaction is related to cycling at the aggregate level or within different levels of deprivation.

4.7.8 Attitudes towards cycling infrastructure
The SCSP survey included questions on whether it was felt that cyclists can make safe trips in the local area and whether there are good facilities for cycling (cycle lanes, cycle parking). It was shown that perceptions of whether cycling is safe are least positive in the most deprived areas, but that there are fewer differences between areas as to whether cycle facilities are adequate, although satisfaction is highest in the 60-80% quintile. This broad pattern would seem to fit with the fact that cycling is also highest in the least deprived areas but the degree to which it is a significant predictor variable of cycling behaviour was tested in the regression analysis presented in Section 6.

4.7.9 Attitudes towards the environment
As with walking behaviour, those who cycle most frequently are also most likely to agree that the environment is important to them as a person and less
likely to agree that people should be allowed to use their cars as much as they like. These relationships are just as strong in each deprivation quintile, although this analysis reveals there to be less of a relationship in the most deprived areas compared to elsewhere. This suggests that when the effect of deprivation is controlled for, environmental attitudes are strong correlates with cycling behaviour.

4.8 Walking as a means of getting around for children/adolescents
Evidence on children’s travel patterns for anything other than the journey to school is limited.

The Scottish Household Survey reports that in 2008 just under half of children walked to school (Scottish Government, 2009b), down from 55% in 1999. Because primary schools are often closer to a child’s home than secondary schools, children in the age of 4-11 walk more often to (primary) school (55%) than children/adolescents in the age of 12-18 (42%). The most common reasons to walk to school are:

- the close proximity of the school to the home
- walking is considered to be the most convenient mode (closely related to proximity)
- walking is considered to be good exercise.

At the average, aggregate level, the degree of deprivation does not affect the extent to which children in Scotland walk to school: 55% of the children in the most and least deprived areas walked to school. However, this percentage is lower in areas with ‘average’ degrees of deprivation (Figure 4.10). In line with this, no clear relationship was found between the number of children that walk to school and household income. From this it can be concluded that factors other than socio-economic status are important for determining the frequency of which children walk to school, such as the distance between home and school, or the lack of alternative modes of transport.

With respect to cycling, our own analysis of the SHS (2005/06 dataset) shows cycling to school to be twice as high in the least deprived areas (1.0% compared to 0.4%). However, sample sizes for these subsets are extremely small.
We undertook some further analysis of the SHS data (2005/06 dataset) to understand whether there are different reasons given in the most and the least deprived categories for choosing the main mode of transport to school. Sample sizes at this subgroup level are small so the data needs to be treated with some caution, but, comparing the most deprived areas to the least deprived the following observations can be made:

- those in the most deprived areas were more likely to cite: it is ‘close/nearby’, ‘only method available’ or ‘on way to work’
- those in the least deprived areas were more likely to cite: it is ‘most convenient’, ‘quickest’, ‘good exercise, fresh air’
- those living in both levels of deprivation are equally likely to say: it is ‘too far to walk’, ‘the safest method’, ‘no public transport’, ‘no car’, ‘cheapest method’.

Journey to school data has also been collected since 2008 by Sustrans in their ‘hands-up survey’ (Box 4). This survey collected data from almost 400,000 pupils in three quarters of all primary and secondary schools in Scotland in 2008. Overall, 48% of children reported that walking was their ‘normal’ mode to school and a further 6% used ‘park and stride’ which involves some walking. This ranged from 19% (+1%) in the Orkney Isles to 62% (+7%) in Aberdeen City. It is also higher in primary than in secondary schools.
Box 4. Sustrans Hands-up Survey

**Background**

Hands-up Scotland is a joint project between School Travel Coordinators in Scotland and Sustrans. The first survey was conducted in 2008 with data collected by schools. Data collection takes place on one day over the time period of one week in September. All Local Authorities are invited to take part. During 2008, 29 Local Authorities participated. The total sample comprises 396,777 children across Scotland from 1824 schools. This represents 76% of schools.

**Measurement of variables**

*Walking and cycling*

In each class, pupils are asked to raise their hand in response to the question ‘How do you normally travel to school?’ with the response options: Walk, Cycle, Scooter/Skate, Park and Stride (drive part of the way and walk the rest), Driven, Bus, Taxi and Other.

*Socio-economic status*

Socio-economic status was not measured in this survey. In order to incorporate some measure of social status, each school could be given a post code and SIMD used to give some indication of deprivation. However, this would not necessarily reflect the catchment area of each school.

Source: Sustrans, (2009)

Figure 4.11 Analysis of mode use of the journey to secondary schools in Glasgow

[Image of the chart]

Source: Sustrans Hands-up Survey, 2008 (Whyte & Livingstone, 2009)

The Glasgow Centre for Population Health has carried out some analysis on this data, including deprivation analysis based on the SIMD score (of the school rather than pupil catchment) (Whyte & Livingstone, 2009). They combine walking, cycling, park and stride and skating to create an ‘active
travel’ score for each local authority. Their analysis of Glasgow and the Clyde Valley (336 schools) shows a similar picture to the data from the 2008 Scottish Household Survey – that there are similar levels of active travel in the least and most deprived areas and that it is the areas ‘in between’ where this activity is at its lowest. However, this pattern is particularly marked for primary schools, whereas active travel to secondary school drops off in favour of the car in the most affluent areas. Interestingly, their analysis also shows that there can be considerable variation between schools in the same local authorities. Their analysis of this for Glasgow is reproduced here as Figure 4.11.

4.9 Cycling as a means of getting around for children/adolescents
A very low proportion of children/adolescents in the Scottish Household Survey cycled to school in 2008 (1.5%) and similarly in the Sustrans Hands-up Survey (2.8%), although interestingly this was higher for primary school than secondary school pupils (Sustrans, 2009). The low frequency presents problems in terms of statistical significance when comparing across sub-groups and it was decided that no further analysis could be undertaken on the SHS for this reason.

Overall, the limited data collected on children’s journey patterns suggests that there is a complex relationship between socio-economic status and walking and cycling. This activity is not consistently related to social status and there are likely to be other explanatory factors such as the distance between home and school, or the lack of alternative modes of transport.

Further analysis is required to gather postcodes of schools (and ideally pupil catchments) in the Sustrans data to be able to analyse school travel patterns in relation to deprivation in some considerable depth. This was beyond the scope of this study.
5. Walking and cycling for recreational purposes

**Summary of key findings**

**Frequency of visits to the outdoors**
- frequency of visits to the outdoors differs according to social grade, ranging from 53% of those in the highest social grades (AB (managerial and professional)) saying they had made a visit at least once a week, to 38% of those in the lowest (DE (manual and unemployed)). Of those in social grade DE, around a third said they had not participated at all
- there is no difference between social grades with respect to those who visit the outdoors very frequently (every day or more)
- whilst those in the AB grade have shown a consistent pattern over recent years, those in social grades DE seem to be making more frequent visits.

**Walking**
- 45% of adults in Scotland walked at least once a week for recreational purposes or to keep fit in 2008
- the Scottish Recreation Survey consistently finds walking to be the main activity undertaken on an outdoor visit
- there is mixed evidence on whether or not walking is undertaken more often as a recreational activity in the most deprived areas or among lower social grades
- whilst the SHS finds walking for recreation to be lowest among the most deprived, the ScRS finds the opposite to be true
- the SHS suggests that whilst those in deprived areas walk more to get to and from most types of destination including leisure destinations, they are less likely to use this mode purely as a leisure activity in its own right
- overall, those in the most deprived areas appear to choose walking as a main activity more often when they visit the outdoors, but they undertake these visits less frequently
- between 2005 to 2008, those in the DE social grades increased the frequency of visits to the outdoors and so the gap with the AB’s has narrowed
- for travel to and from recreational destinations, those in social grades DE make more trips of less than 2 miles from home and visit destinations more often by foot than by car.

**Cycling**
- cycling for leisure currently appeals to a wider population than for getting to and from destinations
- 5% of the adults in Scotland cycled at least once a week for recreation or to keep fit in 2008
- cycling for recreation is consistent with the pattern seen for cycling as a way of getting around with those in the least deprived areas cycling up to four times more often.
Walking and cycling are common (outdoor) recreation activities\textsuperscript{15}. Because walking and cycling are ways to keep fit and to enjoy an outdoor environment, people often walk and cycle for its own sake, without necessarily even having a clear destination. Such walking and cycling trips are usually referred to as cycling/walking for leisure or for pleasure, which include walking and cycling as a sports activity or as a means of recreation\textsuperscript{16}. This is distinct from using these modes as a means of getting to and from a leisure destination. We discussed walking and cycling as a means of getting around in Section 4 where we revealed that those on lower incomes walk more when travelling to and from leisure destinations but for cycling the opposite seems to be true. In this Section we will examine whether the same patterns exist for recreational purposes.

5.1 Frequency of outdoor trips
In addition to some limited data in the SHS, we relied on reanalysis of the Scottish Recreation Survey (ScRS - see Box 5) to investigate the link between socio-economic status (in this case Social Grade\textsuperscript{17}) and recreational walking and cycling.

In each year since 2005, the ScRS shows that 80\% of people made at least one visit to the outdoors\textsuperscript{18} for recreational purposes within Scotland and 45\%\textsuperscript{19} of respondents indicated that they visited the outdoors at least once a week (TNS, 2009 and 2005-2008 data supplied by Scottish Natural Heritage). The corollary to this, of course, is that a fifth of the population do not participate at all in outdoor recreation. A similar proportion participates very infrequently.

Frequency of visit differs according to social grade, ranging from 53\% of those in the highest social grade (AB - the professional and managerial occupations) saying they had made a visit at least once a week, to 38\% of those in the lowest (DE - those in unskilled manual occupations or unemployed). Of those in social grade DE, around a third do not participate at all in outdoor activity. Also, the last outdoor visit made was often over three hours for those in social grade AB, while the last outdoor visit was usually under three hours amongst those in social grade DE.

It is Scottish Natural Heritage’s objective to increase the frequency of participation in the outdoor environment among infrequent participants (SNH, undated). Over the period from 2005 to 2008, whilst those in the AB grade have shown a consistent pattern, those in the DE social grades seem to be

\textsuperscript{15} (Outdoor) recreation is defined as any non-motorized activity carried out for leisure purposes (TNS, 2009).
\textsuperscript{16} It is difficult to make a distinction between walking and cycling for ‘leisure’, ‘sport’ or recreation as the literature largely uses these terms interchangeably and it is not always possible to understand what has been measured. In the following review, we reflect the wording used in the evidence being reviewed and offer further clarity where it was available.
\textsuperscript{17} Social grade (AB, C1, C2, DE) was the indicator of socio-economic status included in the ScRS. See Technical Annex, Appendix E for a breakdown of these categories.
\textsuperscript{18} ‘Outdoors’ includes mountains, moorland, farmland (enclosed and unenclosed), forests, woods, rivers, lochs and reservoirs, beaches, and the coast, and open spaces in towns and cities (TNS, 2009)
\textsuperscript{19} Taking the 2005-2008 combined dataset (N=46,832, weighted)
making more frequent visits to the outdoors and so the gap has narrowed as shown in Figure 5.1. However, it is notable that, in any case, there is no difference in social grade with respect to the proportion of people who visit the outdoors very frequently (every day or more) (Figure 5.2).

Box 5. Scottish Recreational Survey (ScRS)

Background
Scottish Natural Heritage measures the levels of participation in walking and other open-air recreational activities by means of the Scottish Recreation Survey. This is a continuous survey that has taken place as a monthly in-home Computer Aided Personal Interview as part of the Scottish Opinion Survey since July 2003. This involves around 1000 adults a month (on adult aged 16+ per household). Quota targets are set on the basis of age-group, social grade and working status. Within each stratification, respondents are selected randomly. At the analysis stage, the survey data is weighted to match the population profile based on sex, age and working status.

Measurement of variables
Walking and cycling
All questions in the ScRS concerned respondents most recent visit in the past 4 weeks to the outdoors for leisure and recreation’. Trips could either have been from home or while being away from home on holiday, provided the holiday was in Scotland. ‘Outdoors’ includes open spaces in the countryside such as woodland, parks, farmland, paths and beaches as well as town and cities. To make the results regarding most recent visits more representative of all the visits taken during the survey period, responses are upweighted by a factor equal to the number of visits in the previous 4 weeks.

Participants are asked to indicate their main activity and other activities during their last visit. For both questions, walking and cycling categories were (of a list of 22 options):
- walking - less than two miles
- walking - 2-8 miles
- walking - more than 8 miles
- cycling - on public roads
- cycling - on paths and tracks
- cycling - not on paths and tracks or roads.

Questions were asked about the main means of transport used to get to the main trip destination and foot and bicycle were include among 10 response options.

Socio-economic status
TNS (2009) refers to social grades (AB, C1, C2, DE), which is a classification based on current or last occupation of respondent (i) and current or last occupation of householder with highest income (see also Technical Annex).

Source: TNS, 2009
Figure 5.1 Proportion in each social grade making a trip to the outdoors at least once a week in the past 12 months (%)

Figure 5.2 Frequency of visits to the outdoors in previous 12 months

5.2 Walking for recreational purposes for adults
The literature on walking and cycling for recreation is extremely thin. In the Scottish context, we found reference to one study only. This was amongst adults living in the Western parts of Scotland20 whereby various ‘sports’

20 A random sample design based on postcode sectors within the Central Clydeside Conurbation was used.
activities including walking/rambling and cycling amongst people in their late 30’s and 50’s were examined (Hunt et al., 2001). Walking and rambling were amongst the most commonly undertaken sporting activities for participants in their late 30’s (men 19%, women 16%) and 50’s (men 16%, women 20%). Participants in both groups rarely cycled as a sports activity (2% or less).

The popularity of walking for leisure is confirmed in the national data sets. Overall, walking for pleasure takes place slightly less frequently than walking as a way of getting around. In the 2008 SHS, 45% of adults claimed to have walked at least once in the past week for leisure purposes or to keep fit, compared to 52% as a means of transport. This captures trips “just for the pleasure of walking or to keep fit or to walk the dog (and running and jogging)” (Scottish Government, 2009b, see also Box 3).

Figure 5.3 Walking as the main activity during outdoor visits in the past 4 weeks

The ScRS consistently finds walking to be the main activity undertaken on an outdoor visit. In 2008, over three quarters of all visits which took place in the preceding four weeks (78%) involved short walks of less than 2 miles, 2-8 miles, more than 8 miles or hill walking/mountaineering. Interestingly, walking is still the main activity for 66% of those who make a leisure trip only once or twice a year. Our analysis of the ScRS (2008 dataset) reveals that walking is more often the main activity among those in social grades DE, especially walks of less than 2 miles. For those in the lower social grade (DE), walks of less than 2 miles account for 43% of outdoor trips, compared to only 33% in grade AB (Figure 5.3).

---

21 A sample of people from the Twenty-07 Study was drawn (see also, Macintyre et al., 1989).
However, these two different data sets (the SHS and the ScRS) appear on the face of it to give conflicting results as to whether the frequency of walking for leisure as an activity in its own right is related to the degree of deprivation at the area and individual level.

Whilst ScRS data reveals walking to be a more popular activity among the most deprived groups, this contrasts somewhat to the SHS which suggests that, whilst those in deprived areas walk more as a way of getting around for most journey purposes, they are less likely to use this mode purely as a leisure activity. In the most deprived areas, 33% had walked for pleasure at least once in the past 7 days, whereas this was 51% in the least deprived areas. Also, those in lower income households walked less for leisure purposes (36% had walked for pleasure at least once in the past week in households earning up to £10,000) than in higher income households (59% in households over £40,000) (Scottish Government, 2009b).

This apparent discrepancy might be at least partially explained by the different ways in which ‘frequency’ has been measured on the two surveys. It could be that, whilst those in the lower social grades might tend to walk more when they make an outdoor visit, they tend to make fewer visits in the first place as we saw in Figures 5.1 and 5.2. However, the frequencies displayed in Figure 5.3 have been weighted by the total number of visits in the past month, so this has been controlled for to some extent. In addition, even when only the most frequent walkers are examined (only those who say they make outdoor visits once a week or more), those in the lower social grades DE still are still more likely to cite walking as their main activity (80% compared to 75% in AB grades).

Nevertheless, closer examination of the data from the ScRS (2003 dataset) suggests that those in the lower social grades appear to be making more walking trips from home. The vast majority of outdoor visits were made from home on the day out (95%) rather than when staying away from home on holiday. Those in social grade DE undertook fewer recreational activities while being away from home.

Therefore, a finer grained measurement of frequency as well as distance that is not confined to the previous outdoor visit would reveal whether those in lower income groups or social grades travel more or less in total on foot for recreation trips.

There was consistency between data sets in terms of travel to and from the leisure sites. Interestingly, walking was the dominant means of transport used to travel from home to make outdoors visits and is on an upward trajectory (64%, up from 61% in 2007), followed by car/van/minibus (30%), public bus (3%), bicycle (3%) and train (1%) (ScRS, 2008 dataset). Strikingly, just over half the visits made by those in the DE social group were within 2 miles of their origin and 75% travelled by foot to get there, compared to only 34% and 55% in social grades AB. Those in the higher social grades choose the car as often as they do walking and choose destinations further away from home. In the ScRS (2008 dataset), 57% in the DE grades had no car compared to only 11% in the social grade AB but of those who hadn’t made any visits in the previous
12 months, only 3% cited lack of car access as a reason. This fits with the analysis of the SHS survey in Section 4 which showed that those in lower income groups walk more for leisure trips and that their car availability is lower.

Another striking result is that 72% of people who made an outdoor visit did not spend any money during their visit, for example on leaflets, souvenirs or fuel to get to the outdoor location (TNS, 2009). Interestingly, those in the lower social grades were marginally more likely to have spent money on their trip, although when they did, they spent about 25% less than those on the higher social grades.

In conclusion, therefore, there is mixed evidence on whether or not walking is undertaken more often as a leisure activity in the most deprived areas or among the lower social grades, but there is consistent evidence that walking is carried out more often to travel to and from leisure activities in these groups.

5.3 Cycling for leisure purposes for adults
Cycling for leisure is consistent with the pattern seen for cycling as a means of transport and there is consistency across the data sets.

Similar to the number of people cycling as a way of getting around, 5% of respondents in the SHS stated that they cycled at least once a week for to get somewhere, and the same amount ‘just for pleasure’ (Scottish Government, 2009b). As with transport, cycling for pleasure appears to be greatest among the more affluent segments of society. The SHS shows that in the most deprived areas only 2% of respondents cycled for pleasure in the previous seven days, whereas the number rose to 8% in the least deprived areas.

Whilst this suggests that there is more cycling for pleasure in the more affluent areas, caution should be exercised when interpreting these figures as the number of cycling trips captured in the SHS is very small to make reliable comparisons.

In 2008, the ScRS reveals that cycling on public roads or paths and tracks was undertaken as a main activity by 3% of those who had made an outdoor visit in the previous 4 weeks. Additional analyses indicates a clear trend that less cycling is undertaken during outdoor recreational visits among the lower social grades either as a main or secondary activity.

5.4 Walking and cycling for leisure purposes for children/adolescents
The only evidence found on this topic was in relation to levels of physical activity among children presented in Section 3.2. This found some differences between levels of deprivation and physical activity, particularly among girls, where walking is highest in the most deprived areas. Boys in the most deprived areas also undertake more exercise which can include riding a bicycle.

Some inference about walking and cycling by children as a recreational activity can be drawn by looking at only those people who were accompanied by children on their last visit to the outdoors as measured in the ScRS. In 2008, children were included in the party for 43% of visits on average, increasing to 49% among DE social grades. When children are included, walking as a main activity reduces to 64% if trips overall, but is still highest in DE grades at 69%.
As would be expected, ‘family outing’ increases in importance to 21% of trips and this is also higher in the lower social grades. Those in social grades AB are more likely to undertake cycling on paths and tracks, swimming and rugby.
6. Determinants of walking and cycling behaviour

Summary of key findings

Regression analysis
- regression analysis applied to the SCSP baseline data identified the most significant factors explaining walking frequency as (i) perceptions of travel time (ii) having a long standing illness or disability (iii) car ownership (iv) educational attainment (v) the compulsion to walk for fitness
- the influence of deprivation (as measured by SIMD) on walking was weak relative to the influence of these five factors but has a greater influence once a car is owned
- the most significant factors explaining cycling frequency are (i) bicycle ownership (ii) believing that cycling is a healthy way to travel around (iii) believing that cyclists can make safe trips (iv) car ownership (v) educational attainment
- cycling has a possible role for car owners in particular to overcome difficulties in using the car such as parking or congestion constraints
- the less accessible local shops and services are perceived to be, especially for car owners, the more people cycle
- for non car owners, perceived safety of cycling, health benefits and educational attainment are the only variables that explain behaviour over and above bicycle ownership.

Conclusions on the determinants of walking and cycling
- determinants can be grouped into attitudes and perceived benefits, social factors, safety and traffic conditions and environmental and structural factors
- there is a general tendency for the health impacts, particularly losing weight, to be much more widely acknowledged for walking than for cycling
- instead of being viewed as healthy, the effort required to cycle, and the perceived safety risks, means that cycling can be viewed as a ‘bad’ thing to do and ‘difficult to adopt’
- walking can suffer from negative perceptions of travel time and barriers in terms of the distances people perceive and are prepared to walk
- people who feel supported by their social network to walk and cycle are more likely to do so
- participation in cycling can be influenced by whether the area is seen as ‘the kind of place where cycling would ever take place’
- walking and cycling for recreational purposes are often perceived as activities without direct goals, particularly in deprived areas and thus tend to particularly suffer from a lack of social networks and support
- perceived traffic safety is a factor more likely to influence cycling than walking
- the extent to which children walk and cycle to school, strongly depends on parental beliefs about traffic safety
- there is consistent evidence that infrastructure is a strong determinant of behaviour but is not sufficient on its own.
The preceding three sections have brought together a large body of evidence and examined the different behavioural patterns, and potential associations with those patterns of cycling and walking, across different social groups in Scotland. However, this evidence has largely been ‘data driven’ with results determined by those characteristics measured within the available data sources with enough statistical power to draw meaningful conclusions.

This Section will draw together the preceding three sections to offer some conclusions on the main determinants of cycling and walking in relation to socio-economic status in Scotland. Firstly, it will summarise the main explanatory variables emerging from the secondary analysis of the data. Secondly, it will bring the quantitative analysis together with the main findings from the literature review to offer some additional interpretation of the patterns of walking and cycling for active travel across socio-economic groups.

6.1 The determinants of walking and cycling

In the analysis in the preceding Sections we have determined that there is a relationship between walking and cycling activity and attitudes and different income groups or levels of deprivation. This analysis, however, does not help us determine the extent to which social status at the individual or area level has an independent influence on the level of walking and cycling or whether there are other factors which are stronger determinants of behaviour but which just happen to be more prevalent in specific social groups.

Therefore, in addition to the cross-tabulations and bivariate correlations reported above, additional multivariate analysis using regression has been undertaken on the SCSP baseline data (reported in Anable, 2010). By including in the models both socio-economic and attitudinal variables, regression analysis allows us to separate out the effects of socio-economic status vis a vis specific attitudes on walking or cycling, perceptions of one’s neighbourhood and environmental concerns. This helps overcome the danger in the bivariate analysis that the effect of one variable (area level deprivation for example), is confused with the effect of another (e.g. access to a car). The purpose was to distinguish the different effects of the various socio-demographic and attitudinal factors on the level of walking and cycling.

The SCSP dataset was regarded as suitable for regression modelling for two main reasons. Firstly, the SCSP survey had collected the travel mode ‘frequency’ variables in a way that usefully distinguished across the population. Instead of asking whether walking and cycling had been undertaken at least once in the past week/month or year (as is for example the case in the SHeS) or restricting this to the past seven days (as with the SHS) the SCSP was able to capture a wide variation in behaviour by asking for frequency of use over the past 12 months on a five point scale. Secondly, specific attitudes to the walking and cycling environment, neighbourhood satisfaction and perceived safety and health benefits had been included in the survey and these were all relevant to the topic being studied.

However, the regression modelling must also be considered as exploratory and treated with caution. This is because the SCSP data is not a Scotland-wide data set but was collected from 10 discrete locations. However, as
regression analysis is a test of the associations between the observed variables it was felt that the 10 locations represent a sufficiently large variation in the possible relationships between the independent and dependent variables that are likely to exist in the population as a whole. For instance, all levels of deprivation are included and a wide range of patterns of behaviour and attitudes are expressed by the survey respondents. Nevertheless, the specific geographical context of the results should be considered when interpreting the results. In addition, whilst diagnostic tests were used to select the most appropriate sets of variables for inclusion in the models (see Technical Annex, Appendix B and Anable, 2010), there are some issues with the non-normal distribution of walking and cycling in relation to some predictor variables, particularly with respect to cycling. Nevertheless, the large sample size and limited number of independent variables meant that regression was deemed to be an appropriate exploratory approach.

In each case, either walking frequency or cycling frequency is the dependent variable and, due to the significant interaction between car ownership and deprivation, the regressions were each run three times - once for all respondents, again for those with a car in the household and again for those without.

An exploratory stepwise method was used because the aim was to explore which variables determine walking and cycling in addition to socio-economic status. In this case, the proportion of variance in the dependent variable accounted for by each explanatory variable is assessed one by one in an iterative process. If each additional variable contributes to the model then it is retained, but all other variables in the model are then re-tested to see if they are still contributing to the success of the model. If they no longer contribute significantly they are removed. This method provides a greater likelihood of ending up with the smallest possible set of explanatory variables being identified as relevant.

The dependent variables included in each model were those identified from the previous analysis as being most relevant to either walking or cycling behaviour. These can be seen in the summary tables in order of importance.

6.1.1 Walking
Table 6.1 highlights the significant independent variables in order of importance for each of the three models – all respondents, those with a car in the household and those without.

The most notable conclusions from the analysis of the whole data set are as follows:

- the most significant factors explaining walking frequency are (i) perceptions of travel time (ii) having a long standing illness or disability (iii) car ownership (iv) educational attainment (v) the compulsion to walk for fitness
- with regard to educational attainment, the direction of the relationship suggests walking increases as education increases
• the influence of deprivation (as measured by SIMD) on walking was weak relative to the influence of these five factors but confirms that those in the least deprived areas will walk somewhat less than people in the most deprived areas
• the more people agree that they would fear crime during the day time, the less they will walk and this is a weak but significant determinant of walking
• satisfaction with the built environment is also weakly but significantly related but, as discussed earlier, the less satisfied with the built environment, the greater the tendency to walk. Given that this effect is over and above deprivation level it suggests that walkers are less satisfied with their surroundings
• being environmentally responsible\textsuperscript{22}, the perceived quality of pedestrian facilities and perceived access to goods and services are also significant so that the greater the sense of responsibility and satisfaction, the greater the walking frequency
• as we saw earlier, the regression model confirms that people appear to be less likely to walk the higher their sense of community spirit’. However, we found earlier that when deprivation level is held constant, the impact of community spirit is found to be negligible
• several factors did not add to the explanation of walking behaviour and were rejected by the model, notably employment status, whether pedestrians are believed to be able to make safe trips, whether traffic congestion is seen as a problem in their local area, and fear of crime in the evening. With regard to employment, this is not surprising as we had already seen that the relationship between employment and working was mixed and notably weak in the more deprived areas. With regard to the last three variables, traffic congestion and fear of crime, it is likely that there is not enough variation in the responses to these factors (i.e. consistently high support) to mean that they discriminate well enough across respondents and areas.

The most notable conclusions from the analysis of car owners only are as follows:
• a different mix of variables are important in predicting frequency of walking for car owners compared to the sample as a whole
• perception of travel time, disability and highest educational attainment are still the most significant factors explaining behaviour, but where people live in terms of its deprivation profile has a greater influence once a car is owned
• the compulsion to walk more to keep fit is also important for car owners and a weaker but nevertheless significant set of additional factors include fear of crime, satisfaction with the built environment (with an inverse relationship to walking), pedestrian facilities and environmental responsibility

\textsuperscript{22} This was determined by asking people to agree/ disagree to the statement ‘being environmentally responsible is important to me as a person’ and was left up to the respondent to define what this means.
- work status, pedestrian safety, fear of crime in the evening, community spirit, access to local shops and services and traffic congestion were all rejected by the model. In some cases this seems surprising, but the model has adopted those variables with the most discriminatory and explanatory power and these other factors appear to have less variability across walkers and non-walkers.

The most notable conclusions from the analysis of non car owners only are as follows:

- there are fewer significant explanatory factors
- in this case, the presence of a disability or illness is the most significant factor followed by perception of time, educational attainment, fear of crime, compulsion to get fit, environmental responsibility and access to local shops and services
- it is notable that greater satisfaction with local access is an important predictor of walking behaviour for those who do not have a car but is not significant for car owners suggesting that car owners satisfy their access needs with the car and walking journeys may be less about accessing goods and services and more about leisure
- deprivation is a much weaker predictor of behaviour for those without a car. We discovered this in the earlier discussion that the behaviour of non car owners is less variable across income and deprivation categories.
Table 6.1 Summary of three walking regression models

<table>
<thead>
<tr>
<th>Variable</th>
<th>CAR OWNERS ONLY</th>
<th>NON CAR OWNERS ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>N= 9003</td>
<td>N= 5862</td>
<td>N= 3141</td>
</tr>
<tr>
<td>R=.43, Adjusted R2 = .18</td>
<td>R=.39, Adjusted R2 = .15</td>
<td>R=.48, Adjusted R2 = .22</td>
</tr>
<tr>
<td>F = 166.497 (&lt;0.001)</td>
<td>F = 118.015 (&lt;0.001)</td>
<td>F = 91.649 (&lt;0.001)</td>
</tr>
</tbody>
</table>

**Significant variables (p<.05)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>Variable</th>
<th>Beta</th>
<th>Variable</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>I tend not to walk, even for short journeys, because it takes too long</td>
<td>-263</td>
<td>I tend not to walk, even for short journeys, because it takes too long</td>
<td>-287</td>
<td>Illness/ disability</td>
<td>-264</td>
</tr>
<tr>
<td>Illness/ disability</td>
<td>-180</td>
<td>Illness/ disability</td>
<td>-114</td>
<td>I tend not to walk, even for short journeys, because it takes too long</td>
<td>-221</td>
</tr>
<tr>
<td>Car ownership (yes/no)</td>
<td>-128</td>
<td>Highest educational attainment</td>
<td>-089</td>
<td>Highest educational attainment</td>
<td>-087</td>
</tr>
<tr>
<td>Highest educational attainment</td>
<td>-092</td>
<td>SIMD quintiles</td>
<td>083</td>
<td>I would be worried about being a victim of crime when walking in my local area during the daytime</td>
<td>-099</td>
</tr>
<tr>
<td>I feel I should walk more for short journeys in order to help keep fit</td>
<td>.072</td>
<td>I feel I should walk more for short journeys in order to help keep fit</td>
<td>.057</td>
<td>I feel I should walk more for short journeys in order to help keep fit</td>
<td>.090</td>
</tr>
<tr>
<td>SIMD quintiles</td>
<td>.073</td>
<td>I would be worried about being a victim of crime when walking in my local area during the daytime</td>
<td>-071</td>
<td>The buildings, streets and public spaces in my neighbourhood help make it a pleasant place to live</td>
<td>-104</td>
</tr>
<tr>
<td>I would be worried about being a victim of crime when walking in my local area during the daytime</td>
<td>-081</td>
<td>The buildings, streets and public spaces in my neighbourhood help make it a pleasant place to live</td>
<td>-081</td>
<td>Being environmentally responsible is important to me as a person</td>
<td>.065</td>
</tr>
<tr>
<td>The buildings, streets and public spaces in my neighbourhood help make it a pleasant place to live</td>
<td>-085</td>
<td>There are good facilities for pedestrians in my local area</td>
<td>054</td>
<td>There is good access to local shops and services in my area</td>
<td>.059</td>
</tr>
<tr>
<td>Being environmentally responsible is important to me as a person</td>
<td>.056</td>
<td>Being environmentally responsible is important to me as a person</td>
<td>.048</td>
<td>SIMD quintiles</td>
<td>.044</td>
</tr>
<tr>
<td>There are good facilities (e.g., pavements, road crossings, pedestrian-only areas etc) for pedestrians in my local area</td>
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<td>I think pedestrians can make safe trips including crossing roads in my area</td>
<td>.10</td>
<td></td>
<td>.040</td>
</tr>
<tr>
<td>There is good access to local shops and services in my area</td>
<td>.038</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There are friendly people and a good sense of community in my neighbourhood</td>
<td>-.024</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Excluded variables (p>.05)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>all</th>
<th>Car owners only</th>
<th>Non Car owners only</th>
</tr>
</thead>
<tbody>
<tr>
<td>working or not working</td>
<td>.006</td>
<td>.002</td>
<td>.031</td>
</tr>
<tr>
<td>I think pedestrians can make safe trips including crossing roads in my area</td>
<td>.022</td>
<td>.016</td>
<td>.131</td>
</tr>
<tr>
<td>I would be worried about being a victim of crime when walking in my local area during the evening</td>
<td>.018</td>
<td>.027</td>
<td>.101</td>
</tr>
<tr>
<td>Traffic congestion is a problem in my local area</td>
<td>.001</td>
<td>.029</td>
<td>.101</td>
</tr>
<tr>
<td>There is good access to local shops and services in my area</td>
<td>.021</td>
<td>Traffic congestion is a problem in my local area</td>
<td>.026</td>
</tr>
<tr>
<td>Traffic congestion is a problem in my local area</td>
<td>.014</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: SCSP 2009 (Anable, 2010). Notes: R is a measure of the correlation between the observed and the predicted value of the independent variable. Adjusted R Square (R2) takes into account the number of variables and participants and gives the most useful measure of the success of the model. If we have an Adjusted R2 value of 0.20 we can say that the model has accounted for 20% of the variance in the dependent variable. Beta is a measure of how strongly each predictor variable influences the dependent variable: a value of +/- 1.0 indicates that a change of one standard deviation (SD) of the predictor will result in 1 SD of the independent variable, and thus the higher the value the better. The figure indicates the direction of the effect but caution must be used as there is no consistency in whether a variable has been coded to mean a higher or more positive value. For instance, with car ownership, 1=yes and 2=no (so the lower the number, the more cars that are owned). For the attitude variables, 1=strongly agree and 5=strongly disagree in all cases.
6.1.2 Cycling

Table 6.2 highlights the significant independent variables in order of importance for each of the three models – all respondents, those with a car in the household and those without. The most notable conclusions from this analysis are as follows:

The most notable conclusions from the analysis of the whole data set are as follows:

- the most significant factors explaining cycling frequency are (i) bicycle ownership (ii) believing that cycling is a healthy way to travel around (iii) believing that cyclists can make safe trips (iv) car ownership (v) educational attainment
- the influence of deprivation (as measured by SIMD) was weak relative to the influence of these five factors
- environmental responsibility, access to local shops and services (the worse access is perceived to be, the greater cycling frequency) and employment status (cycling is greater by those in employment) are weak but significant determinants of cycling.

The most notable conclusions from the analysis of car owners only are as follows:

- slightly different factors have the greatest explanatory power for car owners only – notably education and environmental responsibility have stronger explanatory power than for the aggregate sample
- interestingly, at both the aggregate level and for car owners, the less accessible local shops and services are deemed to be, the more people cycle. At the bivariate level, accessibility did not appear to be a significant variable and did not prove to explain cycling behaviour. However, this would suggest that for car owners in particular, cycling is used in order to overcome accessibility barriers.

The most notable conclusions from the analysis of non-car owners only are as follows:

- perceived safety of cycling and the health benefits are the only variables that explain behaviour in addition to educational attainment and over and above bicycle ownership
- area level deprivation does not add anything to the model suggesting that these factors are strong regardless of socio-economic status
- several factors did not add to the explanation of cycling behaviour and were rejected by the model, notably sense of community, perceived traffic congestion in local area and perceived facilities for cyclists. This latter finding may seem particularly surprising but is likely be due to the fact that there is relatively little variability across the sample. However, it does raise a question as to the value of improving the infrastructure versus promotion of the relative safety, health benefits and perceived access advantages of cycling which have more explanatory power over this behaviour.
### Table 6.2 Summary of three cycling regression models

| Source: SCSP 2009 (Anable, 2010). Notes: R is a measure of the correlation between the observed and the predicted value of the independent variable. Adjusted R Square (R2) takes into account the number of variables and participants and gives the most useful measure of the success of the model. If we have an Adjusted R2 value of 0.20 we can say that the model has accounted for 20% of the variance in the dependent variable. Beta is a measure of how strongly each predictor variable influences the dependent variable: a value of +/- 1.0 indicates that a change of one standard deviation (SD) of the predictor will result in 1 SD of the independent variable, and thus the higher the value the better. The figure indicates the direction of the effect but caution must be used as there is no consistency in whether a variable has been coded to mean a higher or more positive value. For instance, with car ownership, 1=yes and 2=no (so the lower the number, the more cars that are owned). For the attitude variables, 1=strongly agree and 5=strongly disagree in all cases. |}

<table>
<thead>
<tr>
<th>N= 8983</th>
<th>N= 5845</th>
<th>N= 3138</th>
</tr>
</thead>
<tbody>
<tr>
<td>R=.55, Adjusted R2 = .31</td>
<td>R=.52, Adjusted R2 = .27</td>
<td>R=.63, Adjusted R2 = .40</td>
</tr>
<tr>
<td>F = 444.380(&lt;0.001)</td>
<td>F = 276.017 (&lt;0.001)</td>
<td>F = 523.549(&lt;0.001)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Significant variables (p&lt;.05)</th>
<th>ALL</th>
<th>CAR OWNERS ONLY</th>
<th>NON CAR OWNERS ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Beta</td>
<td>Variable</td>
<td>Beta</td>
</tr>
<tr>
<td>Bicycle ownership (yes/no)</td>
<td>.533</td>
<td>Bicycle ownership (yes/no)</td>
<td>.482</td>
</tr>
<tr>
<td>I think that cycling is a healthy way to travel around</td>
<td>.060</td>
<td>I think that cycling is a healthy way to travel around</td>
<td>.074</td>
</tr>
<tr>
<td>I think cyclists can make safe trips in my area</td>
<td>.057</td>
<td>Highest educational attainment</td>
<td>-.053</td>
</tr>
<tr>
<td>Car ownership (yes/no)</td>
<td>-.067</td>
<td>I think cyclists can make safe trips in my area</td>
<td>.055</td>
</tr>
<tr>
<td>Highest educational attainment</td>
<td>-.058</td>
<td>Being environmentally responsible is important to me as a person</td>
<td>.044</td>
</tr>
<tr>
<td>SIMD quintiles</td>
<td>.034</td>
<td>SIMD quintiles</td>
<td>.037</td>
</tr>
<tr>
<td>Being environmentally responsible is important to me as a person</td>
<td>.029</td>
<td>working or not working</td>
<td>.028</td>
</tr>
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<td>There is good access to local shops and services in my area</td>
<td>-.020</td>
<td>There is good access to local shops and services in my area</td>
<td>-.025</td>
</tr>
<tr>
<td>working or not working</td>
<td>.020</td>
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<th>NON CAR OWNERS ONLY</th>
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<td>-.002</td>
<td>There are good facilities for cyclists in my local area</td>
<td>-.009</td>
</tr>
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<td>There are friendly people and a good sense of community in my neighbourhood</td>
<td>.001</td>
<td>There are friendly people and a good sense of community in my neighbourhood</td>
<td>.002</td>
</tr>
<tr>
<td>The buildings, streets and public spaces in my neighbourhood help make it a pleasant place to live</td>
<td>-.002</td>
<td>The buildings, streets and public spaces in my neighbourhood help make it a pleasant place to live</td>
<td>-.014</td>
</tr>
<tr>
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<td>Traffic congestion is a problem in my local area</td>
<td>-.009</td>
</tr>
<tr>
<td>Illness/ disability</td>
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<td>Illness/ disability</td>
<td>-.019</td>
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6.2 Additional evidence from the rapid evidence review

6.2.1 Individual attitudes and perceived benefits

The regression modelling above confirms the literature cited in Section 3 that the compulsion to get fit is one of the most significant factors explaining walking frequency and, to some extent, cycling frequency (Ryley, 2006). However, the secondary data analysis found strong evidence that people who live in deprived areas perceive fewer benefits from cycling and walking and those in the lowest income brackets with poor health are significantly less engaged than their more healthy counterparts.

Similar results have been found in studies in Australia which suggest that people in deprived areas are less aware of the positive health effects that are associated with walking and cycling. (Cerin & Leslie, 2008; Cerin et al., 2009). In addition, other benefits may not be perceived or valued, for example the positive effects on the environment or congestion levels or the time and cost benefits.

A recent qualitative study of attitudes towards active travel (here including bus travel) in and around Glasgow concluded that ‘if active travel is to become more popular, active modes of travel will need to be recognised as being convenient, safe, pleasant and efficient’ (JMP, 2009). The results of the JMP study do not allow conclusions to be drawn about the attitudes and perceptions of specific social groups, but offers some interesting conclusions about a general tendency for the health impacts, particularly losing weight, to be much more widely recognised for walking than for cycling. Instead of being viewed as healthy, the effort required to cycle, and the perceived safety risks mean that cycling can be viewed as a ‘bad’ thing to do. Also, some people regard cycling in particular as ‘difficult to adopt’, with particular reference to the need for a certain level of physical fitness (JMP, 2009).

Walking, on the other hand, can suffer from negative perceptions of travel time and barriers in terms of the distances people perceive and are prepared to walk. Although the majority say they are not put off by walking time for short journeys (Anable, 2010) and other recent research in Scotland confirms that walking is more often seen as the easiest and quickest option (JMP, 2009; Halden et al., 2010), the secondary analysis revealed that of those who are put off by the time penalty of these journeys are most likely to live in the most and the least deprived areas. The regression analysis revealed that walking time was a significant explanatory variable. To our knowledge, the degree to which certain social groups may have a greater or lesser tendency to misperceive travel time or value time differently has not been examined in relation to walking and cycling and socio-economic status. This would be a useful addition to the evidence to aid our understanding of the barriers to these behaviours.

Another gap in the literature and the data is the degree to which the cost benefits of walking and cycling are indeed a factor in behaviour and could be used to promote these modes to lower income groups. For example, one explanation might be that people in deprived areas to choose to walk more often in order to avoid costs for fuel or public transport, but those in more
affluent areas walk more because they live in areas with less traffic or a more pleasant built environment. However, this review has not found the evidence presented in a way that allows us to draw such conclusions.

From this it could be concluded that, for many, current walking or cycling activity is actually a negative choice – i.e. one which is due to a lack of opportunity rather than a proactive choice. Such a negativity would contribute to the fact that walking is declining and car ownership increasing most rapidly in the most deprived areas (Bayliss, 2009). If people perceive no alternatives other than to walk or cycle, their attitudes and perceptions of the health benefits or other benefits are unlikely to be an important influence on their behaviour (cf., Ajzen, 1991). We saw from the secondary analysis that there is a negative correlation, particularly in deprived areas, between the satisfaction with the local neighbourhood in terms of community spirit, built environment aesthetics and traffic, and the level of walking. In such cases, awareness-raising may need to turn perceived negative choices into positive ones.

This may go some way to explaining why there is such a large gap between attitudes and behaviour in Scotland as a whole i.e. the vast majority in Scotland believes that cycling is healthy for them but cycling levels are still very low (Halden et al., 2010). This would indicate that the health benefits are not the most important factor that explains cycling behaviour in particular. So, whilst informing people of the health benefits of walking and cycling is likely to be an important precursor to their uptake, the gap between attitudes and behaviour that we already witness implies that there are other significant barriers which must be overcome.

6.2.2 Social factors

One objective of this study has been to understand why cycling as a viable alternative to car (or even bus) use is generally not well received among more deprived sectors of the population despite its seeming attractiveness as a low cost transport solution. The secondary analysis confirms that cyclists tend to be wealthier and healthier, yet active cycling lifestyles are not currently a mainstream aspiration of most of the population of Scotland.

Unfortunately however, it seems likely that the reasons underpinning the deep normative and cultural motivations that shape individual, inter-personal and community level attitudes and behaviours around cycling and walking have not been widely studied. In any case, it is possible to argue that such motivations are virtually impossible to include on quantitative survey instruments. To the extent that it has been measured, there are inconclusive results about the impact of a greater sense of ‘community spirit’ on walking behaviour as we have reported above.

Behaviour is to some extent based on people’s social environment. For example, in areas were many people walk or cycle, there is a social norm in favour of walking and cycling. As a result, people are more likely to walk and cycle when others do so. This is particularly the case when the others who walk and cycle are important to someone, for example friends or family members. Therefore, when people live in a social environment where walking and cycling is common, individuals are likely to walk and cycle more frequently.
In addition, people who feel socially supported by their social network to walk and cycle are more likely to do so (Cerin & Leslie, 2008; Giles-Corti & Donovan, 2002; Poortinga, 2006).

The importance of norms and local cultural factors was a clear finding in the recent qualitative research on active travel in and around Glasgow (JMP, 2009). This was particularly strong in relation to cycling where participation was influenced strongly by perceptions that the locality was ‘simply not the kind of place where cycling would ever take place’. This research also identified issues around social status and concluded that social norms, supported by the organisation of land uses which prioritise the car over other modes, positions active travel as the ‘worthy but poor relation’ to car based mobility.

Likewise, qualitative work underpinning the SCSP baseline quantitative work found a general cultural unwillingness to cycle in at least three out of the seven SCSP target areas. Focus group discussions about the potential for infrastructure improvements to encourage residents to cycle ‘were often met with laughter with factors such as self consciousness (“what would I look like on a bike”), weather and local culture (“get real”) all being important. There was sufficient opposition to cycling in Dundee, Glasgow, and Kirkintilloch, to suggest that promotion would only be successful within tightly defined niche markets such as students or keep fit groups (Halden et al., 2010).

Other studies have identified this lack of ‘social support’ for cycling and walking particularly in relation to their use as recreational activities. Giles-Corti & Donovan (2002) and Poortinga (2006) noted that walking and cycling for recreational purposes are often perceived as activities without direct goals, particularly in deprived areas and thus tend to particularly suffer from a lack of social networks and support.

6.2.3 Safety and traffic conditions
Pedestrians and cyclists are vulnerable road users. In 2008, 2,589 pedestrians and 725 cyclists were killed or seriously injured in Scotland (Scottish Government, 2008). The number of accidents involving pedestrians and cyclist has decreased significantly in recent years: casualties (seriously injured or death) fell by 41% and 44% when comparing figures of 2008 with the average number of casualties between 1994 and 1998, respectively. Nevertheless, the number of road accidents involving pedestrians and cyclists is still high in Scotland when compared with other countries (Scottish Government, 2008). Also, the falling pedestrian casualty rates have to be considered alongside the fact that walking has itself been declining.

From the secondary data analysis and literature review, perceived traffic safety is a factor more likely to influence cycling than walking frequency. More specifically, the behaviour, volume and speed of other road users are the main causes of this negative perception of safety (Scottish Government, 2006; 2009a). The more people who avoid cycling due to these factors, the longer feelings of unsafe traffic conditions for cyclists will be maintained.

Belief that ‘pedestrians can make safe trips including crossing roads’ received majority agreement in the SCSP baseline research but is notably lower in the
most deprived neighbourhoods (Anable, 2010). This fits with the statistics about road safety. Generally, accidents with pedestrians and cyclists tend to occur more often in deprived areas than in less deprived areas (Whyte & Livingstone, 2009; Abdalla, Reaside, Barker & McQuigan, 1997). Whyte and Livingstone (2009) observe that child road accident casualties have been falling in the last 10 years, but the greater number of casualties in more deprived areas has remained, with rates up to 4 times higher in the most deprived areas (Figure 6.1).

Figure 6.1 Rates of pedestrian accidents by deprivation for 5-15 year olds in Glasgow and Clyde Valley

![Rates of pedestrian accidents by deprivation for 5-15 year olds in Glasgow and Clyde Valley](source)

Whilst the relatively favourable casualty statistics in the least deprived areas might help to explain the higher level of walking to school in these areas (Section 4), the high casualty rates do not explain the high levels of walking in the most deprived areas. The contradiction may be explained by the relative lack of choice in these areas or expense of the alternatives, but further research is required to confirm this and to triangulate various data sources, potentially using accessibility indicators to understand the extent to which this can explain the trends. Indeed, our (albeit limited) analysis of the journey to school data in the SHS survey did not find any difference between high and low levels of area deprivation and feelings that there were fewer choices around the car or public transport (Section 4).

Austrian studies indicate that the extent to which children walk and cycle to school, strongly depends on parental beliefs about traffic safety (Collins & Kearns, 2005; Timperio et al., 2004). That is, the more concerned parents are that walking and cycling is not safe for their children, the less often children walk and cycle to school. As a consequence, parents often decide to drive their children to school, which often results in unsafe traffic situations around
school premises, and thus, further demotivates parents to allow children to walk or cycle to school (Granville et al., 2002).

It follows, therefore, that as conditions for walking and cycling are often less safe in deprived areas, parents in deprived areas are likely to have more concerns about allowing their children to walk and cycle (cf., Timperio et al., 2004). On the other hand, parents in deprived areas may have few alternatives then allowing their children to walk and cycle to school, for example due to low car access. As a result, they may feel forced to let their children walk or cycle to school, or accompany them when possible.

Another barrier for walking and cycling is the (perceived) crime levels in a neighbourhood. This was demonstrated in the secondary data as crime rates during the day were an important determinant of walking behaviour in each deprivation quintile (Section 4). The SCSP study showed that the perceptions of the walking environment are least positive in the most deprived areas, particularly general safety of walking around and fear of crime in the evenings, but it also shows that the attitudes are not necessarily the most positive in areas with the least deprivation. Other literature generally shows that in Scotland, people living in deprived areas are more likely to encounter more common occurrences of anti-social behaviour such as; noisy neighbours, vandalism, rubbish, groups of people taking drugs, or groups of young people hanging around (Scottish Government, 2005b). As a result, people in these areas tend to feel less safe, particularly after dark. In Scotland, 47% of the people living in the 15% most deprived and 65% of the people living in the rest of Scotland fear the consequences of crime whilst walking alone in their local neighbourhood after dark (ibid).

6.2.4 Environmental/structural factors
As explained above, people are more likely to walk and cycle if they feel safe when engaging in these behaviours, particularly for cycling behaviour. The environment in which people walk and cycle determines largely how attractive, convenient and safe walking and cycling is. In this respect, infrastructure is very important. For example, walking and cycling is much more safe, attractive and convenient when pavements and bicycle lanes are of good quality and without obstructions (Mackett, Achuthan, & Titheridge, 2008; Pucher & Buehler, 2008; Saelens, Sallis & Frank, 2003). Also, sufficient pedestrian and cycle crossings will facilitate convenient and safe walking and cycling conditions.

In addition, evidence from the Netherlands, Germany and Denmark suggests that cycling is more attractive when convenient, secure and, when possible, sheltered parking places for bicycles are available (Pucher & Buehler, 2008). This is also important with respect to bicycle theft, which is a problem for cyclists, particularly in urban areas and was a feature in recent qualitative research on attitudes to active travel in Scotland (JMP, 2009; Halden et al., 2010).

An important reason why walking and cycling is not considered to be safe, attractive and convenient is the behaviour of other road users (Scottish Government, 2006; 2009a). Therefore, environments should be designed in a
way that motorised traffic is discouraged. For example, speed ramps in
neighbourhoods reduces the speed of motorised traffic, and as a result walking
and cycling in these areas will be (perceived to) be more safe. Also, when
speed of motorised traffic is reduced, children can play, walk and cycle more
safely in their living area.

The design of an environment strongly influences people’s behaviour.
Therefore, if an environment is designed in a way that locations are accessible
by foot or by bicycle, people are more likely to engage in these behaviours. It
is true to say that the secondary analysis was inconclusive with measures of
perceived accessibility tending to have an overall weak association with
walking behaviour, and a potentially important role for cycling. Cycling has a
possible role for car owners in particular to overcome accessibility barriers.
However, there is scope for better research in to the role of objective and
perceived accessibility as barriers to walking and cycling in lower socio-
economic groups. The SIMD indicator includes an accessibility domain, but
this has its limitations, particularly in that it does not measure perceived
accessibility which has the greatest impact on behaviour (Halden, 2009; Fone
et al., 2006).

Macintyre et al. (2008) studied differences in the accessibility of 42 locations
across areas in Glasgow with different levels of deprivation. They conclude
that in deprived areas public and private facilities are equally as accessible as
in more affluent areas. Indeed, the SIMD indices suggest that, in general,
accessibility is better in the more deprived neighbourhoods and we know that
walking is higher in these locations. First, locations must be within range of
walking or cycling, such as nurseries, schools, post offices, sport centres, bus
stops. In neighbourhoods with high accessibility in relation to these various
locations, walking is more common (Aditjandra, 2008; Saelens et al., 2003).

Although objectively, accessibility may be comparable across locations, people
do not always perceive this. Also, the quality of locations such as parks and
leisure centres is unclear. It was found that people living in deprived areas
often perceive their neighbourhood as less attractive (Scottish Government,
2005b). For example, in 15% of the most deprived areas of Scotland people
perceive their neighbourhood to be:

- less quiet/ peaceful
- less convenient for shopping/ other amenities
- poorly provided with nice landscaped/ open spaces
- lacking a good outlook/ view
- poorly maintained
- lacking in good local schools/ local leisure facilities/ good facilities for
  children.
7. Promoting walking and cycling

Summary of key findings

1. The promotion of walking and cycling seems to be most effective when programmes are targeted at specific individuals who are already motivated to change behaviour.
2. However, those targeted at sedentary members of the population and deprived areas can also be successful, particularly if developed with the support of the local community recognising specific culture and attitudes.
3. Recent community-wide approaches to cycling in England have been particularly successful at reducing physical inactivity in people in the lowest social grades and those looking for work.
4. Any uncertainty in the evidence is more likely to be due to the lack of concerted effort made so far to target low income groups or those in deprived areas, rather than evidence which suggests that this would not be successful.

The literature on interventions to increase walking and cycling levels is plentiful and spans policy measures focused on structural and physical changes to the environment, fiscal incentivisation, health referrals and ‘soft’ measures (such as cycle training, individualised marketing, travel plans and promotional activity). There is also a large body of literature on the potential health benefits of increased walking and cycling activity, as well as environmental and congestion impacts. It is beyond the scope of this report to assess in detail ‘what works’ with respect to specific measures or packages of measures to promote walking and cycling. Instead, this Section focuses on evidence specifically addressing the potential for interventions to increase walking and cycling and net levels of physical activity among low income groups or in deprived areas.

7.1 Interventions to promote walking and cycling

A significant strand of the available academic literature on walking and cycling behaviour relates to the effects of interventions to promote uptake of these activities. It is beyond the scope of this study to review this body of evidence in any detail. Instead, the findings of three major international studies that have reviewed a significant number of interventions and two Scottish studies to promote walking and cycling are summarised here in order to offer an overview of the principal findings to emerge in recent years.

First, Ogilvie et al. (2004) undertook an international review of 22 interventions to promote both walking and cycling. The key findings can be summarised as follows:
- The best available evidence of effectiveness in promoting walking and cycling is for targeted behaviour change programmes; these programmes generally involve individuals or households identified as interested, contemplating or actively preparing to change their behaviour.
- The best available evidence about publicity campaigns, engineering measures, and other interventions suggests they have not been effective;
these interventions are applied to whole groups of people undifferentiated by motivation or personal travel circumstances

- some less targeted types of intervention have not been rigorously evaluated which must qualify the assessment of their effectiveness.

Secondly, in another review, Ogilvie *et al.* (2007) undertook a systematic international review of interventions to promote walking, but not cycling. Forty-eight studies were shortlisted of which 27 studies were concerned with walking in general and 21 studies were concerned solely with walking as a way of getting around. The key findings can be summarised as follows:

- people can be encouraged to walk more by interventions that are:
  - tailored to their needs
  - targeted at the most sedentary or at those most motivated to change
  - delivered to individuals or households or through group-based approaches. Interventions applied at the institutional or community level are less convincing.

- among targeted participants, successful interventions could increase walking in general by up to 30-60 minutes per week on average

- successful interventions could increase walking as a way of getting around in the general population by up to about 15-30 minutes a week on average; this estimate depends on a group of studies that are larger, but less robust than the studies of walking among more targeted groups.

Thirdly, Pucher & Buehler (2008) analysed why cycling is very common in the Netherlands, Denmark and Germany. On average, 27%, 18% and 10%, respectively of trips are made by bicycle in these countries compared to 1% of all trips in Scotland. Their main conclusion is that a combination of policy measures, physical changes and interventions is the key to the high number of cycling trips made in these countries. The most important policies and interventions that promote cycling in these countries are:

- an extensive system of separate cycling facilities; e.g. well-maintained, fully integrated paths, lanes and special bicycle streets in cities and surrounding regions

- intersection modifications and priority traffic signals; e.g. advanced cyclist waiting positions (ahead of cars) fed by special bike lanes facilitate safer and quicker crossings and turns

- discouraging motorized traffic; e.g. bicycle streets, narrow roads where bikes have absolute priority over cars

- facilitate bicycle parking; e.g. large supply of good bike parking throughout the city

- coordination cycling with public transport; e.g. bike rentals at most train stations

- traffic education and training; e.g. comprehensive cycling training courses for virtually all school children with test by traffic police

- traffic laws that protect cyclists; e.g. motorists assumed by law to be responsible for almost all crashes with cyclists.

In Scotland, Mutrie *et al.* (2002) reviewed impacts from an intervention to promote walking and cycling involving some 295 employees from three workplaces in the city of Glasgow. This was a self-help intervention involving
the provision of written interactive materials (the “Walk in to Work Out” pack) to an intervention group, whilst a control group received the pack 6 months later. The key findings can be summarised as follows:

- the intervention group was almost twice as likely to increase walking to work as the control group at six months
- 25% of the intervention group were regularly actively commuting at the 12 month follow up
- the intervention was not successful at increasing cycling (the campaign emphasis was on walking, although a good deal of cycling information was provided)
- the study reported no gender, age or distance travelled to work influences on the results.

The extent to which the influence of socio-economic status upon the uptake of the Walk in to Work Out intervention can be assessed is limited by the fact that participants were drawn from a narrow socio-economic cohort:

- they were pre-identified as thinking about or doing some irregular walking or cycling to work
- 76% of participants were members of social class 1 and 2 (professional and managerial categories)
- the majority of participants were economically advantaged car-owning women from medium and large sized workplaces
- these circumstances limit the representativeness of the intervention and the generalisability of its findings.

The Scottish Cycle Challenge Initiative was launched in 1997 and funded 37 projects from a total of £2.5 million in funding (Halden et al., 2001). These included cycle route construction, secure cycle parking, support for cycling to work, safer routes to school schemes, publicity and cycling promotion, cycle purchase and hire schemes, integration of cycling with public transport and support for cycle training, information and cycle clubs. Some of these initiatives were targeted at relatively deprived areas (e.g. safer routes to school in Dundee, Inverclyde, Clackmannanshire, Aberdeen). Evaluation was qualitative (of 16 projects) and the impact on social inclusion or health inequalities relatively buried in the results. For some, the initiatives were viewed as opening up cycling to communities who would otherwise have not become engaged in this activity. However, it was acknowledged that in deprived areas cycling can be viewed antagonistically by some adults, particularly when seen to be a council-led initiative, so exploiting the links with the health service and working with children are important. Whether or not the promotion of cycling helped to build respect within communities is difficult to gauge. The publicity often aimed to describe the attractive features in the area aiming to build a local pride and respect. The overwhelming conclusion of the evaluation is that the more successful initiatives were implemented within broader programmes such as health promotion and need to be developed with the support of the local community recognising specific culture and attitudes.

7.2 Promoting walking and cycling in deprived areas
From the examples outlined above, it is feasible to conclude that targeted interventions, including targeting the most sedentary groups, are likely to be
more successful than general campaigns. However, this conclusion is partially a consequence of the fact that more general campaigns have not been evaluated in as much detail. However, none of the above reviews specifically set out to report evidence in relation to the potential for interventions to increase walking and cycling among low income groups or in deprived areas. Indeed, the extent to which the influence of socio-economic status upon the uptake of interventions to promote walking and cycling can be assessed is limited, because few interventions have explicitly sought to target deprived groups or evaluate the social distribution impacts. When findings were reported they are generally brief and/or lack supportive data and, overall, the evidence is generally insufficient to permit meaningful synthesis.

Nevertheless, some individual studies have reported results in a way to allow some conclusions about the potential for walking and cycling interventions to increase walking and cycling and net levels of physical activity among different socio-economic groups.

For instance, ‘Walking for Wellbeing in the West’ involved a pedometer-based walking programme with physical activity consultation and a 12 month follow-up with an intervention group and a control (no action) group (Fitzsimons et al., 2008; Baker et al., 2008). This study was based in Glasgow with targeted recruitment at low active individuals in the more deprived groups. The key findings can be summarised as follows:

- significant increases were found in the intervention group for step-counts and time spent in leisure walking. Significant decreases were found in this group for time spent in weekday, weekend and total sitting with no corresponding changes in the control group
- a 12-week pedometer-based walking program in combination with a physical activity consultation is an effective way to increase walking and reduce sedentary behaviour in a community-based sample not meeting current physical activity recommendations.

The targeted nature of the study cohort and its very narrow socio-economic base means that the issues of representativeness and generalisability identified in previous studies apply equally in this context. However, it is significant that the two Scottish interventions discussed above both achieved successful outcomes despite being targeted at very different population groups in terms of socio-economic status and motivation to participate. This further adds credence to the conclusions of the systematic international reviews of interventions by Ogilvie et al. (2004) that targeted interventions are best placed to deliver improvements in active travel behaviour.

However, it has to be noted that less successful outcomes have been reported with similar targeted approaches in Scotland. In Scotland, an important approach to improving levels of walking has taken place through the promotion of physical activity in primary care settings through exercise referral or through the Paths to Health scheme established in September 2001. In response to the report *Let’s Make Scotland More Active* (2003), Paths to Health had a vision to encourage inactive people to walk more, with a specific focus on areas with greatest health inequalities (McKay et al., undated). This vision is to be reached through ‘active communities’ where each community has a network of
paths which people want, and are able to use, for recreation and everyday journeys.

Creating local partnerships to encourage walking in the community has formed the core of their work and since around 2004 the aims have been developed to include engaging health professionals in promoting walking; developing workplace initiatives to promote walking (not specifically areas with greatest inequalities); supporting other national organisations to support walking for health objectives, such as Living Streets, Sustrans, Ramblers' Association Scotland, Greenspace Scotland.

More specifically, a Pedometer Loan Pack project set out to engage people who might normally be seen as ‘hard to reach’ by similar projects. These included working age men (who are typically not engaged by such projects), people from more deprived communities and individuals in weight management clinics or those with weight problems. An evaluation concluded, however, that although the scheme had a positive impact in terms of participant reactions and motivational outcomes, there were problems identifying motivated individuals (McKay et al., undated). Indeed, those who would benefit most from using the packs were the individuals who lacked motivation, and for those that did, the loan pack or the method of calculating average daily step-counts was too challenging. On the other hand, Schmidt et al. (2008) found that exercise referral schemes appealed to women in the more deprived groups in a multi-ethnic urban setting appealed to them because of the facilitating role of the health professional, the supportive environment and the neighbourhood setting. Nevertheless, there was a common critique among the studies reviewed that there was no evidence as to the longer term impacts of such interventions, (Ogilvie et al., 2007; Williams, 2009; Morgon, 2005; Schmidt et al., 2008).

In contrast to these targeted behaviour change programme in the Scottish context, Morrison et al. (2003) have reported on the impacts of an engineering based intervention in Glasgow. This involved (6 months) before and (6 months) after surveys (postal questionnaire to local households and pedestrian counts at three locations on the route) relating to the introduction of a traffic calming scheme on a main road bisecting a housing estate in Glasgow. Of course, the location of the intervention and the measurement of its effects are, in effect, targeted - in that it primarily serves the resident population of the area, which in this case was classified as deprived. The key findings can be summarised as follows:

- 20% of residents said they walked and 4% said they cycled more in the area as a result of the introduction of the traffic calming scheme
- the pedestrian counts recorded substantial increases at most sites after the introduction of the traffic calming scheme
- low response rates and selection biases may compromise the findings
- the validation of the findings is necessary through further observational and experimental studies.

In order to assess the combined effect of engineering and motivational based approaches, it is useful to examine the recent experience within the Cycling
Demonstration Towns and the Sustainable Travel Towns in England. These interventions were aimed at medium sized towns (ca. 100,000 population) and there is no reason to believe that the results of the interventions would be any different in a Scottish context.

Sloman et al., (2009), summarise the evidence on changes in cycling and physical activity in six towns\textsuperscript{23} following the first phase of the Cycling Demonstration Town (CDT) investment programme between October 2005 and March 2009. This involved approximately £10 per head of population investment per year (£5 from Cycling England and £5 from the Local Authorities) to bring investment in these towns to a level comparable to many European cities where cycling is popular. Investments were typically made in improving, extending or building cycle routes; working with employers; offering Bikeability cycle training and other cycling promotional programmes in schools; implementing a tailored cycle hire scheme; introducing 20mph zones; implementing cycle signs with times (rather than distance); working closely with Primary Care Trusts; improving cycle parking facilities in schools, at stations, and other key destinations; and updating cycle maps (Cycling England, 2010).

The evaluation, which included surveys in the towns as well as analysis of data from the Sport England Active People survey as a control, set out to understand whether there was an increase in cycling, and if there was, whether this was associated with an increase in physical activity and therefore benefits to health. It is important to measure physical activity as it is possible that people who took up cycling had a corresponding decline in other aspects of their physical activity.

In the first three years of the CDT programme, there have been encouraging increases in cycling observed at a population level in the CDTs that were not seen in other (non-CDT) towns. The CDTs have also seen significant and important reductions in sedentary behaviour, that are likely to be associated with benefits to public health.

The mean increase in cycling across the towns was 27% relative to a 2005 baseline as determined by automatic cycle counters. From the surveys, the proportion of adult residents of the CDT local authorities cycling for at least 30 minutes once or more per month increased from 11.8% in 2006 to 15.1% in 2008, an increase of 3.3 percentage points or 28%. Meanwhile, the proportion of adult residents of the six towns who cycled regularly (that is, for at least 30 minutes 12 times or more per month) increased from 2.6% in 2006 to 3.5% in 2008, an increase of 0.9%-points or 37%. Moreover, with respect to those doing any cycling in the past week, respondents in higher socio-economic groups were generally more likely to have cycled in the last year, but there was an increase in propensity to cycle between before and after surveys across all social grades (Figure 7.1).

\textsuperscript{23} Aylesbury, Brighton and Hove, Darlington, Derby, Exeter and Lancaster/Morecombe.
Analysis of physical activity data showed that there was a significant decrease in the proportion of people classed as inactive in the towns (those with a sedentary job and no recreational activity) and a corresponding increase in the proportion classed as moderately inactive and moderately active. In particular, the greatest reduction in people classed as inactive took place in social grade E, with a 10% reduction (95% CI -6.8 to -12.4), compared to -2.6% overall (95% CI -1.5 to -3.7).

Only one of the 6 CDTs explicitly targeted health inequalities or deprived groups (Darlington), and yet the whole-town approach appears to have been successful in achieving an increase in cycling activity across all social groups. Darlington also received additional funding for implementation of a large scale Smarter Choices Programme as part of the Department for Transport’s Sustainable Travel Town’s programme and invested in additional individualised marketing and other promotional activity. Cycling to work as a proportion of trips doubled (from 1.3% to 2.6%), but more than tripled for those looking for work (from 0.95% to 3.48%) and those in part time or casual work (0.7% to 2.5%) (Sloman et al., 2010). Although employment status does not map exactly on to deprivation or social status, this is the proxy we are able to use from this evaluation and another indicator that the interventions were relevant to all social groups through a whole-town approach. In Scotland, this is important evidence to support the approaches being adopted in the Smarter Choices, Smarter Places programme where health inequalities are being specifically targeted in many of the seven locations (Halden et al., 2010).

Following on from the results of this evaluation, a press release on the 2nd March 2010 acknowledges the health benefits of the CDT programme. There are now 18 locations being funded in the same way, and several of these are specifically seeking to target low income neighbourhoods. These are still at the exploratory stage.
7.3 Limitations of the evidence

The above review, albeit partial, reveals that there is limited evidence to assess the extent to which interventions to promote walking and cycling can be successful in increasing activity levels in low income groups or deprived areas. The most important limitations are as follows:

- there is an insufficient number of robust studies of the impacts of interventions to promote walking and cycling. This applies worldwide, but is particularly acute in the Scottish context
- where evaluation and monitoring has been undertaken, socio-economic issues are under-reported in the literature either because they are not the primary focus of the intervention in the first place, the data that is available is not always suitable, particularly at the sub-group level, or many studies are focussed on specific socio-economic cohorts which cannot be used to generalise findings for application to wider society
- it can be unclear whether interventions lead to improvements in overall levels of physical activity attributable to increases in walking and cycling
- the effects of successful interventions targeted at motivated groups of volunteers cannot be assumed to apply to wider sections of the population as increases in cycling may be largely attributable to existing cyclists making more trips
- evidence about interventions at the level of the community and institution (workplace or school) usually depends on small isolated studies or subgroup analysis
- in order to consider or influence the societal determinants of walking, interventions are needed at a sufficient scale to influence patterns of travel behaviour. This raises practical difficulties of implementation and is not the case with many of the interventions reviewed here or elsewhere
- there is a lack of evidence on the effects of large scale community level interventions, both planned health promotion activities and natural experiments involving major changes to the built environment
- it is unclear whether or how benefits of individual and group level interventions effective in selected groups or in the short term can be sustained and generalised.

Consequently, the evidence presented above does not allow any definitive conclusions on the potential for walking and cycling interventions to reduce physical inactivity among low income groups or in deprived areas. However, on balance, the evidence does not suggest that interventions are likely to be unsuccessful in this regard. Indeed, whilst it is clear that interventions targeted at the most motivated groups are likely to have the greatest success and this could conceal increasing disparities in levels of physical activity between social groups, those which either specifically target sedentary groups or adopt a comprehensive, whole-town approach have also witnessed impacts across the social spectrum. It is significant that the two Scottish interventions discussed above both achieved successful outcomes despite being targeted at very different population groups in terms of socio-economic status and motivation to participate. This further adds credence to the conclusions of the systematic international reviews of interventions by Ogilvie et al. (2004) that targeted
interventions are best placed to deliver improvements in active travel behaviour. Therefore, to a large extent, the inability to offer definitive conclusions can be attributed to a lack of effort so far applied to reducing health inequalities through targeted walking and cycling interventions, rather than evidence to suggest that this would not be successful.
8. Conclusions and recommendations

8.1 Conclusions
Comparing the results from various surveys allows more definitive statements about population trends to be made. From the analysis of the four major Scottish datasets, it can be concluded that the relationship between socio-economic status and cycling is clearer than for walking. Overall, the higher the deprivation level, the more walking and less cycling is undertaken as a means of getting around. This relationship holds true whether household income is examined or whether the area level indicator of deprivation (SIMD) is used.

For recreational travel, results for cycling follow the same pattern with more trips being undertaken by those in higher social grades AB. For recreational walking, the data is less conclusive but, on balance, it appears that those in lower social grades DE undertake more walking when they spend time in the outdoors, particularly short walks from home, but they undertake this activity less frequently. A summary of the results from each dataset is presented in Table 8.1.

Table 8.1 Summary of the results from each dataset on the relationship between walking and cycling and socio-economic status

<table>
<thead>
<tr>
<th></th>
<th>For transport</th>
<th>For recreation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>Cycling</td>
<td>Walking</td>
</tr>
<tr>
<td>SHes</td>
<td>lowest among</td>
<td>highest among</td>
</tr>
<tr>
<td></td>
<td>most deprived</td>
<td>most deprived</td>
</tr>
<tr>
<td></td>
<td>(frequency of 5 min or 15 min trips + total time spent travelling)</td>
<td>(total no. of trips; ave. length of trips + trips as a % of total trips)</td>
</tr>
<tr>
<td>SHS</td>
<td>highest among</td>
<td>lowest among</td>
</tr>
<tr>
<td></td>
<td>most deprived</td>
<td>most deprived</td>
</tr>
<tr>
<td></td>
<td>(total no. of trips; ave. length of trips + trips as a % of total trips)</td>
<td>(frequency)</td>
</tr>
<tr>
<td></td>
<td>walking declining at a faster rate in most deprived areas</td>
<td></td>
</tr>
<tr>
<td>SCSP</td>
<td>highest among</td>
<td>lowest among</td>
</tr>
<tr>
<td></td>
<td>most deprived</td>
<td>most deprived</td>
</tr>
<tr>
<td></td>
<td>(frequency)</td>
<td>(frequency)</td>
</tr>
<tr>
<td>ScRS</td>
<td>highest among</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>most deprived</td>
<td></td>
</tr>
<tr>
<td></td>
<td>for travel to leisure destinations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

With respect to the contribution of walking and cycling to levels of physical activity, walking is an important contributor across all social groups, but less so in the more deprived areas. Cycling has a negligible impact overall, but a potentially large impact for the minority who undertake it on a regular basis.

The secondary data analysis and the evidence review show a strong relationship between socio-economic status and walking and cycling activity. Realising there is a link does not, however, help us to understand why it
should exist and the factors leading to the different behaviour patterns. The datasets needed examining in more detail to understand the extent to which the underlying factors which are associated with higher deprivation such as unemployment, low car ownership or poor neighbourhood perceptions have a role to play in influencing walking and cycling.

The consequences of this for policy designed to increase physical activity levels by encouraging walking and cycling among low income groups or in deprived areas are outlined below.

8.2 Policy implications
The secondary analysis of four major Scottish data sets and a selection of the international literature have concluded that there are important differences in the propensity for those in different socio-economic groups to walk and cycle. These differences create both challenges and opportunities for policy efforts which are attempting to increase levels of physical activity among those on the lowest incomes or living in the most deprived areas.

The main opportunity arises due to the fact that walking among these groups is already high, and walking to leisure destinations or for recreational purposes is tending to buck the general downward trend. The main challenge, on the other hand, comes from the fact that total walking frequencies are declining among these groups even faster than for Scotland as a whole, at the same time as car ownership is rising most rapidly and cycling activity is extremely low. Moreover, people in the most deprived areas perceive fewer benefits from cycling and walking, despite the time and cost benefits that these modes theoretically offer.

At face value, the evidence suggests there is no basis for using the promotion of walking and cycling as a way of reducing health inequalities. With respect to walking, the tendency for those who already walk more frequently than average to believe they should walk more for fitness, the relative disengagement with the health benefits of walking amongst those who would benefit the most and the rapid decline in walking as a favoured mode in the most deprived areas all potentially lead to such a conclusion. With respect to cycling, the extremely low and declining numbers of cyclists in the most deprived areas and the apparent cultural barriers towards this mode suggest cycling has a minor role to play.

However, this study has highlighted a number of reasons why an alternative argument could be presented suggesting that investment in walking and cycling interventions could play an important role in reducing inactivity and health inequalities in low income groups and in deprived neighbourhoods:

8.2.1 The lack of evidence can be attributed to lack of targeted interventions aimed at motivating the most deprived groups
Any lack of evidence on the potential for walking and cycling interventions to reduce physical inactivity among low income groups or in deprived areas could be attributable to the fact that such interventions are rarely targeted towards these groups, rather than any suggestion that they are not successful when they are. To the contrary, the most recent evidence from the Cycling
Demonstration Towns (CDT) and the Sustainable Travel Towns in England suggests a town-wide approach can increase cycling levels in all social groups and even lead to the greatest reduction in levels of inactivity among those in the lowest social grades (Sloman et al., 2009; Cavill, 2009). Such interventions have succeeded in applying the key ingredients of galvanising community support through inclusive, town-wide branding exercises, consumer surveys and media campaigns, investment in infrastructure improvements and a gradual cultural shift.

8.2.2 Interventions can be successful regardless of the target group, so long as targeting takes place
Although town-wide interventions appear to have had some success, it is clear from the literature that targeted interventions are best placed to deliver improvements in active travel behaviour (Ogilvie et al., 2007). Albeit confirming the fact that the most motivated groups are likely to respond to interventions, the evidence presented in the literature also suggests that interventions can be successful regardless of the target group, so long as targeting takes place (see Section 7). It is also important to recognise that this study revealed engagement with the health benefits of walking for those who are currently inactive to be very similar regardless of the level of deprivation. This shows that, relatively speaking, there is better engagement with health in the least deprived areas but that the segments who most need to become active are hard to reach regardless of deprivation.

The multivariate analysis undertaken for this review found that higher levels of walking and cycling are clustered within different subgroups of the population in different levels of deprivation. In areas of highest deprivation, the people who walk the most are young men, those not at work and those with children at home. This is all important information to inform targeted interventions. Those who are not in work were the group to respond the most to the cycling interventions in Darlington as part of the CDT interventions (Sloman et al., 2010). Further rounds of CDT investment are setting out to specifically target deprived communities but so far it is true to say that there has been relatively little thought and effort applied to how to target these groups.

8.2.3 Locational and individual factors can have a stronger impact than deprivation
The multivariate analysis undertaken for this study revealed that there are certain individual, social and structural factors which are stronger determinants of walking and cycling behaviour than deprivation per se. For instance, there is strong evidence from within the SHS and SCSP datasets and elsewhere that where, on an individual basis, people think most positively about walking and cycling, they are most likely to undertake these activities. This suggests that, within any given deprivation level, it is still worth improving the environment and the infrastructure in order to foster more positive opinions about these modes. We also saw that, compared to socio-economic status, perceptions of travel time and the compulsion to get fit are stronger determinants of walking and perceptions of health and perceived safety are stronger determinants of cycling. This suggests that there are factors at the individual level which are worth influencing which have the potential to mitigate any underlying barriers related to socio-economic status at the area or individual level.
Likewise, by controlling for deprivation across different cities in Scotland, we saw that there was no longer a consistent pattern between deprivation and walking and cycling levels. There is strong evidence that factors at the local level - likely to be a combination of the quality of the built environment and infrastructure, accessibility and cultural factors - are worth influencing in order to increase levels of walking and cycling even in the most deprived neighbourhoods.

8.2.4 There are potential big wins in the area of recreation travel
Walking is a popular activity for recreational trips across all social groups. The evidence as to whether walking for recreation is undertaken more or less frequently in the most deprived groups is currently mixed. This is testimony to the fact that the picture is complex and dependent on the time period over which measurements are made and whether distance, frequency or time spent on the activity are measured. It is clear that around a third of those in the lowest social grades (DE) do not participate at all in outdoor activities. Little is known about this group, but given the lack of stigma attached to walking in general among this group as compared to cycling, there is great potential to target inactivity through recreation as opposed to transport activity. This ties in with the Scottish Natural Heritage’s current focus on increasing the number of new participants to the outdoors (SNH, 2009 and undated).

8.2.5 Walking is a particularly important contributor to physical activity among girls in deprived areas and working with children could be the key to future success
Children in the most deprived areas tend to be slightly more physically active and especially for girls, walking plays an important role in these levels of physical activity. Although not based on evidence directly from this review, it could be suggested that nurturing this activity could be a key ingredient in future activity levels.

8.2.6 Interventions are necessary to at least stem the decline in walking in deprived areas
Given that walking and cycling frequencies are declining at the fastest rate in the most deprived areas, there is an argument to suggest that investment is needed to at least maintain current levels of activity.

8.2.7 Efforts should not be confined to improving walking and cycling infrastructure but also to discourage car use
Walking frequencies are reducing the fastest in the same areas that car ownership is increasing the fastest. Nevertheless, even when cars are owned, people walk more in the more deprived areas than in their less deprived counterparts. This suggests that factors such as affordability and accessibility dampen car use in these areas. It follows that further measures to increase the cost or reduce the accessibility of car use might stem the decline in walking. In addition, the analysis revealed that for car owners in particular, cycling is used in order to overcome difficulties in using the car such as parking or congestion constraints. This also suggests that measures to discourage car use could be an important ingredient to encourage cycle use.
Overall, it is beyond the scope of this study to detail the types of initiatives that may be most successful in increasing physical activity levels in different socio-economic groups. To the extent that evidence even exists, the rapid review did not permit a detailed synopsis of best practice. However, it seems clear from the above recommendations that the following would be important in the most deprived areas:

- **Individual factors**: interventions which alter perceptions of the relative travel time, safety and health benefits of walking and cycling; targeted promotions at those out of work and the most inactive groups
- **Social factors**: promotional campaigns based on local research into specific attitudes and barriers and which aim to get the community on board
- **Structural and environmental factors**: planning which supports equal access by disadvantaged groups to jobs and essential services by identifying local accessibility problems and solutions; investment in good quality and safe infrastructure including traffic calming and interventions to ‘reclaim the streets’ in order to encourage active travel especially by children.

### 8.3 Suggestions for further action

#### 8.3.1 Understanding the ‘why’ in addition to the ‘what’

In order to target low income groups or deprived neighbourhoods it is necessary to identify the specific barriers and motivations to walking or cycling for these target groups and design targeted pilot programmes to apply this knowledge before scaling up. However, the existing evidence base only allows detailed diagnosis of ‘what’ is happening in relation to this activity rather than ‘why’ walking and cycling patterns are as they are. For instance, walking and cycling could be assumed to be attractive due to their relative affordability. However, we have no evidence on this issue. Whilst the data sets reviewed for this study do include limited information on attitudes to cycling and walking, the current data does not permit sufficient understanding of the degree to which walking and cycling are attractive on the grounds of costs. Whilst it can be assumed that these modes are attractive due to their relative affordability, we have no evidence to confirm this.

Similarly, we know from broader research on behaviour change that social norms are an important influence. However, the degree to which other peoples’ opinions influence an individual’s travel choice is absent from the data and largely missing in the literature. The latter issue may be a route to shedding light on the idea of a ‘cycling culture’ and the route to communities and social groups which view walking and cycling as a normal everyday behaviour. This would merit more detailed research, potentially using qualitative rather than quantitative methods in the first instance. These need to be followed by quantitative measures in order to be able to gauge changes over time.

#### 8.3.2 Road safety

An important barrier for walking and cycling is the perceived safety of the pedestrian and cycling infrastructure. Safety issues seem to be more urgent in
the more deprived compared to the more affluent areas and is likely to have had an effect on activity levels of adults as well as children. Creating supportive environments with respect to safety characteristics may decrease between-area differences and area deprivation inequalities in walking and cycling for getting about as well as for recreation. Future studies are needed to explore how various safety issues are related to walking and cycling in a Scottish context, particularly across locations.

8.3.3 Neighbourhood characteristics
Two of the major datasets used for this study (SHS and SCSP) measured perceptions of the local neighbourhood including the built environment, pedestrian environment, perceived friendliness, congestion and accessibility. These variables appeared to account for some of the variance in walking and cycling beyond deprivation, but not always in the direction expected. Whilst there is a statistically significant tendency for those who walk more to have a more negative view of their neighbourhood, congestion is perceived to be less of a problem among those who walk the most and the relationship between walking and perceived access is not statistically significant.

Evidence documented in the literature suggests that, in general, residents from communities with higher density, greater connectivity, and more land use mix report higher rates of walking/cycling for utilitarian purposes than low-density, poorly connected, and single land use neighbourhoods (Saelens et al., 2003). In contrast, this review did not discover evidence of the influence of recreation and green areas on recreation walking or cycling. One hypothesis may be that compact, high-density neighbourhoods may be good for utility cycling, but not so for recreational activity unless specific resources were allocated to campaigns and good quality places to facilitate local cycling activity.

Given that our analysis revealed walking to be higher in the deprived areas even though satisfaction with the neighbourhood is generally lower, more needs to be understood about the neighbourhood factors which have any influence on walking and cycling and the interplay between objective and subjective judgements. This includes measures of accessibility. This would involve the collection of detailed individual travel data and perceptions of the neighbourhood and travel times to be correlated with objectively defined measurements using GIS. It may be that measures of the built environment have stronger associations with walking and cycling than objective measures (Lin and Moudon, 2010) and should help to unpick why, when deprivation is controlled for, levels of cycling and walking can be very different in similar types of settlement.

There is also a lack of evidence on the effects of large scale community level interventions involving major changes to the built environment.

8.3.4 Recreation
There is a specific lack of evidence on cycling and walking undertaken as activities for their own sakes. The dedicated ‘travel’ surveys (SHS, SCSP) generally do not distinguish well between travel to get around and for recreation and have difficulties in documenting very short trips. The dedicated recreation survey (ScRS) has the problem of placing much emphasis on the
respondent’s previous visit to the outdoors, which has the potential to miss many casual activities and makes it difficult to measure total activity. There is the potential to improve question wording on both the SHS and the ScRS to rectify this gap in the evidence.

8.3.5 **Children**
The SHS suggests that walking is an important part of children’s physical activity levels, particularly for girls. However, it is unclear how much of this walking is discretionary leisure time walking versus visits to shops or to school. This lack of detail means that it is difficult to understand what the net impact on physical activity levels might be if such walking activity were to be reduced. It would also be useful to understand the age at which children become independent travellers (i.e. tend to go out alone) and how this might vary across socio-economic groups, genders and settlement types.

With respect to the journey to school, there are unanswered questions about why walking does not vary at the aggregate level between the most and the least deprived areas, but there is considerable variation between schools in the same local authority areas. Sustrans Hands-up survey data for Scotland could be used by adding in the postcodes for all schools and the appropriate SIMD indices. However, this may not explain (i) variations due to the catchment area of the schools (ii) objective differences in access to the school by the different transport modes, the existence of a school travel plan and Safe Routes to School Infrastructure etc.

8.3.6 **Monitoring**
While the evidence base for interventions targeted at walking, cycling and specific group action now exists, some of these links and their implications for policy design and delivery need further development. Section 7 revealed a number of significant limitations in the available evidence on the link between cycling and walking interventions and their social distributional impacts. Many of these limitations stem from the lack of evaluation and monitoring applied to interventions at the community level. Particular emphasis needs to be placed on adopting appropriate methods to collect data. Quantitative and qualitative surveys need to be designed to collect data across a broad enough range of socio-economic cohorts to allow sub-group analysis and before and after studies with control groups. Finally, it is necessary to understand the longer term effects of interventions and the degree to which any behaviour change is sustained over the longer term.
9. References


Lin, L. and Moudon, A.V. (2010) Objective versus subjective measures of the built environment, which are most effective in capturing associations with walking? Health and Place. 16(2), pp. 339-348.


Scottish Executive (2005b) Social focus on deprived areas. Scottish Executive, Edinburgh.


SNH (undated) *Enjoying the outdoors*. Scottish Natural Heritage.

SNH (2009) Developing the contribution of the natural heritage to a healthier Scotland. Scottish Natural Heritage.


**High priority references reviewed in full**
*(see Appendix A for a Proforma on each; duplicate numbers where two or more references belong to the same study and have been reviewed together)*


