Physical Activity and Urban Living:

A Mixed Methods Analysis of How Urban Form Influences Walking in Scotland

A Thesis submitted in accordance with the requirements of Heriot-Watt University for the degree of Doctor in Philosophy

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ABSTRACT

Despite the importance of regular physical activity for maintaining health, large proportions of the population are sedentary or inactive, presenting a considerable challenge to public health. It is argued that the best way to increase the activity of those who are least active is through encouraging more everyday activities such as regular walking. There is a large body of research demonstrating that more walkable urban characteristics such as high density, mixed land use, better connections and closer destinations, are positively associated with walking. However, questions remain about the nature of the environment-walking relationship. Critics of walkability suggest that the detected association may be due to spatial difference rather than behavioural change.

The aim of this study is to explore how neighbourhood environment is related to walking and physical activity in Scotland. There are three research objectives: firstly to ascertain whether there is an association between urban form and physical activity in Scotland, secondly to evaluate the effect of neighbourhood selection and thirdly to provide a meaningful account of these relationships. The study uses mixed methods, with semi-structured interviews being the main research component. A special version of the Scottish Health Survey (N>36,000) is used to create a logistic regression model for predicting habitual walking, showing that walkability significantly predicts variations in habitual walking. Analysis of the City Form data corroborates these findings showing that residents of inner city areas are more like to walk or cycle.

For the qualitative investigation, residents were recruited who had recently (<3 years) moved into one of the three case study areas in Edinburgh: Dalry, Restalrig and Corstorphine. Semi-structured interviews were conducted with 21 residents, exploring accounts of relocation, neighbourhood use and attitudes toward being active. 12 participants also completed an accelerometer and diary exercise. The findings highlight how neighbourhood relocation is contingent on resources, life events and life stages. Self-reported activity and the accelerometer data illustrates how mundane walking can significantly contribute to overall physical activity attainment. Corresponding with the quantitative analysis, participants from walkable neighbourhood report walking more regularly. However, some participants are more active than others regardless of neighbourhood environment. In conclusion the evidence supports the viability of developing more walkable neighbourhoods to increase physical activity in the Scottish population. Furthermore it is argued that future research could better conceptualise walking as an ambient activity: something enjoyed as part of, rather than incidental to, everyday life.

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CHAPTER ONE: INTRODUCTION

"The sovereign invigorator of the body is exercise, and of all exercises walking is the best."

Thomas Jefferson

The health of human societies is shaped by the activities and occupations of its people. Populations of rural labourers have historically needed to manage skeletal and muscular injuries, whilst the pollution and poor sanitation of industrialising Britain challenged its people with infectious and respiratory diseases. The chief public health problems facing human societies today are those caused by inactivity, diet and obesity (Morris, 2010a). Inactivity accounts for around a third of diabetes and heart disease and about a quarter of all breast and colon cancers (Morris, 2010b). A seventeen-year longitudinal study has found that low respiratory fitness accounts for around 16% of all deaths in the sample, concluding that physical inactivity is the biggest health problem of the 21st Century (Blair, 2009). The British Heart Foundation estimates that if an additional 5% of Scottish adults participated in physical activity, it would reduce coronary heart disease and other chronic conditions by 2,231 cases and save more than £85 billion in associated life years (British Heart Foundation, 2013). This is why promoting more active behaviours is so important, and why the Scottish Government aims to increase the number of people in Scotland meeting physical activity recommendations from 39% to 50% by 2022 (Hill, 2012).

The most significant public health benefits will come from increasing the activity of those who are least active (Haskell et al., 2007). In Scotland, increasing the physical activity of those that are inactive and sedentary could reduce all chronic diseases by 20-40% (Burns and Murray, 2012). However, this is not an easy task as it requires changing patterns of inactivity that are built-in to our daily lives. Desk jobs, car-dependence and home entertainment are all aspects of contemporary British life that are predominantly sedentary. Changing inactive behaviours requires something of a cultural shift that normalises regular activity as part of a routine (Burns and Murray, 2012). Promoting sports and exercise can only achieve so much, and reaching those who are least active requires increasing the opportunities for physical exertion in everyday life (Ratzlaff, 2012). Encouraging people to walk more is one way of promoting regular exercise. From a public health perspective, the benefit of promoting walking is that it is easy to maintain and is achievable for most

people (Biddle and Mutrie, 2008, Morris and Hardman, 1997). Increasing the opportunity and attractiveness of walking requires a combination of policy measures, including the development of walkable urban spaces (Sallis et al., 2004, Schilling et al., 2009, Brownson et al., 2008). The design and physical characteristics of urban environments have the potential to change behaviour because they define the ways in which people travel and use urban space (Frank et al., 2006b, Saelens et al., 2003b, Handy, 2004, Sallis and Glanz, 2009).

The purpose of this study is not to reaffirm the indisputable connection between physical activity and health. Instead the intention is to better understand how walking behaviour, as a particular type of physical activity, is related to urban environments in Scotland. Chapter Two begins by outlining how physical activity is measured and who in Scotland is failing to meet recommended levels of activity. There are various ways in which a person can be active, and each has different incentives and motivations. It can be understood as a matter of individual choice, sociocultural factors, or confidence and self-efficacy. An ecological framework depicts behaviour as emergent from the interaction between individuals, social relations and the environment. Chapter Three looks specifically at how the physical characteristics of the environment, or 'urban form', can impact on walking and physical activity behaviour. The evidence shows that residents are more likely to walk in neighbourhoods with a combination of walkable characteristics. Previous studies have combined urban form measures into 'walkability' scores. However, reported associations tend to be moderate and mediated by individual and social factors. It is argued that this research tends to lack a meaningful articulation of the causal mechanisms involved in such associations. In particular, the detected associations may be better explained by behavioural difference rather than behavioural change (Heath et al., 2006). The notion of 'neighbourhood selection' is introduced as a form of counter-explanation for environment-behaviour correlations. Chapter Three closes by proposing that a qualitative investigation of relocation and neighbourhood-use is required to better understand the relationship between neighbourhoods and walking in Scotland.

Chapter Four outlines the methodology of the study and how the data were collected. A mixed methods approach was used, which utilised data from two surveys, semi-structured interviews, accelerometers and diaries. The main research component of the study is semi-structured interviews with residents who have recently moved into one of three case study neighbourhoods in Edinburgh. Participants were recruited through a mixture of postal invitations and community advertising. The interviews explored issues of relocation, neighbourhood selection and physical activity. Some of the participants also agreed to wear an accelerometer and keep a diary for five days. Chapter Five reports findings from the quantitative analyses. A unique version of

the Scottish Health Survey that includes environmental variables was used to create a regression model predicting walking and overall physical activity. Measures of density, proximity, and connectivity were combined into a walkability score and entered into a logistic regression model alongside individual and lifestyle predictors. The results show that walkability predicts some of the variation in walking but not of overall physical activity. Chapter Five also discusses a comparative analysis of the City Form survey, the findings of which support the suggestion that commuting and shopping patterns underpin neighbourhood differences in walking.

The next two chapters discuss the qualitative findings. Chapter Six examines neighbourhood preference and reasons for relocation. It is shown that moving to the suburbs was felt to be a natural progression and part of settling down. There was a general desire for walkable attributes regardless of travel preferences. Chapter Seven looks specifically at participants' physical activity and walking. There were considerable differences in participants' feelings towards being active, with some being more motivated than others. It is argued that a change in neighbourhood walkability is most likely to impact on the behaviour of those who are least active. Whilst more active individuals are adaptive and remain active despite their environmental context, there are others for whom local walking trips are their only sources of regular exercise. The nature of and significance of walking is discussed further in the concluding chapter. Chapter Eight draws attention to the concurrence of findings between the quantitative and qualitative analyses. The results of the study show that residents of more walkable neighbourhoods will tend to walk more often. This difference is largely due to the culmination of utilitarian trips such as travel to work or to the shops. Contrary to some selectionist accounts, the behavioural differences happen despite rather than because of neighbourhood and lifestyle preferences. The qualitative evidence suggests a more complex understanding of walking than being either incidental or recreational. It is argued that the desire to have opportunities to walk is separate from the practical convenience. Regardless of participants' feelings toward exercise, walking trips were often valued as a pleasant albeit passive aspect of everyday life.

CHAPTER TWO: PHYSICAL ACTIVITY

This chapter explores why it is that people are active or inactive. Rather than being a systematic literature review, the intention is to introduce key concepts in understanding the behaviour, patterns and determinants of physical activity. The first part of the chapter summarises why it is important to be active and outlines the recommended amount of activity a person should achieve in order to stay healthy. There is a discussion of how physical activity is measured and the common distinctions that are made between types of activity, including walking. This is followed by an overview of physical activity levels in Scotland, the UK and globally, where it is shown that activity levels are often patterned by gender and age. The final part of the chapter concerns how best to conceptualise the determinants of physical activity behaviour. It discusses *individual choice*, *self-efficacy*, *cultural* and *ecological* approaches to researching physical activity. In particular, an ecological model is conceived of multiple determinants on behaviour: individual, social and environmental. The chapter ends with a discussion of the research agenda for the study. It is argued that because physical activity is complex and contextual, a mixed methods approach is necessary to better understand how the environment influences behaviour.

2.1 Physical Activity and Health

The link between physical activity and health is generally acknowledged and understood. It is physical *in*activity that is a key issue for mortality. Smoking, diet and physical inactivity are the three behaviours responsible for about a third of all deaths in developed countries (Hardman and Stensel, 2009). There is now abundant medical evidence that insufficient physical activity has a number of negative health consequences: obesity (Wareham et al., 2005), type 2 diabetes (LaMonte et al., 2005), coronary heart disease (Powell et al., 1987), stroke (Lee et al., 2003) and some cancers (Thune and Furberg, 2001). The World Health Organisation estimates that physical inactivity accounts for 21-25% of breast and colon cancer, 27% of diabetes, and 30% of ischemic heart disease (2010). Being regularly active is essential for proper muscle and bone development as well as maintaining a healthy weight and blood pressure (Hardman and Stensel, 2009). There is also growing evidence that activity can improve self-esteem, enjoyment and wellbeing (Biddle and Mutrie, 2008).

The number of obese people has doubled in the last thirty years due to sugar-rich diets and falling levels of activity (Morris, 2010a). As well as causing poor health and death, obesity also comes with a significant cost to public health (Prentice and Jebb, 1995). It has a widespread impact on health which has caused some to refer to obesity as an epidemic (Sallis and Glanz, 2009, Hardman and Stensel, 2009). Yet obesity is entirely preventable, not through drugs or by surgery, but by encouraging and enabling the general population to have healthier diets and more active lives. Physical inactivity is responsible for 3.2 million deaths a year (World Health Organisation, 2010a) an estimated 6% of total global mortality (Townsend et al., 2012). The yearly deaths due to inactivity are believed to be more than those caused by smoking (MacCallum et al., 2012). Furthermore, this number is likely to increase if action is not taken to increase activity levels in the general population (Armstrong et al., 2007). If Scotland an increase of 5% of the proportion of adults participating in physical activity over the next five years, this would reduce coronary heart and other chronic conditions by 2,231 cases, save the NHS £15.5 million and savings £85.2 million in associate number of life years (British Heart Foundation, 2013). This is why promoting physical activity in the general population is regarded by many to be the 'best buy' in public health (2010a).

2.2 Metabolic Rates

Before discussing how much physical activity people should maintain to stay healthy, it is helpful to consider how physical activity is measured. Physical activity is "*any bodily movement produced by contraction of skeletal muscles that substantially increases energy expenditure*" (Hardman and Stensel, 2009). Physical activity can happen at different intensities, which is the amount of effort it takes to perform. This effort is measured in metabolic rates (METs); one MET is the energy expended while sedentary and is equivalent to a caloric consumption of 1kcal/kg/hour. A 'doubly labelled water' test is the gold standard for measuring an organism's metabolic rate over time. However, this would be impractical for measuring physical activity in groups of people. Instead many researchers use an accelerometer device, which, attached to a person's hip, measures multi-directional movement. When measuring physical activity in even larger populations it is often necessary to rely on self-reports. In order to guide physical activity estimates for self-reported activity, different exercises have been estimated as being of either vigorous or moderate intensities. An example of these estimates is given in Table 2.1.

Moderate-intensity Physical Activity (Approximately 3-6 METs) *Requires a moderate amount of effort and noticeably accelerates the heart rate.*	Vigorous-intensity Physical Activity (Approximately >6 METs) *Requires a large amount of effort and causes rapid breathing and substantial increase in heart rate.*
Examples of moderate-intensity exercise: Brisk walking Dancing Gardening Housework and domestic chores Active involvement in games and sports with children / dog walking General building tasks (e.g. Roofing, thatching, painting) Carrying / moving moderate loads (<20g)	**Examples of vigorous-intensity exercise:** Running Walking/climbing briskly up a hill Fast cycling Aerobics Competitive sports and games (e.g. Football, Volleyball Hockey, Basketball) Heavy shovelling or digging Carrying / moving heavy loads (>20g)

Table 2.1: A table of physical activity intensities that has been adapted from
http://www.who.int/dietphysicalactivity/physical_activity_intensity/en/index.html

The intensity of 'moderate activity' is about three to six times as much effort as being sedentary (3-6 METs). Vigorous activity is around six times as much effort (>6 METs). Although people have different thresholds of exertion, activities such as running, playing football, weight lifting or carrying heavy loads are generally considered to be vigorous. Such activities should increase a person's heart rate, making them breathe heavily and perspire. Moderate activities do not require as much effort, although the heart rate should increase somewhat. Walking briskly, gardening, and carrying moderate loads are all examples of moderate forms of activity. Everyday activities such as gardening, shopping, housework and walking sufficiently expend calories to count as being active.

These general estimates of exertion underpin much of the global public health guidelines on physical activity, including those of the Scotland and UK Governments. It is worth noting that whilst self-reported measures are necessary, studies have found that there are often considerable discrepancies between self-reported and objective measures. A recent British comparison found that objective measures of physical activity were considerably lower than self-reported measures (Townsend et al., 2012). In this study three measures of activity are used: self-reported (survey), self-reports (interviews) and active minutes (accelerometers).

2.3 Moderate to Vigorous Physical Activity (MVPA)

There are many ways a person can be healthfully active: through leisure activities, recreation, active travel, occupational activities, household chores, sports or planned exercise (Morris, 2010a). Healthful amounts of physical activity can be attained by combining moderate and vigorous activities. It is widely recommended that adults (aged 16 to 64) do at least 150 minutes of moderate-intensity physical activity each week, or 75 minutes of vigorous-intensity aerobic physical activity each week, or an equivalent combination of the two. This should be accumulated in bouts of ten minutes (Bull, 2010). Throughout this study, measures of physical activity are compared with these recommended levels and the accumulation of moderate and vigorous activities will be referred to as 'MVPA'. More technical detail on these measures is given in Chapter Four.

Achieving 150 minutes of moderate or 75 minutes of vigorous activity are the minimum amounts required for maintaining health. They do not include specific details on maintaining flexibility, resistance and muscle strengthening, which are also important (Mutrie, 2010). A recent statement from the British Association of Sport Exercise said that every adult should do some muscle-strengthening exercises (O'Donovan, 2010). They suggest that beginners should be set achievable tasks such as walking an extra ten minutes a day in order to build confidence through success. All adults should strive to meet these recommendations. Beginners are advised to build confidence through less intense exercises (O'Donovan, 2010). The recommended MVPA is different for children, older adults and for people of different capabilities (O'Donovan, 2010, Bull, 2010).

2.4 Physical Activity in Public Health

Despite an early recognition that daily, mundane activities have the potential to improve the health of the population (Morris, 1975), early research focus tended to be on exercise for enhancing an individual's strength and fitness (Hardman and Stensel, 2009). It was not until the 1990s that this focus shifted to look at activity within the general population (Frank et al., 2003: 40, Hardman and Stensel, 2009). The United States Surgeon General's report of 1996 is notable for formally acknowledging that moderate activities, such as walking, have potential to improve public health (US Department of Health and Human Services, 1996). The report called this a 'lifestyle' approach, because it emphasized active daily routines (US Department of Health and Human Services, 1996). This move from *purposeful exercise* to *everyday activities* has since been repeated in a number of physical activity policy documents, such as the WHO Global Recommendations (Morris, 2010a), the UK Chief Medical Officers' report on physical activity for health (Department of Health, 2011) and the Scottish Government's action plan for better diets and activity (The Scottish Government, 2008).

At an individual-level, everyday activities such as walking may not incur the same health benefits of more intense activities such as aerobic exercises, but from a public health point of view, they have the potential for reaching a larger number of people (Haskell et al., 2007). For many of the at-risk population, who are inactive or sedentary, vigorous sport and exercise can seem unachievable and may even deter them from activity altogether. Although there are many people who feel unconfident or unable to participate in sport and exercise, most are able to take part in everyday activities such as walking (Biddle and Mutrie, 2008). There is more of a public health benefit in encouraging sedentary and inactive people to do some activity then there is in increasing the activity of those who are already active (Haskell et al., 2007, Brown et al., 2009, Khan and Davis, 2010). These are the reasons why public health messages in the UK tend to encourage moderate forms of activity achieved through everyday tasks such as shopping and walking to work (Department of Health, 2011).

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The Scottish Government's 2011 Guidelines for Adult Physical Activity

1. Adults should aim to be active daily. Over a week, activity should add up to at least 150 minutes of moderate intensity activity in bouts of 10 minutes or more – one way to approach this is to do 30 minutes on at least five days a week.

2. Alternatively, comparable benefits can be achieved through 75 minutes of vigorous intensity activity spread across the week or combination of moderate and vigorous intensity activity.

3. Adults should also undertake physical activity to improve muscle strength on at least two days of the week.

4. All adults should minimize the amount of time spent being sedentary (sitting) for extended periods.

</div>

Table 2.2 Available at http://www.scotland.gov.uk/Topics/ArtsCultureSport/Sport/physicalactivity

Promoting behavioural change in Scotland has become of international importance, as public health researchers have looked to Scotland as an example of tackling historically-rooted unhealthy behaviours, sometimes referred to as the 'Glasgow effect'. Health-related behaviour in Scotland presents "a psycho-social problem that will not be fixed by targeting conventional risks behaviours alone" (Reid, 2011). The Scottish strategy for physical activity, 'Let's Make Scotland More Active', aimed to set in place strategies to 'increase and maintain the proportion of physically active people in Scotland' (The Scottish Government, 2003)*.* In order to achieve the target of 50% of all adults over 16 meeting the minimum levels of physical activity by 2022, the Scottish Government suggests interventions at a number of levels, including improving the opportunities for active daily routines and habits as well improving the visibility and popularity of healthful sporting activities (The Scottish Government, 2003).

2.5 Physical Activity as Behaviour

For the purposes of this study, physical activity is sometimes referred to as a 'behaviour' and it is helpful at this stage to outline how this term is used. Behaviour refers to activities that are patterned and can be understood as having some significance beyond the discrete action. The term is used in

scientific research where there is believed to be a pattern to be ascertained. For example, a psychologist may observe a behaviour that consistently follows a certain stimulus. Another example is how actions can be patterned across populations, just as an epidemiologist might look at *smoking behaviour* in the Scottish population. For the purposes of this research, 'activity' is used to refer to any singular type of action, such as a person taking her dog for a walk in the park. The term 'behaviour' is used where these activities are in some sense generalizable to a wider population. For example, most dog owners regularly walk in local parks.

Examining patterns of behaviour is useful when trying to ascertain consistencies and associations in order to gain a better understanding. Later in the chapter it is shown that physical activity is patterned across populations. However, understanding the 'causes' of this is very difficult because 'physical activity' refers to some very diverse activities. So whilst the physiological measurement of METs is relatively unproblematic, understanding *why* people are active or inactive is more complex. Treating physical activity as a discrete outcome runs into various methodological problems (Gabriel et al., 2012) so it is practical and cogent that research should start by acknowledging that physical activity is complex and multi-faceted. It is perhaps better thought of as a set of behaviours, with some being more effectual than others. In this study, walking behaviour is the main focus, although not to the exclusion of overall physical activity, sports and exercise.

2.6 Recreational and Utilitarian Activities

The ways in which a person might attain the MVPA are almost limitless: from dancing to diving, or from gardening to golfing, so some categorisation of the types of activity is required if it is to be better understood. A common distinction that is made is between sporting activities and more practical tasks. These are classified as being either *recreational* or *utilitarian* (Frank et al., 2003). *Recreational* activities are performed *for their own sake*, such as a sport, gym exercise or jogging. Utilitarian activities, on the other hand, are those undertaken for an alternative purpose, such as walking to work, shopping or gardening. These are activities that are undertaken in order to accomplish another purpose (Frank et al., 2003, Handy et al., 2002). As Frank et al. (2003) points out, the built environment has the potential to influence both types of activities because recreational exercise takes place in parks and playgrounds whilst utilitarian transport requires good connections and accessible destinations. There has been a lot of research attention on how walking, as a utilitarian activity, is associated with urban planning and design and this research is presented in

more detail in Chapter Three. However, walking can also be recreational and encouraged, for example, by making neighbourhoods safer and more attractive.

A similar classification is made between *leisure-time* and *incidental* physical activity (Cerin and Leslie, 2008, McCormack et al., 2003) to distinguish physical activities undertaken for pleasure and those that are incidental to another activity, such as traveling to work or shopping. These distinctions are an attempt to formalise the reasonable assumption that sport and exercise (leisure) behaviour is motivated differently from walking and incidental activities. Sport and exercise is presented as more of a matter of individual choice, whereas walking is often presented as being susceptible to external opportunities and barriers. This distinction is explored further in Chapter Three where the relationship between activities and the urban environment is discussed. It will be shown that researchers have found stronger correlations between environmental factors and utilitarian activities than recreational activities. It is therefore supposed that utilitarian activities, particularly walking, mediate the overall environment-physical activity relationship (Ewing, 2005b). Although some researchers have argued the environment can equally affect physical activity through leisure time activities (Owen et al., 2007). There is also a methodological consideration in studying these activity types: sports and exercise are generally more memorable and have better recall in self-reported measures than routine activities such as walking (Bromley and Shelton, 2010). This means that utilitarian behaviours may be relatively under-reported.

Although these distinctions are helpful, they can also be misleading when applied to specifics. For example, it is misrepresentative to conceptualise walking as simply utilitarian and incidental. Walking for pleasure may occur in concurrence with practical purposes. In this study, the terms 'recreational' and 'utilitarian' are used to discuss the *motivation* and are not activity-specific. 'Incidental' is used to refer to activities that are undertaken for an alternative purpose, where the physical exertion is incidental to the task being performed, and 'recreational' is used to refer to activities in which physical exertion is wholly or partially the purpose of that activity. These terms are used only as an *analytical distinction*, as it is important to note that, in practice, activities can be simultaneously purposeful and pleasurable. Much of the qualitative data presented in this research concerns walking people do for errands, commuting and shopping.

2.7 Walking

At a typical walking pace of around 4.8 km per hour, the metabolic rate increases three-fold (Hardman and Stensel, 2009), making it moderate physical activity (between 3 and 6 METs). Regularly walking has been found to be independently associated with 'low risk of all-cause mortality, CHD/CVD, ischemic stroke, type 2 diabetes, cognitive decline and weight gain...' (Hardman and Stensel, 2009: 283). In a study of walking amongst people with diabetes, Gregg et al. (2003) found that compared to those who report doing no walking, those that walked for at least two hours a week had a 39% reduced CVD mortality risk. Such findings suggest that habitual walking significantly increases physical activity and can improve the health of the population. In a Finnish study, 3,316 adults (aged 25 to 74) were followed up after an average of 18 years. They found that active commuting has an inverse relationship with total and CVD mortality (Hu et al., 2004). How much walking affects someone's health depends on their physical capabilities. For a young person, a brisk walk might be light exercise but for older groups this would count as moderate or even vigorous exercise (Hardman and Stensel, 2009: 282).

In their persuasive vindication of walking for health, Morris and Hardman describe walking as the nearest thing to perfect exercise (Morris and Hardman, 1997). This is because it is simple, accessible, and pleasurable, with physical, social and psychological benefits (Hardman and Stensel, 2009). As they point out, walking is the most common form of weight-bearing activity and an exercise that is available to nearly everybody. Because it is safe and easy, it is the best method of increasing activity for those that are inactive or sedentary (Morris and Hardman, 1997). Walking has been suggested as the best activity for those that would not otherwise be active (Siegel et al., 1995, Simonsick et al., 2005). Whereas exercise interventions are often limited in the number of people they reach and the duration of effect, making neighbourhoods more walkable has the potential to motivate a larger number of people to adopt more active habits (Lee and Buchner, 2008). This is assuming that most people will take up the opportunity to walk to places if the option is available to them.

Since 1976 the average distance that British people travel by foot or by bike has fallen considerably (Townsend et al., 2012). Although overall transport distance has increased by some two thousand miles a year, the average walking distance in Britain has fallen from 255 miles in 1975 to 179 miles in 2010 (Townsend et al., 2012). Two thirds of all trips were made by car compared to one fifth made by foot. Increased car travel is one of the main reasons that people are insufficiently active (Townsend et al., 2012), and encouraging people to use active transport is an important

intervention for sustainable transport and public health (Sustainable Development Commission, 2007).

Walking trips are found to be most common in environments that have higher residential and commercial densities, good pedestrian infrastructure, interconnected streets and a variety of available destinations (Forsyth et al., 2008). There is some contrasting evidence about how walking is related to overall physical activity. Some research suggests that walking more can also encourage and support people to increase their engagement in other forms of physical activity, although the causal pathways are not understood. Some transportation literature argues that there may be a trade-off between walking and other forms of physical activity, where individuals have a physical activity threshold (Forsyth et al., 2008, Forsyth et al., 2007). This is the idea that people have a 'physical activity budget' (Forsyth et al., 2008), that doing one type of activity means that you are less likely to undertake another (Krizek et al., 2004, Rodríguez et al., 2006). This would mean that, whilst the built environment can increase walking, it will have a limited effect on physical activity overall.

2.8 The Demography of Physical Activity

MVPA is patterned across populations, with certain groups being more likely than others to meet recommendations. The following section outlines who is physically active in Scotland in order to discuss their causes and determinants later in the chapter. The main sources of data are the Scottish and English Health Surveys. Difference in physical activity is presented by gender, age, ethnicity and socioeconomic status.

2.8.1 Adult Men and Women

Scottish Health Survey data (2011) shows that 39% of the adult population is meeting the physical activity recommendations of at least thirty minutes of moderate activity on five or more days of the week (Hill, 2012). Men are significantly more likely to be meeting recommendations than women (45% compared with 33%). The percentage of adults meeting recommended MVPA has been shown to be the same between Scotland and England (Bromley and Shelton, 2010). Women's activity changes little between the ages of 16 and 44; the percentage meeting recommendations falls with

age from 42% (16-24 year olds) to 7% (over 75s). Men's activity also falls with age in Scotland and England, particular after 34 years of age. Table 2.2, adapted from Bromley and Shelton (Bromley, 2010), summarises the Scottish- English comparison of adult men and women meeting MVPA recommendations of at least 30 minutes of moderate activity on five days of the week.
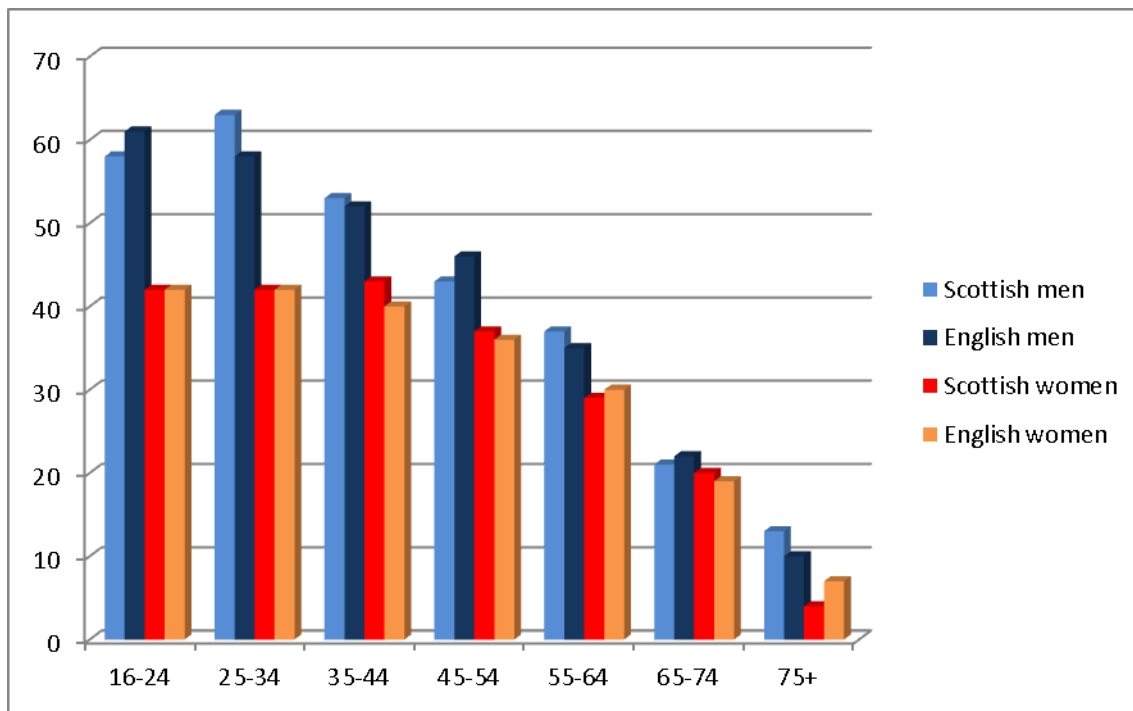
Figure 2.1 Percentage of Scottish and English men and women attaining recommended MVPA.

The Scottish gender difference in overall physical activity is consistent with other research from a range of countries. A number of studies have shown that, across various countries, women's activity is worryingly low and puts them at greater risk of chronic illness (Guthold et al., 2008). Men have often been found to be more active than women (Booth et al., 2000, Guthold et al., 2008, Lawder et al., 2010, Pan et al., 2009, Garcia et al., 1995, Owen et al., 2007, Sallis et al., 2000, Azevedo et al., 2007, Byrd-Williams et al., 2007, Simmons et al., 2010, Barrett et al., 2007, Biddle et al., 2004). Men have also been found to be more physically active in childhood and youth (Biddle et al., 2004) as well as in older age (Booth et al. 200). As well as differences in MVPA, there are also gender differences in the types of activity that adults do. Men in Scotland are more likely to do sport than women (47%

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compared to 42%) and this is most pronounced between 16-24 years of age (74% compared to 61%) and 25-34 years of age (68% compared to 56%) (Bromley and Shelton, 2010). Men were more likely to have been running, jogging, cycling or playing football or rugby. Women were more likely to have participated in aerobics, keep-fit classes or dance (Bromley and Shelton, 2010).

2.8.2 Children and Young People

The physical activity recommendations for children up to 17 years of age is to achieve at least 60 minutes of vigorous activity a day (Rutherford et al., 2012). The Scottish Health Survey shows that 65% of Scottish children between 2 and 15 years of age are achieving recommended levels of physical activity (Rutherford et al., 2012). The physical activity of both girls and boys falls as they get older (Sherar et al., 2007, Brodersen et al., 2007). Although some researchers say that the decline is sharper for girls in Britain (Brodersen et al., 2007), there is some disagreement on this matter (Biddle and Mutrie, 2008). The gap between girls' and boys' activity in Scotland is greatest among older children: 41% of girls (aged 13 to 15) meet recommendations compared to 59% of boys. In a large cohort study of British children (*n*=5,863), Brodersen et al. (2007) found that the fall in physical activity in adolescence was more pronounced for those of lower SES background and ethnic minorities (Brodersen et al., 2007). In Scotland, controlling for other factors, girls' physical activity is significantly correlated with parental socioeconomic status (SES) whilst boys is significantly associated with area deprivation (Hill, 2012).

There has been a lot of research into active school travel, as encouraging children to walk to school significantly increases their activity levels and improves prospective health (Pabayo et al., 2010). In an Edinburgh-based study of 92 schoolchildren, Alexander and colleagues found that walking to school was associated with higher activity throughout the day (Alexander et al., 2005). Another study also found that children who walk to school are significantly more physically active than those that travel to school by car (Cooper et al., 2003, Cooper et al., 2005). Distance from schools is the most common factor associated with active school travel (Cohen et al., 2006) as well as the safety and convenience of the environment (Boarnet et al., 2005). Although neighbourhood safety and walkability are associated with walking to school, the relationship is moderate and dependant on parent perception (Schlossberg et al., 2006, Timperio et al., 2006, Ewing et al., 2004). Additionally it is interesting to note that there is less of a gender difference in active travel to school than in sports and exercise (Townsend et al., 2012).

There has been a particular concern with more 'interior' activities of children: spending more time indoors with television and computers (Cahill, 2010). For example, it has been shown that one third of American children watch more than four hours of television daily (Gorely et al., 2004). However, other researchers suggest that this sedentary time may not be at the expense of physical activity (Marshall et al., 2006, Elgar et al., 2005). Furthermore, it has been suggested that this sedentary time is not notably different from pre-television eras (Cahill, 2010). Both children's physical activity and sedentary time has been found to be related to parental attitudes and behaviours (Burdette and Whitaker, 2005, Van Der Horst et al., 2007, McMinn et al., 2012). Children whose parents perceive their local neighbourhood to be safe are more likely to be active (Andrews, 2010). In Scotland, children's activity is positively associated with that of their parents and inversely associated with parents' car use (Rutherford et al., 2012, Bromley, 2010). There is evidence that childhood physical activity influences physical activity in adulthood (Telama et al., 2005), which has recently been supported through tracking studies (Telama, 2009).

2.8.3 Older People

Definitions of older people vary by study, but the Scottish Health Survey categorises this as people aged 65 and over. Keeping active in older age is important for maintaining strength, balance and stamina and is significantly associated with all-cause mortality (Manini et al., 2006). In 2011, for the first time, the UK recommendations for physical activity included separate recommendations for older adults (Department of Health, 2011). Whilst these are largely similar to adult recommendations, additional emphasis is put on doing *some* rather than *no* activity (Department of Health, 2011). Older people are the most likely age group to be sedentary and the public health message is for older adults to try and achieve regular and continuous activity. A report on older people's health in Scotland showed that only 17% of men and 12% of women over 65 years of age are meeting physical activity recommendations in Scotland (Bromley and Mindell, 2011). The decline in physical activity with age is statistically significant and consistent with findings in other countries (Booth et al., 2000, Nelson et al., 2007). Walking is particularly recommended for older people as it reduces anxiety and depression and maintains wellbeing (Bromley and Mindell, 2011).

Walking is an excellent way for older people to stay active as it is an accessible form of exercise. Several studies suggest that, because the older population is more likely to do utilitarian rather than recreational activities, their behaviour is more susceptible to environmental constraints and facilitators (Hall and McAuley, 2010, Li et al., 2005, Li et al., 2009, Lim and Taylor, 2005,

Patterson and Chapman, 2004). These results likely reflect how people of working age are more likely to walk to work, whilst people of retirement age are more likely to walk to visit shops and facilities (Crombie et al., 2004). Having confidence and experience of being active have also been suggested to be key determinants in whether people are active into older age.

2.8.4 Ethnicity

Non-white ethnicities make up only 3% of the Scottish population, with the largest non-white group, Pakistani, being only 0.7% of the population. In order to make valid statistic comparison with such small populations, a recent report combined four years of Scottish Health data (Whybrow et al., 2012). This showed that Scottish Pakistanis are the least likely ethnic group to be sufficiently active. The report found that significantly fewer Pakistanis were meeting MVPA recommendations than the white majority (27% compared 38%). Pakistanis in Scotland were also less likely to participate in sports (30% compared 49%) (Whybrow et al., 2012). This is consistent with findings related to Pakistani and south Asian groups in Britain generally, who have been shown to be less likely to achieve MVPA recommendations (Brodersen et al., 2007, Fischbacher et al., 2004, Townsend et al., 2012). The British Heart Foundation's 'Physical Activity Statistics' also reports that Pakistani activity is low in Britain (Townsend et al., 2012). There is evidence that ethnic differences in physical activity in Britain develop from school age (Brodersen et al., 2007). A qualitative study of British South Asians has been used to explore how inactivity is related to cultural norms. Lawton et al. identified how certain cultural barriers to exercise existed for South Asian women in Britain (Lawton et al., 2006).

2.8.5 Socioeconomic Status

Socioeconomic status (SES) is a measure of education, occupation and income applied to families, households or individuals. Measures of SES have found to be a strong predictor of a number of health indicators including physical activity (Trost et al., 2002). SES is associated with numerous health related indicators, cutting across gender, age and ethnicity. The relationship of socio-economics on health-related behaviours is of particular interest in Scotland. Poor diet and inactivity historically entrenched by socio-economic deprivation and 'stark' inequalities of post-industrial urban area (Reid, 2011). Both leisure-time activities and walking have been found to be significantly

associated with SES (Trost et al., 2002, Giles-Corti and Donovan, 2002, Cerin et al., 2009). Those people with lower incomes are more likely to report poor health and lack of money as a reasons for not participating in physical activities (Townsend et al., 2012). Higher income men are more likely to cite work and time commitments (Townsend et al., 2012).

A person's particular demographic and social position means that they have specific resources to be active. An Australian study found that residents of a lower SES actually had superior access to recreational facilities but were less likely to use them (Giles-Corti and Donovan, 2002). Previous research into income and car ownership found that people with less income were less likely to be able to drive and therefore more likely to walk due to a lack of alternative. More recently research has shown that active travel is more strongly associated with education than income (Ogilvie et al., 2009). A strong association between income and active travel has also been found in the US (Cerin et al., 2009, McNeill et al., 2006). In a Belgian study of SES and walkable neighbourhoods, Van Dyke et al. found SES had a separate effect on active travel from neighbourhood environment (Van Dyck et al., 2010).

2.8.6 Summary of Physical Activity Patterns

This section has briefly outlined some of the key demographic patterns in physical activity behaviour in the population. In Scotland, as elsewhere, men are more likely to be meeting physical activity recommendations than women. The gender difference can be seen to start in adolescence, when many girls will start to drop leisure time physical activity. Parental attitudes are a key determinant of childhood activity and getting children to be active early on improves their chances of being active throughout their lives. People become notably less active as they get older. Those over the age of 65 are the least likely to be sufficiently active despite its continued importance for health. Older people are more likely to be active if they have been active throughout their lives. Although not as distinct as age and gender, physical activity levels are also associated with socioeconomic indicators and ethnicity. Overall physical activity is higher high socioeconomic groups, although this can differ depending on the type of activity. The following section considers some theoretical approaches to understanding these demographic patterns.

2.9 Understanding Physical Activity Behaviours

The chapter so far has been concerned with how physical activity is measured and which people are meeting the MVPA guidelines. This next section starts to consider *why* people are active or inactive and how these behaviours can be understood. There is an extensive amount of literature related to physical activity determinants, more than can be feasibly reviewed here. Instead, the purpose is to introduce key theoretical themes concerning how physical activity is chosen, motivated and determined. Specifically, the following section discusses *individual choice*, *self-efficacy, cultural explanations* and *ecological models*. These are important because they are the theoretical basis for behavioural interventions. It also helps to discuss these theoretical frameworks in order to outline a research agenda for this study and situate it within the literature.

2.9.1 Individual Choice

When asked, the most common reasons people give for not doing more activity are a lack of time (Sallis et al., 2002) and money (Salmon et al., 2003, Reichert et al., 2007). The reasons that most people give for being active are: enjoyment, confidence, motivation and social support (Reichert et al., 2007, Townsend et al., 2012). These surface reasons can be seen to be associated with demographic patterns. Inactivity due to lack of money is clearly correlated with income (Townsend et al., 2012). Girls and young women are less likely to feel confident to take up sports, and older people have reported uncertainty about exercise. Such findings have helped inform targeted interventions that improve social support and encourage peoples' confidence to be active. For example, providing positive feedback to maintain exercise in teenagers (Whitehead and Corbin, 1991) or creating exercise groups that are dedicated to women or older groups (Williams et al., 2007).

One way of understanding activity levels is to look at why some people *choose* to be active whilst others do not. It could be argued that an individual has to *decide* to be more active in order for change to happen. For example, an individual might chose to join a gym, exercise or walk to work in order to be become fitter and healthier. Public health promotions concerned with individual choice have tended to focus on education and incentivising, for example, through subsidising gym membership for older people. However, such a focus easily overlooks extraneous factors and the fact that decisions do not happen in a vacuum but involve choices between available options. For example, how far can utilitarian activities such as travelling to the shops be said to be consciously

chosen (Biddle and Mutrie, 2008)? In everyday life, such behaviours are contingent on an array of pragmatic factors and available alternatives. As Mutrie and Biddle put it, the individual might not be consciously choosing activity or inactivity, but 'choosing activities that are seen as higher priorities' (Biddle and Mutrie, 2008: 40). So for example, a person may enjoy walking, but taking the car is the necessary choice for getting to work on time. Furthermore, certain activities such as using active travel maybe more possible for some people. Specifically in relation to this study the availability of different travel modes maybe limited by the type of neighbourhood in which people live (Handy, 1996).

In this research, qualitative interviews are used to explore individual preference in relation to neighbourhood environment and physical activities. Individual choice is related to the 'lifestyle' approach to disease prevention that has underpinned early health promotion. These approaches to health promotion tended to concentrate on educating the individual to act more healthfully and make better choices. Such a perspective has been criticised for an over-emphasis on individual responsibility that ran the risk of 'victim-blaming' and stigmatisation (McLeroy et al., 1988). Moreover it ignores how individual behaviour is closely connected to cognitive processes, social norms, communities, social policies and environments (McLeroy et al., 1988).

2.9.2 Self-Efficacy

There are several psychological theories of motivation applied to physical activity (Biddle and Mutrie, 2008), more than can be discussed here. However, it is helpful to introduce the concept of 'self-efficacy', which has been particularly influential. Self-efficacy refers to a person's judgment about their capacity to execute a certain action with their given skills and competencies (Biddle and Mutrie, 2008:107-108). It is distinct from *individual choice* because it attempts to articulate how action depends on having previous experience and motivation to act. It is analogous with the idea of *confidence*; that a person can do something because they feel it is within their capacity. People have differing levels of motivation and confidence to be active depending on their previous experience and resources.

Bandura differentiates between *efficacy expectations* and *outcome expectations*, which refer to the expectations to realise a particular action (such as exercising) and expectation that the action will have an effect (such as losing weight). This kind of cognitive model of behaviour recognises that understanding the benefits of healthy diet and exercise is only the first step, and that a person has

to feel confident in their ability to realise such action. Importantly, having previous positive experiences of an action will reinforce a person's efficacy and outcome expectations. In Bandura's articulation of the self-efficacy concept, although people will be differently efficacious, this depends greatly on previous experience (Bandura, 1977). Experience, for example, of performative success and positive reinforcement will be powerful expedience for accomplishing the desired action. In terms of being physically active, having previously been active with positive results is the key determinant of future success. This openness to extra-personal influences is why self-efficacy is referred to as a 'socio-cognitive' explanation of physical activity behaviour: it includes both the individual person (trait) and the context and circumstance (state) (Biddle and Mutrie, 2008).

The concept of self-efficacy, having been operationalised and tested, has been found to be strongly associated with actual physical activity levels (Pan et al., 2009). It has been successfully applied to behavioural studies of sport (Moritz et al., 2000, Feltz et al., 2008, Sonstroem and Morgan, 1989), exercise (Sonstroem and Morgan, 1989, Marcus et al., 1992) and physical activity generally (McAuley et al., 2000, McAuley and Blissmer, 2000). The evidence suggests that various methods of positive reinforcement can improve an individual's motivation to be active. This explains why older adults who have not had much experience of activity find it hard to start (McAuley, 1993).

Having early positive reinforcement is particularly important in promoting future efficacy. This corresponds with how school and familial experience are significant in determining physical activity levels in adulthood. It suggests that the propensity for an individual to be active can be shaped throughout their early familial and school experience. This accounts for how parental attitudes and behaviour are associated with children's attitudes and behaviour. The concept of self-efficacy draws attention to how individual action is shaped by experience and settings over time. People are differently motivated depending on their confidence and expectations to realise certain actions. Therefore improving self-efficacy to be active requires investment beyond individual education (Davidson et al., 2010).

2.9.3 Cultural Explanations

In her book on inactivity in the United States, McElroy (2002) argues that the spread of inactivity across countries worldwide suggests that the problem is societal in nature rather than simply to do with individual choices. In this sense, physical inactivity has become a public issue that is embedded within cultural practices (McElroy, 2002). From a sociological perspective, behaviour is conceived of

not as a discrete set of choices, but as meaningful interactions with social and cultural norms. This means that behaviour is contingent on the social position and role of the individual. For example, it was mentioned earlier that the transition to secondary school is when many children drop out of physical activity participation. One way of understanding this change is to look at how identities of these individuals are changed during this phase. For many children, the move to secondary school signifies a period of maturation and change in how they view themselves. It is also a period when children become more aware of their body-image, particularly girls (Huang et al., 2007, Paxton et al., 1991). Compulsory school-based activities can be, but often are not, replaced by optional extra-curricular activities. As a young adult, being active requires opting to partake in active hobbies, although this may not always be socially acceptable among peers. Allender et al. suggest that this is the stage when many young women would like to be physically active but experience 'a tension […] between wishing to appear feminine and attractive and the sweaty muscular image attached to active women' (Allender et al., 2006: 831). In this way, social norms and expectations have their bearing on individual choices and action. Whilst a teenage boy may find that regular sports support his bid for a masculine identity, a teenage girl may experience subtle but pervasive contradictions between a feminine identity and sports participation. Although such an example could easily be overstated, it serves to demonstrate how cultural factors can be affecting.

The decline in MVPA with age can also be considered from a cultural perspective. Older people, who are the least likely to be active, have been found to report feeling alienated from certain exercises. In a study of doctor-prescribed exercise intervention, older patients felt uncomfortable attending a gym and exercising alongside younger people, so often dropped out of the scheme. Qualitative studies demonstrate how many older people feel that physical activity is meant for younger people, even when they themselves used to be active. Importantly, this reluctance is unrelated to previous positive experience, but a *perceived understanding of what is socially appropriate* for their age group. Researching the socio-cultural meaning that people attach to certain activities is best explored through qualitative investigations.

In their review of qualitative evidence of physical activity participation, Allender et al. point out that the 'barriers to participation include transitions at key stages of the life course and having to reorient individual identities during these times' (Allender et al., 2006: 834). This recognises how identity is not static but adaptive, reconstructed with new roles and responsibilities. What might be called 'lifestages', such as becoming an adult, getting married or having children are often defining periods in a person's life when they reorient their sense of self towards new roles and responsibilities. This recognition suggests that a person's propensity to be active will depend, not

only on self-efficacy, but whether these activities are supported or contrary to social roles and norms. For example, earlier it was mentioned that a study of South Asian women found there were culturally-specific barriers to their exercise participation. In particular, some South Asian women felt that for them to participate in sports or exercise would be inappropriate, particularly as married women (Lawton et al., 2006). In this example, the capacity to participate in physical activity is not only a matter of confidence but depending on what is felt to be appropriate for the social role of 'married women'.

Paying attention to the social structures underpinning behaviour is a way of resisting the 'victim-blaming' of individualistic approaches (Marmot and Wilkinson, 1999). It acknowledges that social positions can be salient in determining behaviour and that not everyone is equally able to become efficacious. Qualitative research is useful in exploring how these varieties of activities relate to identity. Previous studies have drawn attention to how it may be necessary for interventions to be targeted and sensitive to cultural particularities. For example, the cultural differences that are likely to mediate gender differences in physical activity require exercise promotion tailored differently to men and women (Pan et al., 2009, Kerr et al., 2010, Belcher et al., 2010). How such cultural factors interact with the material and environment contexts of these behaviours is an important objective for physical activity research.

2.9.4 Ecological Models

The last theoretical approach to be introduced is the ecological model. The term 'ecology' is used within biological science to denote the study of interactions between an organism and its environment. Similarly, the label is used within behavioural and health sciences to denote a study of how human behaviour is determined by the environment. The ecological approach recognises that individual choices need to be understood within their social and physical settings (Sallis et al., 2008). Within the context of the particular behaviour of interest, social and physical environments can have a causal impact on an individual. The relationship is two-way, as the action of an individual can have a reciprocal influence on the environment. Because of this emphasis on environmental determinism, ecological approaches have been particularly visible within physical activity and the environment research, much of which is discussed in the following chapter. It is therefore helpful here to consider what this approach entails and how it relates to psychosocial and cultural conceptions of behaviour described above.

There are several different articulations of ecological frameworks, but most describe the environmental conditions as intersecting with intrapersonal (cognitive/individual), interpersonal (sociocultural), institutional and social policy levels (Sallis et al., 2008, McLeroy et al., 1988). Therefore, a key characteristic of an ecological approach is that the environment is understood to work both directly and indirectly through other dimensions. So, for example, the lack of safe cycle routes may directly prevent someone from cycling whilst indirectly it may also shape people's attitudes and feelings, or self-efficacy, towards cycling in the future. Different spheres of influence can also interact with, or against, one another.

Ecological Model Applied to Physical Activity		
Principle	**Description**	**Physical Activity Example**
Multiple dimensions of influence on behaviour	In addition to intra- and inter-personal influences, ecological models include social and physical environments as important influences on health behaviours.	Previously car-dependent, an individual starts cycling to work after moving somewhere that is cycle-friendly and where it is common practice among her colleagues.
Interactions of influence across dimensions	An ecological appoach should say how the different types of determinants will interact to influence health behaviour over time.	Familiarity with a pedestrianised neighbourhood can influence intrapersonal beliefs about the safety of walking.
Multiple levels of environmental influences	Ecological models specify levels of influence, such as different types of environment (e.g. urban, climate etc.).	Although physically similar, some neighbourhoods may differ in physical activity prevalence due to pollution levels or climate.
Environments directly influence behaviours	Ecological models propose that environments directly influence health behaviours as well as indirectly through other factors.	Regardless of preferences or confidence to be active, some neighbourhoods make active travel impossible.

Table 2.3: Adapted from tables in Biddle and Mutrie, 2008 and Owen, Sallis and Fisher, 2002

An ecological perspective is perhaps best understood as a framework that can be applied to different research settings. It invites the researcher to consider how individual, social and environmental conditions interact over time to produce behavioural outcomes (Sallis et al., 2008). Studies that have used this perspective to explore the neighbourhood-physical activity relationship

have typically been statistical, comparing the relative determinism of individual, social and environmental factors. However, it is worth noting that whilst statistical modelling of this kind can be informative; controlling and contrasting individual, social and environment factors can be at odds with a core tenant of an ecological framework, which is that different spheres can operate on and within one another. This is discussed in more detail in the next chapter.

2.10 Summary and Discussion

This chapter has outlined what physical activity is, who is doing it and how it can be understood. Essentially, physical activity is bodily exertion measured in metabolic rates (METs). There are recommended levels of activity that can be achieved through combinations of moderate and vigorous activities (MVPA). Increasing activity levels in the population is a significant public health challenge that requires a better understanding of the underlying mechanisms. However, physical activity includes a complex diversity of activities undertaken for different reasons. There has been a growing research interest in the incidental 'everyday' activities of the population. Utilitarian activities such as walking are potentially a 'best bet' for public health as they are widely accessible and achievable. Activity levels in Scotland are similar to those in Britain and other countries: MVPA tends to fall with age and men are, on average, more active than women. Children's activity has received a lot of research attention, as this is a crucial time for forming a lifelong propensity to be active. Still, research shows that physical activity in Scottish children falls notably around secondary school age. Scotland contains neighbourhoods of historically entrenched health-related behaviours and therefore has considerable potential for researching how health related behaviours, such as physical activity, are sustained or changed inter-generationally.

The latter part of the chapter introduced theoretical approaches for understanding why people are active or inactive. Focusing on individuals and encouraging them to make healthier choices can only have limited success because being active often requires confidence, motivation, and access to social and material support. 'Self-efficacy' was introduced as a psychosocial concept of how motivation and confidence is acquired through methods of positive reinforcement. Interventions that attempt to increase self-efficacy have focused on providing supportive environments and reward systems. It was suggested that the propensity to be active is accumulated through a person's life course. The significance of life stages was also mentioned in the discussion of cultural determinants of physical activity. Cultural approaches are concerned with the sociocultural meanings that behaviours have for different groups, for example, how sport and exercise may be

culturally gendered or 'sex-typed' (Biddle and Mutrie, 2008). An ecological model can be understood as incorporating the individual and social explanations that invite researchers to consider how these factors interact.

The purpose of this chapter has been to 'set the scene' of physical activity literature in an overall sense before Chapter Three reviews evidence of environmental determinants in more detail and outlines the aims of the research. However, two general points raised in this chapter can be noted for their relevance to the study. Firstly, understanding physical activity behaviour requires looking beyond the individual to the contexts and settings of these behaviours. This point has been repeated often within ecological approaches. Here, Owen states it as an imperative:

> 'The central challenge in pursuing public health advocacy for physical activity is to build this case on systematic research and theory development to identify the most relevant environmental influences on physical activity. In doing so, it is imperative that this research be used, if possible, to reframe the predominant, implicit model of physical activity as a conscious, discretionary life choice. This is particularly important in socioeconomic contexts where prolonged, enforced (or at least strongly reinforced) periods of sedentary behavior in occupational and domestic environments constitute a major health risk.'
>
> (Owen et al., 2004: 75-76)

The following research looks to be non-reductive and explore the interactions between individuals, environments and social factors. In Chapter Three it is argued that doing this necessitates a qualitative investigation, beyond statistical correlations. A second, related point is the importance of life course and experience. In this study, interview participants have recently moved into a new neighbourhood, some expressly to 'settle down' and raise a family. The purpose is to provide a snapshot of this crucial moment of urban relocation when residents are selecting a neighbourhood to raise a family and, presumably to (re)create habitual behaviours such as active travel.

CHAPTER THREE: URBAN FORM AND WALKABILITY

This chapter provides a narrative review of urban form and physical activity research in order to reveal how urban environments determine physical activity behaviours. Essentially, research in this area has tried to capture and provide evidence that urban environments that have good pedestrian access, a variety of destinations and safe, attractive design will increase walking behaviour of their residents. The public health interest in supportive environments is complementary to interests of planners in developing healthy, sustainable places (Handy et al., 2002, Hoehner et al., 2003) and contributions from these fields have been integrated (Saelens et al., 2003b, Corburn, 2004). Much of this research is driven by North American vindication of compact cities that emphasize smart growth rather than suburban sprawl. This is followed by attempts to test the strength of associations between measures of urban form such as density and land use mix with walking and physical activity.

This chapter starts with an outline of key methodological considerations in studying urban form, namely issues of scales and measurements. The chapter then moves on to introduce different dimensions of urban form and discusses how each are believed to influence behaviour. All research exploring the influence of the environment on people and health has to narrow its focus to particular characteristics that are felt to be salient. Urban form refers to different dimensions of the environment typically measured. As walkable neighbourhoods require a combination of urban characteristics, researchers have used composite measures in order to capture neighbourhood 'walkability'. The purpose of this chapter is to critically evaluate the evidence of walkability and identify a research agenda. There is substantial evidence from these studies that walkable characteristics correlate with walking behaviour, particularly walking for transport and errands. However, there is a lack of detail about the processes underlining these associations. The majority of evidence in this area is cross-sectional and lacks meaningful accounts of whether the everyday behaviour of people is susceptible to environmental change and intervention. Critics of environmental determinism propose that the detected associations can be explained by neighbourhood selection: the idea that people naturally relocate to areas that reflect their lifestyle preferences. The chapter is concluded by setting out research aims and agenda.

3.1 Spatial Scales

Before outlining how urban form is measured, it is worth mentioning the different spatial scales of analysis that can be used. Built environment research can be conducted nationally, regionally or at the neighbourhood- and street-level. At the larger scale; researchers have studied whole countries or regions, using surveys or geographical information systems (GIS) to conduct a cross-sectional analysis of geographic and behavioural information. Much of the evidence presented in this field of research is of this spatial scale: large geographical associations between environments and behaviour. These are well-represented in this chapter. While large-scale, cross-sectional studies succeed in identifying patterns and associations, they can lack detail on causes and motivations to be active. Some researchers have therefore called for greater detail and context in research (Cummins et al., 2007, McCormack and Shiell, 2011, McCormack et al., 2010, Cao et al., 2009, Giles-Corti et al., 2005, Cerin et al., 2007, Owen et al., 2004, Saelens et al., 2003b). To this end, smaller scale studies have focused on specific activities, neighbourhoods or areas. Neighbourhood-based studies often involve purposefully selected areas in order to compare behavioural outcomes (Badland et al., 2009, Cao et al., 2006, Andrews, 2010). Such studies are able to provide more detail regarding resident and pedestrian experience. A smaller scale of study might focus on particular aspects of the environment or even specific interventions, such as parks, road-types and pathways. Different scales of analysis are likely to capture or obscure different dimensions and aspects of the environment. Large-scale studies, in their generality, may obscure the details of the neighbourhood such as street design and safety. Too small a focus on a neighbourhood may say little about which aspects of the environment are most influential in a range of settings or how people travel beyond their immediate neighbourhood boundaries.

3.2 Areas of Effect

Whichever scale of analysis is used, it is important to consider the most suitable geographical space for studying behaviour. Different areas are likely to be more or less appropriate depending on the type of behaviour. Regional road infrastructure may influence driving whilst the local street design may be pertinent to walking. Environment-behaviour correlations can differ depending on the thresholds of the environment studied. For example, Boone-Heinonen et al. (2010) found that access to facilities within 3 km had a significant correlation with Moderate Vigorous Physical Activity (MVPA), whilst density of road intersections were only significant within 1 km. Deciding on the appropriate threshold for study is partially dependent how neighbourhood boundaries are defined.

Researchers often delineate neighbourhood boundaries administratively. However, local and lay delineations of neighbourhood boundaries are important as they are likely to better reflect those spaces that are used (Jenks and Dempsey, 2007, Moudon et al., 2006, Perchoux et al., 2013, Jones et al., 2010). On the other hand, administratively defined boundaries, such as American zip codes, can artificially 'cut through' urban spaces (Moudon et al., 2006). Scottish data zones were designed to reflect natural community boundaries and to have demographic homogeneity and with population ranges. Inevitably, they sometimes cut across neighbourhoods. Large-scale studies tend to use smaller units of analysis, such as data zones or zip codes, as environmental numerators. Although it can be tempting to achieve 'more detail' by using the smallest available geographical units (see for example Leslie et al., 2007), this can mean artificially disaggregating units from their neighbourhood context. For example, in the map of Dumbrae in Edinburgh (Figure 1), data zones 'A' and 'B' would be considered to be alike as they have similar characteristics: both are primarily residential and have tendril road patterns (cul-de-sacs). However, seen within their wider setting, area 'B' could be said to be more conducive to physical activity because it is adjacent to a public park. In large-scale statistical analysis, units such as these will be treated discretely, dislocated from their surroundings.
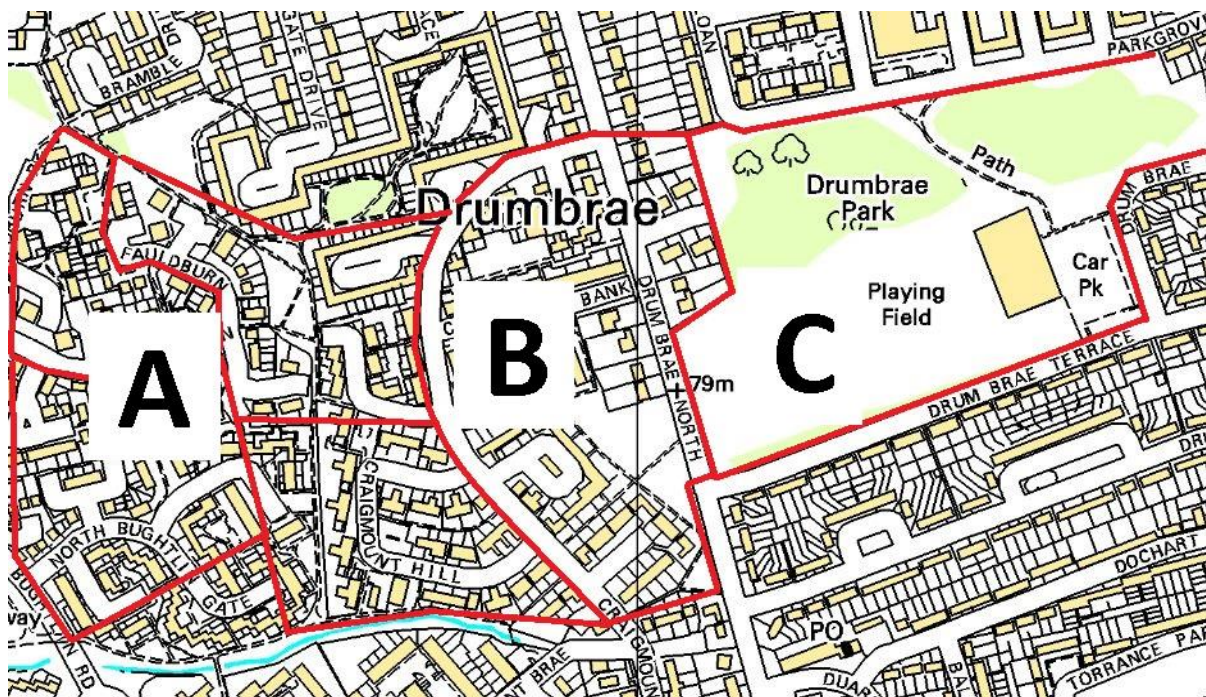
Figure 3.1: Data zones in Dumbrae, Edinburgh.

This is an example of how decisions on how to delineate geographical units are likely to capture or omit certain types of behaviour. It is worth noting that the methodological dislocation described is somewhat mitigated in cases where the each geographical unit is scored according to its relative proximity to parks, shops or other destinations, for example, where zone 'B' in Figure 1 might score higher than 'A' for being closer to the park or main road. This is how units of analysis are treated in the logistic regression analysis presented in Chapter Five.

3.3 Trips and Travel Modes

Because it can be difficult to establish a suitable area of effect for studying travel behaviour, some researchers have looked specifically at trips and travel modes. How the environment influences walking depends on the purpose of the trip. Neighbourhood aesthetic may encourage strolling for pleasure whilst access to commercial districts will increase utilitarian walking trips (Cao et al., 2006). Studies have used self-reported trips, for example, through a questionnaire survey (De Geus et al., 2008, Schlossberg et al., 2006). More common methods have been to use travel diaries (Cervero and Kockelman, 1997, Frank et al., 2006b, Saelens et al., 2003a, Ogilvie et al., 2008, Ogilvie et al., 2010), pedometers (King et al., 2005, Tudor-Locke et al., 2005, Van Dyck et al., 2009b) or accelerometers (De Bourdeaudhuij et al., 2003, Jones et al., 2010, Krizek et al., 2008, Sallis et al., 2009b, Timperio et al., 2008). A less common method is to use residents' narratives or virtual routes in order to better represent how pedestrians negotiate urban spaces (Walford et al., 2011). Research into travel modes has tended to focus on the extent to which reasoned action is susceptible to environmental and policy interventions, or past travel modes can be seen to be predictive of future travel choices (Bamberg, 2006). For example, in a study of cycling behaviour it was found that the neighbourhood environment only needed to be adequate for cycling, after which individual factors were significant (De Geus et al., 2008). In this research, trips and travel are explored through semi-structured interviews, accelerometers and travel diaries.

3.4 Dimensions of Urban Form

The purpose of good urban design is to make places that are functional, attractive and sustainable. The design and layout of urban environments has a profound impact on how people live, work and travel in those spaces. In this research, 'urban form' refers to the measurable *physical characteristics of a city*. This includes the buildings, roads, parks and transport infrastructure. It also includes the

type and layout of buildings, whether building types are mixed or separate and whether they are densely or sparsely grouped. Building types and layout are important as it is suggested that a greater concentration and diversity of buildings means there are more locations and reasons for walking. Interconnected roads and pathways are needed to allow transport between locations. More intersections and junctions allow for a greater possibility of travel between destinations. The following section outlines different dimensions of urban form and how they relate to walking and physical activity. Specifically, these dimensions are *density*, *diversity, proximity*, *connectivity*, *green space* and *street design*. Whilst this is not an exhaustive list, a review of the literature shows that these are the most commonly used dimensions of urban form in the analysis of environmental correlates of walking and physical activity (Leyden, 2003, Frank et al., 2006b, Bergman et al., 2009, Giles-Corti et al., 2009, Millington et al., 2009, Sallis et al., 2009b, Van Dyck et al., 2009b, Van Dyck et al., 2010). Some of the urban form measures outlined here are used in this research as part of the logistic regression model presented in Chapter Five.

3.4.1 Urban Density

Density is a deceptively complex concept (Jenks and Jones, 2010, Bramley et al., 2009) that describes the number of something within a given space. The density of persons, households or dwellings can be used either as a gross (of the total area) or net measurement (of a specific type of land use). Within urban studies, densities of people or buildings per hectare are typically used (Forsyth et al., 2008). Thresholds of density vary widely between different countries and cities. Places such as Hong Kong and Singapore have densities of more than 6000 people per square kilometre whilst most European countries tend to have only a few hundred people per square kilometre. Importantly, research into effects of sprawling urban design on health have typically come from North America and Australia where urban densities are considerably lower than those found in Europe.

For some time, planners have been critical of the expansion of low-density suburbs, drawing attention to their social and environmental impacts. Sprawling land use patterns are criticised for being poorly designed, lacking public spaces and prioritising car-use at the expense of pedestrians and public health (Handy, 1996, Ewing et al., 2003, Frumkin et al., 2004, Frank et al., 2006b, Saelens et al., 2003a, Cervero and Kockelman, 1997). Ewing and colleagues (2003) found that the level of sprawl was significant associated with minutes walked, as well as obesity, BMI and hypertension. They suggest that people living in counties with more sprawl were less likely to walk and therefore more likely to be overweight and suffer from weight-related illness. The problem with studying

'sprawl', however, is that the term refers to something that is difficult to operationalize (Ewing et al., 2003, Feng et al., 2010, Frumkin et al., 2004, Lopez and Hynes, 2003, Owen et al., 2004). As Galster et al. (2001) put it, although many people could recognise a sprawling neighbourhood, we would have trouble providing it a measurable definition.

Density is often used as proxy measure for urban compactness. Areas that are more compact are hypothesized as having more potential trip-ends (Cervero and Kockelman, 1997). So for example, living in a dense, inner-city area will often mean there are more shops, facilities and destinations within walking distance. It is this density of available places to walk that is believed to be the mechanisms underpinning the relationship between physical activity and urban density. Conversely, areas of low urban density tend to have fewer trip ends, making walking and active travel less functional. This raises the question of what level of density is most appropriate for sustainable and healthful urban design (Bramley et al., 2009). Whilst it is evident that very low density areas necessitate car-travel, it is not clear whether higher densities will increase active travel beyond a certain point. Much of the research attention on urban densities concerns the policy questions of whether high densities should be encouraged (compact city) or allow for urban development to grow at lower densities (Bramley et al., 2009). In the UK, US and Australia, there has been policy support for compact urban design. City centre populations in Manchester and Liverpool have grown considerably as a result of such policies. However, people often 'vote with their feet' by relocating to low-density suburban areas (Neuman, 2005, Couch and Karecha, 2006). There has been a tendency to treat density as being synonymous with sustainability, although this has been accused of over-simplifying the issue (Neuman, 2005). The benefits of compaction may be outweighed by negative externalities (Gordon and Richardson, 1997) detrimental to active living, such as over-crowding, pollution or the loss of green and open spaces (Barton and Tsourou, 2000, Jenks and Jones, 2010, Barton, 2009, Bramley et al., 2009).

In summary, neighbourhoods that have a higher density are often more walkable because they are more likely to have more shops and facilities and better connections between roads and pathways. People in more dense neighbourhoods are believed to have more reasons and opportunities to walk places rather than those who live in low-density suburban neighbourhoods. Residential and building densities are the most common measures of urban form used to study the environmental determinants of physical activity. Correlations between densities and physical activity have been reported in some of the earliest research in the field (Cervero and Kockelman, 1997). However, it is better understood as a proxy for walkable and sustainable neighbourhoods rather than a guarantee. High dwelling density alone is unlikely to make dramatic changes in activity levels

(Forsyth et al., 2007), as it needs to be in concordance with other planning elements such as connected infrastructure and available facilities. Interventions such as traffic-calming, cycle path development, improved lighting and having accessible green space are also important (Barton et al., 2009).

3.4.2 Land Use Diversity

'Land use diversity' or 'land use mix', refers to the heterogeneity of building types and function of urban space (Jenks and Jones, 2010). Urban areas of low diversity tend to be dominated by one land use type such as retail, industrial or residential buildings. High diversity areas, which have a mix of shops, office spaces and public amenities, provide residents with a purpose for walking locally. Essentially, the greater degree of diversity, the more potential trip-ends there are. Depending on the scale of analysis used, the diversity of potential destinations will provide incentives to walk. Post boxes, shops, public transport, and schools have all been shown to be significantly correlated with walking for transport (McCormack et al., 2008). Farthing et al. (1996) found eight types of facility services that were typically used: a food shop, newsagents, open space, post office, primary school, pub, supermarket, and secondary school (Bramley et al., 2009). However, the list could also include banks (Jenks, Barton 1997), general practice surgeries (Barton 2008, Jenks), libraries and community centres (Aldous 1992). UK planning policy supports 'mixed land use' design for promoting accessible services and facilities for residents (Jenks and Jones, 2010).

Land use diversity has been linked to more active and healthier communities (Hoehner et al., 2005) as access to a mix of locations are positively associated with walking for transport and leisure (Hoehner et al., 2005, McCormack et al., 2008, McCormack and Shiell, 2011, Cerin et al., 2007). In summary, it is believed that living in a neighbourhood with a mixture of land-uses will provide more reasons for walking as residents are close to shops and places of work. However, there are some contrasting findings, for example Kaczynski et al. (2010) found that park-based physical activity was more likely happen in neighbourhood of limited diversity. These results, which seem contrary to the connection between diversity and physical activity, may be due to extraneous factors. The authors recognised that socioeconomic status of these neighbourhoods are likely to mediate the relationship (Kaczynski et al., 2010). Disentangling socioeconomic status from neighbourhood characteristics is discussed later in the chapter.

3.4.3 Proximity and Distance

Proximity can be defined as the straight line, or 'as-the-crow-flies', distance between different points (Saelens et al., 2003b). It is often used to refer to the closeness of destinations within a particular radius of a person's home. The more destinations that are within close proximity, the more opportunities and incentives there are for that resident to walk. It is important to note that proximity is different from walking distance, which will be longer depending on the *connectivity* of pathways and roads. However, it is suggested that residents are more likely to walk when they have a number of *proximal* destinations. For example, in an influential Australian study, Bauman et al. found that people living near to the coast were significantly more likely to be active and less likely to be sedentary (Bauman et al., 1999). It has been argued that access to natural-resources provide reason and motivation for walking and significantly increase overall physical activity (Giles-Corti and Donovan, 2003). As well as natural spaces, peoples' distance from practical destinations such as shops, schools and a place of work can also determine the amount of walking they do. Living with closer destinations and having alternatives to driving is believed to result in less driving and more walking (Handy et al., 2005: 429). There has been some research into how far people will generally walk. The further the distance, the fewer people will be prepared to walk there. This is what is sometimes referred to as 'ped-sheds' (Davies, 1998). Walkable distances have been found to range from around 90 meters to 1 kilometre (McCormack et al., 2008, Frank et al., 2004, Moudon et al., 2006), or around a 10 to 15 minute walk from home (McCormack et al., 2008, Saelens et al., 2003a). The distance people will travel depends on the type and quality of the destination as well as the ease and safety of the route.

Although it might be reasonable think that short distances mean *less* time being active, some researchers suggest there may be more physical activity accrued through greater *number of trips.* Having destinations that are in close proximity encourages people to walk for a number of functions and these trips are more likely to be combined (Krizek et al., 2008). McCormack et al. found a dose-response relationship between proximity and walking, whereby closer destinations will add to residents total walking time (McCormack et al., 2008). It seems intuitive that proximity to amenities will influence utilitarian walking (McCormack et al., 2008, Lovasi et al., 2008). This is because the two main forms of utilitarian walking are shopping and commuting. Living in an area that includes not only residential buildings but shops and other facilities mean that residents can walk more and do not need to rely on a car. A number of studies have found that proximity to shops and to place of work emerge as the most significant predictors of regular active travel (Cerin et al., 2007, Ogilvie et al., 2008).

Residents' self-reported accounts of proximity have been found to be unreliable when contrasted with actual distances (Macintyre et al., 2008). This is probably because self-reported accounts are likely to reflect that person's familiarity with the route and destination. This may be why self-reported accounts are more closely associated with *respondent characteristics* rather than *objective proximities* (Hoehner et al., 2005). Many of the researchers who led the field in proximity and travel emphasize the importance of looking at pedestrian perspectives and actual trips alongside objective measures (Handy, 1996, Sallis and Glanz, 2009, Handy et al., 2006).

In this research, proximity measures include both direct and network distances. These are distances of the data zone centres to other destinations. Scottish data zones are coded according to their distance to the nearest central business district and by travel time to local shops. Furthermore, the three case study neighbourhoods used in this study represent different proximities from the city centre.

3.4.4 Connectivity

Connectivity refers to the spatial arrangement and interconnection of roads, pavements and pathways which allow for movement between destinations. It is 'the directness and variety of possible routes to destinations' (Owen et al., 2007: 388). The direct distance refers to an 'as-the-crow-flies' straight line between two points. The network distance refers to travel distance using the available road and pathway network. There is good connectivity where the network distance is as close to the direct distance as possible. A neighbourhood that has a good network of roads and pathways allows for residents to walk as near a direct route as possible. A street with many linkages provides more opportunities to travel between locations (Frumkin et al., 2004). Because activity-promoting urban space is all about creating opportunities for people to walk, it is important to study the effect of connective networks (Chin et al., 2008). The grid-pattern road network has been found to be more conducive to walking then tendril road networks (Owen et al., 2007, Saelens et al., 2003a, Saelens et al., 2003b, Chin et al., 2008). Good connectivity has been found to be negatively correlated with residents' BMI (Timperio et al., 2010). Improving cycle lanes, cycle paths and footpaths are essential for enabling people to elect to actively travel. Scale of analysis is important in considering connectivity, as more walkable neighbourhoods are those with more junctions within a given space. Inner city areas tend to have more junctions per hectare than outer-city areas, and there are also more facilities in such areas. Connectivity is typically measured by the density of intersections within a certain area (Boone-Heinonen et al., 2010, Frank et al., 2005). In this study,

connectivity measures are estimated from a multiple centrality analysis (MCA) developed as part of the City Form study (Bramley et al., 2009), and are used as part of the logistic regression modelling. Furthermore, the case study neighbourhoods used to recruit interview participants have comparatively differentiated road networks.

3.4.5 Green Space

Having access to green space access has been found to be positively associated with a number of health outcomes (Richardson and Mitchell, 2010, Maas, 2007, James et al., 2009, Maas et al., 2008). Green space is believed to improve residents' health through a number of causal pathways. Exposure to green and natural space can improve mental wellbeing (Berg et al., 2007, Pretty et al., 2005, Barton and Pretty, 2010), reduce stress (Grahn and Stigsdotter, 2003, Nielsen and Hansen, 2007, Van den Berg et al., 2010) and improve restorative functions and self-esteem (Barton and Pretty, 2010). Green space access is also believed to improve health through encouraging more physical activity. This is because green spaces are attractive places for recreational activities as well as a means of active travel. Natural resources such as woodlands, parks, coastlines and lakes can increase the physical activity of residents living nearby as they are attractive and pleasant places. Green space has been found to increase the likelihood of utilitarian walking (Sugiyama et al., 2009, Cutts et al., 2009, Richardson and Mitchell, 2010, Tilt, 2009), which is believed to underpin the relationship of green space to all-cause mortality (Mitchell and Popham, 2007) and obesity (Lachowycz and Jones, 2011).This association is believed to be due to the fact that green space promotes more physical activity. In fact it has been argued that 'green exercise', meaning physical activity in green space, is of greater health benefit because of its combination with mental restorative properties (Pretty et al., 2007, Pretty et al., 2005).

Although it has been argued that urban compaction is antithetical to green space, as densification may mean that green areas are removed (Hartig and Fransson, 2009), others argue that this contradiction can be overstated and smart growth can incorporate or even improve upon green design (Ståhle, 2010). Certainly the quality of green space can be said to be at least as important as its accessibility. Tilt (2009) looked at whether people's propensity to walk varied with degrees of green foliage. Whilst neighbourhood greenery was positively associated with people's propensity to walk in the area, too much foliage was negatively perceived by some respondents, as poor visibility made them concerned about their safety. In their study of green space in England, Mitchell and Popham (2007) found that all-cause mortality varied significantly by exposure to green space. They

argue that the influence of green space on health appears to be mediated by deprivation and the quality of the green space (Mitchell and Popham, 2007). Similarly, Jones et al. (2009) found that residents of deprived areas lived closer to green spaces but were less likely to visit them.

Studies in the United States have found that children's physical activity is associated with parks, sports fields (Lovasi et al., 2008, Lovasi et al., 2013) as well as green, smart-growth environments (Almanza et al., 2012). A recent study of seven Korean cities similarly found that the proportion of public parks to the population was independently associated with physical activity, controlling for other factors (Park et al., 2013) and similar results were found in Australia (Sugiyama et al., 2010). More mixed results were found in Europe; at least two Dutch studies found that greener space has no relation to walking and cycling (Maas et al., 2008). However, this is likely to reflect the smaller effect size of a country that has a comparatively good cycling infrastructure and a high number of cyclists (Maas et al., 2008). In the UK, a number of studies have found that living near parks improves chances of meeting physical activity recommendations (Coombes et al., 2010) although some of the same authors also reported no association between green space and recreational physical activity in the UK (Hillsdon et al., 2006).

Including green and natural areas as part of the roadways and pathways are particularly important for encouraging walking for transport (Owen et al., 2004). This includes aspects of the streetscape such as 'trees, wide grassy verges, parks, private gardens, diverse and interesting and natural sights' (Maas et al., 2008: 207). In a cross-sectional study of eight European countries, Ellaway et al. concluded that for 'respondents whose residential environment contains high levels of greenery, the likelihood of being more physically active is more than three times as high, and the likelihood of being overweight and obese is about 40% less' (Ellaway et al., 2005).

In summary, green space is understood to have significant health benefits for the population as it reduces stress, facilities recreational activity and incentivises people to walk more. Whereas the previously discussed urban form measures largely enable active travel, creating greener neighbourhoods is about making those spaces more pleasant to travel in. The evidence shows that such measures are effective. Within this research there is some consideration of green space between the case study neighbourhoods. The use of green space was also a particular focus in the interviews the data which is presented in Chapter Six and Chapter Seven.

3.4.6 Street Design

Clearly, planning attributes such as density and connectivity will only make an area walkable when they come together with good street design. Street design has a role in making places pleasant and safe through pedestrian-centred layout, signposting, street furniture, foliage and street lighting. Good street design makes destinations and public transport locations easily visible to pedestrians. Areas that are cleaner and have people using them are more likely to feel safer and more welcoming. Compared to European cities, many post-war neighbourhoods in the United States are poorly provided for in terms of sidewalks (Moudon et al., 2006, Ogilvie et al., 2008). Although European neighbourhoods are more likely have pavements, the quality of paving and access has been found to impact on walking for transport (De Bourdeaudhuij et al., 2003). Improving pedestrian infrastructure and furniture is associated with walking behaviour (Hoehner et al., 2005, Giles-Corti et al., 2006).

3.5 Walkability

The chapter has so far discussed different dimensions of urban form and how they can influence physical activity, primarily through enabling walking. Whilst this list is not exhaustive, it includes those elements commonly used in studies of the built environment and physical activity: *density*, *land-use*, *proximity*, *connectivity*, *green space* and *design*. In reviewing the literature, these dimensions were those most commonly used in studies of environmental influences on physical activity. Clearly, these characteristics are interrelated. High density areas are also often well-connected whilst low density areas often are not, for example. It is likely that the most 'walkable' places are those that have a *combination* of these beneficial characteristics. For this reason, researchers have attempted to capture something of the *concordance* of walkable attributes by developing composite measures of urban form or what are typically referred to as measures of 'walkability'. In order to better review the current evidence regarding the environment and physical activity, the following section outlines findings from some influential studies of 'walkability' from the United States, Australia and Europe.

3.5.1 United States

SMARTRAQ (Strategies for Metropolitan Atlanta's Regional Transportation and Air Quality) is an Atlanta-based project assessing the role of land use policies and transport investments for reducing car-dependence and promoting health. Whereas previous US studies concerned areas of low density, SMARTRAQ involves high density areas in Atlanta. Frank et al. (2005) used two measures of the urban area: 1 km radius and 1 km road network-based buffer from the point of interest. This means the study uses boundaries defined by the 'network distances' to reflect residents' actual travel time from the area of interest. Urban areas were categorised as low- or high-walkability. Walkable areas were those with a net residential density greater than six dwellings per acre and more than 30 intersections per square kilometre. The odd mixture of metric and non-metric measurements may have been due to the way in which study areas and environment characteristics were calculated, although this is not referred to by the authors. Land-use diversity was taken from the 'evenness' of residential, commercial and office buildings within a square kilometre. The physical activity of 357 participants was measured using an accelerometer. A logistic regression, controlling for demographic characteristics, showed that land-use mix, residential density and intersections were positively associated with minutes of moderate activity (Frank et al., 2005). A second model used a composite measure of walkability and explained more of the total variation in moderate activity. Through a number of publications, SMARTRAQ research has demonstrated that walkability is a significant predictor of residential walking and health (Norman et al., 2013, Frank et al., 2005).

Saelens et al. (2003a) used a similar walkability measure, purposefully selecting two neighbourhoods in San Diego, California using a walkability scale (Saelens et al., 2003a). Fifty residents from each neighbourhood were recruited to complete a survey and return accelerometer data. The highly walkable neighbourhood had a mixture of single-family and multiple-family residential buildings consistent with high residential density as well as a variety of building types such as restaurants, grocers and small stores (Saelens et al., 2003a: 1552). The high-walkability neighbourhood had grid-like street patterns indicating high connectivity. The low-walkability neighbourhood had predominantly single-family homes and a mixture of less connected streets. There were no observed differences in leisure or exercise walking. However, walking for errands was significantly different (Saelens et al., 2003a: 1554). Residents from the high-walkability neighbourhoods engaged in around 52 minutes more physical activity a week than those in low walkability neighbourhoods (Saelens et al., 2003a).

3.5.2 Australia

Leslie and colleagues looked to study how the environment was directly influencing physical activity in an Australian context (Leslie et al., 2007: 113). The Adelaide-based PLACE study (Physical Activity in Localities and Community Environments) used GIS to develop a walkability index (Leslie et al., 2007). The PLACE walkability measure prioritised proximity and accessibility as the 'key elements of neighbourhood walkability' (Owen et al., 2007: 388). Part of their aim was to test the applicability of walkability scales found in the United States in Australia, whilst also controlling for the effects of socioeconomic status. They compared physical activity levels of residents with similar SES characteristics who lived in high- or low-walkable areas (Owen et al., 2007). The geographical units of analysis were neighbourhood districts, each consisting of around 250 households. Four environmental attributes were used to designate low or high walkability: dwelling density, street connectivity, land-use mix, and net retail area. They used street centreline data, land use, zoning and shopping centre location data as well as census data in GIS to create a composite index of walkability (Owen et al., 2007). Thirty-two districts were divided into four groups: low walkability/ high SES, low walkability/ low SES, High walkability/ high SES, and high walkability/ low SES. Self-reported walking data was gathered from the districts and allocated into these 'quadrants'. The findings show that there were no significant effects on weekly minutes of walking by objective walkability measures after adjusting for individual-level socio-demographics (Owen et al., 2007). The findings support the hypothesis that attributes of neighbourhood such as street connectivity and proximity to retail locations are associated with residents walking for transport (Owen et al., 2007). This suggests that Adelaide residents living in more walkable areas are more likely to make walking trips.

In Western Australia, a study The RESIDE project (RESIDential Environment Project) was set up in 2003 to evaluate the effectiveness of a new governmental policy on liveable neighbourhoods and community design (Giles-Corti et al., 2007). This study is particularly relevant here as participants were relocating to a new neighbourhood. There were three periods of data collection over five years. RESIDE used a measure of walkability similar to that used by Frank and colleagues in the SMARTRAQ project. Neighbourhoods were evaluated on having good land use diversity and inter-connected road networks (Giles-Corti et al., 2007). The study took an ecological approach, collecting data on individual, social and environment factors. By collecting data from participants before and after moving home, they hoped to capture behavioural changes. Reported findings from RESIDE suggest that green and attractive neighbourhoods, better connectivity and controlled traffic

will support residents in choosing means of active travel (Titze et al., 2010, Sugiyama et al., 2010). There was also evidence that participants took up cycling for the first time as a result of moving into a more supportive environment (Beenackers et al., 2012). It was also found that dog-ownership is independently associated with walking (Cutt et al., 2007). The study aimed to provide better causal understanding of the relationship between residential health and urban design (Giles-Corti et al., 2007).

3.5.3 Europe

European cities can have very different urban forms to those of the US and Australia. Generally, European cities are of higher densities and there are fewer examples of what might be considered suburban 'sprawl'. This makes comparative studies of walkability in Europe important, because it allows a test of significance of urban form characteristics at higher density thresholds. There are fewer studies of walkability in European countries. A few of the exceptions include research in Sweden (Bergman et al., 2009), Netherlands (Kamphuis et al., 2010), Belgium (Van Dyck et al., 2009b, Van Dyck et al., 2009a, De Bourdeaudhuij et al., 2005) and Scotland (Millington et al., 2009, Wilson et al., 2010, Ogilvie et al., 2008).

The same walkability scale used in the PLACE study was applied to a Belgian region by Van Dyck and colleagues in studies of adults (Van Dyck et al., 2009b) and adolescents (Van Dyck et al., 2009a). Their results showed a contradiction between adults and adolescents. Adults living in highly-walkable neighbourhoods reported an average of 23 minutes more walking for transport per week than those living in low walkable areas (Van Dyck et al., 2009a). The pedometer data showed that residents in highly walkable areas took an average of 1,200 more steps per day (Van Dyck et al., 2009b). However, in the study of adolescents, those living in highly walkable areas were *less* likely to use active modes of travel (Deforche et al., 2010, Van Dyck et al., 2009a). It was later suggested that this was due to the effects of psychosocial factors, whereby adolescents' confidence and perception of neighbourhood safety mediate the effect of access to recreational facilities (Deforche et al., 2010). The authors concluded that policies aimed at increasing connectivity and density in Belgium may be more effective for promoting physical activity in adults than adolescents (Van Dyck et al., 2009a).

The Scottish Walkability Assessment Tool (SWAT) was developed by Millington and colleagues on behalf of the Scottish Physical Activity Research Collaboration (Millington et al., 2009).

Inspired by a systematic environment assessment used in Australia (Pikora et al., 2003), the Scottish researchers developed an instrument for auditing environmental influences on walking and cycling behaviour in Glasgow. The SWAT assessment tool included factors specific to Glasgow, such as different types of road crossing and density of vegetation, as well as typical urban form characteristics such as access to shops, road connectivity and proximities. After piloting and validating the tool, it was used in a study of inactive participants recruited from a 25 km² area of Glasgow (Fitzsimons et al., 2008, Millington et al., 2009). The purpose of only looking at inactive participants was due to an interest in the viability of the environmental enablers for making inactive residents more active. The tool was used to assess participants' neighbourhood area within a 30 minute walking time or 1.6 km radius (Fitzsimons et al., 2008). The SWAT tool is a Scottish example of developing systematic neighbourhood assessments, which cross-country comparisons have found to be reliable (Cerin et al., 2013). However, Millington and colleagues found assessing objective dimensions were considerably more reliable than those of subjective dimensions such as neighbourhood safety (Millington et al., 2009). The authors discuss the fact that such subjective measures are best studied from the participant's point-of-view rather than objectively assessed. They also suggest that the studies could have benefited from using a greater range of neighbourhood characteristics to allow for higher variability and comparability (Millington et al., 2009).

3.6 Walkability and Determinism

A number of studies have used composite measures of walkable attributes to test the environment-walking relationship. These studies have typically found significant correlations between walkability and walking, with a few exceptions (Lovasi et al., 2008). Studies of walkability have provided substantial evidence that utilitarian physical activity, primarily walking and cycling for transport, is significantly higher in neighbourhoods with a concordance of walkable characteristics (Handy and Clifton, 2001, Saelens et al., 2003b, Craig et al., 2002, Owen et al., 2004). It is argued that this evidence shows that transport and land-use decisions have significant public health implications (Heath et al., 2006, Frank et al., 2005). Walkability measures are attractive as they provide public health officials and planners with objective criteria for developing frameworks for healthier urban spaces (Bias et al., 2010). However, comparing walkability studies can be difficult due to lack of agreed measurement (Feng et al., 2010, McCormack and Shiell, 2011) leading to calls for an integrated walkability index (Frank et al., 2007, Feng et al., 2010).

The urban environment has been shown to be more closely associated with utilitarian walking than recreational activities (Bergman et al., 2009, Owen et al., 2004, Giles-Corti and Donovan, 2002, Frank et al., 2006a) and there has been some agreement these should be studied separately (Pikora et al., 2003, Humpel et al., 2004, Owen et al., 2004, Ewing, 2005b). People engage in travel for different reasons than they do recreation, so the built environment is going to influence the two differently:

> 'In particular, travel will depend on land-use patterns because land use accommodates specific activities, whereas leisure-time physical activity will depend on proximity to and quality of recreational facilities.'

> (Ewing, 2005b: 73)

A related consideration in assessing environmental interventions is to ask whether the resulting increase in utilitarian walking is sufficient to represent an increase in *health enhancing* physical activity (Bergman et al., 2009).

Walkability studies still leave a number of questions unanswered. Firstly, the majority of evidence so far has come from the United States and Australia, where densities are typically very low. Furthermore, measures of walkability often lack a more meaningful account of residents' experience of the neighbourhood and how they use urban spaces. Relatively little is known about the types of people (Cao et al., 2006, Cao et al., 2009) and activities most susceptible to environmental intervention. We know that suburban residents drive more and walk less but it is not yet established whether this is environmentally determined (Cao et al., 2006). Aspects of walkability often coincide with area deprivation or prosperity, so the influence of walkability may be compounded by socioeconomic factors. However, the most prominent critique of walkability, and the focus of this research, is whether these correlations can legitimately be interpreted as evidence of environmentally determined behaviour. As the majority of walkability studies are cross-sectional, they cannot be treated as definitively causal explanations (McCormack and Shiell, 2011). As Bauman et al. (2002) points out, many of the researchers in this field have been too quick to claim evidence of *determinism* when there are only *associations.* Similarly, Ewing called for moderation when interpreting statistical correlations (Ewing, 2005b). Heath et al. suggest that much of the research into walkability would be better described as measures of *behavioural differences* rather than *behaviour change* (Heath et al., 2006). The question therefore remains how important the neighbourhood walkability is in *changing* the behaviour of residents. The challenge of research into

environmental influences on physical activity is therefore to identify the behavioural processes unpinning these associations and to account for alternative explanations.

> 'Cross-sectional studies by their design do not provide explicit information about temporal precedence and most to date have not included mechanisms to rule out competing explanations of the built environment physical activity relationship, such as neighbourhood self-selection.'

> (McCormack and Shiell, 2011: 2)

3.7 People and Places

A pertinent example of how associations may indicate *neighborhood difference* rather than *behavioural change* is where residents of a particular socio-economic status are clustered within certain neighbourhoods. In particular, areas of deprivation in Scotland are known to perform poorly in terms of physical activity, diet, smoking and drinking. There are a lot of known socio-demographic influences on choices and activities, such as travel mode, and studies have looked to control for these, certainly at the individual or household level. The concern that detected environmental-behavioural patterns may be individual- rather than place-characteristic is related to questions of *context or composition*. A number of studies have attempted to disentangle context and composition in order to illuminate the 'real' environmental effect. Typically this has been done through statistical modelling that controls for individual factors, such as demographics (Pan et al., 2009). Corti and colleagues examined the direct influence of the environment on exercise and found that it was secondary to individual and social determinants (Giles-Corti and Donovan, 2003). Other studies have similarly reported that the environment-activity relationship is considerably reduced once individual predictors have been taken into account.

However, treating people and places as mutually exclusive undermines the integrated and reciprocal nature of people and places (Cummins et al., 2007). In their paper of relational aspects of place, Cummins Curtis, Diez-Roux and Macintyre argued that understanding the health importance of place requires more than just 'distance from resources' and argue against the artificial dualism of context and composition (Cummins et al., 2007: 1830). They point out that conventional associations, such as those relating distance and behaviour, have not gone far enough in understanding the context of people and places. There are effects that are specific to a configuration

of people and places, for example gender differences in the perception of safety, proximity, quality of residents neighbourhood (De Bourdeaudhuij et al., 2003, Richardson and Mitchell, 2010, Humpel et al., 2004, Kerr et al., 2010, Phongsavan et al., 2007, Cerin et al., 2007). Individual differences in the interaction with the environment make sense within an ecological framework because, as described in Chapter Two, an ecological model articulates the interaction and relative autonomy of environmental, individual and social determinants.

3.8 Neighbourhood Selection

Krizek et al. (2008) suggests three ways in which urban form influences travel choices. Firstly, the urban form can *directly* influence travel choices, for example, due to an available bus route. Secondly, urban form changes the attractiveness of travel choices, for example, by making cycle routes safer. Thirdly, urban form can lead certain residents to relocate in order to *realise travel and behavioural preferences*, which is referred to as 'self-selection' (Krizek, 2003). Neighbourhood selection is the idea that the environment-behaviour correlations are explained by how people tend to live in areas that facilitate their behaviours. Individuals with a disposition for a particular activity, such as driving or walking, will tend to relocate to neighbourhoods that enable them to do this activity. Neighbourhood selection therefore poses a possible alternative explanation for spatial variations in behaviour. For example, residents within a close proximity to a public park may be observed to have higher park use; however, it does not necessarily follow that the park has determinative influence, as it may be that these residents have selectively chosen an area that corresponds to their high park use. Essentially, neighbourhood selection reverses the causal pathway often assumed within walkability studies. This is an important contestation that could undermine the viability of travel and environmental policy for changing health-related behaviours in the population (Bagley and Mokhtarian, 2002, Boarnet and Sarmiento, 1998, Kitamura et al., 1997). Seen in a positive sense, neighbourhood selection may be considered as part of how walkable urban form facilitates people to realise, perhaps even discover, a latent preference for active travel. Indeed, the qualitative findings presented in Chapters Six and Seven suggest that preferences for walkable characteristics are common and not exclusive to the already fit and active. However, neighbourhood selection is more often depicted in the negative sense as contradicting the viability of environmental interventions for increasing the physical activity of those who are sedentary and least active.

One way of accounting for neighbourhood selection is to collect data on residents' neighbourhood preferences to compare with their behaviour and travel modes (Panter and Jones,

2010). For example, a San Francisco-based study of vehicle miles travelled found that residential location had no separate impact on travel after controlling for travel preferences (Bagley and Mokhtarian, 2002). Kitamura et al. (1997) used survey and diary methods to look at residential behaviour, concluding that personal travel preferences were more important than the location. A Likert scale of neighbourhood preference was used in the Australia-based 'PLACE' study described earlier (Owen et al., 2007). Participants were asked questions regarding where they would like to live, for example, whether it was important to be near school or place of work. The authors reported a significant but weak association between walkability and walking for transport whilst controlling for neighbourhood preference (Owen et al., 2007). In a recent publication, Norman et al. (2013) used a 5-point scale of four neighbourhood preference factors: 'ease of walking, near public transport, near shops and services, and near outdoor recreation' (Norman et al., 2013: 278). The results showed that walkability and neighbourhood selection independently influenced on walking behaviour. Interestingly, the authors conclude that those with a preference for walkable characteristics found ways to walk regardless of where they were living (Norman et al., 2013).

Using survey questions to ascertain, and ultimately control for people's behavioural preferences seems intuitive. However, it could be argued that responses are likely to reflect current behaviours and may not be a valid representation of previous or potential behaviours. Furthermore, how people respond to questions of preferred neighbourhood may not be an accurate indication of how people actually choose where to live. In another study of neighbourhood selection, Cao et al. (2006) asked more specifically why participants had chosen to live where to do. The authors identified shop proximity as significant correlated with walking, but concluded that effects were mediated by whether or not shops had featured in residents' decision to live in that area (Cao et al., 2006). This suggests that strolling frequency is partly explained by neighbourhood preference and therefore lends support to the self-selection hypothesis (Cao et al., 2006). This means that 'having the option to walk to the store is to some extent an effect of the desire to walk to the store' (Cao et al., 2009).

Another way to account for neighbourhood selection is through longitudinal research. This can be done by examining behaviour before and after environmental intervention, such as cycle paths, pedestrian walkways or park improvements. Another form of longitudinal research examines behavioural changes before and after people moved home (See for example: Burton et al., 2009, Cao et al., 2009, Giles-Corti, 2010, Hartig and Fransson, 2009, Timperio et al., 2010). Giles-Corti referred to this as a 'natural experiment' (Giles-Corti, 2010). Krizek (2003) looked at several waves of residents, comparing vehicle miles travelled and 'people miles' travelled before and after moving

home. The intention of the study was to shed light on the causal relationship between urban form and travel (Krizek et al., 2004). He found that moving to a neighbourhood with better overall access resulted in reduced vehicle miles. Krizek also found that in walkable neighbourhoods, residents were more likely to make trips for errands. These 'trips' were often strung together; for example, getting shopping on the way home from work or meeting friends whilst out. Krizek therefore found that those in less walkable neighbourhoods would make longer, single-purpose trips, whilst those in walkable neighbourhoods would make more frequent multi-purpose walking trips (Krizek, 2003). However, Krizek fails to address the question of selection that he originally suggested because the research design does not account for the reason that residents had moved. Initial findings highlighted the variety of reasons people have for moving and how these complicate attempts to control for neighbourhood preference (Krizek, 2003).

Whilst there are a substantial number of publications reviewing the evidence of environmental influences on physical activity (Handy et al., 2002, Heath et al., 2006, Humpel et al., 2002, McCormack et al., 2004, Owen et al., 2004, Pikora et al., 2003, Sallis et al., 2009a, Sallis et al., 1998, Trost et al., 2002, Van Der Horst et al., 2007) few reviews have considered methods for dealing with neighbourhood selection. A recent exception is a review by McCormack and Shiell (2011). McCormack and Shiell (2011) looked at quantitative methods of controlling for preference and the 'quasi-experimental' approaches of interventions. Although they report some mixed results, in general, the authors conclude that the environment independently influences physical activity even after selection is controlled for (McCormack and Shiell, 2011).

3.9 Conclusion

In the previous chapter it was argued that promoting more active lifestyles is likely to be the most effective method of increasing physical activity in the population. In particular, enabling walking has the potential to affect a large number of people as this is an activity that is generally achievable. The relationship between the urban environment and physical activity levels is believed to be underpinned by residents walking for transport. People living in neighbourhoods that are relatively dense, with good interconnection and access to shops and facilities are more likely to walk regularly than those living somewhere that is sparsely populated with limited routes and destinations. Neighbourhoods can also provide opportunities for recreational physical activities through the provision of green space, parks and exercise facilities. In short, these urban form factors make a more walkable neighbourhood, and researchers have developed indices in order to evaluate and

compare the walkability of urban spaces. This chapter provided an overview of evidence concerning how the environment determines physical activity and walking. Researchers have consistently found significant associations between various measures of the built environment and physical activity levels (Frank et al., 2005, Leslie et al., 2007, Owen et al., 2007, Millington et al., 2009, Van Dyck et al., 2009b, Berrigan and Troiano, 2002, Giles-Corti and Donovan, 2002, Saelens et al., 2003a, Owen et al., 2004, Badland and Schofield, 2005, Frank et al., 2006b, Cao et al., 2007). However, results can be mixed and are often moderate when considered against individual factors. It is suggested that more research attention is required on illuminating the *causal mechanisms* that underpin these associations so as to help inform the development of planning interventions (Bauman et al., 2002, Humpel et al., 2002, Owen et al., 2004, Townhsend and Lake, 2009, Ewing, 2005a, Frank et al., 2006b, Cao et al., 2007, Handy et al., 2005, Subramanian et al., 2003, Panter and Jones, 2010).

The latter part of this chapter outlined how walkability indices have been used to measure and compare neighbourhoods. Neighbourhood self-selection describes how residents elect to live in areas that reflect their travel and lifestyle preferences. So for example, those who prefer car travel are more likely to live somewhere that is less walkable. Whilst this presents an important counterpoint to the walkability hypothesis, the polarization may unhelpful. The tendency to fall back on a linear conception of causality between the environment and behaviour may fail to capture a more reciprocal relationship between individuals, culture and the environment discussed in Chapter Two. The complexity relates to what might be called the indeterminacy of influence, how motivations and preferences are interrelated with experience and habit, which are in turn formed and *trans*formed through exposure to particular environments. Such indeterminacy may explain why there are often large unexplained variations in the typical quantitative models.

3.10 Implications for the Research

This chapter has focused on how urban form is believed to be related to physical activity, largely through enabling walking for transport. A review of the literature focused on key dimensions of urban form with an explanation of how these can affect the behaviour of residents. It has been argued that whilst there appears to be a general environment-physical activity relationship, there is relatively little known about the causal mechanisms involved. In order to properly inform a strategy for planning intervention the issues of causality and complexity need to be addressed. To do this the proposed research uses mixed methods, firstly to ascertain whether a correlation exists at a national level, and then to explore the nature of this relationship through semi-structured interviews.

The aim of this research is to better understand how the urban environment affects physical activity in Scotland. A secondary data analysis of the Scottish Health Survey will be used to determine whether measures of 'walkability' predict physical activity in Scotland as has been found elsewhere. As it is suspected that neighbourhoods require a combination of density, proximity and connectivity, these measures are combined into a composite measure of walkability, similar to other studies reviewed in this chapter (Leslie et al., 2007, Owen et al., 2007). A logistic regression is then used to compare the association between walking and physical activity with walkability and with individual and demographic measures. Other health-related behaviours are also entered into the model. The following chapter provides more detail on the quantitative methods used and the data is presented in Chapter Five. In order to add context to the types of activity taking place within high- and low-walkable neighbourhoods, an additional data set (City Form) is used to compare commuting, mode of travel to shops and park use between high and low walkability neighbourhoods in the UK. The main research component of this study is semi-structured interviews with residents who have recently moved into one of three case study neighbourhoods in Edinburgh. The neighbourhoods are different proximities from the city centre and vary in walkable characteristics. This allows for an exploration of residents' own accounts of how they use the neighbourhood and why they choose to live there. In order to make some critical account of neighbourhood selection, all interview participants have recently moved into their neighbourhood. As suggested earlier, studies of residential relocation are a form a kind of 'natural experiment' (Giles-Corti, 2010), as this is a point at which a person's environmental circumstances will be changed and they may need to adapt their behaviour accordingly. There is a quasi-longitudinal dimension to the interviews as participants are asked to discuss and describe this period of transition. Although self-reports can be different from objective measures, qualitative research has an important role in examining the basis of people's decision-making (Macintyre et al., 2008) as well as how urban spaces are used (McCormack et al., 2010). Through the interviews, participants commuting, recreating and use of the local area are explored. Qualitative data is further enhanced through the use of accelerometers and travel diaries by some of the participants.

The last two chapters have reviewed literature regarding physical activity and urban form, arguing that the relationship between the environment and physical activity is likely to be mediated by utilitarian walking. Although physical activity behaviour is complex, neighbourhood context can increase residents' activity levels by enabling active travel. The use of qualitative research is intended to provide more depth and detail regarding how this relates to the 'everyday' practices of individuals. This is the more meaningful account that is often missing from walkability research and which may also be important for the development and assessment of environmental interventions.

In this sense, the proposed research strategy intends to make a valuable contribution to this field whilst also collecting evidence relevant to Scotland and Edinburgh.

CHAPTER FOUR: METHODOLOGY

The aim of the research is to ascertain how urban form influences physical activity behaviour. Within this, there are two research objectives: to assess the association between the environment and physical activity in Scotland, and to develop a more meaningful account of the processes involved in this relationship. This chapter outlines the methods used for this research. This includes the design, epistemological stance and practical aspects of data collection, management and analysis. Methodology is particularly important for this study because of the combination of research methods involved and how their interpretation is integrated. The research triangulates data from large scale household surveys, in-depth interviews, activity diaries and accelerometer data. The approach to combining different data types is in part pragmatic, using each method to its strength and within its limits, while critically assessing the relationship between findings from each approach, rather than using one method to falsify or validate another.

A unique version of the Scottish Health Survey is used to create a logistic regression that assesses individual, social and environmental predictors of walking and activity attainment. Semi-structured interviews are the primary component in the research. These were conducted with residents who recently relocated to one of three case study neighbourhoods in Edinburgh purposely chosen for their urban characteristics. These neighbourhoods have urban form attributes that are directly comparable to the variables used in the logistic regression analysis. The purpose of speaking with recent movers was to try to disentangle walkability and 'selectionist' explanations of the environment-physical activity relationship, as explored in the literature review in Chapter Three.

Pilot interviews informed interview schedule design and a variety of recruitment strategies were used to gain eligible participants. Twenty one interviews were completed and the data were audio recorded and transcribed. Transcripts were coded according to theoretically-informed criteria and emerging themes. A thematic chart, similar to those used for framework analysis, was developed for the analysis and writing. Twelve of the participants also wore an accelerometer for five days and kept a diary which provided greater context for understanding participants' activities. This chapter begins by setting out the research design and mixed methods approach. The epistemological approach is pragmatic, integrating different types of data in the analysis to best address the research question. The secondary data analysis is then outlined. The latter part of the

chapter describes how the qualitative research was conducted, including data collection and analysis.

4.1 Research Design

In the previous two chapters it was argued that understanding the physical activity-built environment association requires some contextual account of this relationship. The walkability hypothesis suggests that the environment will influence behaviour through enabling or constraining mundane and routine movement; for instance walking to the shops and commuting on foot. It has been argued that people become more active when living somewhere with walkable characteristics. On the other hand, it is also true that people may elect to live in neighbourhoods that reflect their behavioural preferences. In order to capture the point at which behavioural change (walkability) or neighbourhood choice (selection) may be happening, this research uses semi-structured interviews with residents who recently relocated. The aim of this research can be stated as follows: *to understand the influence of the neighbourhood environment on the walking and physical activities of residents*. Within this aim, three research objectives can be summarised as follows:

- To test the association of urban form with physical activity and walking in Scotland
- Evaluate the importance of neighbourhood selection through exploring residents' accounts of relocation
- To develop an understanding of the urban-form physical activity association through qualitative accounts of residents' activities

This study uses quantitative survey analysis to test the association of urban form with physical activity and walking in Scotland. A uniquely enhanced version of the Scottish Health Survey, which includes small area urban form variables, is analysed in order to carry out the first research objective. The urban form variables used are the same as some of those discussed in Chapter Three: density, proximity, land use diversity, connectivity and centrality. A logistic regression model is used to test the relative strength of association between these variables and both walking and overall physical activity. This analysis answers the question of whether an *urban form – physical activity* relationship can be detected in Scotland, as has been found elsewhere. The qualitative research is then used to explore these associations in the context of case study neighbourhoods in Edinburgh.

The second research objective is met through qualitative interviews, activity diaries and accelerometer data. The interviews are complemented by researcher-led map exercise.

Summary of Scale of Analysis

RESEARCH COMPONENT	AREA	SAMPLE SIZE	DESCRIPTION
Scottish Health Survey	Across Scotland	30,000	Logistic regression model predicting regular walking and physical activity attainment
City Form Survey	15 neighbour-hoods across five UK cities	4,500	Comparison of commuting, shopping and park use between inner and out-city neighbourhoods
Interviews	Edinburgh Residents:	21	In-depth interviews with recent residents to three Edinburgh neighbourhoods
Accelerometer	*Dalry*, *Restalrig* and *Costorphine*	12	Some interviewees agreed to wear an accelerometer and keep an activity diary

Table 4.1: This research triangulates data from different methods and scales of analysis.

Table 4.1 summarises the different methods used and how these different methodologies are integrated within the research design. A key strength of this study is how different data are combined. The case study neighbourhoods used for interview recruitment are also part of the City Form dataset, which has information on residents' self-reported commuting, shop-use, park use and

other activities. The urban form measures held for these neighbourhoods are directly comparable to those used in the larger, national logistic regression analysis.

4.2 Epistemology

Ontology concerns the nature of reality and what the world is like, and epistemology concerns larger questions regarding the possibilities of knowing this reality. A strict positivist position asserts the existence of an external reality knowable through careful observation (McLennan, 2006). This is closely associated with the idea of an objective science where the researcher can assume objective distance from the phenomenon under investigation. This is problematic in social research where the researcher is implicated in the phenomena under investigation and aware of the relative nature of perception. Such philosophical concerns have often been at the centre of methodological discussions concerning quantitative and qualitative methods. There has been a tradition within social scientific methods to focus on the incommensurability of the positivist objectivity of quantitative methods and the interpretivist subjectivity of qualitative methods. However, this paradigmatic dualism has been largely overstated and a number of social science methodologists have since argued that integrating or combining qualitative and quantitative methods is philosophically valid as well as pragmatically desirable (Morgan, 2007, McEvoy and Richards, 2006, Onwuegbuzie et al., 2009). Post-positivist and critical realists have argued for the existence of tangible reality knowable through systematic research, which is compatible with subjectivist conception of multiple life-worlds. The epistemological position of this research aligns with pragmatist and realist epistemologies that suggest that mixed methods are compatible and can mutually contribute to causal reasoning and identifying mechanisms.

4.2.1 Mixed Methods and Pragmatism

'Mixed methods' describes a type of research in which quantitative and qualitative methods, including techniques, methods, concepts and language, are combined into one study (Onwuegbuzie et al., 2009). Recently, advocates of mixed methods have argued that it should be considered as a distinctive approach in its own right (Clark and Creswell, 2011, Creswell, 2011, Teddlie and Tashakkori, 2009, Bryman, 2007). Integrating different perspectives can help to elucidate a complex problem where there is likely to be a number of salient factors. A key aspect of mixed methods is

'pragmatism', which is effectively an approach where epistemological concerns are treated as secondary to the research objectives. Pragmatist social researchers tend to depreciate the significance of philosophical dualisms in order to focus on the immediate 'real-world' concerns and generate findings that are ultimately useful (Johnson et al., 2007). This makes pragmatism particularly suited to the practical concerns of policy and evaluative research.

In this research, the aim of integrating different data is to achieve *confirmation*, *completeness* and *abductive reasoning* (Risjord et al., 2002). 'Confirmation' involves looking for points of corroboration between quantitative and qualitative methods. This is not to say that qualitative and quantitative findings are used to falsify or validate one another; they are not expected to be unequivocal (Ritchie and Lewis, 2003) or reducible to one another. Instead the research acknowledges the possibility of reasonable comparison between sources in a way that can enhance validity and reliability (Morgan, 2007). 'Completeness' refers to how mixed methods can build a more comprehensive picture of the phenomenon under investigation, for example, by highlighting facets of the problem not previous appreciated or capturing a broader range of perspectives (McEvoy and Richards, 2006).

Comparative Summary of the Pragmatic Approach

	Qualitative Approach	Quantitative Approach	Pragmatic Approach
Connection of theory and data	Induction	Deduction	Abduction
Relationship to research process	Subjectivity	Objectivity	Intersubjectivity
Inference from data	Context	Generative	Transferblility

Table 4.2: Adapted from Morgan, 2007: p71

'Abductive reasoning' refers to how theory and data are related. Research practice often means going back and forth between empirical evidence and theoretical interpretation. Abduction refers to the iteration of inductive supposition and deductive theoretical reasoning (Morgan, 2007). This research has also been informed by the ecological framework discussed in Chapter Two. The emphasis on individual, social and environmental determinants informs the statistical modelling and interview design. Findings are presented in the form of reflection on how these relate back to the

ecological framework. Throughout the research the intention is that data and analytical process is transparent, clearly stating the inference, interpretation and assumptions made.

4.3 Quantitative Methods

There are two quantitative components in this research. The first is a logistic regression model using a unique Scottish Health Survey (SHeS) dataset (2011) to examine urban form and physical activity in Scotland by data zone (N>30,000). The second quantitative method used is an odds ratio comparison of commuting, shopping and park use between neighbourhoods of high- and low-walkability in the City Form study.

4.3.1 Scottish Health Survey (2008-2011)

Chapter Five presents findings from the analysis of the Scottish Health Survey (SHeS), which is a comprehensive, annual survey of the health of people in Scotland. This research benefitted from the generation of an original data set, which combined four consecutive years of SHeS data, from 2008 to 2011, (N=36,922) with built environment variables. This facilitated the unique possibility of examining the relationship between numerous health and behavioural variables in Scotland with details about the physical environments in which those people live. The environmental measurements were sourced from the 2001 Census of Population at the level of data zones. The Scottish Government's data zone areas are a standard statistical division of Scotland into small areas comprised of groups of Census Output Areas typically having a population of between 500 - 1000 residents. There are a total of 6,505 data zones in Scotland. These were merged with the SHeS dataset specifically for this thesis. The researcher worked with Analytical Services Department at the Scottish Government in order to band environmental variables so as to ensure respondents were unidentifiable and maintain disclosure restrictions. As a result of this process, inevitably some detail was lost. Thanks are due to the Analytical Services team for helping to find appropriate variable bandings which observe restrictions whilst also maximising the detail of the environmental variables.

The independent variables used in the model are grouped into *urban form*, *individual demographics* and *lifestyle*. The urban form measures include measures of density, proximity and connectivity. Similarly to previous walkability studies described in Chapter Three, urban form

characteristics are combined into a composite walkability score. Grouping data into a combined score helped to mitigate problems of multicolinearity, whereas urban form measures were intercorrelated. The individual demographic variables are age, gender, ethnicity, income and education. The lifestyle variables are self-reported smoking, diet and alcohol consumption. The outcome variables in the model are 'habitual walking' and 'total physical activity'. The SHeS contains its own derived variables of walking and total physical activity that are calculated from detailed questions about walking, sport, exercise and other activities. However, the habitual walking variable used in the model was derived specifically for this analysis and needs some justification. The standard SHeS measure of walking is a derived, continuous variable of 'total walking time'. Although this initially seemed an appropriate outcome variable, the distribution is heavily clustered because respondents tend to estimate their walking in ten- and five-minute intervals, meaning that it was inappropriate for regression. Furthermore, the way in which total time was calculated meant that it contains a large number of outliers that are likely to be misrepresentative. Total time walking is calculated by multiplying the respondents' last reported walking duration with the number of trips they tend to make in a day, and then multiplying again by the number of days a month they would walk. This means that participants who report having recently done a long walk (an hour for example) and who also report walking frequently will have exaggerated total walk time that skew the distribution of the variable.

For this reason a new binary outcome measure was created for the purpose of this analysis. 'Habitual walking' is a binary variable of *respondents who walk more than once a day for at least ten minutes on most days of the week*. This is more transparent as it does not rely on the problematic assumption that a person always walks for the same duration as their last reported walk. Although this variable prioritises number of trips over duration, a respondent would still be meeting minimum physical activity guidelines if they did the minimum to achieve this. 'Habitual walking' is also more suited to capturing trips and errands that are believed to mediate the built environment-physical activity relationship (Krizek, 2003, Frumkin et al., 2004). It is important to note that this score did not include other active travel methods such as cycling. The measure of *overall physical activity* used in the analysis is the same as used in SHeS and the standard for Scottish Government target indicators. It is derived from a combination of self-reported activities: walking, exercise, labour, housework and sport.

These predictors are entered into a logistic regression model predicting walking and overall physical activity as binary outcomes. This is a method of testing the relative predictive power of variables in a data set. The model includes three blocks of variables: measures of walkability,

individual descriptors and behavioural indicators. Individual variables include sex, ethnicity, age, self-rated health, education, income, occupation and car ownership. The behavioural variables were smoking, drinking and diet. These were entered in blocks: first individual then behavioural and finally walkability. At each stage, variables with low significance that weakened the overall model due to collinearity were removed. This process is described in detail in Chapter Five. The overall purpose was to present a good explanatory model of walking and overall physical activity variation.

4.3.2 Case Study Neighbourhoods

The second dataset used in this research comes from City Form, a collaborative project across several universities examining how urban form relates to transport, the environment and sustainability in the UK[1]. The City Form database is a collection of resident surveys from fifteen neighbourhoods across five British cities. These neighbourhoods were purposefully selected for their differential urban form characteristics. Five neighbourhoods are categorised as being 'outer city' areas and five of the neighbourhoods are 'inner city' areas. The other five are 'in between' areas. Inner city areas have a higher densities and a greater diversity of building types as well as more junctions (Jenks and Jones, 2010). Outer-city areas are more residential with a higher number of detached and semi-detached properties and cul-de-sac roads (Jenks and Jones, 2010). For this reason the inner- and outer-city case study neighbourhoods exemplify the high and low walkability measures used in the logistic regression. For the reason, and for the purposes of this research, these case study areas are considered to represent high- and low-walkability.

A benefit of using the City Form data is that it has already been collected. Furthermore it contains more detail on the types of activity residents are doing. The City Form survey includes information on residents' mode of commute, exercise, sport participation, shopping and park use. Because these neighbourhoods were purposefully-selected for their comparable difference in urban form characteristics, this makes them suitable for a case study comparison (Lewis, 2003, George and Bennett, 2005, Bechhofer and Paterson, 2000, Pole and Lampard, 2002). Behavioural outcomes are compared between high- and low-walkable neighbourhood types in the form of odds ratios. In addition the use of this data helps to bridge the gap between the SHeS regression analysis and qualitative research because the interview participants were recruited from the three Edinburgh City

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[1] City Form was funded by the Engineering and Physical Sciences Research Council (EPSRC), grant reference GR/S20529/01 (http://www.city-form.org)

Form neighbourhoods (Dalry, Restalrig and Corstorphine). Using the same case study neighbours for recruiting interview participants better provides to the 'completeness' of this mix methods study. Chapter Six, the first qualitative chapter, starts with a description of these neighbourhoods. Both the SHeS logistic regression and the City Form odds ratios are intended to frame the qualitative research which is the main component of this study.

4.4 Qualitative Methods

In Chapters Two and Three it was argued that the relationship between physical activity behaviour and the environment is complex and contextual. These contextual aspects are not properly captured through quantitative analysis alone. Qualitative methods are used to explore residents' own accounts of how they use the environment and why they relocated. The intention is to provide a more meaningful understanding of the mechanisms underpinning the activity-environment association. Qualitative research is recognised as a tool for better understanding the processes that underpin static correlations (Ritchie and Lewis, 2003: 5) and can contribute toward developing causal explanations (Maxwell, 2012). The purpose of using qualitative methods in this study is to capture residents' accounts of why they moved to neighbourhoods of differing walkability and how they have come to use the local area. This section of the chapter outlines the qualitative methods: the methodology, interview design, recruitment, data management and analysis. The aim of the qualitative research is to develop a meaningful account of how physical activity behaviour is related to residents' choice of neighbourhood and the neighbourhood's walkable attributes. The qualitative component is both contextual and explanatory, providing both a comparative account of contrasting neighbourhoods and also relating these to the wider survey analyses.

4.4.1 Methodology

A constructionist epistemology suggests that the reality is multiple as it is contingent on subjective accounts of the world. In this sense, realities are constructed and reconstructed through human interaction. The purpose of conducting an interview is therefore not simply to get information about what a person does but also to capture something of their motivations and understandings. From a constructivist point-of-view the validity of a research interview is not judged by whether it accurately measures events outside of the interview setting, but by whether it represents the beliefs

and understandings of the participant. Residents' accounts of their own physical activity behaviour may not have objective validity but their narrative accounts of their behaviour and experiences can be treated as authentic in their 'performativity'. Performativity refers to how people are understood to use talk and language to perform and construct identity. In this research qualitative analysis is sensitive to the *performative* aspects of interviews as an insight into how participants identify and related to physical activity and the environment.

An important aspect of qualitative methods is the extent to which findings from a sample can be applied beyond the context of the research. It should be acknowledge that the sample size and subjective nature of qualitative data means that it is not possible to make generalising statements in the sense of statistical probability. However, qualitative methodologists have defended the possibility and necessity of making generalising statements as part of qualitative research (Seale, 1999, Bryman, 2008, Williams, 2000). Generalisation should be made with care and transparency. One way of improving validity of generalizable statements is to conduct qualitative research as part of a mixed methods project where the similarities between the samples can support the comparison of findings between different methods. In this study the participants were purposefully sampled to make them analogous to the City Form data set. Relatedly, methodologist have discussed the importance of inclusivity of the qualitative sample to support the generalizability of findings (Ritchie and Lewis, 2003). Williams argued that qualitative research involves 'moderatum generalisation' in which participants 'can be seen to be instances of a broader set of recognisable features' (Williams, 2000: 215, Bryman, 2008: 392). Through talk and interaction, participants draw on the taken-for-granted sociocultural structures that make their utterances meaningful. In this sense, researching interaction and conversation can elucidate cultural features that have significance beyond the individuals interviewed. This is type generalisation is appropriate within qualitative data and is quite different from the probabilistic reasoning of statistical generalisations.

As outlined earlier in this chapter, the epistemological position of this research is pragmatic and does not observe a strict objective and subjective dualism. Whilst what is said in the interview is not treated as equivalent to objective physical activity measures, these statements are taken to be relatively reliable reflections of the types of activities the participant engages in. How reliably the interview discussion reflects the objective behaviour of the individual is core concern within analysis, which explores this based on the internal logic of conversation and its relationship with other data. The intention of the qualitative analysis is to present data so as to make the interpretive reasoning explicit.

4.4.2 Semi-Structured Interviews

The interview design is semi-structured, using a mixture of closed and open questions within thematically ordered sections. Pilot interviews informed the design of the interview schedule, which are discussed below. The design of the interviews were chosen to facilitate relatively consistent data, so as to triangulate with the City Form survey, whilst also allowing room for participants to express themselves in their own words. Closed questions concerned specific activities or neighbourhood characteristics whilst open questions allowed for more open discussion of experience and opinions. There was also an element of biographic questioning: asking participants to reflect on their previous neighbourhood, reasons for moving, and history of being physical active or inactive. A full account of the schedule designs is given in Section 4.4.4 below.

4.4.3 Pilot Interviews

Before recruiting participants, pilot interviews were conducted to test the suitability of the schedule. Pilot participants were recruited through email invitations and snowball sampling through friends and peers. In order to meet criteria for eligibility, pilot participants had to be adults who had moved home in the last three years. Three pilot interviews were conducted with a man, a woman and a couple all living in Edinburgh, although outside the case study areas. It was originally considered that interviewing couples, rather than individuals, may be useful in terms of capturing accounts of 'settling' and raising a family. However, whilst the couple interviewed was interesting in this respect, talking about physical activity and daily routines with two people was problematic. Information on daily activities became convoluted as the couple's experiences and motivations diverged. For the sake of a narrative consistency, it was decided to conduct one-on-one interviews.

Following the pilot interviews a number of changes were made to the interview schedule. Some questions were added and others reworded. The opening question of section C was reworded from 'tell me about your neighbourhood' to 'what is it like living in your neighbourhood'. This is because respondents tended to give more of an objective description of the area rather than their opinion. In section E, the question of whether the participant thought of themselves as a 'sporty' or 'active' was asked earlier. Demographic questions were asked at the end of the interview. In general the pilot interviews raised some interesting issues about how people oriented themselves towards their different neighbourhoods and about how they account for walking and being active. Following

these insights, open and closed questions were reordered to encourage frank and honest discussions.

4.4.4 Schedule Design

An interview schedule helps the researcher to structure the conversation whilst also responding adaptively (Green, 2004, Maxwell, 2012, Ritchie and Lewis, 2003). For this research the schedule is composed of six sections (A to F), with an introduction and opportunity for closing comments. The interview schedule can be found in the appendix. Section A is the introduction; this allows for the researcher to establish the setting, relieve feelings of anxiety and prepare the participant for deeper level of conversation (Legard et al., 2003). Practically this involves taking consent and providing information about the study. Section B starts with an open question: 'To start with could you tell me a bit about yourself and talk me through a typical day?' By asking residents to introduce and talk about themselves it is a way of inviting starting the discussion on issues most prominent to them. This was helpful because participants gave their overview of what they did each day. Typically this included a morning routine, travel to work, employment and leisure activities. This helps to get the conversation started, put the participant at ease and also provides the researcher with material that can be drawn on throughout the interview.

Sections C, D, and E all start with open questions followed by a set of closed questions. This allows the participant to volunteer information before being led to talk about specifics. For example, section C begins: 'what is it like living in your neighbourhood?' After the respondent has given their own account, the researcher asks the respondent to comment on specific aspects of the neighbourhood such as crime, rubbish and traffic, or parks, shops and transport links. These closed questions are directly related to the City Form questionnaire so allow for subsequent comparison. Section D concerns the participant's previous neighbourhood and reasons for relocating. Again, the section starts with an open question before the participant is asked to comment on specifics, reflecting on how the two neighbourhoods differ. Common themes of discussion were car-use, commuting habits and active travel. During the interview the researcher is mindful of the research objectives, guiding the discussion towards the daily activities before and after relocation. At this point in the interview the researcher draws on what has already been said, asking, for example, 'you mentioned having good bus connections; how often do you use the buses?' At an appropriate point during sections C and D the researcher produces a map of the area and asks participants to mark what they would consider to be their neighbourhood. The map exercise is discussed below.

Section E concerns physical activity. This was deliberately kept until the end of the interview so that this could be related back to those topics already discussed. The section starts with two open questions: 'would you say that you are a physically active person?' and 'would you say that you are a sporty person?' These are purposefully rather provocative questions. The intention is not for an accurate account of activity, but to draw out issues of identity and identifying with active behaviour. The question leaves the participant to decide what being an 'active' or 'sporty' person means. Indeed the interviews were interesting in highlighting how these were quite varied. Typically during interviews these questions were followed with qualification questions and probes, such as 'what makes you say that…' or 'could you tell me more about that'. The researcher then asks more specific questions about exercise, sports participation, previous exercise, school experience and friends and family. In the final section the researcher signals to the respondent that the interview is coming to a close. This is a last opportunity for the participant to correct or make additions to the discussion (Nazroo and Arthur, 2003: 113). The participant is asked to give their demographic information. This was left until the end of the interview because it was a rather formal type of questioning that might have undermined a friendlier, conversational discussion if asked earlier.

4.4.5 Sampling Strategy

As behavioural change is a primary focus of this research, it would have been ideal to conduct a repeat cohort study, collecting data before and after a move. Unfortunately, this would have been difficult within the time constraints of a doctoral project. Instead participants who had recently (<3 years) moved home were interviewed about their neighbourhood with some retrospective focus on why they had moved home and how their activities had changed. As already mentioned, participants were recruited from three case study neighbourhoods in Edinburgh: Dalry, Restalrig and Corstorphine. The aim was to capture similar but comparable individuals who have relocated to areas of differing urban form characteristics. This is a stratified purposive sampling because it involves recruiting participants in order to fulfil theoretically-informed criteria (Patton, 2001, Kuper et al., 2008), in this case differently walkable neighbourhoods. Purposive sampling aims to capture information-rich data by ensuring some diversity is included within the key criteria (Ritchie et al., 2003a, Patton, 2001). Diversity in the sample is needed to improve the chances of identifying the whole range of features related to the phenomenon of interest as well as to allow for investigation of the interdependency between variables (Ritchie et al., 2003a).

Purposeful sampling requires defining and prioritising certain selection criteria. There were no imposed restrictions on gender, ethnicity or socioeconomic background. However, it was decided to delimit the age group to 23 to 40 year olds. The age range was chosen so as not to be too restrictive but also to capture adults who are relocating to a neighbourhood of potential long-term residency. This is an approximation of the age group most likely to be relocating in order to 'settle', perhaps to raise a family. The purpose is to capture the transition from being residentially mobile to establishing an area of fixed tenancy. This is presumed to be a crucial point where residents are making selective choices and will, arguably, be susceptible to changing their behaviour to suit their new environmental barriers or opportunities. This is a way of capturing aspects of neighbourhood selection and environmentally influenced behavioural change. People will be moving for a variety of reasons and not all people will be concerned with characteristics of 'walkability'. The intention of this sample strategy is to interview people with a range of preferences and reasons for moving home.

An additional sampling decision concerned the length of time that a person had been living at the current address. The period is of particular significance, not only as neighbourhood of long-term residency but also as the location in which children are raised and subsequently form their physical activity habits. There is limited literature on the length of time that a person needs to have been living in a neighbourhood before it is believed that their habits start to emulate the resources and restriction of that neighbourhood. In the RESIDE study, discussed in Chapter Three, participants' relocation was studied over a five year period (Giles-Corti et al., 2007). Although there is little evidence about the amount of time necessary for habitual behaviour to adapt to the local environment, three years was selected as reasonable maximum period for participants to have been living in the case study area. The intention was to capture residents' accounts of why they relocated and how their activities have changed if at all.

4.4.6 Eligibility Criteria

The sample strategy is essentially a trade-off between capturing the most research-significant participants and achieving recruitment targets. There are three criteria for eligibility: a) between the ages of 23 and 40, b) have moved home in the last three years, and c) are currently living in one of the three case study neighbourhoods. The criteria were clearly outlined in the recruitment letters and advertisements. On occasions when there was an expression of interest from individuals who were not eligible, they were thanked for their interest but politely declined. One participant was

accepted from Clemiston, which is close to but just outside of the Corstorphine case study area. This was agreed with partners at NHS Lothian who were keen to have some input from residents in this area. Recruiting to the study was difficult, particularly from Restalrig and Corstorphine. This is potentially because of the second eligibility criterion. Restricting the study to participants who have only been at their current address for a short time imposed a considerable limitation to recruitment.

4.4.7 Recruitment

The main recruitment method was postal invitations to recently sold properties in the three case study neighbourhoods. The Registry of Scotland (RoS) database of housing sales was used to compile an address list of properties within the study area postcodes. The database included the date that the properties had been sold. All the properties that had been sold more than three years ago were removed from the database. The remaining list was all properties in Dalry, Restalrig and Corstorphine that had been sold within the last three years.
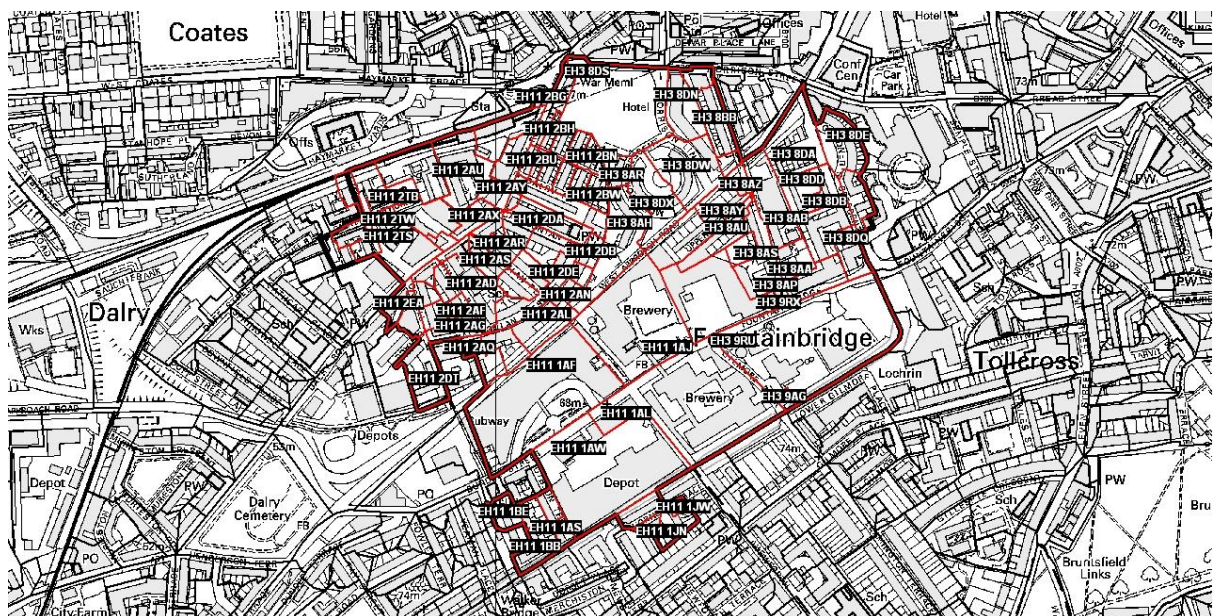
Figure 4.1: The Dalry study area and postcodes. Recruitment letters were sent to recently sold properties.

The initial extraction resulted in a 2,985 properties between the three neighbourhood areas. Dalry had a larger list of properties than Restalrig and Corstorphine, which is likely a reflection of a more

transient population. After removing records that were incomplete, duplicate or not within the boundaries of the study area a total of 1,509 addresses remained. Letters to these addresses were sent in five batches over a period of four months. 642 letters were posted to Dalry, 228 letters were posted to Corstorphine and 239 letters were posted to Restalrig. Residents were invited to contact the researcher to express an interest in the study either by phone or email or alternatively by returned slip in a self-addressed envelope. Participants were offered a ten pound gift voucher for their time.

Of these invitations, approximately 20% were returned for having incorrect addresses. 50 residents responded, 3.3%, expressing interest in participating. Of these, 26 people were eligible to be interviewed. Using the RoS database, which is publicly available information, was innovative way of reaching people living in recently sold properties. However, developing the postal database was time-consuming and the response rate was disappointing. The fact that a fifth of letters were returned suggests that many of the addresses were incomplete or invalid. This was likely because the RoS database is designed for tracking sales and prices rather than an accurate record of postal addresses.

A number of alternative recruitment methods were used in an effort to boost participation. The researcher visited the case study areas to place advertisements in shops and community centres. Around 300 leaflets, some general, others specific to the neighbourhood, were hand delivered to properties. Figure 4.2 is a sample of one of the general leaflets used. As with the invitation letter, flyers contained simple outline of the research purpose, the eligibility criteria and promise of a £10 gift voucher as a 'thank you' for participation.

Whilst it is not expected that this sample be representative, it is important to note possible selection

Recruitment Leaflet

Figure 4.2: Neighbourhood-specific leaflets were used to promote the study.

bias from the recruitment methods used. Those residents recruited through the postal invitations were more likely to be middle class and living in owner-occupied accommodation. The community centre and leaflet recruitment achieved the participation of residents who were unemployed and living in social housing. Clearly these participants have very different stories of neighbourhood relocation. Although the recruitment was quite poor, using a variety of strategies had the unintended benefit of providing a heterogeneous sample within the eligibility criteria.

4.4.8 Risk Assessment and Ethics

Research ethics issues were addressed through a standard proforma and were approved by Heriot-Watt University School of Built Environment ethics committee. The health and safety risk aspects were covered by a risk assessment approved by the School. The researcher was made aware of possible risk involved in home interviews and was reminded to leave the premises if he felt uncomfortable or at risk. Researcher safety was maintained by a phone call system to University staff, a call at arrival at the location and a call once the interview was complete.

Ethics were a primary consideration throughout the research process. Interview participants were given an information sheet about the study and provided opportunities to ask any questions they had. All interview participants signed a form consenting to participate in the study. A copy of the form is included within the appendices. This included a check list to say that the participant:

a)   Realised the purpose of the study

b)   Had had chance to ask any questions

c)   Was happy to have the interview recorded

d)   Understood that they were free to discontinue the interview at any time

e)   That they understood they would not be named in any reports or publications

Audio recordings, correspondence, the thematic chart and map exercises are stored in secure electronic files. To protect the identity of the individual all participants were given pseudonyms after interviews were transcribed. In cases were the interviews contain additional information that could identify participants, such as employment, these have been excluded or altered. In Chapters Six and

Seven, which contain details of participants' homes, families, hobbies and employment, some of these details have been changed so as ensure that participants cannot be identified.

All interviews were conducted face-to-face either at the participant's home or at local public place, depending on the participant's preference. Fourteen participants were interviewed at home, five participants opted to be interviewed at a local café or restaurant, another at a local community centre and one at their place of work. Interviews were polite and friendly meetings and most participants were keen to discuss thoughts openly. Ethical concerns were considered during home visits and interviews. The researcher was sensitive to issues that might be delicate or personal: when sensitive topics did come up in conversation, the researcher acknowledged them with respect and sympathy before moving the conversation to another topic.

4.4.9 Interviewing

During interviews the researcher occasionally adopted empathetic neutrality attempting to being relatively value-free whilst contributing to the conversation (Ritchie and Lewis, 2003). This allows space for the respondent to discuss topics in their own words so as to capture the participants' own language and wording (Legard et al., 2003: 142). However, it is important to acknowledge that the interviewer is not always passive but an active participant in the interview process (Legard et al., 2003). A mixture of follow-up and probing questions were used to achieve a breadth and depth of data (Legard et al., 2003). Explorative or mapping questions were used to build a more complete picture of participants' perspective and life. There was some research design consideration regarding how participants were told about the study. Whilst wanting the participant to be well-informed about the purposes of the study, too much information can be leading (Lewis, 2003). For this reason emphasis was placed on 'daily activities' rather than 'physical activity'. This is because too much emphasis on physical activity may prompt participants to exaggerate how active they are or, more important, neglect to talk about the more mundane activities such as walking for errands.

Interviews were typically around 45 minutes in length with the longest interview being just over an hour. After each interview the researcher made post-interview notes with initial thoughts and impression from the interview. Post-interview notes also included information about the location, recording, rapport or other issues of the immediate setting that might be relevant to how the audio recording is understood. Post-interview notes were also recorded on the table used for the framework analysis described below.

4.4.10 Map Exercise

During the interview, participants were asked to mark on a map what they felt to be their neighbourhood. The intention was simply to capture how the participant delineated their local areas. However, this also provided a useful prop for discussion as the map could be used to think about their local space. Having a map present at the interview was of general use, allowing participants to point out destinations that they used and in a few occasions to reflect on areas of their neighbourhood that they rarely used. It was common for participants to mark out shops, services and green space which said that they used. This was also helpful in discussing walking routes and commuting. As suggested above, details of the map exercise were amended in the findings so as to protect participants' locations and identities. Having a map present during the interview was helpful in gathering data on which parts of the neighbourhood were used for various activities.

In many of the interviews the map exercise actually prompted a more detailed discussion of how participants used their neighbourhood. In this extract from the interview with Hilary, she said that the map exercise had helped her think about her local area. Throughout the interview extracts in this research, 'I' refers to the interviewer and 'R' refers to the respondent.

R: It's been quite interesting for me to think about how little of my local area I actually use […]

I: Well this is the railway here [indicates on the map] does that become a bit of a barrier then?

R: Well that's interesting, I hadn't really thought of it as being a barrier but clearly I have drawn that in as being a kind of… boundary. I don't know. It's certainly not something that I physically noticed: 'oh I can't go that way because of the railway'…

4.4.11 Interaction

It is helpful here to give some mention of interactional dynamics. Interviews have sometimes been said to be a more 'natural' form of social research data because it is in the form of an interaction and therefore closer to how the participant might express themselves in an ordinary setting. This is true

in comparison to, say, a structured questionnaire survey, because there is a dynamic and reciprocal interaction and a process of 'sense-making'. However, with that said, the interview setting is a rather different from a 'natural occurring' conversation. There is an atypical power dynamic, where the researcher sets the terms of the conversation and understanding of what might be an underlying purpose. The follow extract is an example of a respondent assuming a very one-sided form of conversation before the interviewer prompts a more reciprocal conversations. An upward-pointing arrow shows that tone goes up to indicate a question.

I: And this is you and your husband?

R: Yes.

I: [1.0] …And you are on maternity leave at the moment?

R: I am: Yes.

I: […] So… beforehand were you ↑working?

R: Yes, a-huh.

I: [2.0] W-What work do you do?

R: Oh right: I work in town as an accountant […] my husband's an accountant too so we're quite stereotypical.

This extract is from the beginning of the interview, where Mary starts to answer with yes/no appropriate for a survey questionnaire or market research. She assumes the position of relatively the passive interviewee. The interviewer therefore feels the need to produce more questions. Then, in the last line, Mary picks up on the interviewer's hints that he is looking for more detail and more general line of discussion. Mary's 'Oh right' announces that she has picked up on the interactional cue and she shifts to more conversational interaction. The extracts highlight the particularity of the interview setting. Such interactional considerations impact on the validity of the data and were considered during the interviews as well as in data analysis.

The extract also demonstrates how qualitative data is presented in Chapters Six and Seven. Numbers within squared brackets indicates seconds of gap in the conversation. Transcription notes regarding the tonality, expression, background noise or other audio aspects of the interview are also given in square brackets. Underlining is used for discussion purposes: to highlight a point of interest.

4.4.12 Data Management

Once an interview was complete it was transcribed by the researcher and then uploaded onto NVivo 10. This is computer-assisted qualitative data analysis software (CAQDAS), which is an efficient way of managing qualitative data. The strengths and limitations of CAQDAS have been discussed by a number of methodologists (Seale et al., 2004, Weitzman, 1999, Bryman, 2012, Spencer et al., 2003). The advantages are in increasing the speed of handling large volumes of data and improving analytical rigour. Software packages, such as NVivo, can improve the processing of data inquiries and exploration enumerating the degrees of empirical support for various themes and assisting in the identification of deviant cases. Therefore using CAQDAS can help demonstrate that the researchers' conclusions and based on a rigorous analysis (Seale et al., 2004, Weitzman, 1999, Bryman, 2012, Spencer et al., 2003). There is concern that CAQDAS, such as NVivo can distance the researcher from the interview context. To avoid this data analysis was conducted reiteratively, systematically referring between the coding, transcript and audio recording. The qualitative analysis is reported using the participants own phasing and terminology where possible. NVivo was used for coding, memos and developing inter-nodal relationships. Initial nodal categories were theoretically-informed, but these changed and developed as themes emerged from the data.

4.4.13 Coding

The researcher listened to the audio recordings whilst organising aspects of the interview into nodes. Coding is the process of marking out sections of the interview into particular categories. It is essentially a process of data reduction, interpreting aspects of the interview and categorising them according to their relevance to the research objectives. Nodes were either descriptive, such as 'car-use' or theoretical and interpretive, such as 'self-efficacy'. New nodes were created as to reflect themes that emerged from the data. As the number of interviews grew, more nodes were created.

Name		Sources	References	Created On	Created By	Modified On	Modified By
Childhood neighbourhood		15	26	09/01/2012 16:51	PM	16/12/2013 19:21	PM
Friends and family		6	9	10/01/2012 14:54	PM	16/12/2013 19:21	PM
Healthy lifestyle		5	14	11/01/2012 11:15	PM	16/12/2013 19:21	PM
Lifecourse		16	35	09/01/2012 14:07	PM	16/12/2013 19:21	PM
Maternity or pregnancy		7	36	09/01/2012 15:48	PM	16/12/2013 19:21	PM
Neighbourhood		22	127	09/01/2012 12:32	PM	16/12/2013 19:21	PM
	Access to amenities	17	38	09/01/2012 15:46	PM	16/12/2013 19:20	PM
	Aesthetic	7	11	11/01/2012 11:47	PM	16/12/2013 19:20	PM
	Area boundaries	14	29	16/01/2012 14:43	PM	16/12/2013 19:20	PM
	Cafes, Pubs and restuar	11	19	16/01/2012 10:23	PM	16/12/2013 19:20	PM
	Crime	15	22	11/01/2012 11:47	PM	16/12/2013 19:20	PM
	Distance to work	3	3	13/01/2012 16:48	PM	16/12/2013 19:20	PM
	Dog fouling	6	6	16/01/2012 10:13	PM	16/12/2013 19:20	PM
	Entertainment	3	5	11/01/2012 11:17	PM	16/12/2013 19:20	PM
	Green space	22	72	09/01/2012 15:15	PM	16/12/2013 19:20	PM
	Layout	4	5	16/01/2012 14:45	PM	16/12/2013 19:20	PM
	Noise	3	4	09/02/2012 15:07	PM	16/12/2013 19:20	PM
	Overcrowded	8	8	02/02/2012 10:46	PM	16/12/2013 19:20	PM
	Parking	2	4	13/01/2012 11:00	PM	16/12/2013 19:20	PM
	People	20	64	09/01/2012 14:42	PM	07/12/2013 11:32	PM
	Plans to move or settle	4	4	13/01/2012 14:25	PM	16/12/2013 19:20	PM
	Pollution	3	3	27/01/2012 12:01	PM	16/12/2013 19:20	PM
	Property	21	72	09/01/2012 14:03	PM	02/07/2013 16:43	PM
	Public transport	19	42	09/01/2012 15:14	PM	16/12/2013 19:20	PM
	Quiet	10	16	11/01/2012 11:18	PM	16/12/2013 19:20	PM

Figure 4.3: Part of the nodal list used in the qualitative analysis.

The coding frame was reiteratively developed through the coding process, and a system was developed so that interviews in the early stage of coding were then recoded with the new nodes. Because coding is an interpretive process, being systematic can help prevent coding to preconceptions and allows for unanticipated findings. For this reason, the first stage of coding was largely descriptive and the later coding stages were more interpretive.

The process of coding was kept distinct from analysis, because this helps to keep a 'conceptual purity' by not making interpretive links too early in the coding process (Spencer et al., 2003: 237). As analysis developed, some nodal trees become more prominent. The project culminated in over 150 individual nodes. The majority of these were children nodes organised under key parent nodes such as: 'relocation', 'previous neighbourhood' and 'physical activity'. Many of these were used as topics within the thematic chart.

4.4.14 Thematic Chart

Qualitative coding is a process of reducing the data into themes and topics. Alongside the coding, a thematic chart was developed to keep track of emerging topics and keep them within context of the rest of the interview. Figure 4.4 shows a selected part of what became a large and detailed chart of participants and themes. Each row is an interview participant and the columns are the nodal themes and subtopics. Several themes were organised within the key topic areas of participant details, post-interview notes, current neighbourhood (including reasons for relocation/relocation story) and physical activity (including mundane and daily activities). Within each box, notes or summaries are made. As an analytical technique, using a thematic chart with topical sub-divisions is part of what is referred to as framework analysis. However, unlike some framework methods, this research did not use an additional chart where participants are removed to allow for a more abstracted comparison of themes.

Throughout the process of indexing and sorting, statements were not removed from their context (Legard et al., 2003: 229). In developing a thematic chart, key connections to the transcript we retained include participants' own words and some quotes (Spencer et al., 2003). The thematic table includes demographic details, an overview of the participant, their physical activity behaviour and their relocation reasons. The chart allows for quick reference between emerging themes and the interview context and was frequently referred to during writing the qualitative findings.

Demographic		Post-	B: Person		C & D:		E & F: Physical Activity	
Pseudonym					Details		PA person?	
Penny		Good interview	Works in		Moved as part of the		Yes and a sporty person.	
Victoria		Comfortable place, good repport, friendly. Baby interrupted	On maternity leave at the		rented. April 2010. temporary home rented from family. So in between		Yes, only since having a baby - getting out and about, going swimming, visiting parks etc. Wants	
Rhona		Participant is quite unhappy and depressed - she is lonely being a single	Goes to lots of community thing for her and her		Housing scheme. Small flat on quiet street. Relocated a couple of years ago.		No really. Gave little detail on PA couldn't remember PE at School. But then talked a lot about cycling with her	
Hilary		Repport Friendly. Comfortable setting. Child interrupted a few times. Some	Young mum, 2 yr old son dominates time. Gets		Moved in June 2008 from but lived in area for eight years. OwOcc. Twice said that Arthur's Seat		Yoga class once a week. Job is quite sedentry but does a lot more walking now that she has a young son	
Donna		Nice interview. Hardship with	Charity alturistic		Did not choose to move to Restalrig. It		Yes. She that she is more active than most able	
Peter		Interview recording not great some parts unclear. Comfortable	Works for locally - interesting company doing		nice mention of reasons for moving - middle of the road in terms of access and green space etc.		Yes. Because all his leisure time is taken up with being physically activity. Running once a week. Cycling and	

Figure 4.4: Small section of the thematic chart used for qualitative analysis.

Writing about qualitative data is often an important part of the analytical process, and the thematic chart became an integral part of writing and thinking about the findings. In presenting the qualitative findings the intention has been to represent the range of responses. This includes highlighting and discussing instances that appear contrary to the point being made. Using a thematic chart was particularly helpful in this regard; being able to see all participants in relation to particular themes.

4.4.15 Categories and Typologies

Because of the evaluative nature of this research it was decided to develop some categories of participant: those that are highly active, moderately active, low activity and sedentary. A category was also made for those that regularly used active modes of transport. The categorising of participants relied on a critical evaluation of what they report in the interview, alongside accelerometer data where possible. It should be stressed however, that these categories are illustrative and should not be taken as representative or objective measures of physical activity attainment. The following criteria were used for categorising participants.

Self-reported physical activity	
Sedentary	Reports doing no sports, exercise or active travel
Low activity	Sporadic periods of sports, exercise or active travel
Moderately active	Reports regular form of activity, sufficient to meet guidelines
Highly active	Regular and combined modes of PA.

Figure 4.5: Criteria for categorising participants PA levels.

In Chapter Seven self-reported physical activity attainment is summarised alongside accelerometer data and participants' respective neighbourhoods. Methodologically, this raises the contentious issue of including occurrence within qualitative findings. Some methodologists have argued that numerical representation should not be used within qualitative analysis as it can mislead readers. Spencer and Ritchie make the point succinctly:

'While there is no doubt that recurrence and numerical counts of recurrence should not be ignored, they should not be presented as primary findings in themselves since they will have no statistical value at all. Rather, they should be used to find the significance of the recurring phenomena through other means.'

(Spencer et al., 2003: 244, Ritchie et al., 2003b)

With this caution noted, numerical inference is made from participants' self-reported activity. Specifically, an estimate is made of how active they are based on their self-reported physical activity. The justification for doing so is that it is embedded within the mixed methods design and helps to locate the interview data within the survey analysis. In this sense, estimated physical activity based on qualitative data is not presented as primary findings. A pertinent example is that most of the interview participants from Dalry (the more walkable neighbourhood) reported regular active travel. Whilst this cannot be taken as representative of all Dalry residents, it can be said to be concurrent

with the survey data, which itself is statistically significant. In the following chapters it is shown that the occurrences for interview participants who are active is concurrent with the quantitative findings, and therefore contribute to the mutual reinforcement of the reliability and validity of findings, in keeping with the pragmatic approach of the study.

4.5 Accelerometers and Diaries

The last two methods to be outlined in this chapter are accelerometry and participant diaries. These complementary methods were only possible with a small number of participants (N=12) and should be understood as an illustrative addition to the qualitative interviews. Accelerometers are tools for collecting objective measures of a person's steps and bodily movement. They measure movement in a range of directions, making them suitable for studying everyday physical activity (Masse et al., 2005). Accelerometers also measure the intensity of movement meaning they are a good estimate of moderate and vigorous physical activity (De Bourdeaudhuij et al., 2003). This study uses the New-Lifestyles 1000 accelerometer (NL1000). The decision to use this device was largely due to availability and practicality, as it is easy to use and inexpensive (Trost et al., 2005). Within the price range, this device is considered to be one of the most accurate, consistent and reliable models (McMinn et al., 2010, Schneider et al., 2004).

Interview participants were invited to wear a NL1000 for five days whilst taking a daily record of activities and pedometer readings. Research has found that the more days that are requested of the participant, the higher the chance that they will not take part, drop-out or will forget or lose the pedometer (Tudor-Locke et al., 2005). It was decided that five days would be a good number of days that would not be overly-onerous and still provide good estimate of general activity. Of the six NL1000s used, two were reported lost by the participants and were discounted from the exercise. Twelve participants were able to complete the exercise adequately. All but one of these participants kept a diary of their activities whilst wearing the accelerometer. The diary design is simple, short and easy to use. Each day has a page where participants complete their pedometer readings, main activities during the day and when they were most or least active. The diary also included space for comments and any problems participants had in using the accelerometer.

Step-Count Interpretation

Steps	PA level
> 5000	Sedentary
5000-7499	low active
7500-9999	Somewhat active
10000-12499	Active
>12500	Highly active

Table 4.6: Adapted from Tudor-Locke et al. (2004)

The accelerometers produce two types of data each day: total steps and total active minutes. These results were considered alongside self-reported activity and are reported in Chapter Seven. Table 4.3 shows how step-counts were interpreted in terms of daily activity. Although 3000-4000 steps translated into the daily recommended physical activity this does need to be of at least moderate intensity and accumulated in at least ten minute bouts which can be said to translate into about 100 steps a minute (Tudor-Locke et al., 2008). Tudor-Locke et al. (2008) suggest that below 5000 steps a day is very likely to be sedentary and may be classified as such. Instead it is better to add this to the recommended 3000-4000 steps provides a better indicator. This makes 8000-9000 steps equivalent to the 30 minutes recommendation, or 11000-13000 steps equivalent to 60 minutes of activity. In a 2004 review by Tudor-Locke and Basset, they propose the interpretation of step-counts as shown in Table 4.3. Importantly, these cut-offs are designed for large sample sizes. With a smaller sample size, like in this study, these should be considered alongside additional information about activities and lifestyle.

Active minutes are also reported. These are the number of minutes that a participant is consistently active. This is important as meeting the required recommended minutes of physical activity. The NL1000 was set to detect sustained periods of moderate-intensity physical activity. Only two participants returned four days of data (Jack and Abijah) and in one case the participant returned more days than required (Peter). To evaluate whether participants are meeting recommendations of at least 150 minutes of moderate activity a week, daily averages were

multiplied by seven. In cases where participants reported a day when they had difficulty using the accelerometer, this was excluded (Kurt, Felicity). Results from the accelerometers and diary exercise are presented in Table 7.1 in Chapter Seven. The intention is that these can be compared and contrasted with the interview data. Whilst there was notable consonance between the diaries and self-reported activities, the amount of incidental or utilitarian walking was a notable point at which these data deviated.

4.6 Limitations of the Study

As the focus of this research is evaluating behaviour change after neighbourhood relocation, an ideal study design would have included some longitudinal aspect. However, it was decided the time needed for data collection would not be feasible within a doctoral study. Instead, single interviews were conducted with residents who had recently moved, using the participants own reflection on their behavioural change as a resource and verification. Whilst this generates valuable qualitative data that is relevant to behaviour change, it is acknowledged that this does not have the objectivity of a repeat cohort study. However, the aim of this research design is not to provide accurate records of physical activity but to put this into the context of neighbourhood relocation and day-to-day activities of residents.

The City Form Survey data that is used to contextualise the three case study areas are somewhat dated (2006). Since the collection of the data there have been at some redevelopment to the case study areas, such as the addition of some new housing in Corstorphine and Dalry. However, these new developments do not significantly change the walkability of those areas. Certainly in the case of the Corstorphine housing development, this in fact enhances the areas suburban qualities. Due to available time and limited recruitment, this research does not account for seasonal differences in behaviour. The interviews were conducted between March and September 2011. This could be said to be even more important when looking at Scotland and a number of studies have taken seasonality into account in studying outdoor activity (Tucker and Gilliland, 2007, Tucker et al., 2009).

CHAPTER FIVE: SURVEY ANALYSIS

The main purpose of this chapter is to find whether there is a relationship between walkability and physical activity in Scotland, as has been suggested in some previous literature based on different urban contexts. This chapter presents evidence that residents living in more walkable neighbourhoods are significantly more likely to walk regularly. However, it is also shown that the effect is moderate when considered against individual factors and neighbourhood composition. The following analysis uses self-reported physical activity from the Scottish Health Survey (2008–2011), combined with built environment data by data zone.

Multivariate logistic regression models are used to predict habitual (or regular) walking and moderate physical activity attainment. The statistical models include individual demographic, lifestyle and built environment (BE) variables in order to assess their relative predictive effect. Much of the following chapter describes these variables and how they are individually associated with physical activity and walking. A 'walkability score' allocates each data zone score depending on relative measures of density, connectivity, and proximity. Testing the urban form measures separately against demographic and individual independent variables, proximity retains significance, whilst density loses predictive strength. These results are then discussed in relation to the question of how it is that urban form encourages walking. Regression models are developed using stepwise selection of predictive variables. The findings show that individual and demographic variables are highly predictive of overall physical activity but less so for walking. The walkability score is a significant predictor of habitual walking, although the model is improved when area composition is taken into account. In discussion it is suggested that neighbourhood socio-economic composition may reflect aspects of the environment not included in the walkability score, such as aesthetics, green space or quality of shops and facilities. These questions are explored further in the qualitative investigation presented in Chapters Six and Seven. At the end of the chapter, some data from the City Form Survey (CFS) is presented and discussed. This helps to provide a logical connection to the qualitative investigation, which uses CFS case study neighbourhoods.

5.1 Scottish Health Survey 2008-2011

The Scottish Health Survey (SHeS) is a national survey that aims to provide a comprehensive picture of the health, biological characteristics and health-related behaviours of the Scottish population (Whybrow et al., 2012). It has been running continuously since 2008, and before that was collected in 1995, 1998 and 2003. This is the first time that it has been possible to combine four years of the Scottish Health Survey to allow for a more powerful analysis and provide more detail on smaller groups (Whybrow et al., 2012). The SHeS datasets contain information collected at both the individual and household levels, through a mixture of self-completion and nurse-led interviews. The survey contains detailed information on physical activity behaviour including information on walking, household activities, manual labour, sport and exercise. Participants are asked about the frequency, duration and intensity of these activities. With 36,922 cases, the pooled SHeS is a powerful tool for analysing health-related behaviours in Scotland. The standard SHeS dataset contains no measure of urban characteristics, so in order to facilitate an analysis that considers the built environment a special request was made to merge environmental data onto the SHeS. Built environment data by Scottish data zone held by the School of the Built Environment at Heriot-Watt University, sourced originally from the 2001 Census of Population, were used for this purpose (see section 5.4.1 and Table 5.3 for details). So as to adhere to disclosure controls, the merge was carried out by the Analytical Services team at the Scottish Government. The data merge was initially conducting with the 2008 dataset alone, but later a repeat request was made for the four-year version. Special thanks are due to the Scottish Government Analytical Services for their time and effort in helping to prepare the dataset.

5.2 Logistic Regression

Logistic regression is a method of modelling statistical predictors of a binary outcome. This type of analysis is appropriate because the outcome variables (total physical activity and walking) are best expressed as categorical rather than continuous variables. Although these measures can be expressed as continuous or quasi-continuous variables, Scottish Health Survey analysts focus on binary contrasts for health-related recommended thresholds. Logistic regression is a method of testing the predictive power of a set of variables and of looking at what contribution each independent variable makes to changes in the dependent outcome, whilst all others are controlled for. This means that it is ideal for assessing the relative strength of a number of salient factors. In the

following analysis, walking and overall physical activity are measured as binary outcome variables. An ordinal variable measuring 'low', 'moderate' and 'high' physical activity would have been possible. This would have provided more statistical detail of the strength of effect on total physical activity. However, binary variables are appropriate here as the purpose of the analysis is find the proportion of residents meeting minimal physical activity levels. As discussed in Chapter Two, the focus of this study is whether living in a walkable neighbourhood means that residents are more likely to meet minimum recommended levels. Statistically prioritisation of 'high' over 'moderate' physical activity is ideal when exploring questions such as 'who in the population is most active?' or 'what are the greatest determinants of physical activity?' However, binary variables of minimum physical activity are more commonly used in studies that consider proportions of the population achieving *some* rather than *no* physical activity. It was argued in Chapter Two that it is this latter research focus which is pertinent to public health significance of neighbourhood walkability. The measure of overall physical activity is the same used by the Scottish Government as an indicator of MVPA, described in Chapter Two. This variable includes all aspects of physical activity including those that would not be considered directly affected by the environment, such as housework or paid labour.

The independent variables are grouped into blocks representing 'individual', 'lifestyle' and 'built environment' predictors. For each block of variables a backward stepwise elimination process was used, removing insignificant variables to improve the overall strength of the model at each stage. Individual factors are demographic, socio-economic and personal characteristics of the individual respondent such as age, gender and income, but also car ownership. These are broadly 'exogenous' in the sense that they are given and unchangeable, rather than being a matter of choice/behaviour, although it might be argued that car-ownership is in part a lifestyle choice. 'Lifestyle' factors are measures of drinking, diet and smoking. These are included because, as discussed in Chapter Two, lifestyle behaviours often go hand-in-hand (Lawder et al., 2010). Including lifestyle attributes in the model is a way of controlling for people who tend to live healthier lifestyles regardless of their environmental context. This is important because it goes some way towards controlling for the selectionist effects that may explain the relationship between neighbourhoods and physical activity (Tilt, 2009, Handy et al., 2006, Frank et al., 2007, Cao et al., 2009, Cao et al., 2006).

Also entered into the logistic regression are the environmental variables which include measures of proximity, connectivity, density and composition. As discussed in Chapter Three, these urban form measures are commonly used in studies of walkability that present evidence of an

'environmental determinism' of physical activity (Van Dyck et al., 2010, Saelens et al., 2003b, Owen et al., 2007, Frank et al., 2009, De Bourdeaudhuij et al., 2005). Ideally, more urban form measures would have been included; however, disclosure considerations limited the number and detail of environmental variables which could be attached to SHeS. It would have been helpful to have a measure of green space, for example. However, the variables chosen were intended to represent key influences. Many of these can also be interpreted as proxy measures for other walkable attributes. For example it is suggested that neighbourhood prosperity, which correlates with walking, may reflect the leafiness or shop quality in those neighbourhoods. 'Environmental determinism' is used here cautiously, with a number of conditions. It was emphasized in Chapter Three that a cross-sectional analysis, such as this logistic regression, cannot confirm a causal relationship. A primary aim of this research is to reveal whether or not urban form impacts on residents' day-to-day activities. This is only a soft form of determinism as it involves enabling or constraining people to make certain choices. Rather than a strict causality, this better articulates by the ecological approach described in Chapter Two, whereas environmental attributes interact with other factors to create the conditions for certain behaviours. With this in mind, the approach of this regression model is theoretically-informed: to see whether results support the hypothesized relationship between walkability and regular walking. It is reasonable to present such cross-sectional evidence backed by theoretical grounds and other types of research when the models include appropriate measures and controls. Then then adds to the weight of evidence that there is a relationship which is consistent with the theoretical proposition, and that it is either strong, moderate or weak.

5.3 Outcome Variables

The Scottish Health Survey contains over a hundred variables pertaining to adult physical activity alone. These are organised into the categories of 'housework', 'manual work', 'walking', 'work' and 'sports'. Measures of overall physical activity are the sum of all of these manifestitaions of physical activity. In the following analysis two outcome variables are used: overall physical activity and walking.

5.3.1 Overall Physical Activity

These derived variables of summary activity are used as the government's indicator of physical activity in Scotland. The summary variable categorises individuals according to bouts of ten or twenty minutes of activity, including brisk walking. Respondents are categorised as having low, medium or high levels of activity. Those categorised as achieving 'low' activity are those who do less than one of any activity above the threshold level per week (not managing to do 10 minutes of brisk walking, for example). Those categorised as achieving 'medium' activity are those who are doing between one and three bouts of activity per week.

Variable name	Variable Description	% (wt)	% (unwt)
High activity	Total physical activity is 'high'	38.2	35.3
Low activity	Total physical activity is 'moderate'	68.4	65.7

Table 5.1: Physical activity outcome variables

Medium activity also indicates that the person is achieving the recommended level of physical activity, therefore meeting MVPA guidelines. Respondents categorised as achieving 'high' activity are those doing five or more bouts of activity a week. Table 1 shows the percentage of adults achieving moderate and high levels of activity. Throughout the following analysis, medium activity and high activity are used as outcome measures. Only adults are used in this analysis; respondents under 16 years of age are excluded. It should be noted that where multiple adults could be interviewed from the same household, this would mean that the corresponding households number less than observed cases and could be said to lead to mean marginal errors. However, the approach is still justifiable as these adults would still be residents of the data zone in question.

5.3.2 Walking Behaviour

The Scottish Health Survey contains detailed variables on walking, so there are several ways in which walking behaviour can be analysed. Walking can be explored in term of regularity, duration, speed and frequency. Whereas previous studies have considered one dimension of walking, this analysis uses a combination of these as an outcome variable. A binary indicator is used for those residents

that walked for at least ten minutes, at least twice a day on most days. This is a more appropriate outcome variable than estimated total walking time a week for a number of reasons. Firstly, because of the concern, outlined in Chapter Four, that the way in which total walking time is derived may in fact misrepresent actual walking time. Secondly, focusing on the number of trips seems a more appropriate estimate of the type of walking taking place in or near the data zone in question. In this analysis, the walking outcome variable is called 'habitual walker': whether someone walks more than once a day on most days of the month. The duration of the walking needs to be at least ten minutes to be counted.

Variable Label	Variable Description	% (wt)	% (unwt)
Any walking	At least one period of 10 minutes in last four weeks	82.3	81.1
Daily walking	Walked on at least 20 days in the last four weeks	47.2	45.1
Trip frequency	Walks more than once a day	53.0	50.2
Habitual walker	Walks more than once a day on at least 20/28 days	33.5	31.2

Table 5.2: Walking behaviour outcome variables

SHeS respondents are asked whether or not they had done any period of walking for at least ten minutes in the past four weeks. Overall, 82.3% of people reported having walked at least this much. This still leaves a notable proportion of people in Scotland (17.7%) that report not once walking for only ten minutes over a four week period. For the purposes of this analysis, those that answered 'no' to this question are designated as 'not walking'. This is the first binary measure of walking behaviour: any walking. Table 5.2 shows the weighted and unweight percentages. The following measures similarly assume walking has to be at least ten minutes to be included, and less than that is not counted. 'Daily walking' indicates respondents having walked for ten minutes on at least twenty days in the last four weeks (20/28). This would be achieved if a person walks for ten minutes during their lunch break on every working day, but is sedentary all other times. Less than half of respondents achieved this (47.2%). The third walking variable is 'trip frequency'; this is a binary indication of all people who report walking more than once on any given day in the last four weeks, although this may have been on only one day. Only around half of the respondents (53%) report having done this. The fourth walking indicator, and main outcome variables used in the analysis, is 'habitual walker'. This is a combination of walking on most days (daily walking) and

walking more than once a day (trip frequency). Therefore it refers to those respondents who report having made more than one walking trip a day, on at least 20 days in the last four weeks. This would be achieved, for example, by walking to and from work on most days of the month. Only one third of respondents said that they are walked habitually. For the purposes of this analysis, this is used as an indicator of a regular and ongoing walking behaviour. The main question posed by this chapter is: *how much of the variation in habitual walking and overall physical activity is explained by walkability?* In the following section, urban form variables are described and cross-tabulated the outcome variables.

It should be noted that the walking variables described above were all recoded specifically for this analysis. The syntax for this coding can be found in the appendix. The reason for recoding is so as to include non-walkers in the analysis. Standard SHeS walking descriptors do not include those that could walk but report not doing so. Essentially, the recoding changed the base population from 'all walkers' to 'all potential walkers'. In other words, the standard SHeS walking variables can be read as 'of all those adults *that do walk* only x walk regularly' whilst the recoded variables used for this analysis can be read as *'of all adults *that could walk* only x walk regularly'*. This change is appropriate for the current study which is concerned with the proportion of residents that walk relative to those that do not.

5.4 Independent Variables

Independent variables are those that are expected to have some determining influence over the outcome variables. A regression or logistic regression model looks at how variations in the independent variables are associated with a change in the outcome variables. Figure 5.1 illustrates how three groups of independent variables are entered into the regression model.

Conceptual map for the logistic regression model
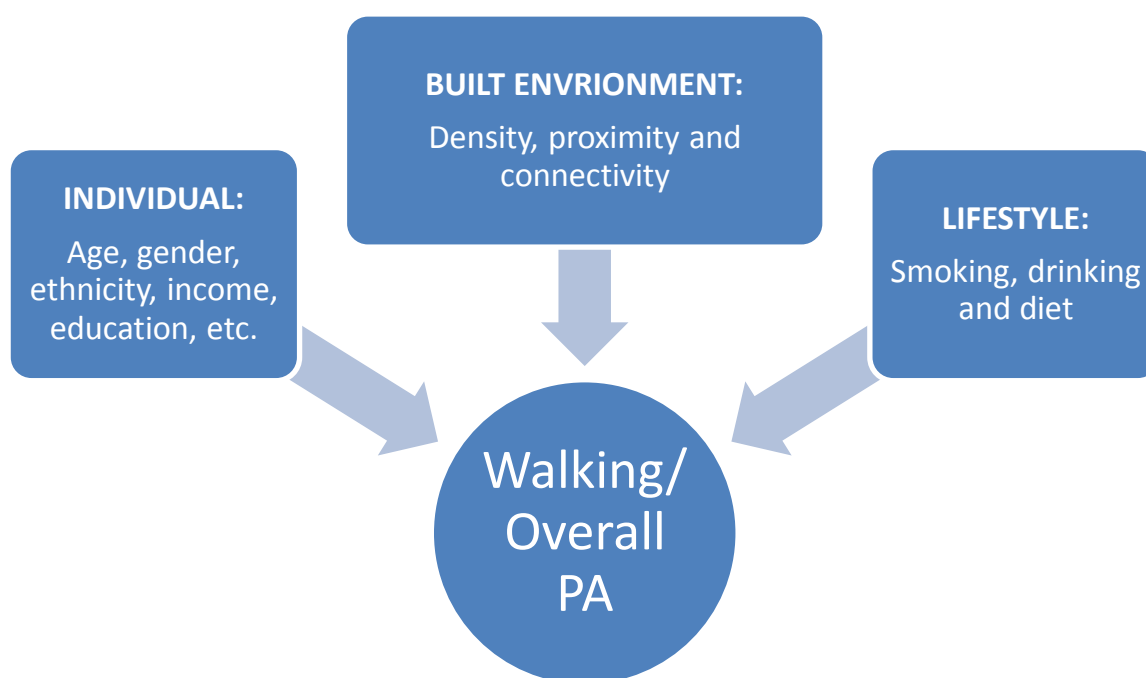
Figure 5.1: Variables are entered into the model representing individual, environmental and lifestyle predictors of walking and overall physical activity.

These variables are categorised as representing *individual characteristics*, *lifestyle behaviours*, and *the built environment*. These may be entered by blocks into the regression model, as reported at the end of the chapter. Individual and lifestyle variables are selected because they are understood to be salient predictors of physical activity, and therefore suitable controls for environmental effects. Individual and lifestyle influences are well-known to predict activity, as documented elsewhere and described and reviewed in Chapter Two, so do not require further discussion here. Instead, the next part of this chapter will describe the built environment independent variables. Six built environment variables are used in the final regression model and six were excluded, so as to reduce the problem of multicollinearity. This is the grounds for deciding on a sub-selection of variables. The decision on which variables to exclude was theoretically-informed, and this reasoning is outlined below. The following section presents and discusses how each of the selected built environment variables independently relates to walking and overall physical activity.

5.5 Built Environment Variables

The built environment (BE) variables were originally continuous variables mapped across the 6,505 Scottish data zones sourced from the 2001 census. In order to integrate this information with the Scottish Health Survey, the researcher worked closely with the Scottish Government's Analytic Services department, to match cases before removing the data zone codes. Removal of specific data zone codes is necessary for maintaining data protection and disclosure regulations. It was also necessary that the (continuous) BE variables were banded into interval data so that no single respondents could be traced. The merged dataset contains BE details for each of the 36,922 respondent by the data zone in which they live. However, the dataset does not identify any of the data zones or even contain data that would make identification possible. Careful data management was required in deciding how to band variables so as not to be traceable whilst also retaining as much detail as possible. Inevitably some detail was lost in recoding. Essentially this meant that the more variables that were merged into the SHeS, the greater the risk of identifying any particular data zone through the combination of values. Data management therefore required decisions on which environmental variables were most valuable to the analysis. The Scottish Indicator of Multiple Deprivation (SIMD) was removed because this was already available in the SHeS dataset. A couple of the remaining variables that were kept had to be recoded so as to collapse certain intervals where the low number of cases meant that data zone may be traceable in combination with other variables. For example, because there were very few cases within data zones with less than 10% of flats, the percentage of flats variable was collapsed 0-10% and 10-20% into 0-20% flats.

Variable name	Description	Bands
phioccband	The percentage of highest SEG in datazone	6
plooccband	The percentage of lowest SEG in datazone	6
pflatband	The percentage of flats in datazone	7
psocrentband	The percentage of social rented in the datazone	7
popdenband3	Population density (pph)	6
dwgdenband10	Dwelling density (dph)	8
EducationSkillsTrainingdomain09	Education, skills and training domain	9
GeographicAccessDom09banded	SIMD indicator of cost and inconvenience of service access	9
Drvtimeshopband1	Av. drive to the shops (5 min. intervals)	12
Pubtimeshopsband5	Av. public transport time to the shops (5 min. interval)	12
Distcentreband2k	Av. distance from the nearest central business district	10
JuctpHAband	The number of junctions per hectare	10

Table 5.3: Built environment measures merged onto SHeS 2008-2011

Table 5.3 lists the BE variables that were merged onto the SHeS. They related to the composition of the area in terms of education and socio-economic status, the types of dwelling, dwelling density, population density, access to shops, distance to the city centre, and the number junctions. As would be expected, many of these variables are intercorrelated, presenting the problem of multicollinarity. To remedy this problem a number of data reduction strategies were used. Predictive variables are considered separately against the outcome variables before reducing data by developing dummy variables for predominant types. Dummy variables were also suitable given the non-linear relationship with the dependent variables. Factor analysis was used to identify collinearity and, finally, six variables were selected to be included in the final model. These were used to make a composite walkability score entered into the final model. It should be noted that all data presented below are weighted by individual weights after the 2008-2011 calibration (Rutherford et al., 2011).

5.5.1 Socio-Economic Composition

Two of the variables relate to socio-economic grouping (SEG). These variables relate to the percentage of people in the data zone that are in the highest or lowest SEG. The table below shows how cases are distributed across data zones of different socio-economic compositions. The first table refers the percentage of people in the lowest socio-economic groups, either unemployed or unskilled labour. Only very few people live in areas with a lot of (>60%) or very few (>10%) low SEG residents. Generally, Scottish neighbourhoods tend to have between 30 – 50% of residents in the lowest socio-economic group.

Percentage of low SEG banded

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-10%	899	3.0	3.0	3.0
	20-30%	5669	18.7	18.7	21.7
	30-40%	8708	28.8	28.8	50.5
	40-50%	7962	26.3	26.3	76.8
	50-60%	5475	18.1	18.1	94.8
	>60%	1562	5.2	5.2	100.0
	Total	30275	100.0	100.0	

Table 5.4: Distribution of people in data zones of low socioeconomic grouping (SEG)

Percentage of high SEG banded

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<20%	5256	17.4	17.4	17.4
	20-30%	7554	25.0	25.0	42.3
	30-40%	6814	22.5	22.5	64.8
	40-50%	5414	17.9	17.9	82.7
	50-60%	2939	9.7	9.7	92.4
	>60%	2296	7.6	7.6	100.0
	Total	30275	100.0	100.0	

Table 5.5: Distribution of people in data zones of high socioeconomic grouping (SEG)

The following table shows SEG composition from the other perspective: the proportion of residents in the highest socio-economic group. This refers to occupations at managerial level and above. Relatively few people live in an area where more than 50% of people are in this high SEG group. Most people in Scotland live in an area with 20 – 40% of the people are in this high SEG grouping. The frequency represents the number of SHeS cases that reside in data zones meeting these categories. To illustrate what these two variables represent, an example of a data zone of high SEG composition is Stockbridge in Edinburgh (data zone S01002195). Stockbridge is well-known as an affluent area and is rated as having more than 70% of residents in the highest socio-economic

grouping. Only 11.2% of residents in Stockbridge are in the lowest SEG, which is relatively unusual for a built-up area. In comparison, Muirhouse (data zone S01002291) is a data zone in Edinburgh of low SEG composition. Although similar to Stockbridge in terms of population, only 13.3% of residents in Muirhouse are in the highest SEG and 56.7% of residents are in the lowest.

Figure 5.2: Stockbridge (left) and Muirhouse (right): data zones of similar density but different SIMD

Wealthy areas may often be more walkable as they tend to be greener, with better pedestrian design and more attractive shops and facilities to walk to. This point is illustrated by the comparison between Stockbridge and Muirhouse in Figure 5.2.

It is not possible to provide SHeS details specifically for Stockbridge and Muirhouse as data zone identifications are anonymised. However, what can be shown is the physical activity and walking averages for neighbourhoods of similar SEG compositions. Figure 5.3 illustrates how data zones that have a large proportion of high social economic groups (60%) perform better in terms of residents' walking behaviour. There is a clear increase in the proportion of people that walk more than once a day by data zone SEG. People living in high SEG areas are more like to report any walking, regular and frequent walking. The opposite can be seen when looking at low SEG percentage. The chances of walking more than once in a day is positively associated with SEG composition.
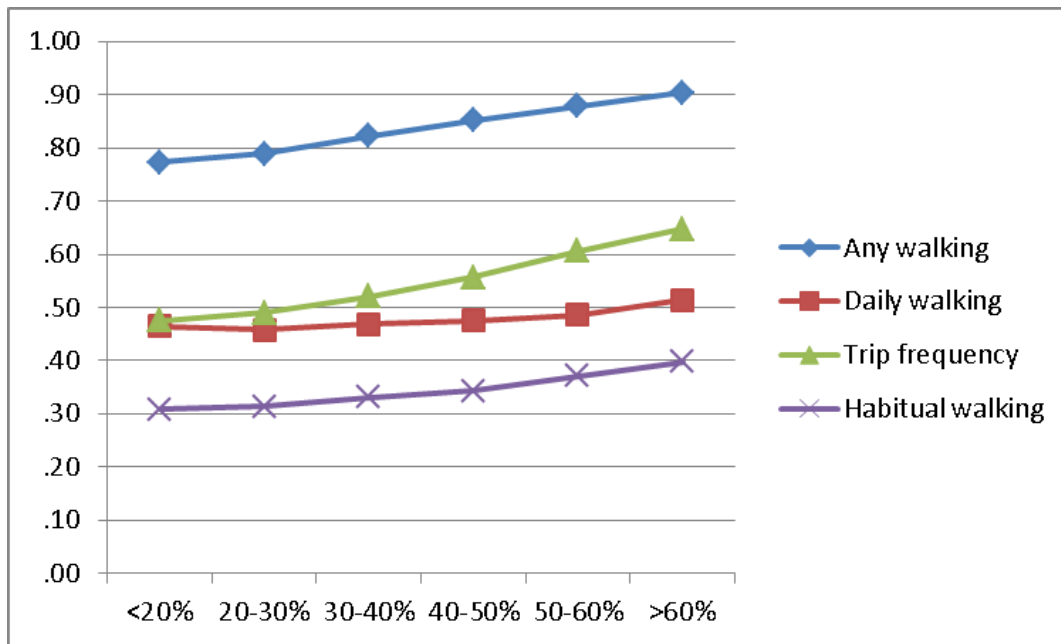
Figure 5.3: High SEG % and walking behaviour

SEG composition is also associated with overall physical activity. 77% achieve MVPA in the higher SEG data zones compared to 63% of those in the lowest SEG data zones. High SEG data zones are associated with more people achieving medium and high levels of physical activity. However, it is not clear whether this relationship is due to demographic difference in residents or because of the difference in neighbourhood design and greenness suggested above. This is accounted for in the final model which includes both data zone SEG and the individual's income and education.

Although the compositional variable was part of the environmental measure integrated into the data, it is not included within the walkability score outlined below. This is because as a measure of residential socio-economic status it relates too closely to individual factors. Walkability score is used to reflect only the physical characteristics of the environment. With this acknowledged, neighbourhood composition may indirectly reflect some aspects of neighbourhood walkability. More affluent areas may be safer, more 'leafy', with more attractive parks, shops and facilities. There is evidence that neighbourhood deprivation is related to walkable attributes. Recreational facilities, pedestrian infrastructure and green space access have been found to be more available in higher SES neighbourhoods (Cerin and Leslie, 2008, Leslie et al., 2005, Cerin et al., 2006, Giles-Corti and Donovan, 2002, Grant et al., 2010). For this reason, neighbourhood socioeconomic averages may reflect urban form factors not objectively measured in this analysis, such as leafiness and pedestrian

infrastructure. It is not possible to substantiate this with the current data, but this is one possible explanation for the connection between neighbourhood SES and regular walking behaviour.
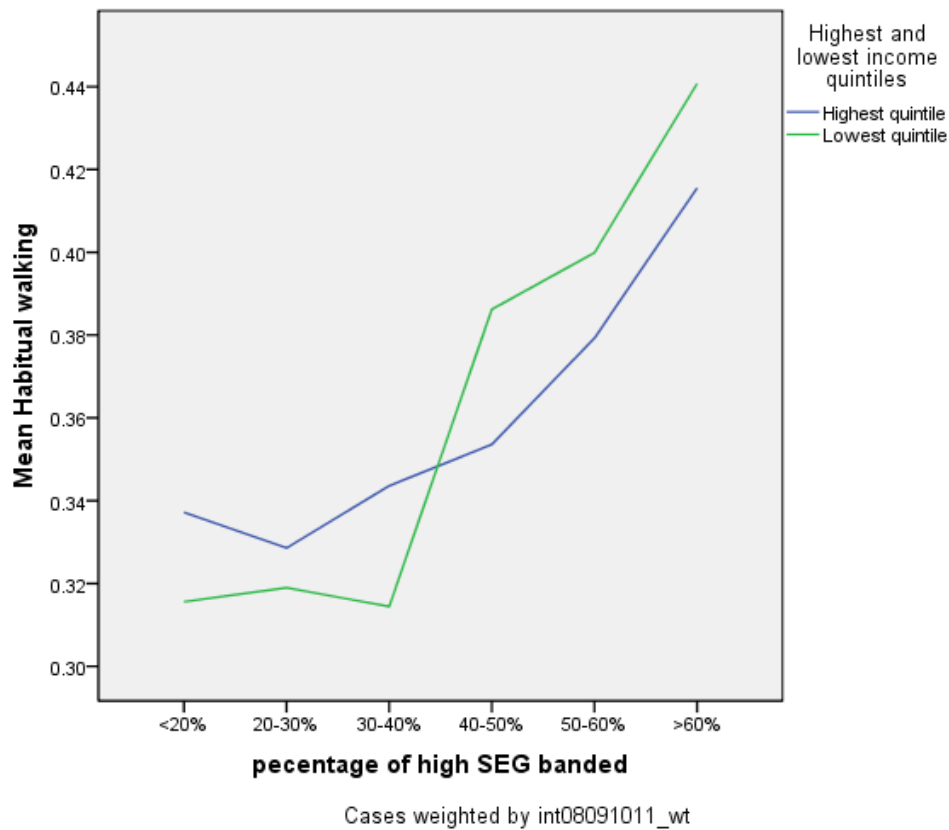
Figure 5.4: Walking is differentiated by neighbourhood SEG for both high and low income residents

This explanation is strengthened by the fact that the effect of neighbourhood composition remains regardless of individual income. This is illustrated in figure 5.4, which shows how the propensity for habitual walking is higher in areas of high SEG for both high and low income individuals. The lines represent those in the highest and lowest income quintiles. The variable is entered into the final regression model as a binary alongside walkability measures. The binary indicates those areas that are 40% or more in high SEG bands (n=10650/30275). The walkability score is shown in table 5.7, showing how the SHeS sample is distributed across the binary.

5.5.2 Density

Two types of density are measured in the dataset: dwelling density (number of dwellings per hectare) and population density (number of residents per hectare). Density was sourced from the 2001 Census of Population at the level of data zones. They are derived from gross calculations that were then converted from continuous to interval data in order to merge with SHeS. As discussed in Chapter Three, density is understood to be a key ingredient of the walkable neighbourhood. Denser neighbourhoods have been found to have higher prevalence of walking than less dense neighbourhoods. This is likely to be due to these areas having a higher number of destinations within a smaller, walkable radius. A moderate association can also be detected using the SHeS dataset. Scottish neighbourhoods can be seen to have an association within walking. Figure 5.5 illustrates how data zones with higher population density are characterised by residents who walk, make more trips and walk every day.
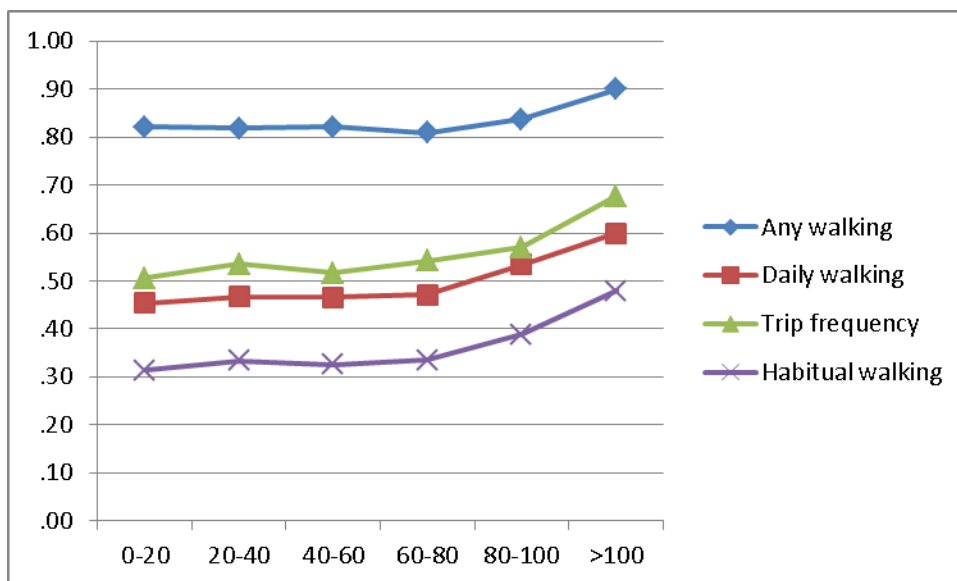
Figure 5.5: Population density and walking behaviour
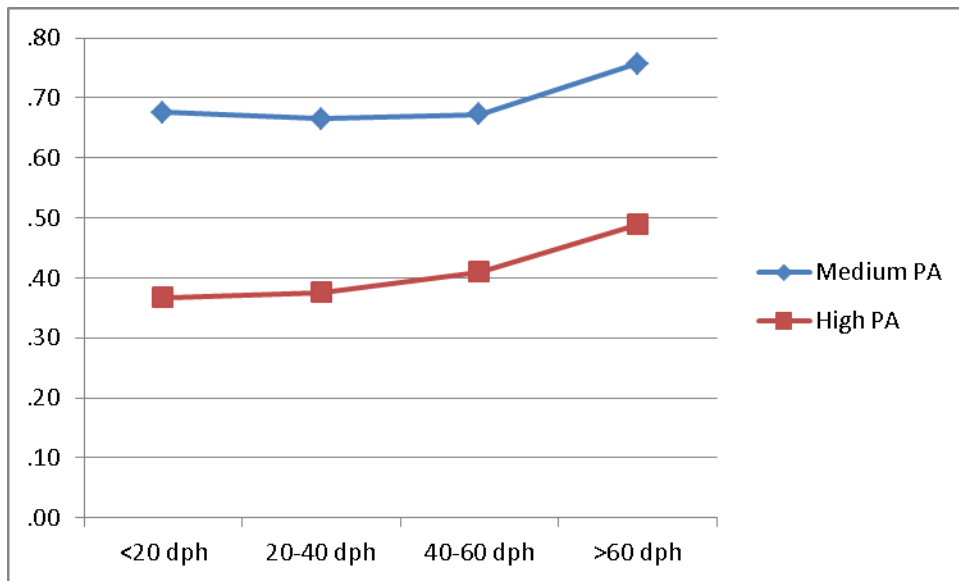
Figure 5.6: Dwelling density and overall physical activity

Interestingly, there appears to be a threshold at which density 'affects' walking. Whilst there is a clear and significant increase between data zones with the lowest and highest densities, walking only 'increases' upward of around 80pph or 40dph. People living in areas of higher population density are also more likely to achieve medium or high overall physical activity. However, the increase in overall activity is due to higher levels of walking having a visible influence on overall PA, rather than an increase in other activities.

The same general upward trend in walking and physical activity can be seen with dwelling density. Dwelling density also has a positive relationship with walking behaviour. Residents living in areas with a dwelling density of more than 40-50dph are more likely to walk and significantly more likely to walk more than once a day, or on most days. Dwelling and population density are closely correlated, and the same non-linear relationship can be found between population density, physical activity and walking. Both medium and high physical activity attainment is more prevalent in areas that have a dwelling density of 60dph or more.

Figure 5.7: Residents walk more in areas with a population density of around 60pph, below this population density there is little difference in walking behaviour.

In Chapter Three, the question was posed whether there would still be an association between density and physical activity in Scotland, despite density thresholds being much low than North America or Australia. The descriptive statistics from the SHeS suggest that there is an association with population and dwelling density and walking. However, it is not yet clear what confounding factors may be at work, whether the association is better explained by co-existing urban elements or by the demographic characteristics of those neighbourhoods.

5.5.3 Connectivity

In this analysis connectivity is measured by the number of junctions per hectare. This junction indicator counts the number of road junctions within each data zone. A classic grid layout has more junctions and is argued to be more permeable, allowing pedestrians to travel more easily and flexibly between locations within the neighbourhood. On the other hand, 'dendritic' or cul-de-sac layouts have fewer connections, are less permeable and therefore tend to make walking less

appealing – in such an area you have to walk further to reach a given destination. It is argued that areas with more junctions are better connected and more conducive to walking, and junctions per hectare have been found to be a good proxy for pedestrian accessibility. As discussed in Chapter Three, greater connectivity is of roads and pathways commonly used as a dimension of the walkable neighbourhood. It should also be noted that this variable is related only to road junctions, so does not include non-vehicle routes such as footpaths and cycleways. Neither is it possible here to measure the quality of pavements or how pedestrian-friendly the street planning is.

The junction variable is positively associated with the walking behaviour. Interestingly, some aspects of walking are differently associated with areas with more interconnections. Although 'any walking' changes little, the number of junctions is associated with regular walking, trip frequency and habitual walking behaviour. The odds of habitually walking increase from .32 in areas with low connectivity to .44 in areas of high connectivity. The effect of connectivity on overall physical activity is not as pronounced as on walking behaviour.
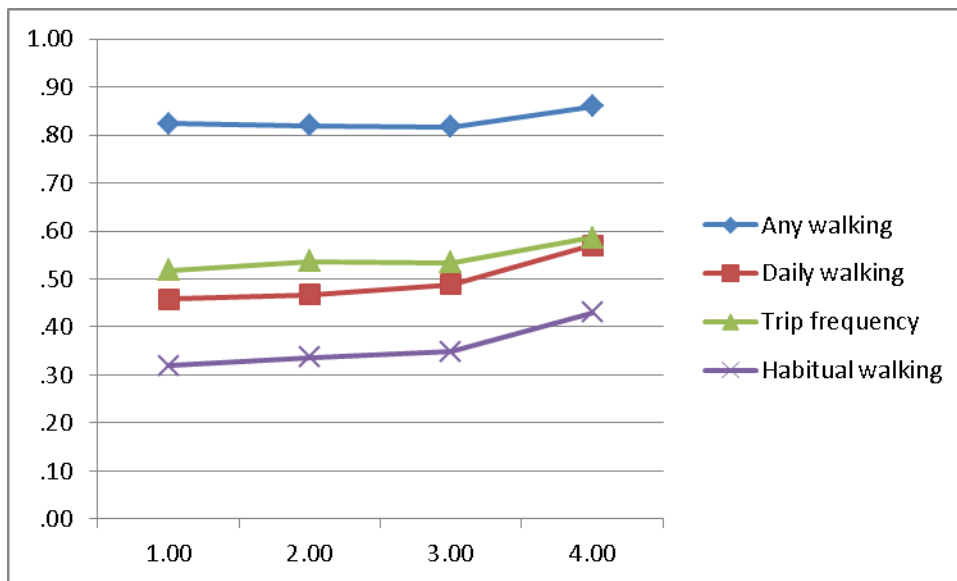
Figure 5.8: Junctions and walking behaviour

5.5.4 Proximity

Two measures of proximity are used in this analysis: distance from city/town centre and drive time to the local shops. Distance from the nearest Central Business District (CBD) or 'city centre' is

measured here in 2 kilometre intervals. The direct effect is that those living close to the centre are more likely to walk to the centre frequently for work and leisure. As discussed in Chapter Three, proximity is a key determinant of walking and there tends to be a threshold of around 1 kilometre or a 10 to 15 minute walk before the distance is too far for most people to walk regularly (McCormack et al., 2008, Frank et al., 2004, Moudon et al., 2006, Saelens et al., 2003b). Studies have shown that walking trips are highly more likely within distances of around 2 kilometres. Distance from the city centre may also have an indirect relationship to walking and physical activity, which again has to do with the typical concordance of urban factors. Neighbourhoods that are close to the city centre tend also to better have walkable characteristics such as a mixture of land uses, public transport, better connectivity, and density. Furthermore these areas will tend to be better serviced by shops and facilities. Almost by definition the central business district implies a level of commercial success that can sustain the regular custom to make facilities, private or public, viable. Areas that are further away from city centres may be less walkable, not only because of the distance to town, but because local shops, cafes and facilities are less successful or desirable.

One of the urban form variables added to the SHeS dataset is distance to major town or city centre. Table 5.6 shows the distribution of SHeS respondents by distance to the nearest central business district (CBD). It can be seen that around a third of the Scottish population reside in neighbourhoods more than 8 kilometres from a town or city centre. Around a third of the Scottish population (36.9%) live within 4 kilometres of the nearest CBD. A third live between 4 and 12 kilometres from the city centre (32.7%) and the remainder live outwith 12 kilometres (30.4%). To put this into context with the qualitative component of the study, the three case study neighbourhoods that are used for resident interviews are approximately 2, 4 and 8 kilometres from Edinburgh city centre. Figure 5.9 illustrates that walking is more prevalent in neighbourhoods close to the city centre. As anticipated, walking is higher in neighbourhoods within 4 kilometre proximity from the centre. The 'effect' of proximity is largest in trip frequency; those that live close to the city centre are significantly more likely to report walking more than once a day. The effect of CBD proximity on overall physical activity is evidence, although marginal, which suggest that there are likely to be confounding factors at work. What effect there is on overall activity is, again, due to the impact of increased walking.

Distance from CBD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>16k	1026	3.4	4.1	4.1
	12-16K	1858	6.1	7.4	11.6
	8-12k	4695	15.5	18.8	30.4
	4-12k	8164	27.0	32.7	63.1
	0-4k	9222	30.5	36.9	100.0
	Total	24966	82.5	100.0	
Missing	-8.00	5309	17.5		
Total		30275	100.0		

Table 5.6: Distribution of people by distance from a city center (CBD)
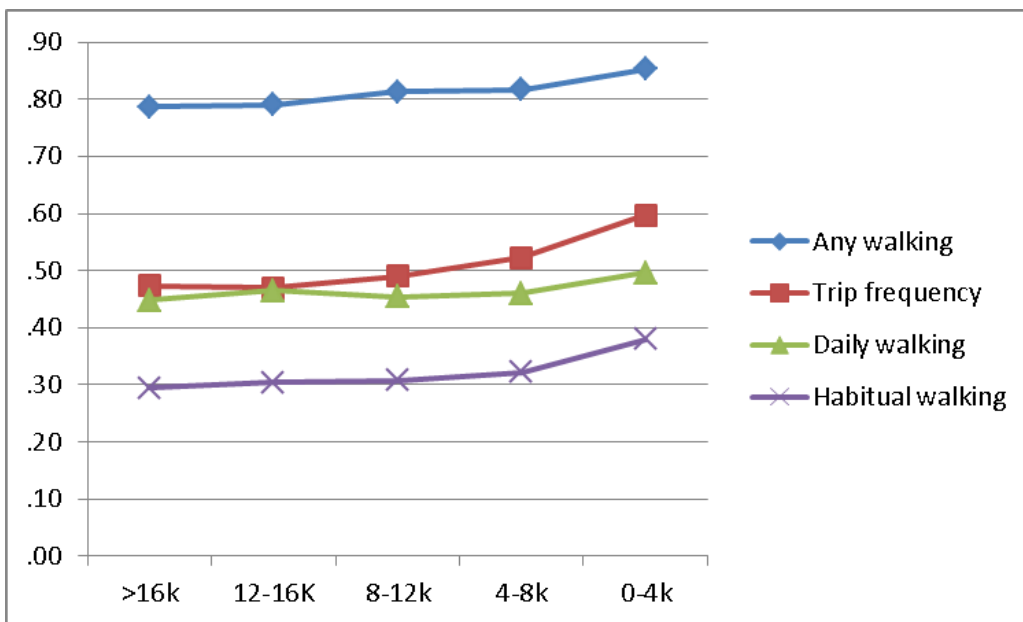
Figure 5.9: Walking and proximity to CBD.

The second proximity measure used in this analysis is the distance from the local shops. The variable used is in fact an estimate of the drive-time to the shops, rather than walking. This variable uses data on road networks to estimate how long it would take to drive to the nearest shops. Because the interest here is walking, it is assumed that being within a 5 minute drive means that shops are either within the data zone themselves or immediately outside of it. Similarly to city centre distance, walking is more prevalent in areas that are within a short distance to the shops. The distance to local

shops includes convenience stores and supermarkets. There is no significant increase in overall physical activity by the travel distance to shops.
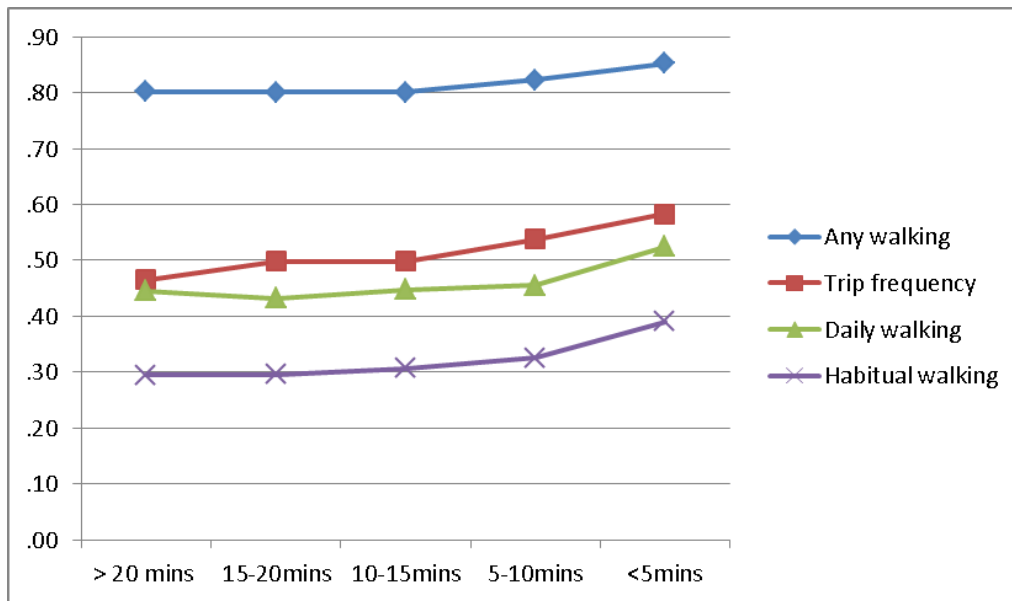
Figure 5.10: Distance to nearest shops and walking.

Both distance to the shops and distance to the city centre have only a marginal influence on overall physical activity attainment. As within the other built environment indicators discussed, the increase in overall PA reflects the impact of increased walking rather than additional physical activities. The graphs here, as with the previous variables, suggest a nonlinear or threshold effect meaning that it would be suitable to reduce them into dummy variables.

5.5.5 Collinearity

Bivariate descriptors of the built environment variables suggest a positive but non-linear relationship with walking behaviour. In particular, regularly walking twice a day, what is referred to here as 'habitual' walking, is positively associated with high SEG proportions, higher population and dwelling density, more junctions and closer proximity to shops and the city centre. It would be expected that these variables are correlated with one another, so it is necessary for some prior exploration of collinearity before developing a composite walkability score. The correlation matrix for these variables is shown in table 5.7. The correlations are not particularly high, although the two density measures are unsurprisingly quite highly correlated (r=0.69). This suggests that using a single one of

these indicators to represent walkability might miss out on quite a bit of useful information, and that a combined indicator is likely to be preferred. The level of bivariate correlations suggests that it might be possible to include two or three of these variables in a regression model, but not all of them, because of multicollinearity.

A factor analysis of the urban form variables described above found a Kaiser-Meyer-Okin Measure of Sample Adequacy (KMO) value of .665 and a significant Barlett's Test of Sphericity (p=.000), which indicates that a factor analysis is appropriate.

	Shop prox	CBD prox	Junctions	Population	Dwellings
Shop distance	1.000	.330	.283	.298	.247
CBD	.330	1.000	.175	.233	.233
Junctions	.283	.175	1.000	.556	.403
Population	.298	.233	.556	1.000	.690
Dwellings	.247	.233	.403	.690	1.000

Table 5.7: Correlation matrix of banded urban form variables
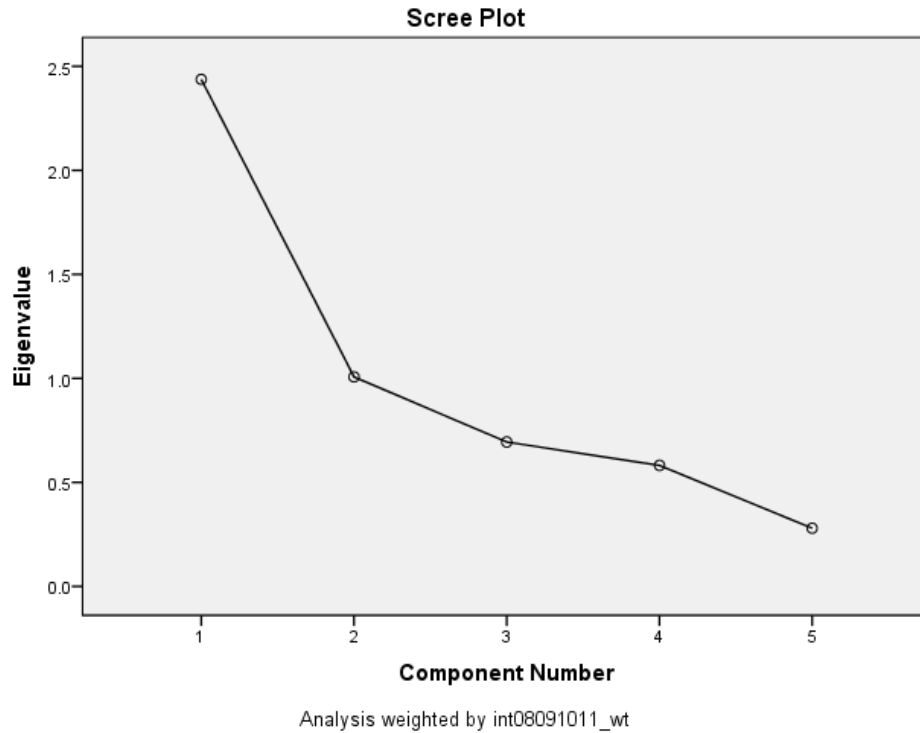
Figure 5.11: A scree plot showing the eigenvalues for components

The factor analysis extracted two principal components, with the first containing all five of the urban form measures, but with particularly strong loadings on density and junctions. Looking at the component matrix (Table 5.8) each of the variables load quite strongly onto the component, suggesting that it is appropriate to use factors. A factor analysis suggests that it is suitable to combine scores into a composite measure of walkability. A second component with distance from CBD and shops might be relevant to walkability.

	Component	
	1	2
Population density banded	.856	
Dwelling density	.790	
Junctions per hectare banded	.723	
Shop distance	.567	.549
Distance from CBD	.485	.694

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Table 5.8: Component Matrix[a]

5.5.6 The Walkability Score

The next stage of the analysis is to undertake a logistic regression in order to assess the relative effect on walking outcomes of individual factors. Before running the regression model, the built environment variables are combined to make a composite 'walkability score'. This helps to avoid the problem of multicollinearity between the variables and also to account for the benefits of an area performing well on a variety of urban characteristics. First the urban form measures were recoded into binary variables, in which '1' represents a walkable characteristic. The choice of how to delineate each binary was made on the basis on how the population was distributed and the thresholds of effect on walking. So, for example, population density was recoded into a binary for all areas with a population more than 60ddp. This means that 21.6% of the sample population are scored for population density. As a 'cut-off' point, 60ddp makes sense in terms of the threshold effects on walking discussed above, and also the balance of distribution within the binary. Each of the binary thresholds can be seen in table 5.9.

Label	Type	Description	*n*/total (wt)	*n%*
Dwellings	Density	> 20 dph	*10606*/25523	35
Population	Density	> 60 pph	*6549*/30259	21.6
Shops	Proximity	5 min. from shops	*8942*/30275	29.5
Location	Proximity	>4 k from CBD	*9222*/24966	36.9
Junctions	Connectivity	>75 junctions ph	*6619*/29833	21.9

Table 5.9: Cut-off points for binary variables

The five binaries are then added together to make an overall score of 0 to 6 (where junctions is double counted – see discussion below). A score of 6 represents the most walkable data zones. Figure 5.10 also shows how habitual walking and overall physical activity is higher with each additional 'score'. The walkability score counts junctions twice, similarly to previous walkability scores (Saelens et al., 2003a, Frank et al., 2009). This is because the measures of densities (dwelling and population) and proximity (shops and CBD) are conceptually and practically similar and can be considered pairs of variables. So as to avoid underweighting of particular factors or dimensions, it was decided to double weight the junction variable so as to be equal weight to the density and proximity measures. The walkability score, 'walkable', therefore has a maximum of six points for

dwelling density, population density, shop proximity, distance from CBD and number of junctions (x2).
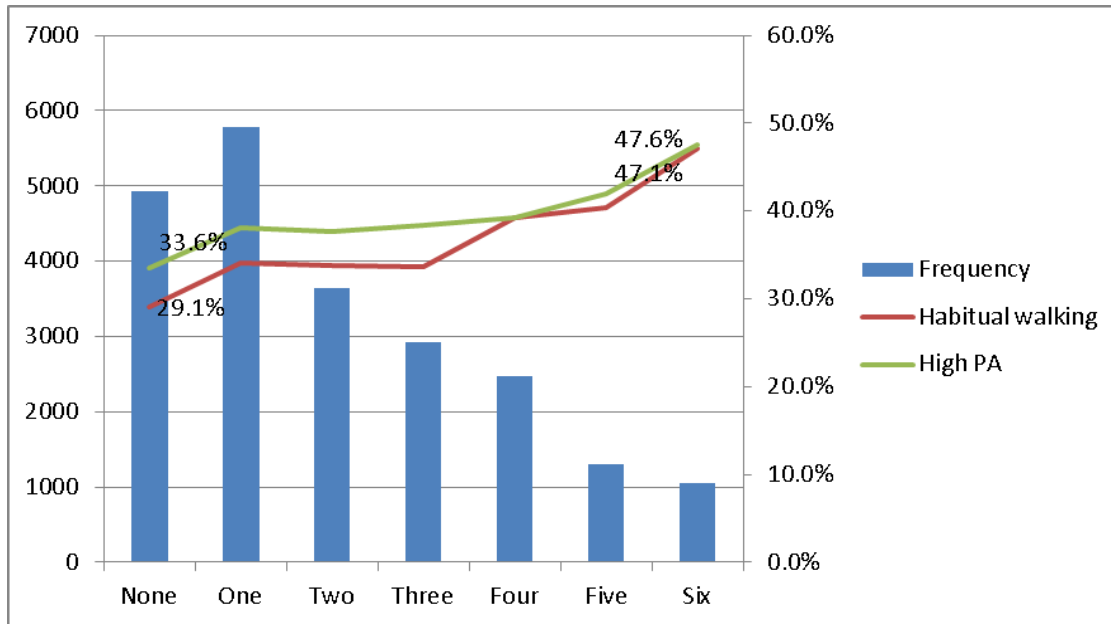
Figure 5.12: Walkability and proportion of residents reporting regularly walking and high overall PA

For those residents living in data zones that have no walkable attributes, the odds of being highly active are 0.34 and the odds of walking on most days is 0.29. For residents living in data zones which are dense, connected with nearby locations, the odds of being highly active are 47.6 and the odds of walking on most days are 0.47.

A Chi-squared test for independence (with Yates Continuity Correction) indicates a significant correlation between the walkability score and habitual walking (Chi-squared=165.0, $p<.000$), as well as between the walkability score and moderate overall PA physical activity (Chi-squared=30.6, $p<.000$). Importantly, the effect size is larger for habitual walking (Cramer's V = .091) than for attaining moderate (Cramer's V = .039) or high (Cramer's V = .065) physical activity, which suggests that walkability has more of an impact on regular walking activity than overall activities. This is what had been expected, as it is likely that urban form impacts walking behaviour but not necessarily other physical activities such as housework, sports or exercise. The association between the walkability score and walking suggests that having a combination of walkable characteristics may be more important than performing well on any single factor. So for example, having a very high

density may not be as conducive to walking as having a relatively high density with good junctions and nearby destinations. Chapter Three considers other research that had used composite measures of urban form to predict walking. As discussed in Chapter Three, a neighbourhood needs to have a concordance of walkable characteristics in order to influence behaviour. It can be seen here that the most walking happens in areas that perform well in terms of proximity to shops and facilities, building and population density, and connectivity. The shortcomings of combining a walkability score are that it glosses over the relative influence of each factor. For this reason, the following regression models are run using both the score and the individual binaries; the results are discussed below. The next part of this chapter will enter the walkability score into a regression model alongside individual level predictors of physical activity in order to assess its relative predictive power.

5.6 Logistic Regression Modelling

The walkability score is a useful predictor of walking behaviour; however, the question remains whether the association of the urban characteristics on walking will remain once demographics are controlled for. Logistic regression is a statistical method for assessing how well selected groups of variables predict a binary outcome. Because the walkability measures and SEG variables are a coded by data zone and physical activity variables by individual there is a concern that these might be clustered with fewer degrees of freedom. Although data zone identifier have been removed from the dataset, it is conceivable that these could have found by clustering area-based descriptive variables. However, such an approach is restricted by the data sharing agreement with the Scottish Government. The number of data zones is sufficiently large that any distorting will not be great. The technique is used here to see which factors are most prominent in predicting walking and overall physical activity. Two models are described here, one predicting overall physical activity and another predicting habitual walking. Individual and lifestyle variables are entered before the walkability score. With each block of variables, a stepwise elimination is used to remove those variables that do not significantly contribute to the model.

5.6.1 Individual and Lifestyle Variables

A large number of individual variables were selected for inclusion in the models, based on reasoning and a review of the literature. As outlined in Chapter One, physical activity behaviour varies significantly by age and gender. The backward stepwise selection method was used to select

variables included in the final version the each of the models. The following variables were taken from SHeS0811 as potential individual characteristics that might predict walking and overall activity: age (categorical), gender (male), ethnicity (white), car ownership, education (degree or higher), equivilised income (categorical), marital status (married or civil partnership), occupation (managerial or above) and self-rated general health (good or better). Additionally, the following variables were selected as measures of general healthy choices and lifestyle: diet (fruit and vegetable consumption), smoking (non-smoker) and drinking (within recommendations).

5.6.2 Logistic Regression of MVPA

Individual-level predictors were entered into a regression model for attaining moderate physical activity. Being male appears non-significant (p=.504) but was kept in the model. Ethnicity (white) was non-significant (p=.268) and removed. All other variables (age, gender, having a degree, occupation and income) were significant predictors of attaining moderate physical activity (p<.000). With individual factors alone, the model explains between 16.3% (Cox Snell R squared) and 23.4% (Nagelkerke R squared) of the total variation in medium physical activity attainment. Table 5.11 shows the results of the first block of the regression model. Age is in four categories: 16-44, 45-64, 65-74 and 75+. Being older, male, having a degree, high occupational status and being in good health are all predictive of being moderately active. Reporting being in good health or very good health is the strongest individual-level predictor of being moderately physically active. This corroborates previous research showing that individual factors strongly predict overall physical activity.

The second block variables entered represent health-related behaviours: drinking, smoking and diet. All three are significantly correlated with medium physical activity, supporting previous research that shows how lifestyle behaviours are often associated (Lawder et al., 2010). Entered alongside diet and smoking, alcohol consumption was non-significant (p=.619) and removed to improve the overall model. The addition of the health-related behaviours means the model now predicts between 17.0% (Cox Snell R squared) and 24.3% (Nagelkerke R squared) of the overall variation in moderate physical activity. 76.8% of observations were correctly predicted by the model. This confirms that health-related behaviours are positively associated with overall physical activity, although are not as predictive as individual factors such as age and health. The second block of variables can be seen in table 5.10

	Block 1		Block 2		Block 3	
	Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)
Aged 16-44	0.000		.000		.000	
Aged 45 - 64	0.000	3.153	.000	7.159	.000	7.283
Aged 65 - 74	0.000	2.716	.000	4.196	.000	4.103
Aged 75 and over	0.000	2.462	.000	2.369	.000	2.536
Sex (male)	0.504	0.983	.004	1.157	.005	1.184
Educated to degree level	0.001	1.126	.096	1.125	.769	1.025
Occupation (Managerial)	0.000	1.252	.000	1.251	.002	1.261
Car ownership	0.000	0.527	.000	.624	.000	.631
Self-reported good health	0.000	2.070	.000	3.162	.000	3.151
Current smoker			.125	.991	.054	.987
Recommended fruit and vegetable intake			.000	1.320	.000	1.368
Any fruit and vegetable			.000	1.246	.000	1.285
Shops					.926	.994
Distance to CBD					.265	1.070
Dwelling density					.978	1.002
Population density					.782	1.026
Junctions					.748	1.025
Socioeconomic composition					.426	1.060

Table 5.10: Three block logistic regression model for moderate physical activity.

The same model was repeated with the addition of the walkability binaries for density, proximity, connectivity and also neighbourhood SEG. With all six binaries entered, none appeared significant (table 5.10). Removing the least significant shows that area SEG is the most significant predictor. The overall predictive power of the model was not improved with the addition of urban form binaries. The significance to the model is not notably improved when urban form values are replaced with the composite walkability score. This regression model shows that there is little association between neighbourhood characteristics and overall physical activity attainment compared with demographic and behavioural variables.

5.6.3 Logistic Regression of Habitual Walking

The same backward stepwise elimination process was used to develop a model of habitual walking. This means for each block of variables, those with poor significance are removed to improve the strength of the model. As discussed earlier in the chapter this is a measure of all people who report regularly walking (at least ten minutes, twice a day on most days). The same individual predictors

were entered first, with the addition of car ownership, which is known to be a strong predictor of walking. Age, gender, ethnicity, car-ownership, education, equivalised income, marital status, occupation, and self-rated health were entered into a regression model. As with the previous model, age was highly correlated. This time, gender was less significant ($p=.05$), although kept in the model because of its theoretical importance. The significance of equivalised income ($p=.905$) was mitigated by occupational level and education, so it was removed in order to improve the model. Being white or married was also non-significant. These were removed to improve the overall model. The remaining individual-level variables (age, gender, education, occupation, car ownership and self-reported health) remained the strongest predictors of habitual walking. The model explains between 5.0% (Cox Snell R squared) and 6.9% (Nagelkerke R squared) of the total variation in *habitual walking*. This model correctly predicts a modest 67.5 % of all observed cases. Age was the best individual predictor of walking, and again, those that are in good health are highly more likely to be walking on most days. The first block of the model can be seen in table 5.11.

This model was repeated with the additional of health-behaviour variables: diet, smoking and alcohol consumption. The significance of smoking was again mitigated when entered alongside smoking and drinking ($p=.804$), so was removed to improve the model. With the addition of diet and alcohol, the overall model changes little, explaining between 5.2% (Cox Snell R squared) and 7.2% (Nagelkerke R squared) of total variation in habitual walking. 68.0% of cases were correctly predicted. Interestingly, the addition of health-related behaviours meant that being male (negatively associated with regular walking) was no longer significant. This may mean that poor diet, smoking and drinking underpin gendered difference in regular walking.

The third block of independent variables to be entered is the urban form binaries: population density, dwelling density, shop proximity, CBD proximity, junctions and area SEG (table 5.11). This notably improves the explanatory power of the model, which now explains between 6.4% (Cox Snell R squared) and 8.8% (Nagelkerke R squared) of the variation in habitual walking behaviour in Scotland. As would be expected, some of the binaries are non-significant due to multicollinearity. Removing junctions and then population density ($p=.976$ and $p=.968$ respectively) leaves the other urban form binaries within acceptable significance. The model now correctly predicts 67.7% of habitual walking in Scotland. Although this is modest, it is notable that the urban form variables have considerably improved the model, even alongside individual and health-related factors.

	Block 1		Block 2		Block 3	
	Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)
Aged 16-44	.000		.000		.000	
Aged 45 - 64	.000	3.153	.000	3.210	.000	3.337
Aged 65 - 74	.000	2.716	.000	2.727	.000	2.730
Aged 75 and over	.000	2.462	.000	2.459	.000	2.470
Sex (male)	.504	.983	.813	.994	.589	.983
Educated to degree level	.001	1.126	.009	1.096	.077	1.078
Occupation (Managerial)	.000	1.252	.000	1.237	.000	1.195
Car ownership	.000	.527	.000	.517	.000	.539
Self-reported good health	.000	2.070	.000	2.016	.000	1.973
Recommended fruit and vegetable intake			.000	1.202	.000	1.197
Alcohol consumption within recommended limits			.000	.928	.001	.922
Shops					.000	1.241
Distance to CBD					.000	1.154
Dwelling density					.093	1.057
Socioeconomic composition					.000	1.179

Table 5.11: Three block logistic regression model for habitual walking

Interestingly, the effect of area socioeconomic composition is significant alongside individual socioeconomic indicators (education and occupation). This suggests that the influence of area prosperity is not simply a reflection of individual socioeconomic status.

It has been argued that neighbourhoods need to have a concurrence of walkable characteristics in order to influence residential behaviour. In order to assess this, the model is repeated using the walkability score developed earlier. For this reason the model was run again with the composite walkability score, entered as a scale variable, to replace the urban form binaries. However, although significant, a composite score did not notably improve the model. Alongside walkability, the socioeconomic composition of the data zone remains a significant predictor. Therefore living in an area of relatively high socio-economic composition means you are more likely to walk regularly regardless of your own socio-economic status. The importance of socioeconomic composition of the neighbourhood is an interesting finding. One explanation for this is that areas that are more affluent may have a higher number of more desirable shops, cafes and restaurants. They may also be safer, with fewer incivilities. Poorer areas, on the other hand, although they may be within a walkable distance to shops and other destinations, may not be as attractive or desirable. More affluent areas may also be better serviced in terms of green space, pedestrian design, attractive 'leafy' destinations and other aspects of street design that are not measured in this

analysis. These are generally attractive attributes and it makes sense that historically, these areas would have been colonised by more affluent classes.

5.7 Discussion

The statistical analysis is unique in using the four-year Scottish Health Survey dataset merged with built environment measures across all Scottish data zones. For this reason, the dataset itself has the potential beyond the scope of this study; it is a powerful tool for exploring the relationship between the urban environment and a range of other health issues. As discussed in Chapter Three, considering physical activity and urban form by data zone is a particular scale of analysis, which could be accused of dislocating data zones from their wider neighbourhood context. However, analysing built environment data across all Scottish data zones has succeeded in capturing something of the effect of urban form on walking. The relationship between the built environment and overall physical activity is weak; any relationship that is present appears to be explained by walking behaviour. These findings support that of other research which has shown that urban form is more conducive to walking than other forms of physical activity.

A derived variable for 'habitual walking' was used as an outcome variable to try and capture those residents that walk often and frequently, who comprise about the 30% of the eligible Scottish population. Regular walking is more likely in data zones that are close to a central business district, have nearby shops, more buildings, more people, and more road junctions and have a relatively wealthier composition. In Chapter Three it was suggested that neighbourhoods require a combination of walkable attributes to change behaviour. In the above analysis, urban form measures were combined into a walkability score. Considered separately, it can be seen that residents who live in data zones with a combination of factors are more likely to walk regularly. However, the regression model was not notably stronger at predicting regular walking with the composite walkability score than with separate urban form measures. Proximity emerged as a strong predictor of walking, as did socioeconomic composition. Although the socioeconomic composition of a data zone is not a physical attribute, it may reflect an 'area effect' on behaviour, as more affluent areas may be greener, have better facilities or pedestrian infrastructure. This cannot be substantiated with the evidence presented here and will be explored further through the qualitative analysis.

Whilst the Scotland-wide investigation presented above is helpful in identifying overall patterns in walking, there is a lack of detail about the nature of these trips. The purpose of this

research is to better understand the association by looking in more depth at the purpose and context of the behaviours underpinning the association. In order to do this, as well as to make a connection between the quantitative and qualitative component of the research, the last part of this chapter considers data from the City Form Survey, which contains more descriptive travel data.

5.8 City Form Survey

The final part of the chapter considers a different dataset. Whereas SHeS data contains information on walking frequency and duration, the City Form Survey (CF) has more detail on the nature and purpose of trips and neighbourhood use. CF data was collected from 15 selected neighbourhoods (each comprising of several data zones) across the UK. The neighbourhoods were selected due to their relative proximity to the city centre. They represent five inner-city neighbourhoods, five outer-city neighbourhoods and five 'in-between' areas. These neighbourhoods differ in their urban form characteristics. Inner city areas are more compact, with better road networks and access to facilities compared to the outer city areas, which tend to be more suburban (Jenks and Jones, 2010). For the purposes here, the different neighbourhood locations are indicative of neighbourhood walkability. So, for example, if you were to take a typical data zone from Dalry, the Edinburgh inner-city case study area (see for example data zone S01002068), this would score six points in the walkability index described above because it has relatively high density, good connectivity and is central, with nearby facilities. In comparison, a typical Costorphine data zone (see for example Hillview Drive in Scottish data zone S01002111, in Figure 5.13) would only score 2, reflecting the fact that it has a low density, fewer junctions and lacks nearby shops or city centre.

Figure 5.13: Hillview Drive in Corstorphine (data zone S01002111).

CF survey participants from these areas completed a questionnaire regarding their use of the local neighbourhood. CF therefore allows for a comparative look at residents' self-reported behaviour and findings reported elsewhere (Jenks and Dempsey, 2007, Bramley et al., 2009). The purpose here is to consider differences between inner and outer city neighbourhoods in terms of active travel, park use, shop-use and sporting activities. Although the following section does not provide a statistical model as used in the SHeS, the purpose is a comparative look at neighbourhoods. This bridges the quantitative data with the qualitative component, which includes interviews with participants from the three Edinburgh CF neighbourhoods: Dalry, Restalrig and Corstorphine.

The CF is a different dataset that looks at a small number of UK neighbourhoods of varying distances from a city centre, in order to look comparatively at residents' travel behaviour. This section presents comparative differences between inner and outer city neighbourhoods in terms of use of facilities, active travel, park use and exercise. The purpose is to fill-in some of the blanks regarding the types of walking trips being made in different neighbourhood types.

5.8.1 Use of Local Facilities

The City Form survey asked residents whether they used various facilities in their neighbourhood. Eleven facility types were listed: chemist, corner shop, supermarket, post office, bank, restaurant/ café/ takeaway, pub, library, public sports facilities, community centre and facilities for young people and children. Outer city residents were less likely to rate their local shops, cafes, pubs and other facilities highly. Few people report using any one facility every day, although many residents reported using particular local facilities at least once a month. The greatest difference between case study locations is between those that use fewer than three facilities. A relatively large number of people use fewer than three local facilities in the outer neighbourhoods compared to those in the inner city areas. Looking at individual facilities, there is no difference in the use of chemists. There is a significant difference in the use of local convenience stories and shops; 74.4% of those in the inner city use shops at least once a month compared with 62.5% in the outer city. However, this difference is perhaps smaller than expected. Inner city residents are significantly more likely to use the following local facilities: supermarkets, banks, sport facilities and library. These differences were significant but only small. The largest difference in usage was in dining facilities: cafes, pubs, restaurants and takeaways.
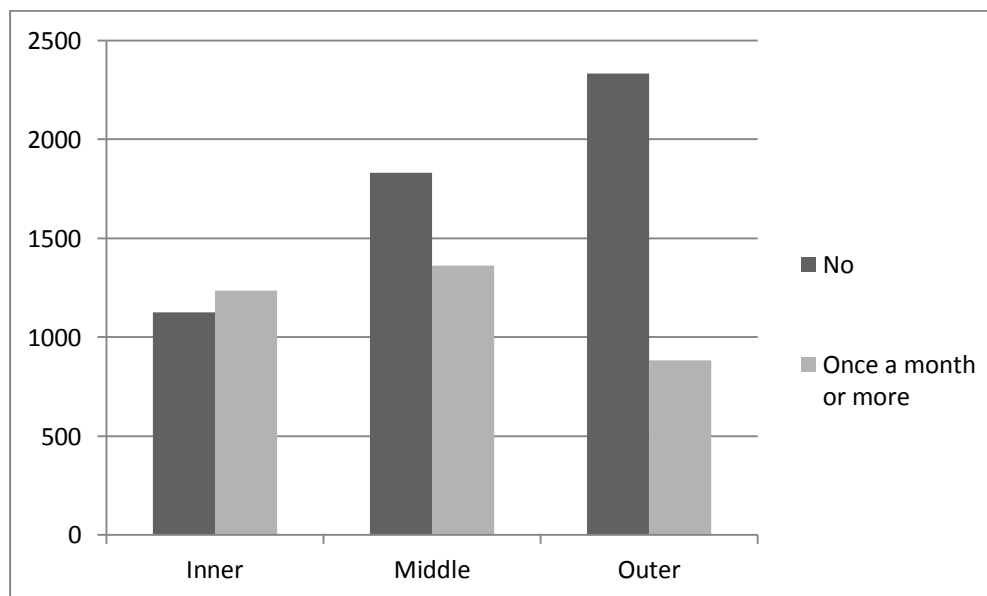
Figure 5.14: Use of local pubs, cafes, restaurants and takeaway facilities by neighbourhood location

Of the inner-city residents, 48.5% (*n*=573) report regularly using local pubs, whilst only 23% of outer city residents report doing the same. Similarly, 56.1% of inner city residents reported using local cafés, restaurants and takeaways. Interestingly, the difference is more marked in those that do not use facilities than those that do.

5.8.2 Active Travel by Location

Analysis of the CF data finds a considerable difference between locations in how residents travel to the shops. When asked how they typically travel to food and grocery shopping, more than half of inner-city respondents (53.9%, *n*=636) report walking and cycling. Of the outer city respondents, only one in ten (9.7%, *n*=156) reported active travel as their primary method of travelling to do food shopping. The graph below illustrates how those living in the inner city areas are notably more likely to report active travel methods for their shopping trips. The opposite association is found with private vehicle travel. The majority of outer-city respondents report using a vehicle to do their food shopping (77.2%, *n*=1,242) compared to about a third of inner-city respondents (32.2%, *n*=380). These results show that people living in the inner city neighbourhoods in the UK are significantly more likely to walk or cycle to do their shopping (OR = 10.9). Analysis of the SHeS revealed how regular walking is more common in data zones scoring high walkability. CF analysis supports this and suggests that mode of shopping trip between inner and outer city areas may well underpin this relationship.
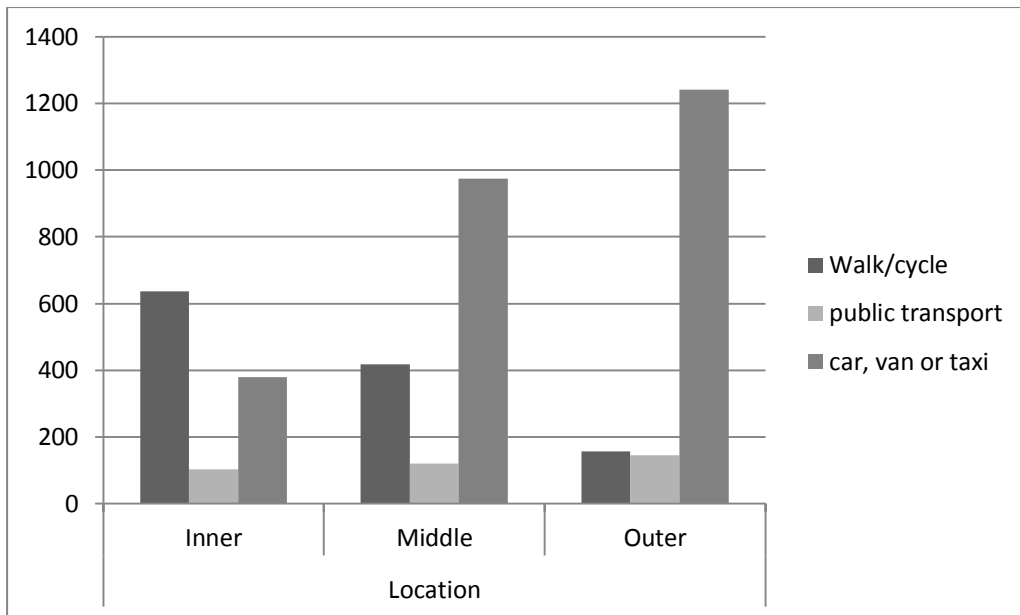
Figure 5.15: Typical travel method to do food shopping by neighbourhood location
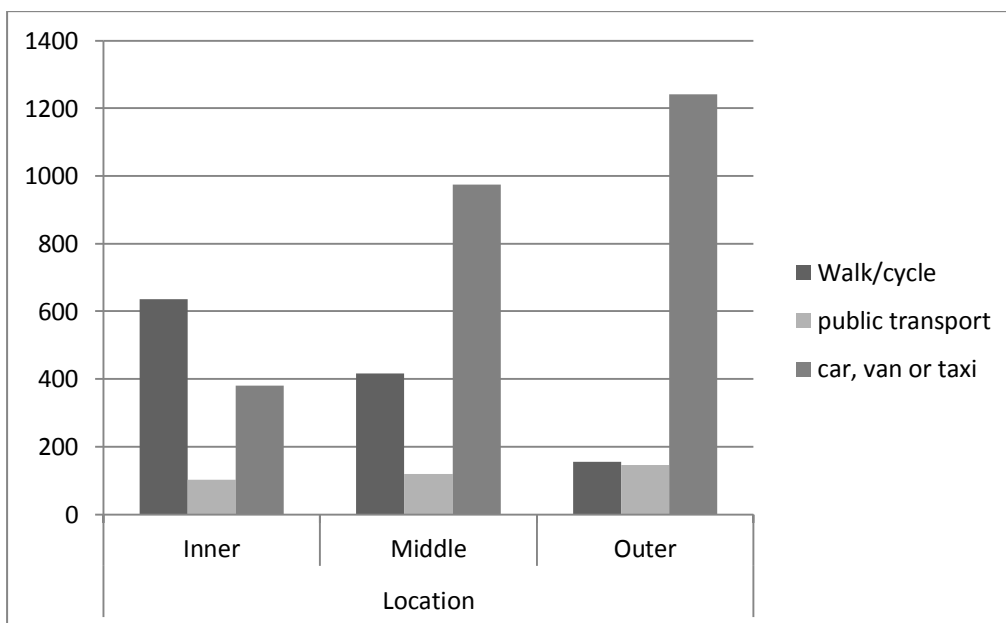
Figure 5.16: Typical mode of commute by neighbourhood location

The other form of active travel recorded in the CF data is mode of commute to main place of work or study. Figure 5.16 shows the difference in mode of commute by neighbourhood location. As with shopping travel there is a notable difference between neighbourhood locations. The main modes of

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commute for inner city residents are by foot or bicycle (37.8%, *n*=333). A large proportion of inner city residents also use public transport (29.4%, *n*=259) or other vehicular transportation (24.6%, *n*=216).

5.8.3 Park Use by Location

City Form respondents were asked whether they used parks and open space in the local neighbourhood area. Residents reported their use and satisfaction with local green space. The results show that walking and running in local parks were more common than sports. Residents were more likely to visit the park to walk or go running if they rated it as at least adequate for those purposes. Only 18.6% of those who did not rate the local open space and park provision for exercise as adequate regularly (at least once a month) used that space for walking or running. Of those that rated the local open and park space as at least adequate, 54%.9 (*n*=1,573) used the space for walking or running at least once a month, and 43.8% report using it weekly or daily. This supports the importance of green space quality for incentivising use, although it could equally be the case that park users are more likely to rate local parks highly. Unfortunately, there is no objective measure of green space quality available.

Around 60% of people say that they use their local park for any reason at least once a month. There is a small difference in park use between locations: 57.3% of people in the inner city use the park, compared to 62% and 60.2% in in-between and outer-city neighbourhoods. The difference is broadly significant (*p*=.014) although the relationship is weak (Pearson Chi-Square = 8.6).The proportion of people that use a local park for walking and exercise is slightly higher in the outer city area than in the inner city area (75.3% compared to 65.3%). Outer city residents were slightly more likely to report having the opportunity to use their local park for sport (73.3% compared to 61.1% of inner city respondents).

5.8.4 Sports and Exercise by Location

The CF was designed for neighbourhood-use rather than measures of physical activity, so the indicators for sport and exercise are somewhat indirect, but worth mentioning. Respondents were asked whether they used local sports and exercise facilities. These figures cannot tell us about those that travel to sports facilities outside of their neighbourhood area. Looking at the percentage of

people who report doing so at least once a month, the proportion is marginally higher for inner-city rather than outer-city neighbourhoods (25.8% compared to 23.0%), although the difference is not significant (p=.195). Another indicator of sports and exercise is how often respondents use their local park for sports. Again, there is very little difference between neighbourhood locations. Of the inner city respondents, 13.9% said they use the local park for sports at least once a month compared to 14% in middling areas and 13.5% of the outer city respondents. Pearson's Phi-Squares test again find no significant relationship (p=.919).

5.9 Conclusion

This chapter has presented an original statistical model using a unique dataset to predict walking behaviour and physical activity attainment in Scotland. This is an original analysis of the four-year Scottish Health Survey dataset (2008-2011) merged with built environment measures across all Scottish data zones. The logistic regression model significantly predicts moderate physical activity attainment and regular walking in Scotland. It was shown that residents living in data zones that have a combination of walkable attributes are more likely to walk often. However, when entered into a regression model, the association is relatively weak compared to individual factors and health related behaviours. It is notable that the model of overall physical activity is much stronger than the model for regular walking. Whilst individual and demographic factors such as age, gender and, in particular, self-rated health is highly predictive of overall physical activity, they do not predict the prevalence of regular walking. In contrast, urban form factors contribute little to a model for overall physical activity, but notably improve the model of regular walking. These results likely reflect the difference in 'recreational' physical activities, such as exercise and sport, to utilitarian walking.

Of the urban form measures considered, proximity indicators appear to be a somewhat stronger predictor of walking than densities. This supports the research discussed in Chapter Three that emphasized the role of proximity in walkable neighbourhoods. These findings suggest that developing Scottish neighbourhoods to be dense and well-connected may not adequately encourage walking without proximal destinations such as shops and central business districts. Planning policies aimed at redeveloping urban spaces to be more walkable should aim to integrate density with proximity, in particular, having a range of accessible shops and facilities. Another notable finding from the SHeS analysis is the significance of socio-economic composition on walking behaviour. This remained significant even when considered alongside (controlling for) individual indicators of socio-economic status, such as education and income. In other words, a resident living in a data zone with

a wealthier composition is more likely to walk regardless of his or her personal socioeconomic status. It could be that this is a reflection of the unmeasured aesthetics and attractiveness of an area. For example parks, green space and traffic safety measures are dimensions of urban form not measured here that may stimulate walking, as may perceptions of safety.

Comparative data analysis from the City Form Survey goes some way to understanding the nature of spatial differences in walking. The results show that residents of central neighbourhoods are significantly more likely to travel to the shops and to work by foot or bicycle, whilst residents of outer-city neighbourhoods are significantly more likely to travel by car. This supports previous research that has found that the neighbourhood differences in physical activity are due to incidental walking rather than sports or leisure activities. In Chapter Three, the point was made that cross-sectional analysis does not establish causal direction. In particular, the data presented here is better understood as establishing a number of associations. There remain some questions regarding whether residents' behaviour is substantially changed through environmental enablers or restraints, or whether residents tend to live in areas that reflect their behavioural and travel preferences. The inclusion of health-related behaviours within the regression model could be argued to provide some control for neighbourhood selection. In other words, it could be said to be controlling for those that have healthier behaviours and would be active regardless of neighbourhood context. Issues relating to health-related behaviours, dispositions towards being active and behavioural change are explored in more detail through the qualitative analysis presented in the following chapters. Travelling to shops and to work as well as sports and exercise and park use were key themes in the semi-structured interviews. Availability of shops and facilities is explored in more detail in the interview study, with particular attention to differences between participants from an inner-city (Dalry) and outer-city (Corstorphine) neighbourhoods.

CHAPTER SIX: NEIGHBOURHOOD AND RELOCATION

The following two chapters present the qualitative findings. The data is presented in such a way as to best represent what was said in the interviews. This means that it reflects not just the average experience, but the total range of experiences. Both chapters are organised thematically, exploring and explaining particular topics through participants' common or contrasting accounts. As discussed in Chapter Four, the qualitative analysis generally avoids numeric representations. Meaningful inference is made based on the internal logic of the interview as a whole, not just on the frequency in which phenomena occur. As discussed in Chapter Four, some numeric information is given where it helps the reader to associate the data within the case study groups and with the other components of the research. This chapter looks specifically at participants' reasons for relocating and experience of their neighbourhood. The purpose is to develop accounts of neighbourhood selection and neighbourhood-use in order to evaluate the selectionist explanations relative to walkability. Neighbourhood selection was outlined in Chapter Three; it refers to the argument that behavioural differences between neighbourhoods are largely explained by the way in which individuals will elect to live in places that support their travel and activity preferences. For this reason, particular attention is given to how participants' relocation decisions are related to their daily activities such as car-use and active travel. If there is evidence that people relocate to 'realise travel preferences', then this potentially weakens the viability of walkable neighbourhoods for changing behaviours.

This chapter starts with short descriptions of each of the case study neighbourhoods (Dalry, Restalrig and Corstorphine) followed by a summary of the main reasons people gave for moving to those areas. This is followed by an extract that demonstrates how narrative accounts of moving home are often complex and contingent on life events. Because of its prominence in the accounts of many participants, data is presented related to 'settling down' as a particular type of relocation. The discussion then turns to neighbourhood selection and the parameters in which people are able to choose where they live. Some residents had little or no choice; others had to prioritise between different neighbourhood attributes. This is followed by a discussion of data related to transport, green space and shops. Finally it is concluded that relocation and neighbourhood choices are heavily embedded in residential trajectories and biography. The decision of where to move to depends

greatly on particular events and life stages. In particular, settling or 'home making' is a distinctive moment of relocation in which attributes of the walkable neighbourhood, although appealing, are often foregone. The biographical context of relocation decisions is largely underestimated in selectionist accounts. The chapter closes with a discussion of how these findings relate to the research objectives.

6.1 The Neighbourhoods

All interview participants had recently moved into one of the three case study areas: Dalry, Restalrig and Corstorphine. These are the same Edinburgh case study neighbourhoods that were part of the CF survey data presented at the end of Chapter Five. Dalry represents an inner-city area and Corstorphine represents a more suburban neighbourhood. Restalrig represents an 'in-between' area with attributes of both types of urban form. Before exploring what was said in the interviews, these neighbourhoods will be briefly described, with reference to the particular areas that participants have moved to. By interviewing residents relocating to neighbourhoods of different walkability, the aim is to compare their respective reasons for moving and neighbourhood experiences. Figure 6.1 list the participants from each of the case study neighbourhoods.

Kurt
Brenda
Kelly
Abijah
Felicity
Ben
Dave
Jack
Amy
Peter

Dalry

Lindsey
Barbara
Arnold
May
Larry
Clare

Corstorphine

Penny
Victoria
Rhona
Hilary
Donna

Restalrig
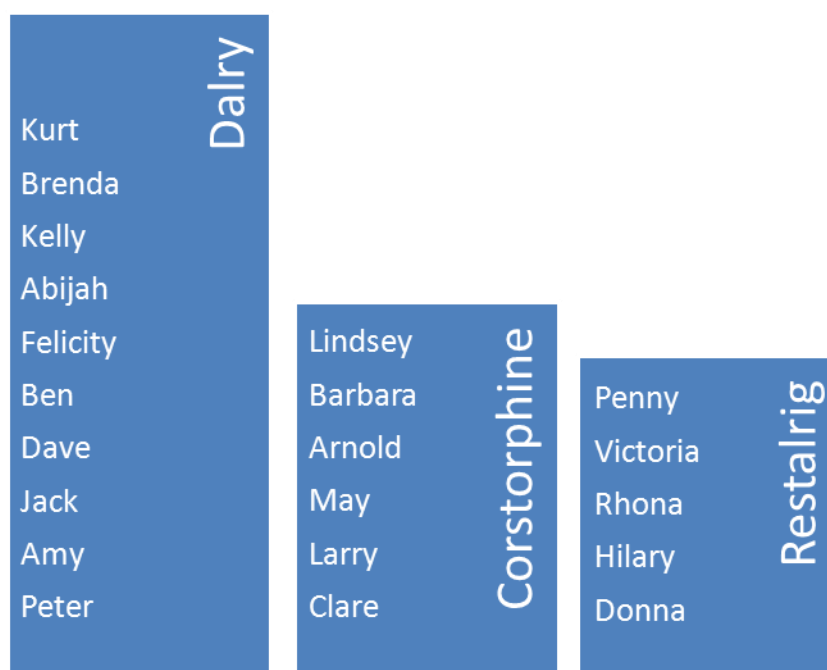
Figure 6.1: Comparison of the number of participants from each case study neighbourhood

6.1.1 Dalry

In the SHeS analysis presented in the previous chapter, Scottish data zones were given a walkability score of 0 - 6. As the example of a more walkable neighbourhood, the Dalry case study area contains a number of data zones that would score five or six, in terms of density, proximity and centrality. Dalry is a central urban area that is ten to fifteen minutes' walk west of Princes Street and the Edinburgh city centre (approximately 1.5 miles) but very close to Haymarket station/interchange and the 'West End' offices. The neighbourhood is situated around three arterial roads travelling west from the city centre: Dalry road, Gorgie road and Western Approach road. It has a high density of flats and tenement buildings and a variety of shops and facilities. The Dalry area has a high percentage of single person households and young couples, and there are relatively few families in the area compared to other Edinburgh neighbourhoods. Although Dalry has few green areas within it, there are some within a walkable distance; The Meadows park in Bruntsfield, Harrison Gardens and the Union Canal. The Union Canal is notable as it provides a walkable green route from Falkirk through the Dalry area to Edinburgh Quay and the city centre. The urban layout of Dalry is compact with a grid and cul-de-sac form (Jenks and Jones, 2010). There are a number of leisure facilities

including swimming pools, gyms and a large multiplex cinema. There are some large supermarkets accessible from the Dalry road as well as a variety of privately owned stores and some pubs and restaurants. Traffic on the Dalry road can be very heavy and the area can be quite polluted (Esteves-Booth et al., 2001). The Dalry-Gorgie road is part of several major bus routes, so the area is well-served for public transport.

Figure 6.2: Dalry is a busy central neighbourhood characterised by tenements and ground-level shops.

Ten of the participants live in Dalry: Peter, Kurt, Amy, Jack, Dave, Ben, Felicity, Abijah, Kelly and Brenda. Kelly and Dave both live in the colonies, which is an untypical part of Dalry with semi-detached maisonettes which are slightly separated from the main road and have small front gardens. Of all the participants, those from Dalry had the broadest range of opinions about their neighbourhood. Most had moved to the neighbourhood for practical reasons such as for a new job or because of affordability. None of the Dalry participants had or were expecting children.

6.1.2 Restalrig

The second Edinburgh neighbourhood is Restalrig. It was designated a 'middle' area within the City Form project, neither inner-city nor suburban outer-city. Restalrig lies north-east of Edinburgh centre. The layout in Restalrig is primarily gridded but not orthogonal (Jenks and Jones, 2010: 41).

There is a fairly even mixture of detached, semi-detached and terrace houses. Two-thirds of Restalrig homes are owner-occupied and less than one-tenth are privately rented (Jenks and Jones, 2010). Social rented accommodation accounts for 17% of housing in the area and almost 40% of the residents are retired (Jenks and Jones, 2010). There is a large supermarket and only a small number of privately owned stores. The area is bisected by a major road and railway line. Arthur's Seat and Holyrood Park, popular Edinburgh heritage sites, are visible to the south and can be easily accessed by residents living in the south of Restalrig. Another notable green space is Lochend Park. It contains Lochend Loch and children's play area. Five of the participants were living in Restalrig: Victoria, Rhona, Hilary, Donna and Penny. Two of the participants, Rhona and Donna, lived in social rented flats and had had very little choice about their neighbourhood location. Penny lives in a mortgaged flat and plans to buy a property in the same area. Victoria also wanted to settle into a family home, although she was planning to move out of Restalrig. Hilary and her husband had moved within Restalrig and felt attached to the area.

6.1.3 Corstorphine

Corstorphine was chosen as the suburban case study neighbourhood. In relation to the walkability scores used in Chapter Five, Hillview Drive (S01002111), a typical Corstorphine data zone, would score only one or two. This reflects that it has low density, few junctions, lacks proximity to shops and is not central. Corstorphine is further west, approximately Four miles from the city centre. It contains a higher number of residential, detached and semi-detached properties. Much of the Corstorphine's residential area is to the north of the Corstorphine/ Glasgow Road (A8). This road leads east to the city centre and west to Edinburgh Airport and receives quite a lot of traffic, particularly during peak times. Corstorphine also has a large supermarket and a large computer store that are positioned on the A8 for customers to access by car. This arterial road also functions as a local Corstorphine high street with a small number of shops and services. A large proportion of the population in Corstorphine are retired, almost a quarter of households in Corstorphine have children and almost all homes in this area are owner-occupied (Jenks and Jones, 2010). The large residential area of Corstorphine is dominated by semi-detached and detached buildings with private gardens. The main road is serviced by a small number of frequent bus routes, and for many Corstorphine residents it may be feasible to travel into the city centre by bus. Six interview participants lived in Corstorphine: Lindsey, Barbara, Arnold, Mary, Larry and Clare. Four of the participants described moving to find the ideal family home and another to find a good school catchment area. Clare had moved due to being dissatisfied with her previous neighbourhood. Larry was an exception as he lives

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in Clermiston, which is close to but just outside of the case study area. Clermiston is generally more affordable with more flats and social rented accommodation.

6.2 Relocation Reasons by Neighbourhood

The interview data suggests that people do not decide to move house because of preferences for transport and lifestyle alone. Within the interview sample the most common reason for relocating was either a new job or what can be described as a 'life course event'. The events described were moving out of a parental home, moving in with a partner, getting married and having children. After these initial motivations, affordability and commuting distance significantly delimit neighbourhood selection.

Dalry	**Restalrig**	**Corstorphine**
REASON: Cohabit, a new job, have own place, to buy.	**REASON:** New job, settling down. Get away.	**REASON:** Married, having children and settling down. Get away.
ATTRACTION: Central, green, shops, walkable, friends and family.	**ATTRACTION:** Central, green, convenience, central, friends and family.	**ATTRACTION:** More space, more rooms, own garden, own door, green, quiet, family-area.

Figure 6.3: Summary of the reasons for relocating by case study neighbourhood.

Figure 6.3 summarises the different reasons that participants gave for relocating. There are notable differences between case study areas. Residents living in Corstorphine tended to say that they had moved to settle and raise a family. The two exceptions to this (Clare and Larry) said that they had

moved in order to get away from an inner city area. There were common themes in how people talked about their relocation, which recurred throughout the case study areas. Many participants said that they had been attracted to their neighbourhood because it was green, even the inner city area. Convenience for daily tasks was a more common attraction for Dalry and Restalrig participants, as was being close to friends and family. Aspects of the home rather than neighbourhood were more given as attractions by those who had moved to Corstorphine.

The next part of the chapter focuses on how types of property and neighbourhoods are associated with stages in a person's life. The following section considers how neighbourhood selection and choice plays a part in relocation within participants' capabilities.

6.3 Residency and Biography

Typically in the interviews, reasons for relocating were both practical and related to the participants' biography and life events. During interviews the question tended to invoke personal accounts of life course and biographic history. Each participant had their own story of why they decided to relocate to that place at that time. The following extract is from the interview with Amy from Dalry. It has many themes in common with the other interviews and also highlights some of the richness of this type of story-telling.

> I had got a job … [...] in Lanarkshire so... well I could of lived there in that area in Lanarkshire but it's awfully remote! And then I spoke to some friends who were living in Edinburgh. They said that they were living here [in Dalry] and that they had a spare room. I'd lived with them before so I knew we wouldn't kill each other and it was the right end of town for the commute… because you just go [..] to the [place of work]. And it meant that I had other people - because it is quite a grim place to work so it was quite important that you have friends when you come back [home]. So that ticked all the boxes and I commuted. I did that commute for about four years. Erm which was great and as I say, because we're on the west it's easy access to Glasgow and things and it's not difficult to get on to […] where my parents [live]. Erm so it's all good! [My fiancé] seems to like this; he ... he was in West Coates when we met which is posh obviously... [I: Hm] Erm and he moved [...] so he's been in this area too so yes we both sort of gravitated towards the west of the city; we're not interested in Leith, so... Portobello that sort of end of town doesn't attract us at all. 'Cause because we're getting married we're sort of contemplating where the next move might be...

Amy, 28. Moderately Active. Dalry.

The reason for opening the discussion with this extract is that it contains themes that are common across the interviews. Firstly, when asked about her recent move, Amy does not describe one move but three: her previous move to Dalry with friends, her recent move with her fiancé and her plans to move again once they are married. In none of the interviews did a participant discuss their recent move as an isolated event. All participants provided an account of their relocation within a richer context of their residential history. Amy's initial move to Dalry was prompted by a new job; she describes utilising an informal opportunity to live with friends in order to realise her preference for being more central in Scotland than Lanarkshire. Throughout the interviews, participants' description of neighbourhood preference are interrelated with accounts of utilising resources and opportunities, not just money but also networks of family and friends. When Amy recently moved again to live with her fiancé, they both wanted to stay in central Edinburgh. She says that they had both 'gravitated' to the west of the city. This idea of 'gravitation' illustrates how relocation occurs through a combination of coincidence and deliberation. The last move that Amy mentions is the future move once she is married. Again, it was common for participants to discuss plans for where they would move next. Future relocation plans were often discussed in the interviews as a continuation of life course and events. Specifically, marriage and having children is seen as the point at which relocation should happen.

Whilst Amy's story is unique to her, many of the themes recur throughout the data and are explored further in this chapter. It is helpful however to start by illustrating and acknowledging the 'messiness' of these stories. In the course of conducting the interviews, it became apparent that it made little sense to separate relocation from a person's life course, as moving home is contingent on life events. Within these parameters people are able to make some choice about where they move to.   What is interesting about some of the stories recorded in these interviews is how they reveal some of the ways in which people can 'gravitate' to certain areas.

6.3.1 What Makes a House a Home?

'Settling down' describes a particular type of relocation that is linked with family and children, in which a person relocates as part of a new stage in her life. As outlined earlier, 'settling' is interesting because it represents the transition to what is for many people, the longest and most significant period of residency. It is has also received little attention from within the field of physical activity

and environment research. In order to capture this type of relocation, participants were delimited to an age group most likely to be making this change. All of the participants discussed plans to settle down, although only four specifically identified their recent move as moving into a family home: Lindsay (Corstorphine), Barbara (Corstorphine), Mary (Corstorphine) and Hilary (Restalrig). With perhaps the exception of Hilary, these women's experiences were remarkably similar. They were recently married, recently had a baby or were pregnant, and had moved from an inner city tenement flat to a suburban house. These women also had similar accounts of why they decided to move. The common 'pull factors' were: having a garden, more space, better parking, and own front door.

> The pull factors were obviously just to have a bit more space and to have a garden.

> Barbara, 34. Corstorphine. Moderately Active.

> [We] particularly needed a garden – that's quite important. And for me – because I hate parking – really wanted to move somewhere I could park easily – with a small child. So we looked at a few places and went for a few houses – in a variety of areas.

> Lindsey, 33. Corstorphine. Moderately Active

These attributes of the property were discussed as practical necessities for having children, but they were also discussed as more emotive sense of what feels like a family home.

> You know, I wasn't up for the kind of er living in town in a flat anymore I was over that and wanted a bit of peace and quiet and you know this area is not dissimilar from the kind of area that I grew up in back in Aberdeen, so...erm although I lived in a very different type of .. I grew up in an ex-council flat but the kind of look and feel of the place is quite similar so it is quite nice to find something that er makes you feel all warm and fuzzy inside!

> Barbara, 34. Corstorphine. Moderately Active.

Here Barbara was contrasting her previous flat with her new house. She says that having a house makes her feel 'warm and fuzzy'. This emotive sense of a nice family home being a house rather than a flat was expressed by other interviewees. In the extract above, Barbara alludes to memories of her own childhood, despite having grown up in a flat herself. Interestingly, the analysis suggests that the idea that a family home should be a house is not related to the type of building that the participant

grew up in. Even those who had not lived in a house before shared this ideal of a detached or semi-detached house being a 'proper' family home.

Clearly there are practical aspects of wanting to move into a house rather than a flat to raise a family. However, the interviews suggest that the connection between house and home is also partly cultural. Participants often had an idea of the 'family house' that was beyond the practicalities of space. This idea was connect to childhood and family, regardless of the property type that the participant grew up in. This suggests it is cultural ideal rather than based on personal experience.

6.3.2 Natural Progression

For many Corstorphine residents, their move was more about being at a particular stage of life that is suited to a particular property. Some Corstorphine participants even described having to compromise on aspects of the neighbourhood in order get a house and garden.

> We decided that it would be nice. Yeah it would be nice to move into a house... we were both living in flats which was nice in many ways but we were tempted by the idea of having somewhere with a garden

> Arnold, 37. Corstorphine. Low Activity.

Arnold and his wife described being very happy with their previous neighbourhood but felt that the time was right to have a house. Participants felt that moving to a suburban home was something that was expected and 'natural'.

> Well 'cause we were staying in flats before, so it was moving on to a house rather than a flat. Flats didn't have gardens so it's just one of those natural progressions, I think.

> Mary, 31. Corstorphine. Highly Active

Other participants described being 'at the right age' or feeling it was 'the right time'. This was not isolated to those that had recently 'settled down'; all participants recognised this as a definitive stage of relocation that they would make some day. This is important because it was discussed as a

move that happens *despite* a preference for a particular type of neighbourhood. Here for example, Ben is talking about how he enjoys living in Dalry.

> At the moment yes! [slower] I don't know what's going to happen later on if we have kids and stuff [1.0] somewhere a bit more *suburby* might be more suitable. But at the moment it's brilliant!
>
> Ben, 26. Dalry. Moderately Active.

Similarly, Kelly was happy with living in Dalry; she was particularly enjoying being able to walk places. Yet despite feeling comfortable at her present place, she says that her current property was not a 'proper' house.

> R: Yeah. And I think that, in the future – say in ten years' time - then I will... and I'm looking for a proper house, well you know a *family house*, then it'll be at the edge in a town where I can still walk places but it'll be quieter.
>
> I: And when you say a 'proper house' what do you mean by that?
>
> R: Err... like a [1.0] yeah, one that you will – yeah, one that you will raise your family in - rather than just one for a couple of years.
>
> Kelly, 25. Dalry. Highly Active.

Even for participants who were not currently settling down there is an awareness of this as a distinct perhaps inevitable stage in life. Just as Mary described her recent move as part of a 'natural progression' other participants felt that this was where they were headed. Unlike other types of move that may be transient and for practical reason, the 'proper' move was something that only happens once. Here Lindsey describes how it was important to get it right the first time.

> And then our house came on the market – and we hadn't really been looking at Corstorphine that much – just a couple of things – and I just loved it! My husband would have moved anywhere, but I was like: no it must be the right house I'm not interested in moving somewhere that's not right for us – I don't want to move and then move again!
>
> Lindsey, 33. Corstorphine. Moderately Active

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Just as Kelly had an idea of the proper house as a place of fixed accommodation, Lindsey realised that this meant getting the house right. In this sense, the family house is seen as the end point in a person's prospective residential trajectory. It is a distinctive type of move that marks a different stage in life and what is for most people a long period of residency.

An interesting exception to the 'natural progression' of residential relocation was Arnold and his family. He and his wife recently moved to Corstorphine to be within a school catchment area for their son and for commuting purposes. Just like other 'home makers', Arnold and his wife had felt that they were at a particular stage in their lives when they wanted to live together in a more spacious property and liked the idea of having a garden. However, during the interview he said that they had recently changed their minds and decided to move again. Only a year into their suburban residency, they found that Corstorphine was not 'working out'. Compared to their previous inner city neighbourhood, Corstorphine was a disappointment and 'deathly boring'. They had decided to leave their jobs to start a business venture elsewhere. So in this instance, they were moving out of the family home. On the face of it, Arnold's story seems to contradict the idea of the suburban household as something that should happen just once, and yet it may be the exception that demonstrates the rule. Arnold described their imminent move as an 'adventure'; something that made them both excited and nervous. This thrill and apprehension is in a sense an acknowledgement that their next move goes against the grain. It was perhaps something that a younger couple might do, but for a married couple with a young son, moving out of their suburban house is an 'adventure'. In this sense, Arnold's story in fact underscores the fact that there are social expectations around how a 'normal' trajectory of residency should happen.

6.3.3 A Time and a Place

Lindsey self-identified as having made this 'normal' transition from an inner-city dweller to suburbanite. Although there were many aspects of living in Bruntsfield that she enjoyed, Lindsay felt she was at the age when she wanted the peace that came with a suburban house. In the extract below, she discusses her disenchantment with the inner city as something that comes from getting older.

> There was more anti-social behaviour if you like... groups of youths hanging around and shouting in the street. Just students – no offense – but you know shouting in the street and

things. And you get to the age where you think: you know I'm sure the argument is really important but we're all just trying to get a bit of sleep here!

Lindsey, 33. Corstorphine. Moderately Active

Lindsay described being 'over' the whole student-living that she associates with tenement flats. The evidence from the interviews has highlighted how particular neighbourhoods are associated with particular life stages. Being in the inner city was associated with being younger, a student and having an active social life. Being in the outer city was associated with a more mature focus on family and home. Just as Amy described not wanting to live in Lanarkshire because it was too remote, Brenda describes why she decided to move out of a rural village into Dalry.

Yeah, [at the] village there is nothing much there: perfect for bringing up children; perfect for retiring into. But in my age group… But in my age group, unless you *do* want to settle down and have kids I don't think it's an ideal place. I didn't really want to stay there. When I lived in Aberdeen, I always rented and always stayed within walking distance from where… I want to be.

Brenda, 29. Dalry. Moderately Active.

Brenda was unable to stay at the village because there was 'nothing there'. This can be taken to mean a lack of entertainment and places to go. Interestingly, in Brenda's account, this absence actually makes the place more suited to raising a family or retiring. Stages of life that Brenda feels she is not yet at. In the next line she talks about her own preference as involving living in a place in which she would be within walking distance from places. A couple of Dalry participants resisted the idea that they would ever move somewhere suburban, joking that this was associated with being inactive, or old. Yet the same participants also conceded that it might be something they would consider when it came to settling down.

6.3.4 'Somewhere Safe, Somewhere Quiet'

It has been suggested that participants who are 'settling' are perhaps attracted more by the property rather than neighbourhood. However, certain types of neighbourhood were felt to be more suited to having a family. It was common to associate the inner city as being busy and noisy, and the suburbs as being safe and quiet. Although not reported here, the City Form data shows that

residents of outer city neighbourhoods are more likely to report their neighbourhood as being safe and quiet than those from inner city neighbourhoods. This difference is also true of the interview respondents. Unprompted, almost all Corstorphine participants volunteered their neighbourhood as somewhere that was 'safe and quiet'. For Clare finding peace and quiet was the primary reason for moving to Corstorphine from inner city. She described how the noise from neighbourhoods, traffic and nightlife had become unbearable for her.

> Like I said it was a move out of necessity...because, yeah, with the shifts, I was just getting driven mad by neighbours, noise and traffic and everything! I just had to find somewhere that was quieter..!
>
> Clare, 38. Corstorphine. Low activity.

Her decision to move to Corstorphine was, as she put it, a 'decision of the heart rather than the head' and was motivated by the desire to have some peace and quiet. Many Dalry participants also talked about experiencing noise and even feeling unsafe at times.

> I live in constant sirens... police and people going... [laugh] at the weekend: there's a couple of pubs.
>
> Jack, 38. Dalry. Moderately activity.
>
> You get a bit of noise that tends to be later - about four o'clock in the morning when they've staggered back. So that's quite annoying.
>
> Peter, 38. Dalry. Highly active

Participants talked about noise from traffic and people congregating near shops and outside pubs, especially late at night. For many however, this was an acceptable cost of living in an inner city area and some even felt it was part of the 'inner city experience'. For example, Peter downplayed the recent theft of his bike, blaming himself for not taking better care whilst living in the inner city.

> In the extract below Barbara discusses why it was important to move out of an inner-city flat. As shown above, Barbara's 'pull factors' were having space and a garden. However, here she says something of the 'push factors' that made her want to move away from her previous inner city flat.

[There were] kids […] going about at night and things erm and I was just over the whole sharing the stairs and things. That was the push factors.

Barbara, 34. Corstorphine. Moderately Active.

When she talks about 'kids going about at night' she is describing youths that she could see in her previous neighbourhood. Although she had not experienced crime, these were visual clues that the area is 'rough' and not suitable for settling down. Other participants had similar stories about neighbourhoods with 'not very nice characters'. In contrast, Barbara describes the composition of her new Corstorphine neighbourhood as 'standard' and comprised of 'nice families and things'. In this sense she is doing what can be referred to as identity work: normalising the values she wants the interviewer to identify her with. This normalising of 'nice family' values and ideals was common when participants framed their neighbourhood experience. In the extract below, Rhona describes how she knows what the neighbourhood is like by viewing the people in the area.

You know neighbourhoods are all friendly- er, people are not– the kids are going up and down on their bikes and... walkin' past and playin' whatever with their go-carts and stuff. 'Eh, it's a nice neighbourhood you know: people look after their gardens, you know, and er everybody is just busy working and doing their own thing.

Rhona, 31: Restalrig – Moderately Active

What is interesting about this quote is that Rhona did not personally know the people in her street. She has an impression that they are 'nice and friendly' from watching them 'walk past' and 'doing their own thing'. Seeing 'kids playing', 'nice gardens', and busy people are signs that the neighbours 'won't cause much bother' because, essentially, they are employed and have children. The evidence is that neighbourhoods composed of families and children are thought of as more desirable; regardless of the participant's own family-status. As Barbara goes on to say, finding such an area may simply be a matter of cost.

And not to be a snob about it... but if you're charging 350...400 grand for a house; it's not going to be people who … are going to cause much bother!

Barbara, 34: Corstorphine. Moderately Active

It may be that this is comparable to the neighbourhood composition variable used in the logistic regression model in Chapter Five. Having a high socioeconomic composition was shown to be a significant predictor of walking, regardless of the respondents of socioeconomic status.

Participants gave accounts of the neighbourhood through discussing the type of residents who lived there. Impressions of fellow residents were achieved through visual clues, for example people being busy or 'hanging about'. A neighbourhood that is felt to be 'nice and quiet' is one associated with families and young children. Participants looking to settle down are attracted to places that have other young families. From the interview accounts, living in the inner city may come with costs of being noisy or feeling less safe, but was more suitable to being younger and more socially active. Being busier with a more mixed composition of people, Dalry may be less attractive as a 'family neighbourhood'.

6.3.5 Life Course and Relocation

Clearly life course context is central to a person's decision to move home. This could be moving out of a parental home or moving in with a partner. In these interviews, settling down and raising a family were recurrent themes of discussion. Participants described a type of natural progression of residential trajectory, which involves eventually moving to a larger home. Neighbourhoods too were related to particular stages in life. The interview data shows how different types of relocation are not equivocal; a person may move for different reasons depending on their perceived 'stage' of life. Participants describe deciding to move to the suburbs based on an entirely different set of priorities than previous relocations. Evidence has been presented which suggest that this is a type of relocation that is often motivated by the need for a particular type of property. In particular, 'settling down' is a distinct type of relocation motivated by the property rather than the neighbourhood. Some participants described their move as happening despite rather than because of their neighbourhood preference. The next part of the chapter looks more specifically at participants' neighbourhood preferences.

6.4 Neighbourhood Preference

Recognising the significance of life course is not necessarily to discount neighbourhood selection. Instead it highlights that neighbourhood selection happens within the parameters of a person's

particular needs and resources. This section is about how the interviewees chose where to live. To repeat the definition given in Chapter Three, 'neighbourhood selection' is used here to refer to a situation where a person moves to a neighbourhood that facilitates their travel and lifestyle preferences. The most pertinent examples of neighbourhood selection will be where somebody moves in order to realise a preference for walking, cycling or car travel.

People have varying degrees of choice in when they move and where they end up living. The idea of 'neighbourhood selection' discussed in Chapter Three makes it easy to imagine that people have the freedom to move to areas that are best suited to them (Frumkin et al., 2004). Of course, in reality, few people are free to move where they wish and the vast majority have to make compromises depending on their available resources. One of the most important factors in how participants related to their neighbourhood was how convenient the area is for every-day activities such as travelling to work or shopping. This section presents participants' accounts of neighbourhood use and facilities. Access and convenience could include a broad range of things. This section considers them under the themes of *transport*, *shops*, and *green space.*

6.4.1 Little or No Choice

Before looking at those respondents that have some degree of 'neighbourhood choice', it is important to acknowledge those that had little or no choice of where they live. Three participants, Larry (Clermiston), Rhona (Restalrig) and Donna (Restalrig), can be said to have not have chosen the neighbourhood they recently moved to. Larry is (quite literally) an outlier because Clermiston is just outside of the Corstorphine study area (<1km). Whilst Corstorphine has a relatively high proportion of detached properties, Clermiston is perhaps similar to Restalrig in having more social and affordable housing. Larry and his wife moved as part of a housing scheme necessary for their particular disabilities. They had initiated the move, having suffered from antisocial behaviour at their previous inner-city neighbourhood. However, they were entirely dependent the availability of suitable housing. Larry was happy with the new neighbourhood and described regularly using the local shop and bus facilities. Unlike Costorphine participants, Larry felt there was some crime locally.

Donna had moved to Restalrig, also as part of a social housing programme. Despite being very positive about her new flat, it was clear during the home-interview that some aspects of the property and building were a problem. Donna lives alone and uses a wheel-chair. The flat is several floors up in a high-rise apartment block. She admitted that she may not have elected to move there

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because it was not ideal for wheel-chair use. However, she said she felt at home, and praised the feeling of community in her immediate area. She too felt that some parts of Restalrig were quite rough and there were signs of crime, although generally felt safe. Despite her physical disability, Donna is a very active person. She dislikes staying at home for any length of time, even to the point of saying that she would be off as soon as the interview was finished. It was clear that the nearby pavements presented consistent difficulties in manoeuvrability, although she was quite stoic about it:

> In the car park here there is no pavement that goes straight along without stopping [I: Yeah?] you have to like physically get off the pavement and then back on again. So it's easier for me just to drive on the road [I: Yeah] most local drivers know me but some drivers drive like maniacs!

> Donna, 23. Restalrig. Moderately Active.

Pavements and curbs are something that able-bodied people rarely think about, but for Donna they are a daily challenge. However, she was keen to point out that these environmental barriers rarely get in the way of her doing what she wanted. She was eager to demonstrate that she led a very active life. The only thing she felt prevented her from doing what she wanted was when her wheel-chair malfunctioned: 'When my wheel chair stops,' she told the researcher, 'then the whole world stops'.

The third participant who was not able to choose her neighbourhood was Rhona. She and her five-year old son were moved to social housing on a quiet street in Restalrig about three years ago. It was clear during the interview that, being a single mother who is long-term unemployed, Rhona feels particularly isolated. She desperately wanted to have more adult contact although she said she felt ashamed to invite other mothers over to her place which was small and sparsely furnished. As described in the previous section, Rhona only knew a few people in her street, but describes feeling safe because of the visual clues that fellow residents are employed and have children. Although she enjoyed the peace of mind that came with living in a neighbourhood where her son could play outside, she missed living somewhere with more social activity: 'It *is* quiet,' she told the researcher, 'that's why I want to get out of this area; there is nothing happening!' Perhaps because of the desire to meet others, Rhona was making good use of local facilities. She often used the local library and community centre, which she spoke positively about. Not owning a car or being able to drive, Rhona and her son cycled frequently. They were able to get about very well using their

bikes, although Rhona seemed unsure whether cycling was something that she enjoyed or whether it was purely a matter of necessity.

In asking the question 'why do people live where they do', it is important to recognise that some residents have very little choice about where they end up. Thankfully Larry, Donna and Rhona were relatively happy with the neighbourhoods in which they lived, although Rhona felt there was a lack of things 'going on'. Each can be said to have made use of the local facilities in Restalrig. None of these participants returned accelerometer data; however, each reported moderate levels of physical activity albeit with a limited relationship to the built environment. Larry was actively involved in a 'keep-fit' group, Donna was physically active through her hobbies, and Rhona cycled regularly as a means of getting around. Being able to afford to a property is clearly fundamental to where you end up, and other participants described neighbourhood choice as happening within the confines of what they could afford.

6.4.2 Affordability

Throughout the interviews participants' described their decision making process as one which involved weighing the pros and cons of the areas which they could afford. For example Peter describes his pragmatic approach to selecting a Dalry flat in his price range:

> It's kind of neither good nor bad but middle-of-the-road, which I suppose is why I picked it; because it's middle-of-the-road… also in terms of cost. Not being able to afford other places.

> Peter, 38. Dalry. Highly Active

What Peter describes as being 'middle of the road' is in fact a comment on how he has weighed-up the options within his price range. Like other participants, he then prioritised aspects of the neighbourhood available to him. For Peter, the most important factor was having cycling access to the city centre and to the canal. Having to decide between neighbourhood attributes were common for those looking to settle and they often described being 'priced out' of particular areas. Amy, who had described gravitating towards the city centre, recognised that she may need to move out of the city once she was married:

I like being close to the city [...] I like having the ease of access to things. Living in the country or a rural settling wouldn't [do]. I think I like the convenience of having things there. But, as you can see, I think maybe moving out a wee bit. But, yeah, I like being in the city.

Amy, 35. Dalry: Moderately Active

Amy expressed a strong preference for living in the inner city because of having a walkable access. However, she said this might have to be compromised to afford the right kind of property. Within their financial capacity, participants ranked and decided between different neighbourhoods. It has already been argued that participants described having to compromise on neighbourhood preferences to get the right property. This following section will present interview data on preferences for specific neighbourhood attributes, namely, transport access, green space, shops and facilities.

6.4.3 Green Space

For many people, having accessible green space was an important factor in deciding where to move. It has already been mentioned that having a private garden is a notable pull factor. Public parks, woodlands and natural space were also significant factors discussed by residents. It may have been expected that Dalry, as an inner city area, would perform poorly in terms of green space. However, Dalry participants said that they enjoyed the canal, Harrison Park and the Water of Leith. Many participants felt that green access was good even in inner city areas of Edinburgh. The canal and the Water of Leith were particularly noted as attractive through routes. For some, green space was the reason they chose to live in Dalry.

One big thing when I was considering where to move to was it didn't have to have green space immediately on the door step but it needed to have easy access to [it], so the fact that the canal is very close [I: Yeah] you can get to the canal in five minutes you can get to the Water of Leith in five minutes you can get to The Meadows in fifteen. So that was a big for… that it was close enough to get to [green space] easily.

Kelly, 25. Dalry. Highly Active.

Kelly enjoys walking regularly. In fact prior to the interview she had walked home for over an hour using the Water of Leith pathway. For her this was a relaxing part of her daily routine, and something that was very important to her. Accounts of enjoying green space correspond to research that identified green space as having restorative effects and reduce stress (Grahn and Stigsdotter, 2003, Pretty et al., 2005, Nielsen and Hansen, 2007). Like Kelly, Peter and Felicity also said that they chose to live in Dalry because it had accessible green areas. However, whilst Kelly liked to have green space on her doorstep, Peter and Felicity are both keen cyclists and described cycling out to the Pentlands.

Restalrig participants talked about using Leith Links, Lochend Park and Holyrood Park. Hilary said that Holyrood Park was the main reason that they had originally moved to Restalrig and an important part of their reason for staying. Similarly, Penny described the Leith Links as being a significant attraction to her neighbourhood. She said that she uses the park on most days. For Corstorphine participants, the woodlands on Corstorphine hill were the most attractive local green space. It is interesting to note that there is no conclusive difference between case study areas in how participants rated their access to green space. The evidence suggests that some of the inner city residents make good use their local green space. A few of the Dalry participants were more forthcoming in identifying green space as the deciding factor that made them move to the area. This is more often about having a pleasant commute to work rather than leisure-time walking. Green space use corresponds with time being active either through cycling, like Peter and Felicity, or spending time with children, like Victoria, Hilary, Rhona, Penny and Lindsey. Importantly, most of these participants, and in particular Kelly, Abijah, and Kurt, discussed enjoying green space as somewhere to walk, sometime as a route to somewhere else and other times just for the pleasure of walking.

6.4.4 Transport and Commuting

As mentioned above, Kelly's preference for walking was a 'big' part of her decision to live in Dalry. She walks from work every day and told the interviewer that if she could not walk places then she would not live there. Another participant keen on walking is Felicity. When her and her boyfriend decided to move to Edinburgh, she actually found the property whilst walking.

It's fine, yeah, it's worked out a treat. We looked around at various things and- and looked a bit further out of town. I was walking along the canal in order to go and visit something else, and I spotted the 'for sale' board... and I thought: 'that's what I want!'

Felicity, 31. Highly Active.

Having walkable access to work was seen as an attraction by many of the Dalry participants. Although for some participants active travel is also feasible from Corstorphine. For example, Arnold and his wife did not change their active commuting after moving to the neighbourhood.

[School catchment was] ...the main motivation really and we are both working [centrally] which is where we met; myself and [my wife]. And although we're both a bit further away in actual distance from [work] - it's pretty easy to commute to work by either bus or cycle.

Arnold, 37. Corstorphine. Low Activity.

Arnold is principled about car-use and said that he disliked the idea of commuting by car. He told the interviewer that they would only use their car on ad hoc trips out of town or to the countryside. This was the only account of active commuting from Corstorphine, however most described using the Corstorphine bus links. Therefore, as a neighbourhood, Corstorphine does not entirely restrict residents to car transport as found in other studies of suburban towns.

There was a general agreement throughout the interviews that Edinburgh has good transport links, which corresponds with findings from the City Form survey (Jenks and Jones, 2010). In particular, the bus service was well-used and viewed positively. All participants rated their access to buses as good or excellent and felt it to be an asset, regardless of how frequently they used them. Within the confines of circumstance and affordability, transport links could be an important aspect of neighbourhood choice. In this extract, Mary identifies the public transport connections as a decision about what kind of lifestyle she wanted.

I: ...What was it specifically about this area that made you want to move here?

R: There are a number of things: the bus service for starters. Because as both of us work in town and we wouldn't want to take the car into work every day – it's just not a lifestyle that we would want.

Mary, 31. Corstorphine. Highly Active.

The implication is that it had not been accessible by public transport Mary would not have elected to move to Corstorphine. It is worth noting that Corstorphine does not have the lack the public transport infrastructure described in some other studies of suburban neighbourhoods. Corstorphine does have fewer bus routes than Dalry and Restalrig, yet residents felt these were sufficient and many used the buses regularly. The City Form data show that bus-use is higher in Edinburgh than other UK cities. Even in Corstorphine which is further out of the centre there is a 'quality bus corridor' with more or less continuous bus priority lane on this route. Again, as with green space, the difference between case study areas are likely not to be as marked as in other studies.

In general, walkable access and public transport links were expressed by the participants as being common neighbourhood attractions. Whilst public transport was mentioned as an attraction to an area, the desire for car travel was not. Generally, participants were proud to say that they did not rely on a car. Those who did tended to present it as a necessity rather than a preference. Victoria, for example, was already comfortable with the idea that there next move would mean greater car dependence.

> I think our choice is influenced by cost because we need somewhere really with at least three bedrooms. 'Cause we have one baby and probably would like another one and will have family come to visit and things. And also because I work from home so could do with a spare room to do that. But um, so we'd probably have move out of town a wee bit. It would be great to find somewhere like this - somewhere central like this in our price range. But we're kind of priced out the nicer parts of this area. [baby noises] I think that, unfortunately, because we'll be priced out of the city centre a wee bit, you know, to get a three bedroom place this close to town is very expense. So I'd imagine, when we're a bit further, out we'll have to take the car more… Which is a shame.

Victoria, 34. Restalrig: Moderately Active

Victoria and her husband are currently living in Restalrig, but were looking to move again after having a baby. Similarly to Amy, she describes how needing a bigger property means being priced out of certain areas. For Victoria the compromise will unfortunately mean having to rely on a car. Several participants were willing to become more car-dependent in order to get the right property. For example, Lindsay said her car-use increased since moving to Corstorphine as part of, what she described as, 'a complete lifestyle change'. Similarly, Arnold described being against car use. He and his wife preferred to cycle places and avoided owning a car 'even' whilst living in Corstorphine.

However, he eventually gave in to mounting practicalities saying: 'the sort of accumulative weight of convenience basically drove us to get a car.'

These accounts suggest that behaviour changes do take place after relocation. It shows how increased car-use was expected by participants moving to a less walkable area. Attributes of the walkable neighbourhood tend to be desirable for participants regardless of their travel patterns. While these participants' accounts are not statistically representative of all people who move to low walkable neighbourhoods, the fact that the same expectation was expressed across people with different travel behaviours, and therefore inclusive, suggests that this is a finding of general relevance. The fact that car-dependence is tolerated rather than chosen by participants supports the suggestion that non-walkable neighbourhoods restrict residents' behaviour and can lead to changes in travel behaviour. Although the interview accounts suggest that residents of Corstorphine would prefer not to rely on a car, some participants said they were attracted to Corstorphine by better parking. For example, Lindsey talked about how unhappy it had made her to have poor parking at her previous neighbourhood. It could be argued that these are examples of a self-selecting group, who have prioritised car facilities and therefore correspond with the selectionist hypothesis. However, in general it can be seen that car-use was expressed by participants as a necessity, whilst walkability was more of a preference and desire. The value of this data is in how participants chose to express positive attitudes towards walking. This is not to say that this reflects what these participants actually do. Indeed it should be repeated that their actual travel habits varied. Instead it illustrates a taken-for-granted assumption that walking is preferable and this is likely to have cultural significance beyond the sample.

Clare is single and was not looking to settle down; she moved to Corstorphine to get peace and quiet, a garden and a parking space. She said that she loves having a car and that she has at time been 'welded' to it. Clare used her car for a number of small trips so did not tend to accumulate many miles. She is in fact one of the least active participants in the study, and this is examined in more detail in Chapter Seven. It is interesting to note however, that although Clare self-identified as avid car user, she also clearly wanted aspects of a walkable neighbourhood, specifically accessible shops and facilities.

6.4.5 Shops and Facilities

Daily commute was the most discussed type of transport during the interviews. However, walkable access to shops and facilities was perhaps more important still, although having this accessibility had to be weighed against other costs. For Penny, having good neighbourhood access was more important than commuting time. Here she is discussing how she and husband decided to move to Restalrig after getting married.

> We like the links and we liked the flat and we liked the fact that you're kind of equidistant between the shore and everything that's there and Ocean terminal but then you've also got the city centre is kind of ten minutes so it was kind of perfect for us either way. Completely the other end of the city for work but it doesn't really matter!
>
> Penny, 31. Restalrig. Moderately Active.

Penny describes how they prioritise proximity to shops and facilities over commuting distance to work. Their new Restalrig flat was accessible for her husband's workplace, but not close. Penny and her husband liked the area because it had available green space and was within walking distance from the city centre and some amenities. She describes this accessibility to shops and facilities as facilitating the kind of life that they wanted to have. Although they needed a car for work, they wanted to be in a neighbourhood where they could 'nip out'. This meant living in an area with walkable characteristics.

Earlier in the chapter, it was shown how Victoria was contemplating moving out of the city in order to afford a house, despite the fact it would mean relying on a car. In this next extract, Victoria is saying that she wants to find somewhere with access to 'nice amenities', although she thinks that too might have to be compromised.

> I'm, quite use to having to take the car to access amenities... [baby crying] [R: Yeah] That's why, when we're looking for our next place, it doesn't bother me too much that we take the car just because I'm used to it. But, but now that I am living here, with so many shops and parks nearby, you know, it is *nice* that you don't need to take the car.
>
> Victoria, 34. Restalrig. Moderately Active.

Victoria's account of her next move is one of relocating despite of rather than because of neighbourhood preferences. Like Penny, Victoria would ideally like to live somewhere with walkable access to shops and facilities however, this preference is somewhat overridden by the cost and number of bedrooms needed.

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Throughout the interviews, participants described wanting to have access to local shops and facilities. Generally having access to local and independent stores was felt to be very desirable. All Dalry participants reported having easy access to a range of shops and most felt that having nearby shops is a positive thing, even if they did not use them regularly. On the other hand, Corstorphine residents in the sample felt they did not have sufficient access to the range of facilities they would ideally like. This corresponds to the City Form data presented in Chapter Five, which showed that outer city residents were less likely to use local facilities. However, there was a general acceptance this is the trade-off they made in choosing to live in a suburban area. Chapter Seven looks specifically at how people use their local area for walking and being active. It is shown that shop quality and access is particularly important. However, the purpose here has been to show how shop access is an important aspect of deciding where to move to.

6.5 Conclusion: Neighbourhood and Relocation

In order to contextualise the relationship between urban form and physical activity, this chapter has presented interview data concerning residents' stories of relocation and their respective neighbourhood experiences. Data analysis has focused on participants' accounts of relocating to neighbourhoods of comparably different walkable characteristics. Generally it has been shown that the decision of when and where to move is highly contextual and contingent on resources, preferences, life events and life stages. Moving home is described chronologically as part of a residential trajectory. Participants talked not only about why they moved but where they were before and often where they planned to move next. There was a tendency to associate inner city neighbourhoods with early tenancy followed by a 'natural progression' to more suburban neighbourhoods to settle and raise a family. Moving from an inner city area to a more suburban home was expressed as normal and natural and the ideals of the family home are expressed as being synonymous with the suburban household. Regardless of where participants located themselves on this trajectory, most shared a culturally-prescribed ideal that the family home is a detached or semi-detached house. This meant that many Dalry residents, although they had opted to live in an inner city area, foresaw themselves moving to a suburban home at some point in the future. This evidence is quite pertinent to the concept of neighbourhood self-selection as it highlights the overriding significance of life stages rather than neighbourhood preference, which have been the focus of previous studies.

The evidence presented here can also be seen to corroborate previous research, also discussed in Chapter Three, showing that having parks, green and natural areas can promote neighbourhood-use (Maas et al., 2008, Lovasi et al., 2013, Ellaway et al., 2005). Additionally, this chapter considers how residents' attitudes towards green space are related to neighbourhood desirability. The evidence presented here corresponds to previous research, discussed in Chapter Three, which shows that having parks or green and natural areas can promote neighbourhood-use (Maas et al., 2008, Lovasi et al., 2013, Ellaway et al., 2005). Additionally, this chapter considers how residents' attitudes towards green space are related to neighbourhood desirability. Green space, accessible shops and amenities, being close to the centre of town, and having transport options were all felt to be highly attractive and associated with various activities. These were volunteered by participants as attractions to the area, and factors that had to be weighted up in their decision-making process. Despite the rich variety of relocation biographies, all participants describe a preference for walkable attributes. It was also noteworthy that access to green resources and networks was very important to many inner city resident respondents. However, there is evidence that preferences for walkable attributes are often overridden by the desire for a family home. Getting the right property can mean a less central location and more car-dependence. For this reason, residents often anticipate having to adapt their travel and activities accordingly. In this sense *settling* can be described as a distinct type of relocation that is focused on property and one that often happens *despite of* rather than *because of* neighbourhood or travel mode preference. The desire to have a suburban home is often stronger than the preference for walkability.

In Chapter Three it was discussed how proximity and connectivity have been found to promote physical activity through walking (Leslie et al., 2007, Saelens et al., 2003a, Saelens et al., 2003b). The suggested connection was supported by the survey analysis presented in Chapter Five, which showed a moderate but significant association. The qualitative analysis presented here contributes a meaningful and temporal dimension to this connection. Understandably residents' own accounts do not use such planning terminology, however these are reflected in the residents' discussions of transportation and access to facilities. In particular, it has been argued that the difference between case study areas is not that participants differently prioritise walkable networks but the circumstance of their relocation. The next chapter looks more specifically at how these features are related to behaviour. However, this chapter has shown that, although participants varied in their travel and physical activity, availability of facilities and transport options were commonly felt to be desirable. What this finding means is that, if urban form characteristics can restrict and enable behaviours as much of the literature presented in Chapter Three suggests, then this is a corollary of relocation circumstance rather than of individual choice. This suggests that the

associations reported in Chapter Five may indeed reflect environmental influences on travel external to selection and individual factors.

The evidence presented in this chapter raises some important questions about how residential selection relates the environment-physical activity relationship. Transport and location are clearly important when deciding where to live. However, to say that people move home to 'realise their travel preferences' is an over-simplification. Furthermore it is misleading in that it suggests that attributes of the walkable neighbourhood will only be utilised by those who chose to active travel. The evidence here suggests a more widespread appreciation of walkable characteristics such as a green space and shop access. How the use of these attributes is related to people's intentions or efficacy to be active is to be examined in Chapter Seven.

CHAPTER SEVEN: ACTIVE AND URBAN LIVING

This chapter examines how participants talk about their own physical activity. The intention is to draw out their attitudes and dispositions towards being active, both generally as well as in their neighbourhoods; this can be compared with the issues of neighbourhood selection discussed in the previous chapter. As these are qualitative findings, the focus is on representing participants' accounts, beliefs and perspectives. As discussed in Chapter Four, a summary of participants' estimated overall activity is provided alongside reports on regular active travel. During the interviews participants were asked if they thought of themselves as being either 'active' or 'sporty', and this information is also included within the summary. These self-identifications provided a starting point for discussing physical activity and participants' responses to these questions are discussed throughout this chapter. Participants had different orientations to physical activity and participation in sports. Those that identified readily with an active lifestyle often accounted for this with a history of active pastimes. Others were explicit in saying that they were not as active as they should be. The evidence presented here supports the significance of early- and younger-years for shaping people's dispositions toward being active. All participants recognised the health-importance of physical activity and it is argued that there is a common recognition of an obligation to be active. Those who felt they were not active enough gave accounts of attempts to adopt exercise routines, which had met with varying levels success. There was also a clear tendency, in some cases, to justify inactivity with claims to having *alternative identities* that are felt to be, in some sense, antithetical to being an 'active person'. Differences between the accelerometer data and self-reported accounts suggest that some participants underestimated how much physical activity was attained through their utilitarian walking trips. Nearly all the Dalry residents reported regularly walking for either commuting or shopping, whilst participants in the other areas walked less regularly. With reference to the qualitative data, it is argued that walking has an importance beyond its functionality.

7.1 An Overview of Participants' Activity

Before discussing the participants' attitudes to and attainment of physical activity in detail, it is worth summarising the key information, to get an overview of the interview and accelerometer

data. The table in Figure 7.1 combines data gathered during the interviews with accelerometer data (steps/minutes). There are also estimates of overall physical activity for each participant. Grey cells denote absent data. The 'self-identifies' columns refer to questions about whether the participants felt that they were active or sporty. As outlined in Chapter Four, the purpose of asking participants about this was to initiate discussion about physical activity. Answers to this question *did not* inform the estimate of overall activity. Most people felt they were fairly active, but notably fewer thought themselves to be 'sporty'. The table also records whether the participant reported walking regularly based on their accounts of their daily activities (around twenty minutes of walking or more on most days of the week).

Three of the column pertains to the accelerometer data. As described in Chapter Four, daily steps and minutes summed and divided by the number of days of data returned. Two of the participants returned four days of data (Jack, Abijah) and one participant returned seven days of data. In order to better compare these to the recommended physical activity, average active minutes were multiplied by seven to get a weekly estimate. Over 150 active minutes per week indicate being *moderately active.* The indexes on the right hand side of figure 7.1 list the ranges for these summaries. The steps and active minute categories should be treated as illustrative approximations that are more meaningfully understood alongside diary information and the interviews themselves. Summary estimates of physical activity attainment are based on a combination of accelerometer data, activity diaries and self-reported activities in the interview. So, for example, although Mary achieved a relatively low step-count this does not include her gym attendance and swimming. She has been summarised as highly active because her diary and interview reports regular sports and exercise that were not recorded on the accelerometer. On the other hand, Clare's accelerometer reads averaged over 10,000 average steps, although her active minutes are considerably lower. Clare's self-reported physical activity suggests that her steps are accumulated at home and at work and she does not achieve many consistent periods of activity. Jack achieved a high number of active minutes and steps through his daily commute, although reports being otherwise sedentary so he has been categorised as moderately active. The reader should use this table as a summary of participant activity that can be used as a reference point whilst considering the qualitative data presented in this chapter.

Neighbourhood	Participant	Self-identitifies		Regular walking	Steps	Act. Mins (Daily)	Act. Mins (Weekly)	Estimated Overall PA
		Active	Sporty					
Dalry	Abijah	Yes	No	Yes	10014			Moderate
	Amy	No	No	No	7740	27	189	Moderate
	Ben	No	No	No	9075	24	168	Moderate
	Brenda	Yes	No	Yes	10636	24	168	Moderate
	Dave	Yes	Yes	Yes	11427	22	154	High
	Felicity	Yes	Yes	Yes	14135	64	448	Very high
	Jack	No	No	Yes	10437	40	280	Moderate
	Kelly	Yes	Yes	Yes				High
	Kurt	Yes	No	Yes	7644	17	119	Moderate
	Peter	Yes	Yes	Yes	15656			High
Restalrig	Donna	Yes		No				Moderate
	Hilary	No	No	No	7018	13	91	Low
	Penny	Yes	Yes	No	10103	16	112	Moderate
	Rhona	No	No	Yes				Moderate
	Victoria	Yes	No	No				Moderate
Corstorphine	Arnold	Yes	No	No				Low
	Barbara	Yes	No	No	8542	21	147	Moderate
	Clare	No	No	No	11335	16	112	Low
	Larry	Yes		No				Moderate
	Lindsey	Yes	No	No				Moderate
	Mary	Yes	Yes	No	9881			High

Self-reported PA

Reports doing no regular sport, exercise or active travel
Sporadic periods of active travel, sport or exercise
A regular type of physical activity. Sufficient for moderate attainment.
Regular and combination modes of physical activity.

Daily steps

<5000	Sedentary
5000-7499	Low
7500-9999	Somewhat active
10000-12499	Active
>12599	Highly

Active minutes

<70	Sedentary
70 to 149	Low
150 to 279	Moderate
280 to 419	High
>420	Very high

Figure 7.1: Summary of participants' physical activity by case study neighbourhood.

It is interesting to see how this information is patterned across the case study areas. Whilst there is no clear case study difference in whether or not residents believed themselves to be active or sporty, there is a notable division between reported walking. None of the Corstorphine participants report walking regularly, whilst all but two of Dalry participants reported doing so. This sample is not representative but the distribution of self-reported walking is concurrent with the results of the quantitative analysis presented in Chapter Five. More of the Dalry participants report walking regularly just as the survey results showed that residents of walkable neighbourhoods walk more.

7.2 Self-Identified as Active and/or Sporty

In order to explore participants' attitudes and dispositions towards physical activity they were asked whether they considered themselves a 'physically active person'. After this was discussed, participants were asked if they thought of themselves as a 'sporty person'. Mary, Felicity, Kelly, Dave, Felicity and Peter all identified themselves as 'sporty' and 'active'. They then justified this identity with accounts of current and previous sporting activities. Mary thinks of herself as an active and sporty person because she has a history of being active with her family and in school.

> Sport has always been a part of my life and that's probably why it continues. When I was younger I would play…play hockey twice a week at least and I did a bit of netball at school erm when I was younger I was in the swimming club and... [I'm] trying to think what other sports I would do in the winter; I would play in-door hockey. So my mum and dad were both been sports–people. My mum played hockey and my dad... well they were both runners actually. So it's always been [there] and I've always enjoyed it so it's always continued through my life. And I probably was at the gym when I was […] in my late teens as well so it's always been a part of life [0.5]. Yeah, from when I first moved to Edinburgh – […] I used the Commonwealth Pool from where I stay so it's always been part of it. And my husband, yeah, he's played football for years and that's… his *main* game but he plays other things as well.

> Mary, 31. Corstorphine. Highly Active.

Although she has not been able to play team sports recently, Mary easily identifies with sport and activity because she has a lifetime of experience being active and has been surrounded with active friends and family. At college she made friends through sport clubs and her husband has also been into sports. Mary's account exemplifies how these biographic aspects reinforce an active identity,

and she draws on these when accounting for why she thinks of herself as 'sporty'. Since having a baby, Mary no longer plays team sports due to time commitments. She explained how she now compensates by going to the gym frequently. She makes clear that doing so is a pleasure rather than a chore:

> No, I enjoy it! As I say it's part of a er.... [0.5] we both work hard so I certainly enjoy it [...] it switches your mind off and works your body when you've been working stationary – both of us have office-based work – so it works your body. […] How long we go for would depend on what time we finish work really. At least half an hour – [sometimes a] long morning on one Saturday when you've not been all week.

> Mary, 31. Corstorphine. Highly Active.

As discussed in the previous chapter, Mary had moved from an inner city neighbourhood to Corstorphine in order to find a family home. The interview suggests that her physical behaviour is adaptive, as she has found new ways to be active since her changing circumstances.

Like Mary, both Peter and Felicity self-identified as active and sporty people. In the extract below, Peter responds to a question about being active when he was younger.

> R: …I use to cycle to school and do competitive swimming and mountain biking.

> I: So that was quite a positive experience..?

> R: Yes, yeah. [1.0] <u>No, I'm not a convert to exercise: as I'm getting older thinking I should 'fight the flab'! I've always being active and into exercise.</u>

> Peter, 38. Dalry. Highly active.

After answering that his experience was positive, Peter positions himself as different to other men his age who have tried to become active later in their lives. Instead he presents himself as somebody for whom physical activity has always been important. Again, Peter is able to draw on specific events and accounts to support this sportiness.

> So my physical activities in a week would be cycling two or three times a week, running at least once a week and swimming two or three times a week.

> Peter, 38. Dalry. Highly active.

Cycling is a real passion for Peter and something that he dedicates most of his free time to. As discussed in Chapter Six, cycle access was part of the reason he chose to live in Dalry. He often also enjoys climbing and hill walking as this is an activity that he can do with some of his friends. For Peter, being physically active is part of what he does for fun. Although he was unable to record active minutes, Peter recorded his daily step count for seven days. This shows that he has been active exceeding 10,000 steps on most days.

> Like Peter, Felicity regularly cycles, as well as undertakes other sports and exercises in her spare time. She is explicit in saying that physical activity is something that is core to her identity.

> I: Do you see yourself as a physically active person? [R: Yes.] And why is that?

> R: [sighs -thoughtful] [1.0] well, I don't do as much as I would like to. But I consider it a key part of my identity, I suppose. [1.0] If I *don't* do it I tend to get a little bit sad.

> Felicity, 31. Dalry. Highly active.

Like Peter, Felicity would like to be active as much as possible and she says that not doing so can affect her mood. Whether it is climbing, mountain biking or just having a walk, Felicity described the importance of being active as a matter of mental wellbeing, saying she becomes unhappy and depressed if she does not do so. Later in the interview when she talks about her partner's physical activity, Felicity refers to exercise as an addiction.

> I: [He's] not as addicted to aerobic activity as me.

> R: I love that you use the word 'addicted'.

> I: Yeah, well... [Laughing] it's the best word [0.5] I think it is the only word that fits really, yeah!

> Felicity, 31. Dalry. Highly active.

Felicity's activity behaviour can also be understood as adaptive in the sense that she will find alternative modes of activity if her preferred is not possible. For example, she can no longer run due to a knee injury so decided to take up cycling 'in a big way'. Recently when she did not have time to go on a bike ride, Felicity went walking locally just 'to get out'.

Felicity's accelerometer data show high active minutes and steps throughout the five days. According to her travel diary, she spent the morning of day one working from home before going hill walking for three hours in the afternoon. On the second day, Felicity had to conduct errands using the car and then on the third day she worked from home before walking locally in the evening. On the fourth day Felicity walked to the Pentlands with her partner. Felicity went climbing on the last day and records in her diary that she was surprised to have only accumulated 51 active minutes. As an endorsement of the effectiveness of a walking environment, it is notable that Felicity achieves the highest active minutes when she walked for errands in the local area. Interestingly however, when asked about being active, Felicity focuses specifically on leisure time events such as cycling, climbing and leisure walking (hiking) rather than these periods of utilitarian walking.
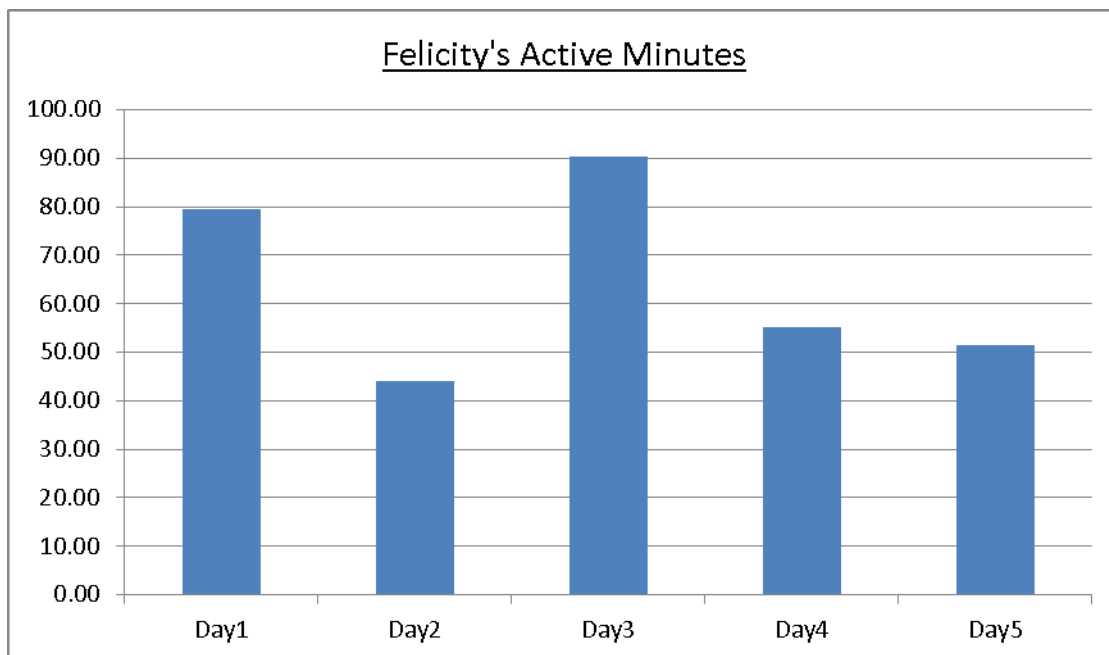
Figure 7.2: Accelerometer showing daily minutes of moderate-intensity physical activity.

Kelly, who also lives in Dalry, thinks of herself as an active although not necessarily sporty. She does not currently take part in team sports because they would require a lot of time and being indoors, although she regularly goes swimming, dancing and climbing. Her favourite activity however is walking, and she finds commuting by foot pleasurable as well as functional:

Physically, I like the exercise of walking. Ah, I think that if you've had quite a –what's the word? Not 'stationary' but...[2.0] 'sedentary' – job, you need to get your exercise somewhere in the day <u>or you don't feel as good</u> so by walking everywhere you get that. So I suppose the freedom... freedom to not be restricted

Kelly, 25. Dalry. Moderately Active

Feeling good and not being restricted is how Kelly feels about living in a walkable neighbourhood. The best part of being active for Kelly is being outdoors. However, when the weather is poor she says she uses the local swimming pool to compensate for not being able to get out. Living in Dalry affords her these options and that is important to her. Like the other participants that self-identified as 'active', Kelly described needing bouts of activity to be happy.

Looking at the participants that self-identified as being active or sporty people, there are some characteristics they have in common. Firstly, these participants all had accounts of positive experiences of physical activity at school and in their younger lives. These experiences seem to reinforce their identification and familiarity with being active. Secondly, each of the participants are fairly adaptive in the type of activity they do; able to change the mode of activity when their circumstances changed. For example, both Felicity and Kelly discussed using walking trips deliberately to 'get out' and compensate for not having a chance to do their typical exercises. Thirdly, participants who self-identified as active and sporty describe physically activity as a pleasure, not a chore. They tended to describe being active as a personal imperative; something needed, not necessarily for their physical health, but in order to feel good.

7.3 Not into Sports

In contrast to Felicity and Peter the most physically active of the interview participants, it is estimated that Clare, who lives in Corstorphine, is the least active of the participants. During her interview Clare explicitly positioned herself as someone who is not physically active and certainly not into sports. Her discourse regarding sports suggests some very negative associations.

[I'm active] because I try and do everything myself... [I: Yeah] I put the insulation in myself – and that was a complete- that got me knackered as well. [1.0] But yeah I do it all myself. So, I'm active but *not* in that whole: *[imitating man's voice]* <u>"cardio activity! Twenty minutes!</u> <u>gym-class"</u> – that's awful it's like sports I detest it!

Clare, 38. Corstorphine. Low activity.

In mimicking the detestable active person, Clare says 'cardio activity - twenty minutes', which sounds close to physical activity recommendations. This suggests that Clare might well react negatively to this kind of promotional health guidance. The researcher then asks Clare why she used the word 'detest':

> I detest football. I think that's where the 'detest' comes from; because it's just an excuse for people to be violent with one another and show lots and lots of hatred. It's not about the sport… [I: …] I just hate football. The people are all like *[imitates man's voice]* "*our* team done this and *we* done that…"

Clare, 38. Corstorphine. Low activity.

The fact that Clare dramatizes the sporty person using man's voice, suggests that her notion of sport is gendered. Other points in the interview suggest that Clare met male footballers at University, whom she disliked. It seems likely that these are the encounters that have subsequently shaped her opinion of sports and sports-players. Here then is a strong account of why Clare dislikes sports: because she has experience of footballers who are violent and unpleasant. What is interesting is the conflation of being physically activity with sports and specifically with football. Clare says that she is active because she does her own home improvement and gardening; however these are too infrequent to be categorised as regular physical activity. Clare is quite car-dependent, and as will be shown later in the chapter she has become less physically active since moving to Corstorphine.

Other participants who said that they were not into sports still considered themselves as active people. For example, Barbara felt herself to be active despite her incompetence at sports. She gives a reason for this by saying that she was someone who was always more into academic pursuits than sporting activities.

> If you go back through my school reports it's always like really patently obvious that I was never going to be a sporty person.

Barbara, 34. Corstorphine. Moderately Active.

I never just sat on the side lines. It's just that I had no ability. So although I was very, very fit. Like, for example, with cross country running I was always the first girl back [0.5] because I was naturally quite fit. I just had no ability to play basketball or hockey or whatever. I think my parents were just so pleased that I was academic – my report card was always flawless – apart from [physical education]! And I don't really come from a very academic family so they were like 'oh she's going to go to university!'

Barbara, 34. Corstorphine. Moderately Active.

Many of the female participants talked about having a negative experience of physical education at school. This was referred to as a point at which they found themselves to be incompetent or unsuited for sport. Whilst Barbara makes a distinction between being active generally and taking part in sports, there is an indication that other participants conflated the two.

7.4 Self-Identified as Not Active

Clare, Rhona, Hilary, Ben, Jack and Amy each said that they did not think of themselves as an active person, let alone sporty. Just as those who identified with sport accounted for this with previous experience of sport, those that felt they were not active commonly gave accounts of being bad or uninterested in sport at school.

I hated sports at school! I mean, I did them because I had to but I [1.0] I'm just not someone who is *good* at sports. [I: Yeah] And I didn't- didn't particularly enjoy it. I played hockey for a little while but I wasn't very good at it. I'm someone who would occasionally try sports and then remember that I wasn't very good at them.

Hilary, 34. Restalrig. Low activity.

Many of the female participants gave accounts of negative experience of physical education at school, often as evidence of being naturally incompetent. In concurrence with the notion of self-efficacy discussed in Chapter Two, there is evidence that feeling incompetent to be active may stem from early and school experiences and shape confidence to be active as an adult. Here Amy is explaining why her previous attempts to go jogging have been hit-and-miss.

Because my experience of exercise and sport was purely through gym and PE at school and that was just miserable. As a chubby not very co-ordinated young girl who preferred reading, preferred other stuff, [like] drama, [1.0] I just- I just didn't enjoy it and I didn't want to… [do it and] I didn't understand why I should be made to do it. So I think I come [to jogging] with that mind-set as well where I was just resentful of having to take exercise or do things that I wasn't any good at.

Amy, 35. Dalry: Moderately Active

Here Amy is talking about trying to train for a charity run, saying that she associates recent attempts to be active with memories of feeling incompetent at school. Despite electing to take part in the run and wanting to be more active Amy cannot help but feel resentful as though she is being made to do something. Another interesting aspect of the above quotation is that she provides some justification for her inactivity by identifying with *alternative pastimes.* She says that as a young girl she preferred reading and 'other stuff' such as drama. Coincidently, the mention of drama as being antithetical to physical activity was echoed in the interview with Peter in his discussion of why he *is* an active person.

I: Do you think of yourself as a physically active person?

R: Yeah, probably.

I: And why is that? […]

R: So, well generally because my leisure time is dominated by physical activity. So I don't do things like drama classes or playing a musical instrument – I'll do that when my knees give up!

Peter, 38. Dalry. Highly active.

Here Peter Jokes that he will only do music and drama when he is no longer able to do active pastimes. Drama, reading or music are presented by both Peter and Amy as self-evident alternatives to physically activity. Not only is drama positioned as characteristic of someone who is not active, but it is presented as *the reason* that someone is active or inactive. In this sense, Amy is making an alternative identity claim; she is not into sports but other things. She is *this* kind of person rather than *that* kind of person.

When asked why participants were not physically active, it was common for residents to invoke *alternative identities* such as a self-made business man (Ben), enjoying computer games or television (Clare and Brenda), being academic (Barbara) or a busy mother (Hilary). These bids for alternative identities are interrelated with that most common practical reason for not being active given in surveys: not having enough time. If leisure time is taken up with less active pastimes, then there is less time to be active. However, the fact that participants felt obliged to provide reasons for their inactivity suggests that there is a moral imperative to be active.

7.5 The Moral Obligation to be Active

Considering that many physical activity researchers have expressed concern that self-reported accounts tend to over-estimate activity attainment, it is perhaps surprising that during the face-to-face interviews, many participants volunteered themselves as being inactive. The reason for this apparent honesty may be that participants were wary of having to sufficiently qualify their response in conversation. Rather than risk being made accountable for an exaggeration, many residents preferred to 'come clean' and be relatively modest about their activity levels. In fact many participants were quick to admonish themselves for not being active enough. For example, Clare who was explicit in saying that she is not active and car-dependent, remarks that she really should start cycling.

> Where do you go on this road? You can only use that cycle path. [1.0] I'll have to find out where that is [.] but yeah I was thinking that I should start cycling to work because that would be an easy journey.

> Clare, 38. Corstorphine. Low activity.

Those that could not legitimately say they were active often volunteered that they *should* be doing more. This form of self-criticism was most apparent in the tendency for participants to blame themselves for being *lazy.*

> Because we've got the car that sort of laziness factor kicks in and you go: 'oh I'll just jump in the car because it's easier' so that's a bit if a disadvantage… so while we probably could walk to our friends we tend to just drive… even though it's not that far away. Oh, terribly lazy!

> Lindsey, 33. Corstorphine. Moderately Active

During one of the pilot interviews, the respondent answered a question about his self-identified inactivity with an admission of guilt saying 'it's my fault really, I'm just lazy'.

Understood within the interactional context of the interview, this type of narrative does some interesting work. It is a way of communicating to the researcher that they too uphold a moral obligation to be active. The participant (correctly) interprets the purpose of the study and the researcher's questions as underpinned by an advocacy for physical activity. By reflexively admitting falling short, the participant demonstrates that they agree that being active is good and desirable. There is a sense of some shame or embarrassment in admitting a lack of activity. In the following extract, Jack tries to side step the question about whether he is active, before 'coming clean'.

I: Would you say that you are a physically active person at the moment?

R: Erm [1.0] well without *knowing* the definition of "physically active"..! [laughs]

I: [1.0] Yes?

R: Well, I'll be honest. In the weekends: yeah. But at the ↑evenings? Monday to ↑Friday? No. My brain is battered after five o'clock [.] yeah? [I: Yeah] All I want to do is go home have my tea, watch the news, yeah, and then we'll, you know, go on the computer and relax [I: yeah] and then go to bed.

Jack, 38. Dalry. Moderately activity.

Jack initially attempts to avoid the questions about being physically active, but then is prompted to continue, at which point he says 'I'll be honest'. He says that he suspects that he is active during the weekends but not during the week. During the week he is too tired to make time to be active and prefers to go home and relax. Being busy and tired provides a kind of reason and alibi for why he does not make more time for exercise.

Throughout the interviews there is a common recognition that being physically active is desirable or even expected. Regardless of whether or not a person identified with active pastimes, all participants expounded some moral imperative to be active. The reason that some participants drew on alternative identities such as being academic or into reading and drama was because these

provide an explanation and justification for inactivity. Participants recognised that being active is part of a desirable and *healthy* lifestyle.

7.6 Physical Activity and Health

Another interesting theme to emerge from the interview data is how physical activity attainment was volunteered alongside other health-related behaviours. Some participants discussed their physical activity together with their diet, drinking or smoking behaviours. For example, both Rhona and Brenda said that they trying to be more active since they stopped smoking.

> Er, yeah, I started running at the beginning of the year – <u>stopped smoking and started running. Decided to be healthy.</u> So I got a friend that lives across the road erm so we started running together and we [go] sort of around Dalry.

> Brenda, 29. Dalry. Moderately Active.

> Since I've stopped smoking and had like [...] I can walk here and, you know, er, go on my bike places and stuff...[I: So that has helped?] Yeah definitely! I've been more active eh been stopped smoking. I mean before I was smoking as well I was still, you know, eh going to the gym and going to classes and stuff, eh, but I wasn't <u>feeling as like… ↑ healthy, you know?</u> I was still getting puffed out if I was walking up the road or whatever as getting out of breath but now, I still get probably I don't get out of breath... eh so much.

> Rhona, 31: Restalrig – Moderately Active

Here Brenda and Rhona found that stopping smoking made them feel healthier and motivated them to try and take more exercise. This is an example of how health-related behaviours can be conflated and made equivalent. In the following extract, Brenda discusses for her non-adherence to exercise as significantly coinciding with a temporarily poor diet.

> But I haven't gone to the gym for a couple of weeks because I just got back from my holiday... and I'm on holiday mood still...! [I: Ah-ha] So I'm eating chocolate and sweets and everything just now! *[Laughs].*

> Brenda, 29. Dalry. Moderately Active

Brenda's 'holiday mode' provides a temporary reprieve from the obligation to take exercise and eat healthily. Throughout the interviews it was common to associate health-related behaviours.

These were also interrelated with how participants identified themselves as discussed earlier. Smoking, drinking or having poor diet were presented as evidence of a non-active or unhealthy type of person. For example, whilst talking about why she was inactive, Clare told the researcher that she would rather be at home with a pizza on her lap thereby contrasting the *active and healthy* person with her own *inactive and unhealthy* lifestyle. Ben is another example of this conflation of health-related behaviours. He associated his lack of exercise with drinking and visits to the pub. When asked about his walking behaviour he was first reluctant to 'count' walking to the pub as legitimate activity, essentially because it was related to an *unhealthy* behaviour of alcohol consumption. Ben talked a lot about drinking beer and being at the pub, suggesting that this was an important part of his identity. What is interesting is how this was treated by Ben as being in some sense antithetical to exercise.

7.7 Aspirations and Motivation

Those participants that admitted to being largely inactive talked about attempts they had made to change. For most people, adopting and maintaining regular physical activities takes planning and effort. A lot of participants said that they had had periodically taken up exercise but struggled to adhere to a routine. For example, Arnold described sporadic attempts to exercise at home.

> I quite often will start myself off on a regime of doing sit ups in a morning, for example, and I will do that for a week, and then let it drop and forget about it. So I'm not someone who is successful at doing regular exercise other than commuting.
>
> Arnold, 37. Corstorphine. Low Activity.

Throughout the interviews many participants talked about their failed attempts to adhere to regular exercise. Such failures can be disheartening and, as with the above extract illustrates, can be taken as evidence of a personal inability to exercise. Although this failure was disheartening, Arnold consoled himself with the knowledge that he occasionally cycled to work. Joining a gym, sports club or signing-up for a charity run were common strategies for exercising more. These are often employed tactically to self-motivate and incentivise. For example, two of the participants discussed how they preferred a pay-for gym membership even when a free gym was available. This was

because it provided a financial incentive to attend and make use of the facilities. Membership to a club or group was commonly felt to be a good motivator. Having an additional purpose and reason for exercise was generally reported as being important. Attending a club or exercise groups with people similar to yourself was helpful in providing moral support as well as the knowledge that your absence would be noted.

For Amy, this motivation was signing-up for the Great North Run for which she was trying to train for with her friends and partner. She does not regard herself as active, so is deliberately incentivising herself to train and be healthier.

> The good thing about the Great North Run…, because then I have to keep running, I have to keep [going], I need goals I need something to work towards […] So, yeah! I think; yeah, I'll enjoy it... I hope I will enjoy the end product and understand that if I don't keep active I'll lose that all. So I hope [to enjoy it]... I aim to...

> Amy, 35. Dalry: Moderately Active

In the above extract she talks about learning to enjoy being physically active. As well as wanting to get the 'end product' of losing weight and being fitter, Amy hopes that she learns to enjoy it more.

> I've really benefited from being with [my fiancé] in terms of getting the buzz off exercise and understanding that it can actually be enjoyable.

> Amy, 35. Dalry: Moderately Active

Just as Felicity and other more active participants talked about their need for activity and feeling addicted to it, Amy was learning that being active could actually be enjoyable. However, it was Abijah who was most vocal about discovering a love for physical exertion.

Abijah is somewhat of a success story as she motivated herself from being largely sedentary to becoming physically active. During the interview she talked excitedly about her experience, which clearly meant a great deal to her. Abijah had been becoming increasingly sedentary, sitting at home on the computer or watching television, doing little apart from a few domestic tasks. Abijah described a moment of realisation when she became concerned about this was affecting her health.

> I started thinking about health […] I realised that I am putting on a lot [of weight] because I have started eating a lot of cheese, chocolates and, you know, started watching TV and

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sitting at the computer – you know. Then I realised I didn't want to be a couch potato. I really have to get up and… you know, because this might kill me in a couple of years' time [...] if I'm like this if I'm not active physically I would have a lot of diseases [...] so I think: I'm young, I have time!

Abijah, 30. Dalry: Moderately Active

She recounts the decision to 'take measures' as a moment of self-confrontation:

I spend couple of hours in the morning on [the internet] and er… I became so addicted that I started thinking 'no [Adijah], this is not happening! You need to *get up* and, you know, *go out*!' I was always on the plumper side and I had started gaining a lot of weight, which wasn't really good. So I started taking a lot of different […] measures.

Abijah, 30. Dalry: Moderately Active

Again health is a key factor in wanting to become more active. One of the measures Abijah took was to join a local group that specialised in exercise and health promotion. This turned out to be a very significant step as it provided her with a place that she could try out exercise classes. Abijah was self-conscious of her body and weight, so the all-female Zumba classes turned out to be safe space where she could be vigorously active. Having fellow exercisers of similar ability and weight was reassuring. Abijah's first visits required some self-motivation, but later she came to love the sessions. Here she describes how she began to get something of a physiological-emotional high after exercising.

If you're active, for half an hour to one hour a day, you feel like: 'oh my god – I have enough energy'; because the days that I go to Zumba or go to the gym, or if I go for a walk after coming back, even though I am tired, because I'm active, that makes you do a lot of things. [.] Even the household chores, you know, like you cook *really* fast and you're happy, so I would really recommend to everyone that physical activity's really making a big change in me.

Abijah, 30. Dalry. Moderately Active

Abijah had learnt to enjoy being active, similar to how Amy described learning to 'get the buzz'. After a session of exercise, Abijah would later get an excited high, feeling happy and having more energy. She referred to this as her 'happy hangover'.

I have a real happy hangover! Mondays after Zumba then Tuesday afternoon it's still there. After [that] it'll still be there but then Friday, Saturday, Sunday , it's like I'm a bit down because, you don't have zumba.. but then that's fine [because] I compensate it with my walks.

Abijah, 30. Dalry. Moderately Active

Just as Felicity, and some of the more active participants, felt that being active was something they needed to feel good and be happy, Abijah was finding that she wanted to be more and more active. At the time of the interview she was starting to find new ways to do so in order to maintain the physiological feeling that comes through bodily exertion.

After joining Zumba I started to realise: 'oh my God there are lots of things [I can do]!' I have stopped looking at my weight because [...] what is important is like the *happiness* that you get after doing something. It's like: 'oh, it's helping me!'

Abijah, 30. Dalry. Moderately Active

Abijah started walking locally, shopping and exploring the local area. She took up a hobby that involved walking around her local area and sightseeing Edinburgh by foot because this gave reason and meaning to her walks. For Abijah joining an exercise group had really helped her to overcome her feelings of being too large or incompetent to be physically active. She described how the health and weight loss became less important as she learned to love exercise.

The interviews have revealed some important aspects and motivations for being active. Earlier it was shown how for those who are active, exercise is pleasurable even necessary. However, for others struggle to adhere to regular exercise and described trying different methods to motivate themselves and incentivise adherence. Abijah's story encapsulates both the initial self-motivation, despite a lack of confidence, and later learning to 'get the buzz' out of being active. Sometime after her interview, when Abijah came to do the accelerometer exercise, she said that she was preparing to attend a gym for the first time. This was quite significant for someone who had previously felt very self-conscious of her body and unconfident about exercise.

7.8 Walking Trips

The latter part of this chapter concerns walking trips specifically. The focus is on the nature of utilitarian trips in Dalry compared to those in Restalrig and Corstorphine. The data presented is supported with evidence from the accelerometer and diary exercises. Participants who described a significant amount of walking on most days were categorised as walking regularly as summarised in Figure 7.1. Utilitarian walking refers to trips that are made for practical reasons such as travelling to work or going shopping.

7.8.1 Dalry

As might be expected from the secondary data analysis presented in Chapter Five, nearly all of the participants from Dalry, the more walkable case study area, reported walking regularly. The two exceptions were Amy and Ben who said they preferred to take a bus or use taxis. However, for both of these participants it later emerged that they probably walked more than they realised. At first Ben said that he hardly ever walked anywhere, perhaps once a month. However, as the discussion went on to include walking into town or going out for a drink, he reconsidered, saying that he probably walked more like three times a week. The hesitation is interesting and suggests that he walks more than he realised. Similarly, Amy said that she did not walk on most days but went on to discuss walking on the canal for pleasure during the weekends and walking to shops and to work during the week. So, from this small sample there is evidence that Dalry residents are walking relatively frequently, and possibly under-reporting the extent to which they walk. Ben and Amy were not the only participants to overlook periods of walking. Comparing the interviews with the accelerometer data, participants seemed to have something of a blind spot to utilitarian walking trips. It was already mentioned how Felicity, one of the most active participants, was most active on a day when she was 'running errands' around Morningside, an attractive neighbourhood near Dalry. However, in the interview discussion of her physical activities, she focused exclusively on hiking and other leisure activities.

Jack, who had to 'come clean' and admitted to being largely inactive, turned out not to be as inactive as he thought. He had told the researcher that he was inactive during the week because after work all he wanted to do was 'go home have my tea'. Although Jack felt it necessary to excuse himself for being inactive, his accelerometer data show that his commute to and from work resulted in a healthy amount of physical activity.
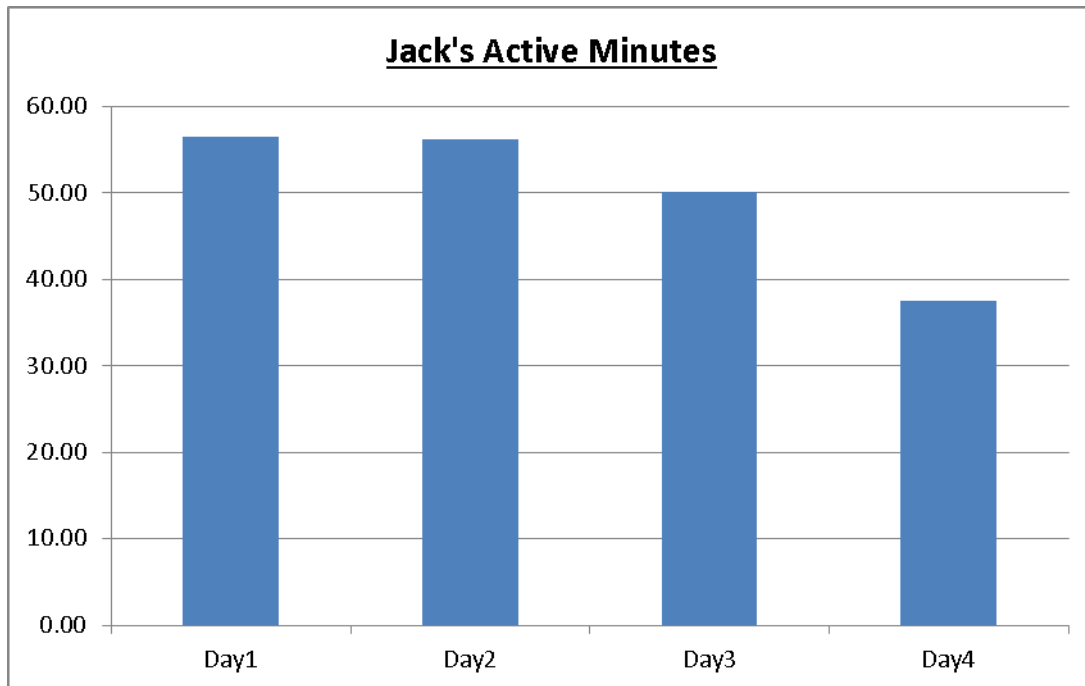
Figure 7.3: Accelerometer showing daily minutes of moderate-intensity physical activity.

Jack made a note of all his activities during the four days he wore the accelerometer. Each of these was a weekday and he recorded much the same types of activity: walking to work, sometimes returning by bus and then relaxing at home. Each day his walking commute was about 16 minutes each way. His active minutes show that, despite doing no other physical activities, Jack is averaging 40 minutes of moderate activity a day. In his diary he expressed some surprise and pleasure at the results. This says something about the *visibility* of different activity types. Because commuting serves a functional purpose, Jack was less aware of its significance. The same can be said of other participants who excused their inactivity. They were in fact feeling obligated to make time for sports and exercise.

Neither Kurt nor Brenda was particularly active and their daily walks made considerable contribution to their daily activity. Brenda recognised that her daily walk was her only form of physical activity, although it was incidental to the practicality of getting about. She said that she had wanted to live centrally because she disliked commuting any sort of distance. She said that her preference for the inner city was an aspect of her laziness as she did not want to have to travel too far to anything. For Brenda walking was simply the easiest option, and since moving to Dalry she

walks everywhere. Like Brenda, Kurt recognised daily walking was his main source of exercise. However, unlike Brenda, walking was not just functional but pleasurable. On most days Kurt walked to and from University and at other times he walked to the city centre to meet friends or go to the shops. He told the researcher how he would take a longer route in order go through the Meadows and some of the greener places in Edinburgh.

> I sometimes go like walking in [parks]. I'll often choose to walk through them rather than on pavements, if there's a route that I can do that's a bit greener…. [I: Yeah] just because […] I quite like grass… and green and natural-*ness* [laughs].

> Kurt, 25. Dalry. Moderately Active.

Kurt would often take the scenic route because he enjoyed walking through green space, which reminded him of his more rural upbringing. For Kelly, access to green space was most important part of her walking trips and commute.

> I'd go along the canal at least once a week. I'd go along the waters of Leith about twice a week the… the meadow [0.5] it depends [on work] but I'll get the bus out […] and then on the way back walk or get off the bus soon and then walk part of the way… and whenever I walk I walk via the canal via the Water of Leith, via the Meadows. [I: Even if it is not the fastest way..?] Yeah.

> Kelly, 25. Dalry. Highly Active.

For many of the participants, having access to green space was an important reason for walking. Both Kurt and Kelly talked about having green space as a crucial part of this experience. This finding supports the importance of making green space accessible to residents of high density areas. In accounts from Felicity, Kurt and other participants there is evidence that supports the importance of green space for mental wellbeing. For example, Kelly's answer to the question of why green space is important suggests that it helps her to recuperate and feel secure.

> Because it... maybe I grew up in the countryside so in part it reminds me of that. I think that it has a relaxing impact too... it has nice colours but also it erm [2.0] compared to buildings and shops they are always trying to sell you something, or advertise something so there is a lot of information to take in. Whereas, in the Meadows, it is nice and calm and it's not there's not lots of things to process... does that make sense? [I: Yes] [laughing] I tree doesn't want anything from you! […] I often thought [that] work and all the pressures of life were

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one side of the Meadows and then you would walk through the Meadows and then you were at home it was safer somehow.

Kelly, 25. Dalry. Highly Active.

Walking to work is one of the most common purposes of walking locally in Dalry. Perhaps because of its functionality, some participants did not think of this as a period of notable exercise, although the accelerometer data shows that it is. For Kelly, Felicity, Peter and others the routine walk to work was an important part of their day. Other walking trips made in Dalry were made not for exercise, but other purposes such as meeting friends, shopping, or as part of a hobby. There is evidence that these are trips are not simply functional but also events that are enjoyed. Having attractive green space, good access and places to visit are what makes these trips useful and pleasurable.

7.8.2 Restalrig and Corstorphine

Interestingly, one of the main reasons for walking given by residents of Corstorphine and Restalrig was related to having children. As discussed in the previous chapter, many of the Corstorphine participants had relocated as part of a plan to settle and raise a family. Many of the female participants were either on maternity leave or were looking after young children. This meant that their current day-to-day life was different to what it had been when they were working. The overall impression is that having a baby or young child makes you *more* active. However, there is also a suggestion that when the child is slightly older, after the maternity period, being a parent can also mean relying more heavily on a car. When the child is younger, mothers tend to go out more. As one participant said, having a baby is like having a dog; you have to take it out for walks every day. Here Penny describes how her daily activities are dominated by entertaining her baby.

> I would say that it is very rare that we are not out and that's only when it's horrible weather. Erm but when you're on your own with a baby then you kind of force yourself to go out *somewhere*. At least once a day. Especially in the flat now that he's crawling he's kind of in everything…and you just think: 'oh god!' better get out somewhere

Penny, 31. Restalrig. Moderately Active.

Penny sees herself as an active person who likes to walk places as well as being into sports. As discussed earlier, she adapted her own physical activity to the new circumstances of having a baby

and living in Corstorphine. Although, as she reflects on this Penny notes that just looking after the baby is a very physically active job.

> Yeah, I mean we've always been very active it's just a very different type of active now because you're geared towards entertaining [the baby] to a degree.
>
> Penny, 31. Restalrig. Moderately Active.

Victoria also found that looking after a child was keeping her busy. For her this meant more active travel than she had previously done. Victoria feels that since having a baby she has used the local neighbourhood more.

> Before I didn't really get out in the local area much because, you know, I was working and then doing you know going out other places in the evening. But when you have a baby you really take advantage of your local area.
>
> Victoria, 34. Restalrig. Moderately Active.

Accounts from these mothers suggest that having a baby is a reason for getting out of the house, perhaps outside of their usual routine. Typical activities include visiting parks, cafes, and shops or play groups:

> I don't work at the moment so just look after [child]. So a typical day is spent around entertainment. So we enjoy going to the shops and the supermarket – it's *amazing* the things that children find entertaining! We go to the park and we go… swimming and meet up with friends.
>
> Hilary, 34. Restalrig. Low Activity.

However, for Lindsey, now that her son was a toddler she found that she returned to relying on her car.

> So yeah I would come down to the shops here sometimes. Especially when he [son] was little I would walk down here but that tends to be more as um as kind of getting out of the house [.] because <u>with a very small child you tend to go a bit nuts and need an excuse to leave the house. We'd do a lot of walking around then – but now that he is that bit older we tend to just jump in the car.</u>

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Lindsey, 33. Corstorphine. Moderately Active

When it came to shopping, all Corstorphine participants relied on a car to visit the large supermarket nearby. Although there are local small shops in St John's Road and some within a ten minute walk of participants' homes, these were rarely used by residents.

> Yeah. I mean sometimes I come down here; come to the shops around here [St John's Road] but most of the time um I would just drive to Tesco, you know, and do a big shop there and then drive back up the hill again. Which is [1.0] I know it's not too good for local shops and things but that's the reality of it.

> Lindsey, 33. Corstorphine. Moderately Active

In the previous chapter it was said the majority of Corstorphine participants felt they had insufficient access to shops and facilities, but often felt to be trade-off with finding the right home. Here Barbara talks about wanting more small shops nearby:

> Obviously there is the huge Tesco's, if you just jump in the car you're there in five minutes! But I think that what would be great is if there was something a little bit near that would you know like I say like a convenience store of some sort so that if you do forget a pint of milk or want to go get the paper in the morning or something it doesn't feel like such a [trek].

> Barbara, 34. Corstorphine. Moderately Active.

When asked how this compared with her previous neighbourhood in Edinburgh city centre, Barbara told the researcher:

> Now you have to jump in the car [.] which isn't the end of the world but, you know, it's just a different. It's just a different from what you're used to.

> Barbara, 34. Corstorphine. Moderately Active.

Several of the Corstorphine and Restalrig participants felt that there was lack of nice shops or places to visit or meet friends. Some said that the places available were undesirable and others said that they were not 'family-friendly'. For Clare, who originally moved to get away from the inner city, the lack of places to go was a notable problem and something that she missed. As previously discussed Clare does not count herself to be active:

I'm not a particularly physically active person. I don't go to the gym I don't walk to work –

Clare, 38. Corstorphine. Low activity.

However, she said that when living in Leith she would tend to go out to 'potter about a bit':

I would have done that in Leith Walk: I would have wandered down to Woolies, I would have come back up, I would have stuck my head in the little card shop, I would have gone up to [the centre], I would have [..] you know: pottered about a bit.

Clare, 38. Corstorphine. Low activity.

Here Clare is talking about what she misses about living closer to the city centre. Above all it is the opportunity to get out of the house:

 [I would] walk up to town; potter about a bit. Occasionally I would prearrange to meet a friend for lunch because I have a friend who works quite weird hours like me he's quite self-employed [I: Hm] and then just go home and I would usually be home in the evenings; just watch some telly or watch a film and get a takeaway or something like that.

Clare, 38. Corstorphine. Low activity.

Clare does not think of herself as active but found enjoyment in the opportunity to get out of the house. To say that these were utilitarian trips would be to underestimate the more general appeal of getting out and walking. Yet when the shops and places that Clare used to visit are no longer around she finds she is left wanting somewhere to go.

[In Corstorphine] <u>When you step out the door,</u> you've got to go somewhere else to do what you want to do. […] there's *nothing here*. […] You wouldn't wander out and just have a browse around the shops here because the shops aren't good enough.

Clare, 38. Corstorphine. Low activity.

The type of activity that Clare missed was not shopping in the strict sense of buying practical necessities, as this was catered for and she was happy to rely on her car to do 'a main shop'. What she missed since moving home was the more general sense of getting out of the house to meet friends and browse stores. It is interesting that Clare's frustration is due more to the lack of quality

and range of shops rather than lack of having some nearby. This was also reflected in the interview with other Corstorphine participants who found the local facilities functional but not attractive.

Without sufficient incentive to walk around the area, Clare suspects that she has become more inactive since moving to Corstorphine. This interpretation of the interview with Clare is strengthened by her accelerometer data presented in Figure 7.4. Here, it can be seen that most days she was largely inactive apart from a notable spike on day two. Her diary shows most days were very much as she described in the interview. Clare made good use of her car for work, shopping and meeting people. She would move about somewhat at work but was largely sedentary. In the evenings Clare stayed home and watched television.
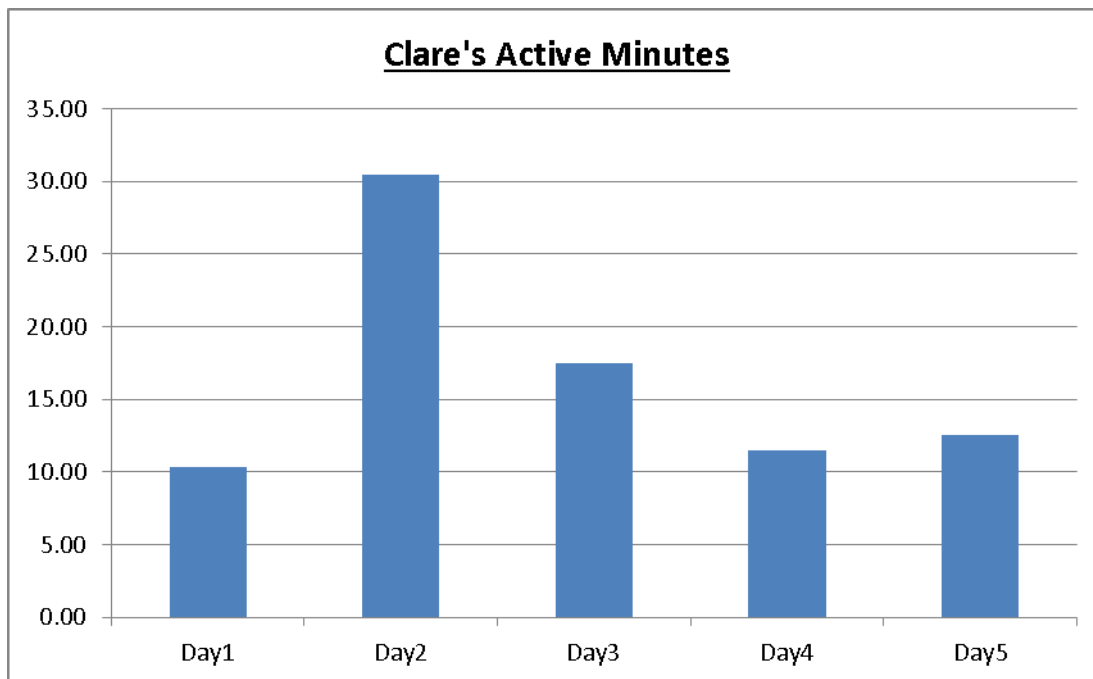
Figure 7.4: Accelerometer showing daily minutes of moderate-intensity physical activity.

Clare's active minutes readings shows that on day two she attained 30 minutes of moderate intensity physical activity. This is sufficient to meet minimum activity recommendations were it to be sustained. According to her diary, on this day, Clare left Corstorphine to spend time shopping with friends near where she had previously lived. It is interesting to see how this break from her routine resulted in a significant increase in physical activity. Although this cannot be substantiated here, it is

reasonable to suggest that this period of activity may be closer to the 'pottering' that Clare use to do in her previous neighbourhood and has subsequently missed since living in Corstorphine.

In Clare's example, the move to Corstorphine has resulted in less walking. It is not so much that the environment restricted Clare making healthy travel choices, as she was happy to rely on her car to go to work and to the supermarket. Rather it is that the change removed the possibility of a more ambient type of walking, what she refers to as pottering around town. Clare was explicit in saying that she was not an active person and yet there was something about getting 'out and about' that was still important to her. The availability and quality of shops stand out as the most significant factor in this change. Furthermore, whilst those that are highly active are also adaptive, changing their mode of physical activity when previous types are restricted, Clare seems to have just become more sedentary. A number of the participants from Restalrig and Costorphine echoed Clare's frustration at the lack of shops available. Few participants from Restalrig and Corstorphine reported regular walking and they were more likely to rely on a car for shopping trips and commuting. Residents from these neighbourhoods wanted more attractive and family-friendly shops, restaurants and cafés were they could meet friends, look around and generally have a reason to move about the local area.

7.9 Discussion and Conclusion

This chapter has reported on a combination of data, qualitative interview data, self-reported activities, accelerometer and diary data. The intention has been to look in more detail at residents' feelings and accounts of active travel as well as their physical activity more generally. The interviews have produced rich data that demonstrate the various ways in which participants orientate themselves towards exercise, sport and walking. The data supports previous findings by showing how many women have had negative physical education experiences that have consequently shaped their disposition towards physical activity. Some participants are notably active and being so is clearly part of their identity. For these participants being active is something of a personal imperative, something needed to be happy and feel good. It was argued that the evidence is that these residents are more able to adjust their activities to changing circumstances. These participants are the ones who started attending a gym or swimming pool to compensate when a previous mode of activity was unavailable. However, not everybody finds it easy to stay active and several participants felt a sense of guilt for not being active enough. It is clear that all participants recognised the health importance of exercise but some people struggled to make time for it. Those

that admitted to not being particularly active often drew on alternative identities as evidence that they were into something else and therefore explain their inactivity.

Whilst those that 'love' being active find it a personal imperative, those for whom it is more of a struggle still find it to be a moral obligation. Self-identified 'inactive' participants clearly understood the importance of being active for health but often struggled to maintain a formal exercise regime. The sense of guilt that could come from failing to be active may further compound a person's sense of incompetence or being 'naturally' unsuited to exercise. Such feelings of inadequacy were particularly unnecessary in cases of Dalry participants who, despite doing no formal exercise, achieved significant bouts of physical exertion through mundane activities such as walking to work. The accelerometer data shows how these incidental walking trips can significantly increase physical activity attainment. When considered alongside the interviews, the evidence is that these walking trips are often overlooked. It is likely that people are more aware of leisure physical activities such as sport and gym attendance, because these are specific 'events' that require putting time aside. Such findings have implications for how survey responses are interpreted. For example, in considering why 'lack of time' is the most common reason given for not being active. It also suggests there may be a health promotional benefit in making the exercise-significance of walking trips more visible.

In Chapter Three it was shown that much of the research in this field has focused on how the environment enables or restricts travel choices (Bamberg, 2006, Krizek et al., 2008, Handy, 1996). Whilst this is undoubtedly important, the findings presented here draw attention to the more passive aspects of walking behaviour. Semi-routinized trips such as shopping, meeting friends, or getting a child out the house are not just utilitarian but a pleasurable part of daily life. These types of activity are undertaken universally as part of urban life and should be considered separate from healthy decision-making. Semi-routinized trips differ by demographics and circumstances, however the point here is that previous research into travel behaviour and walkability may have defined utilitarian trips rather narrowly. The qualitative accounts illustrate how functional trips can be pleasurable as well as practical. Having walkable characteristics such as a range of good quality shops, cafés and restaurants will incentivise recreational as well as functional trips. Furthermore, there is evidence that such factors may have the greatest influence over the behaviour of residents who are least active. Clare was an example of someone whose only source of physical exertion was mundane local walking trips, which she no longer takes since moving to Corstorphine. Without choosing to exercise or adopt more active travel, many participants in Dalry were getting the chance

to move their bodies just by doing everyday practical things. Clearly, Dalry is a good example of a location that facilitates the kinds of mundane activities that make up urban living.

The Scottish Health Survey analysis in Chapter Five showed that there was a significant but moderate relationship between urban form and walking as found in previous research. It was suggested that this say little about the nature of the walking trips involved or the causal direction of the association. Considering statistical regression in light of the qualitative findings it can be said that the detected associations may well reflect walkable attribute having an influence on residents' activities, regardless of their individual or lifestyle characteristics. This is because participants' accounts suggest that having shop and facility access promotes walking regardless of attitudes towards being active or the purpose for moving to that neighbourhood. The statistical analysis found proximity to city centre to the strongest predictor of regular walking, controlling for other factors. Having considered the qualitative evidence it can be said that this association is likely to reflect the way in which residents will take more frequent walking trips when there are shops and facilities available.

CHAPTER EIGHT: DISCUSSION AND CONCLUSION

This research has explored how walking in Scotland is influenced by urban form. A mixed methods approach was used to test the association at a national level before exploring this further through a qualitative investigation. This chapter summarises the findings of the research and discusses their implications.

8.1 Summary of Findings

The aim of this was *to understand the influence of the neighbourhood environment on the walking and physical activities of residents*. Within this aim there were three research objectives:

- To test the association of urban form with physical activity and walking in Scotland
- Evaluate the importance of neighbourhood selection through exploring residents' accounts of relocation
- To develop an understanding of the urban-form physical activity association through qualitative accounts of residents' activities

The findings from this research support the hypothesis that the physical characteristics of the environment can potentially change the behaviour of its residents. The quantitative analysis found a significant non-linear relationship between urban form variables and regular walking in Scotland, but not with overall physical activity. This suggests there are certain thresholds at which residents' walking behaviour is likely to increase. A comparison between City Form case study areas shows that inner-city residents are more likely to walk or cycle to work or to the shops. This suggests that the differences between data zones are underpinned by these types of walking trips. The key contribution of this study has been the use of semi-structured interviews to explore this relationship. Interviewing people who had recently moved home allowed for an exploration of their neighbourhood preferences. It was found that life stages and 'settling' were key motivations for deciding where to live. Although many aspects of the walkable neighbourhood are of general appeal, these would be given-up in order to find a family home and raise a family.

Interviews with people living in Dalry, Restalrig and Corstorphine provided more meaningful accounts of how people use their neighbourhood environment as well as their feelings toward walking and being active. The qualitative analysis is comparable to the quantitative results because participants were recruited from high- and low-walkable case study areas. There is an agreement of results between the different research methods, which show that residents of more walkable neighbourhoods are more likely to walk regularly. Regardless of participants' dispositions toward being active, the majority of Dalry participants reported regular walking. In concurrence with the quantitative results, these walking trips tended to be commuting or going to the shops. When considered alongside the accelerometer and diary data, these periods of walking could be sufficient to realise minimum physical activity recommendations. However, the accounts suggest that walking was often not acknowledged as periods of exercise. There were notable variations in participants' attitudes toward being active. For some, physical activity was part of their identity and a necessary part of their lives. However others struggled to maintain regular exercise and felt a weight of responsibility to try. It is argued that people who are highly motivated to exercise will do so regardless of the environmental context. On the other hand, those that are least active are more susceptible to environmental incentives and constraints. Walkable characteristics can encourage more walking in those who would otherwise be inactive. In this chapter it is argued that the reason for this is due to the general appeal to walking beyond travel preferences or 'lifestyle choices'.

8.2 The Influence of Urban Form

In Chapter Three it was discussed how the physical characteristics of the environment, referred to as 'urban form', have the propensity to influence people's walking behaviour by making walking trips more functional or attractive. The prevailing literature suggests that there are more opportunities for active travel in compact neighbourhoods with a mix of buildings, road infrastructure and nearby facilities (Frank et al., 2005, Cervero and Kockelman, 1997, Forsyth et al., 2007). Walking trips are made more attractive through pedestrian-centred design, safety and green space (Owen et al., 2004, Maas et al., 2008, Ellaway et al., 2005). Whilst the secondary data analysis presented in Chapter Five did not measure all these aspects, it did include dwelling density, population density, number of junctions, distance to shops, and distance to central business district. These variables were shown to have some relationship with the propensity for regular walking in Scotland. This section will reflect on these results in the light of the qualitative data.

In Chapter Three it was discussed how a range of less than about 1 kilometre is necessary to promote regular active travel (McCormack et al., 2008, Frank et al., 2004, Moudon et al., 2006). The SHeS analysis showed the most walkable data zones to be those within a 5 minutes' drive to shops and within a 4 kilometre radius from a central business district. When entered into the regression model as binary variables, these proximity indictors emerged as some of the strongest predictors of regular walking. Corstorphine, the case study example of a low-walkable neighbourhood, is approximately 6 kilometres from the city centre. Dalry, on the other hand is approximately 2.5 kilometres and only few minutes' walk from the centre. Participants' accounts add further weight to the importance of living nearby to a range of shops and facilities. Most of Dalry participants described walking on most days of the week for commuting and shopping but also more general trips to meet friends or browse shops. These trips were described as being practical but also pleasurable, as a chance 'to get out the house'. On the other hand, Corstorphine participants often relied on their cars for practical trips such as getting to work. An interesting finding in regards to proximity is that many of the Corstorphine participants lived nearby the local high street (St John's Road) which has some shops and restaurants. However, they generally felt that these destinations lacked the range or quality necessary to motivate them to walk in that area. When asked what they would change about the neighbourhood, several of the Costorphine and Restalrig participants said they would like to have nicer shops and cafés nearby were they could take children or meet friends. Having a range of facilities that are of sufficient quality and attractiveness appears to be important. The results suggest that this is an incentive for more general walking.

The desire for having access to a range and quality of facilities may also explain why the neighbourhood socioeconomic composition was predictive of regular walking, separate from individual socioeconomic status. Although this is essentially a demographic measure, it was discussed in Chapter Five how this may also reflect certain area effects. Wealthier neighbourhoods may have better provision of shops and facilities, as well as better design or pedestrian infrastructure (Mitchell and Popham, 2007, Cerin and Leslie, 2008, Giles-Corti and Donovan, 2002, Grant et al., 2010). It is difficult to assess relative importance of street design or road connectivity; however, there were notable differences in how residents spoke about suburban and inner city neighbourhoods. Dalry was described as being busy and noisy whilst Corstorphine and Restalrig neighbourhoods were more likely to be described as being safe and quiet. It is not clear that these impressions affected the propensity to walking however. In terms of green space, there was surprisingly little difference in how case study participants rated their local access. However, Dalry participants were found to be more likely to use the local green space for commuting and travel

purposes, whilst Corstorphine and Restalrig participants were more likely to visit green areas recreationally.

8.3 Relocation Neighbourhood and Selection

It was argued in Chapter Three that any investigation of environmental influences on behaviour should account for the way in which people can either electively or passively be sorted into neighbourhoods that reflect their behaviour (Cao et al., 2009, Cao et al., 2006, McCormack and Shiell, 2011, Panter and Jones, 2010). A consideration of neighbourhood selection was therefore built into the design of this research. Interview participants had recently (<3 years) moved home. Interviewing participants at this point of transition was a way of exploring participants' neighbourhood preferences and relocation choices. The analysis presented in Chapter Six concerns why residents moved to their respective neighbourhoods and how they used these areas.

An important finding from the qualitative research was a common notion of a typical trajectory of relocation in which the suburban home is attached to 'settling down'. It was common for participants to talk about a recent life event that prompted moving home, like a new job, having children or living with a partner. Certain life stages are attached to particular neighbourhood types. For example, inner city residence is associated with being younger, and a suburban home is associated with family and children. There was a general sense in which a (semi-)detached house, garden and suburban neighbourhood befit a family and children. 'Settling down' to raise a family was a common theme throughout the interviews. This was seen as a distinctive moment in which a person would typically move to a suburban home. Many of the participants who had moved to Corstorphine did so despite preferences for active travel and walkable characteristics. This is underscored by the way in which several participants discussed their potential move to a family home as a point at which they would reluctantly have to become more car-dependent. For example, Victoria discussed how once they found the right house she expected she would have to 'get used to' depending on a car again. Several participants reported increased car-use since moving to Corstorphine (Clare, Barbara and Arnold) often as a matter of necessity rather than choice. Such a finding is important as it illustrates how relocation to low walkable neighbourhoods happens outside of residents' travel preferences. The findings suggest that settling down often takes precedence over travel preferences. Certainly it would be an exaggeration to say that people select suburban neighbourhoods to realise a preference for car travel. The significance of life events to understanding neighbourhood choice is largely underestimated in selectionist accounts.

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Frumkin et al. (2004) argued that the theory of neighbourhood-selection fails to account for the fact that few people have much choice in where they end up living. Similarly, not everybody who was interviewed can be said to have chosen their neighbourhood. Donna, Larry and Rhona each relocated to out of necessity to places not of their choosing. Additionally, many of the participants could be described as having had varying degrees of choice about where they lived. There is evidence that travel and lifestyle preferences were more prominent in some participants' decision-making. For example, Penny decided to live in Restalrig so that she could have shop access. Amy, Kelly, Felicity and Peter each wanted to have the possibility of walking and cycling. Lindsey, Mary and Barbara wanted a house that had good parking available. These could be examples of travel and lifestyle preference determining relocation decisions that could ultimately explain spatial differences in travel behaviour. However, here it is argued that these examples of neighbourhood selection are not necessarily at odds with walkability. This is because more walkable areas may incentivise walking regardless of travel and lifestyle preferences.

8.4 Physical Activity, Identity and Culture

A key finding from this research has been the contrasting attitudes and dispositions toward physical activity and sport. Interview participants were asked if they thought of themselves as a 'physically active person' or a 'sporty person'. These leading questions provoked divided responses and revealing discussions. As discussed in Chapter Three, the perspective of this study is that the capacity to be physically active is learnt and socially reinforced throughout a person's lifetime. Therefore the purpose of asking these questions was not to ascertain traits or types but rather to explore the narrative differences between respondents' presentation of self. The sample was divided between those who considered themselves to be *active and sporty*, *active but not sporty* and then *not active or sporty.* All participants validated their self-identification with reference to previous experiences and current behaviours. Early years and school experience were consistently drawn on to demonstrate a capacity or inability to do sports and/or be active. Drawing on the concept of 'self-efficacy', these can be understood as key moments that have shaped these participants' confidence to be active. In particular, many of the female participants had negative memories of physical education at school.

Those participants who did identify with being active often talked about the emotional and psychological benefits they gleaned from exercise. They spoke about physical activity as something that was enjoyed and sometimes even needed in order to feel content. Felicity, for example,

described how she would start to feel down if she had not had the opportunity to exercise. This corresponds with survey research that has found that the most common reasons given for being active are enjoyment, confidence and motivation (Reichert et al., 2007, Townsend et al., 2012). The qualitative data suggests that being able to enjoy physical exertion is something that is learned. This could be seen in how Amy talked about wanting to 'get the buzz' or how Abijah described learning to love the 'happy hangover' that came after Zumba classes. This would be expected given that physical activity is known to have psychological and emotional benefits (Biddle and Mutrie, 2008). In Chapter Seven it was argued that participants who found enjoyment in physical activity tended to be more adaptive, finding different ways to exercise when preferred modes were restricted. This includes trying new modes of activity after relocation. This flexibility might explain why the influence of the built environment is often weak or moderate in secondary data analysis: because variations in urban form will have limited impact on the physical activity levels of those residents who are more adaptive. This corresponds with recent research that has found that certain individuals will be active regardless of the walkable characteristics of the environment (Norman et al., 2013).

Many of participants did not feel the same personal draw to exercise as Penny, Mary, Kelly, Felicity and Peter. For those that identified themselves as *in*active, trying to take-up exercise could be difficult. This is not to say that these participants did not understand the health importance of physical activity. There is clear evidence that all interview participants recognised the health benefits of keeping active. In Chapter Seven it was suggested that participants felt a sense of moral obligation and responsibility for their health and lifestyle. There were accounts of failed attempts to take-up and adhere to a regime of exercise. Often these involved strategically trying to incentivise and motivate oneself to get off the sofa, get to the gym or go for a run. Failed attempts at adopting an exercise regime could negatively impact on the individual's confidence as it further reinforced a sense of incompetence or inability. An admission of being inactive was often confessed with guilt and self-blame, for example by admitting to being 'too lazy'. In Chapter Seven it was suggested that participants drew on *alternative identities* as evidence and justification for inactivity. Being a mother, businessman, academic or into reading and drama are all examples of possible alternative identities to 'the active person'. These types of narrative highlight the cultural meanings attached to physical activity and exercising. The conflation of being active with sports was perhaps most dramatically illustrated in how Clare talked about her detestation of the whole 'cardio-twenty-minutes' type of person. There are a couple of important points arising from these findings. Firstly, there is a broad recognition and acceptance of public health messages regarding the importance of physical activity. Secondly, however, many people still feel excluded from exercise because they believe it is

something they are unsuited for or incapable of. This is evidence that being physically activity is not yet 'normalised', which is necessary to improve activity levels in Scotland (Burns and Murray, 2012).

The accelerometer and diary data show that a number of participants were able to meet recommended levels of physical activity through incidental walking trips. However, participants rarely acknowledged these as periods of exercise. This was evident in how Jack tried to excuse what he perceived to be an inactive routine saying that after work he was too tired. However, Jack's accelerometer data shows that he was accumulating around 40 minutes of moderate activity each day by walking to and from work. In Chapter Seven it was argued that incidental walking has less 'visibility' than recreational activities such as sports or gym attendance. Interestingly it appears that the same qualities that make walking widely accessible, such as being part of a routine and not requiring money, training or equipment (Hardman and Stensel, 2009, Morris and Hardman, 1997, Siegel et al., 1995, Lee and Buchner, 2008), are the same qualities that make it less apparent as a way of exercising. The fact that sports and gym attendance often do require planning, financing, training or equipment, are the qualities that make them more visible as particular *events.* The tendency to think of physical activity as purposeful events would explain why surveys typically find the most common reasons for not being active to be lack of time and money (Salmon et al., 2003, Reichert et al., 2007). The fact that sport and exercise still dominate as the recognisable forms of physical activity could be counter to public health objectives in cases where failure to maintain exercise regimes reduces the person's motivation and confidence. Promoting walking as a viable form of health-enhancing activity could help those who are not particularly active acknowledge their own capacity to be so.

In Chapter Seven it was argued that highly active residents will often maintain activity levels regardless of neighbourhood constraints, whilst less motivated individuals will tend to be more receptive to neighbourhood walkability. The reason for this is that opportunities to walk are generally desirable, regardless of attitudes towards being physically active.

8.5 The Significance of Walking

Previous research has often focused on models of trips and travel decisions, identifying those factors that are most important in predicting how people choose between available travel modes (Bamberg, 2006). It is said that good urban design should make a range of travel modes available for those who wish to use them (Handy, 1996). In this sense, a walkable neighbourhood is one in which

destinations are sufficiently nearby to make it possible to undertake trips on foot. The evidence presented in this study supports this explanation. Residents of Scottish data zones with proximal destinations were more likely to walk regularly. Similarly, interview participants living in Dalry were more likely to report walking regularly. Many of the participants that walked to work found these trips enjoyable. Kurt, Felicity, Peter, and Kelly talked about their commutes as periods of respite. It is important to note that proximity alone is not sufficient to make such trips enjoyable as these trips were most valuable to participants where they were through or nearby green areas. Several of the participants would deliberately take a route through the green and pleasant areas. These periods of exercise are not adequately described as being either recreational or utilitarian as they have elements of both.

The qualitative analysis has highlighted the less purposeful and more general character of walking trips. Again, the ubiquitous nature of walking means that descriptions tend to be general and difficult to pin down. Some of the descriptions of walking trips included 'getting out the house', 'getting some fresh air', 'stretching the legs' or 'pottering'. These descriptions suggest a more general appeal of walking *for its own sake* beyond practicalities. This can be seen in several accounts including those of Kurt, Rhona, Peter, Felicity, Kelly and Amy. Furthermore, walking can be seen to be attractive regardless of disposition to be active. Hilary, who dislikes sports and is rarely active, still found it nice to get out the house once in a while. Ben, who said he was rarely active, talked about lunchtime walks that he used to get some fresh air and a break.

A vexatious aspect of these findings is that despite the enjoyment of walking for its own sake, it is often also necessary to have some sort of purpose or destination. For example, it was interesting how Abijah, having discovered a love for being active and wanting to walk more, still found it necessary to take up a hobby that gave local walking purpose. This was similarly evident in how Clare described wanting to get out of the house but was frustrated by the lack of places to go. Perhaps destinations are necessary to give walking trips substance and make them feel more like an event. The desire to have nearby shops, cafés and restaurants is not only in order to get supplies, drink coffee and eat, but to have the option to get out and walk locally. In this sense, Dalry is a good example of a neighbourhood that facilitates this kind of ambient walking trip. Again, this complicates the distinction between *utilitarian* and *recreational* physical activity, as walking is desirable in and of itself whilst simultaneously requiring direction and purpose. Previous studies have distinguished between recreational and utilitarian physical activity in order to illustrate how the latter is more dependent on walkability and environmental enablers (Frank et al., 2003, Frumkin et al., 2004, Cerin and Leslie, 2008, Owen et al., 2007). However, the qualitative analysis presented here calls for a

broader conception of walking as a passive but enjoyable part of daily life. Having the opportunity to walk locally is generally desirable and has autonomy from travel or lifestyle preferences.

8.6 Conclusion

The results of this research show that urban form characteristics have the potential to influence walking behaviour. The fact that travel and lifestyle preferences are often overridden by the desire for a suburban family home illustrates that neighbourhood differences in behaviour are inadequately explained by neighbourhood selection. Furthermore, this research has found evidence that walkable characteristics are utilised by residents regardless of their travel and lifestyle preferences. Although the exercise involved is somewhat incidental to the motivations for walking trips, the physical activity accrued is often sufficient to change a person from being sedentary to moderately active. Rather than being 'incidental', walking trips are often a meaningful part of other activities. However, the nature of walking as a somewhat passive and ubiquitous activity makes it widely accessible but also relatively invisible as a form of exercise. Interviews with Corstorphine participants suggest that better local facilities could incentivise this type of ambient walking behaviour and use of the local area.

8.7 Policy Implications

There has been a great deal of research activity providing evidence of an association between neighbourhood environment and the physical activity attainment of its residents. Such research has informed recent policy for developing neighbourhoods that support more health and active travel behaviours. This study comes at a time when there is recognition of the importance of developing healthier urban environments but also a feeling of caution regarding the need to properly understand how it is that the environment and behaviour come to be related. This study provides a meaningful account of how neighbourhoods in Scotland can impact on people's walking habits and suggests how this relates to overall physical activity and health.

In terms of public health, there a number of policy implications arising from this research. Public health monitoring of physical activity often focused on meeting MVPA. However, the logistic regression analysis shows how although environmental do not make significant changes to overall physical activity there are changes to walking behaviour. As discussed in Chapter Two the focus on

overall measures of physical activity may be at the expense of acknowledging the health benefits of everyday walking. Although it is not possible to make claims about the health benefits of small regular trips, it can be seen from the qualitative accounts how those who would be otherwise sedentary are susceptible to increased walking behaviour due to environmental incentives and enablers. The Scottish Government currently reports and monitor physical activity in terms of MVPA, yet there may be additional benefit in measuring small amounts on activity in those who would otherwise be sedentary.

As outlined above, the evidence presented in this thesis supports the importance of walkable characteristics such as centrality, connectivity and density. Results from the logistics regression suggest that there are thresholds at which these objective measures are likely to be effective. The results support centrality and access to shops as key built environment characteristics predicting regular walking behaviour. Although there are been a lot of attention regarding density levels, the effect of these on everyday walking are not as important as having shop access. Considering these results in light of the qualitative data, it can further be said that there is greater value in promoting a good standard of local facilities for urban communities rather than increasing the number of facilities. In short the results support previous suggestions that the quality of destination is of primary importance to walkability. The immediate policy implication of this is that Scottish neighbourhoods, such as Corstorphine, can increase the walking of residents through incentivising or investing in improving the quality of local facilities. Interview accounts suggest that residents of suburban neighbourhood such as Corstorphine will walk more frequently if there are improvements to local shops and facilities. The emphasis is on making these facilities attractive destinations; places to meet friends or take children, rather than just practical resources.

Another policy implication of the research findings is what has been argued to be a lack of visibility of incidental walking. Chapter Seven looked at how participants had differing attitudes toward being physically active. Those that did not identify themselves as being a physically active tended to associate activity with sports and exercise, which they are uncomfortable with. The evidence presented in this thesis supports the need for targeted interventions directed at those that are least active. Additionally, this study draws attention to the socio-cultural dimensions of physical activity behaviours as a site for identity construction. Importantly it has been shown that being active can be represented as antithetical to other identity-confirming activities. The policy significance of this is that policies aimed at 'educating' individuals into a becoming a sporty or active person may be alienating. Tactics for promoting regular bodily movement as positive aspect of daily life may be more effective at reaching those least active. In light of this, a public health message that

highlighted the importance of smaller incidental activities may be motivating for these people. On the other hand, such an approach may undermine attempts to promote the importance of more intensive, 'health enhancing' exercise.

8.8 Theoretical Contribution

There are a number of theoretical contributions that can be drawn from this study. Firstly, much of the qualitative data concerning participants' attitudes toward physical activity can be understood as compatible with the notion of self-efficacy. This was the model of physical activity behaviour introduced in Chapter Two. It is a psychosocial model that recognises that experience can be instrumental for a person's confidence and motivation to undertake a particular action in the future. In Chapter Seven it was shown how participants drew on previous experiences as evidence of their capabilities to be active, which are broadly analogous with the idea of 'efficacy expectations'. For example it has been illustrated how school experiences can be the basis for developing attitudes towards activity and exercise. Additionally it was shown how some participants underestimated the physical activity benefit derived from incidental walking trips. Theoretically this could be understood as a deficit in 'outcome expectation', as participants are confident to undertake the task (walking) but have low expectations of the health benefits. Previous physical activity research using theories of self-efficacy have found that objective measures of physical activity correlate with self-reported accounts of confidence and motivation (Pan et al., 2009, Feltz et al., 2008, Moritz et al., 2000). These studies tend to suggest that action should be taken to increase people's confidence and motivation to be active. The findings presented are compatible with such conclusions although the analysis has gone further to suggest that confidence and motivation are tied with socialised concepts of physical activity and identity.

This study goes beyond self-efficacy to consider how participant narratives reveal aspects of cultures of physical activity and identity-formation. It was outlined in Chapter Two how sociological theories of physical activity emphasized the aged, gendered and classed aspects of physical activity behaviour. Sports, exercise or healthy eating do not happen in a vacuum but exist as social constructs that individuals draw upon to confirm and assert their selfhood. This research has illustrated the importance of the sociocultural environment and how individuals may need to 'buy into' active identities in order to feel able to participate. The qualitative analysis has paid particular attention to how participants (re)construct active or inactive identities through discourse. In particular, being active was treated as an obligation and social good, aligned with other health

behaviours, but could also be treated as antithetical to alternative identities. In this sense the culturally-prescribed notions of being physically active may alienate certain people. This is an argument that challenges those behavioural theories that conceptually prioritise the individual as decision-maker. Although it is clearly important for individuals to be confident to exercise, this will only happen in a supportive social context. In order to 'normalise' activity behaviour there needs to be an articulation of the sociocultural structures that give these activities meaning. Theoretically over-emphasizing the role of individual choice may be at the expense of the cultural aspects of physical activity that mediate individual action by giving it meaning.

The interdependence of the individual with the social and environmental is the essence of the ecological model of behaviour discussed in Chapter Two. This study has used an ecological approach in order to capture the interaction and relative autonomy of the different determinants of physical activity behaviour. Research within this field has, for a number of reasons, been dominated by quantitative studies aimed at finding evidence of linear causal relationship. This study has explicitly focused on sociocultural dimensions of relocation and walking behaviour that have been largely overlooked. Theoretically, this is related to, what was referred to in Chapter Three as, 'the indeterminacy of influence': how motivations and preferences are interrelated with experience and habit. It was argued earlier in the thesis that quantitative studies that statistically control for determinative factors fail to capture the multiplicity of affective dimensions of behaviour. In particular it is notable that the qualitative sample focused on residents at a crucial point where neighbourhood influences and learning behavioural values meet. Participants were in transition from residential mobility to the fixed residency associated with settling and raising a family. This is a pivotal point for the inter-generational learning of travel and physical activity behaviours. Rather than a static model, these interviews illustrate some of the dynamic aspects of residency and behaviour, where previous neighbourhood experiences, practicalities and identity are interconnected. This research has provided a unique approach to capturing the indeterminacy of influence. It has been evidenced that the walkable environment creates opportunities within people's lived experience of their neighbourhood, rather than as an external determinant of action.

8.9 Methodological Contribution

This research involved the generation of an original data set, which combined four consecutive years of SHeS data, from 2008 to 2011, (N=36,922) with built environment variables. This dataset has research applications beyond the scope of this study as it can facilitate the analysis of a range of

Scottish health variables alongside built environment measures. A further methodological resource generated from this research is the combination of City Form data with around eighteen hours of detailed resident interviews. The mixed methods design of research allows for comparison between interviews and the survey. The data include several topics that have not been used in the analysis such as traffic and littering, which could be utilised for further research.

The inclusion of two deliberately leading questions about whether the participant thought themselves to be a physically activity person, is methodologically contentious, as qualitative research often uses passive questioning. However, the wide variety of responses received to this question suggests that this was a useful technique. Another insight from the qualitative research was the honesty or modesty with which interview participants reported their physical activity. There has been a concern that self-reported accounts are often exaggerated (Rzewnicki et al., 2003), however interviews may provide a more reliable data on physical activity behaviour than survey data.

A final point of methodological note concerns participant recruitment. In order to capture participants who had recently moved, The Registry of Scotland public data on housing sales was used to develop a mailing list. However, as reported in Chapter Four, this received very few responses and a large return of mail because of incorrect addresses. The failure of the initial recruitment methods necessitated using a range of additional recruitment tactics. Although this was not ideal, with hindsight the study benefitted considerably from using a range of recruitment techniques. The number of recruitment methods resulted in a greater diversity in the demographics of interview participants within the selection criteria. There may be methodological benefits in including a number of recruitment strategies within future research designs.

8.10 Limitations of the Study

The focus of this research has been on all types of regular walking activity rather than the contribution of walking to overall physical activity attainment. This is because there is public health importance in those who are least active doing any form of activity. For more active people, daily walking is not likely to compare to the physical exertion gained through recreational activities. However, there are those for whom walking is the only source of activity. Although the objective contribution of walking trips to overall physical activity attainment is of epidemiological interest, the perspective here has been that any walking is better than none.

There are a number of methodological limitations inherent within the methods used. Interviews were conducted with a small sample of residents so should not be used to make probabilistic inferences. Generalising statements derived from the qualitative data were on the basis of the inclusive sample characteristics and how narratives accounts drew from broader cultural features. It should be acknowledge that this is not probabilistic sampling. The qualitative sample should not be taken as indicative of all walking experiences, particularly those outside of the sample demographic. It is likely that residential experiences and opinions will significantly differ by age. Conversely, it should be noted that the quantitative analysis relies on a number of assumptions about how respondents interpret, answer and complete surveys questionnaires. Additionally the logistic regression has been used to infer some causal associations although, as discussed in Chapter Three, there is no methodological basis for such propositions. A key limitation of this study was the absence of longitudinal data that could be used to objectively measure changes before and after environmental intervention or change. Similarly, the interviews with recent movers explored aspects of relocation but are only subjective accounts.

There were only six walkability indicators used in the logistic regression. Some key aspects of neighbourhood's walkability were missing such as green space, traffic and safety. Binary indicators were also only an approximation of effect thresholds and lacked detail on the quality of these features. The walkability measures were applied to the analysis in a way that reflected previous research in this field. However, these were not replicated exactly and therefore limit the possibilities for international walkability comparison. Furthermore, data sharing restrictions from the Scottish Government mean that it was not possible to analysis data by data zone or attempt to geographically locate cases.

A further weakness of the study was the accelerometer exercise that was only completed by twelve of the participants. This limits the extent to which qualitative accounts could be contrasted with objective measures of walking. As with the qualitative data, the accelerometer findings should not be considered as representative of the case study neighbourhood. Another limitation is the use of Edinburgh case study areas, which may not be representative of urban neighbourhoods elsewhere in Scotland. As the qualitative data was collected from only three places within one city, there is a concern that the data or results are relevantly only to Edinburgh, or to Scottish cities.

8.11 Further Research

Findings from the qualitative research have raised questions that could be explored by going back to the SHeS analysis. Primarily, it has been argued here that having accessible facilities will impact on the walking behaviour of those who are least active. A further step would be to repeat the logistic regression model separating those who do and do not participate in regular sports and exercise. To do this the same dataset could be used to separate those that do not take part in any recreational physical activity. If the argument made in this thesis is correct it would be expected that urban form explains more of the variation in the activity levels of those who do not participate in sports.

Pertinent to the policy significance of these findings, further research could be done assessing possible environmental interventions. Such a project might measure residential activity before and after an intervention. From the evidence presented in this thesis, the most appropriate type of intervention would be an investment into quality shops and destinations within lower walkability neighbourhoods such as Corstorphine. This is discussed further below with other policy interventions. However, any such measure should have evaluative research embedded within it to assess effectiveness. Conducting evaluative studies longitudinally can be difficult particularly where a planning intervention takes several years to be fully completed or utilised. A related possibility for further research would be to follow house-movers over time either with repeat interviews or surveys. Both of these approaches have the potential to provide longitudinal evidence of intervention effects. Although there are likely to be significant differences in the types of behavioural change following planning intervention compared to residential relocation.

This research examined relocation in order to make some account of selection effects. The findings reveal an interesting biographic aspect to relocation and neighbourhood choice. It was discussed here as a cultural recognition of the typical residential trajectory. In particular it was shown how different types of relocation are associated with different life stages. This could not be fully investigated in this thesis and could have interesting implications for a range of urban planning topics. One possible approach to exploring the nature and significance of, what could be referred to as 'cultures of residential trajectory', would be to conduct interviews exploring when and why people move home and how it is interrelated with notions of family and life progression. This area of research would be of sociological as well as of housing policy interest.

Part of the purpose of this research has been to provide a meaningful account of walking behaviour. Through discussing participants' day-to-day activities, the qualitative analysis has raised some interesting questions about how walking behaviour is conceptualised. In this chapter it has

been argued that people often derive a sense of enjoyment from everyday walking activities. What is not established by this research is whether this enjoyment is physiological, contextual or as restorative reprieve. Neither do the findings presented in this thesis articulate the exact relationship between walking and other types of activity. A further area of research could be to explore whether regular physical exertion through walking helps prepare someone for other modes of physical activity. Additionally, rather than simply objectively measuring energy expenditure, a unique approach to research in this area would be a more phenomenological study of how the body as encountered and experienced through exercise and movement.

The main contribution of the research has been evidence of how walking trips and how people relate to them are distinctly different from other forms of exercises. There is a lot more that could be investigated with regards to walking and walking interventions. In particular there is more work to be done in evaluating the possibility of encouraging people to walk by making it more visible as health-enhancing. In this chapter it has been argued that some participants would have benefitted from a better appreciation of the health-benefits of incidental walking. This is because it would increase their self-efficacy and confidence to be active. There is scope for exploring this further as a framework for intervention. There have recently been some successful health-related behaviour interventions that focus on self-monitoring and others in aimed at promoting everyday activities such as using the stairs. It is not yet clear how whether or how the findings presented in this thesis relate to such interventions.

APPENDIX A: SCOTTISH HEALTH SURVEY ANALYSIS SYNTAX

```
GET FILE='E:\SHeS0811 BEPA.sav'.
WEIGHT BY INT08091011_WT.

RECODE distshp5 (1 thru 4=0) (5=1) INTO shopbin.
RECODE distcen5 (5=1) (1 thru 4=0) INTO cbdbin.
RECODE Juctha5 (3 thru 5=1) (1 thru 2=0) INTO junbin.
RECODE dwgden (2 thru 4=1) (1=0) INTO dwgbin.
RECODE popden (4 thru 6=1) (1 thru 3=0) INTO popbin.

COMPUTE walkscr=distshpbin + popdenbin + dwgdenbin + (2*jucthabin) + distcenbin.
EXECUTE.

*5.6.3 Habitual Walking.- individual.
EXECUTE.LOGISTIC REGRESSION VARIABLES wlkof20d
 /METHOD=ENTER ag16g4
 /METHOD=ENTER male
 /METHOD=ENTER eqvbin
 /METHOD=ENTER degree
 /METHOD=ENTER white
 /METHOD=ENTER maritalstat
 /METHOD=ENTER manager
 /METHOD=ENTER car
 /METHOD=ENTER goodhelf
 /CONTRAST (ag16g4)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

*Removing martial, white, income.
LOGISTIC REGRESSION VARIABLES wlkof20d
 /METHOD=ENTER ag16g4
 /METHOD=ENTER male degree manager car goodhelf
 /CONTRAST (ag16g4)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

*5.6.3 lifestyle. Urban Form. Removed smoking.
LOGISTIC REGRESSION VARIABLES wlkof20d
 /METHOD=ENTER ag16g4
 /METHOD=ENTER male degree manager car goodhelf
 /METHOD=ENTER frtveg alcohol
 /CONTRAST (ag16g4)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).


*5.6.3 Habitual walking. Urban Form.
LOGISTIC REGRESSION VARIABLES wlkof20d
 /METHOD=ENTER ag16g4
 /METHOD=ENTER male degree manager car goodhelf
 /METHOD=ENTER frtveg alcohol
 /METHOD=ENTER shopbin
 /METHOD=ENTER cbdbin
 /METHOD=ENTER dwgbin
 /METHOD=ENTER popbin
 /METHOD=ENTER junbin
 /METHOD=ENTER segbin
 /CONTRAST (ag16g4)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

*5.5.3  removing junctions and population.
LOGISTIC REGRESSION VARIABLES wlkof20d
```

```
 /METHOD=ENTER ag16g4
 /METHOD=ENTER male degree manager car goodhelf
 /METHOD=ENTER frtveg alcohol
 /METHOD=ENTER shopbin
 /METHOD=ENTER cbdbin
 /METHOD=ENTER dwgbin
 /METHOD=ENTER segbin
 /CONTRAST (ag16g4)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).

*5.5.3  walkbility and segbin.
LOGISTIC REGRESSION VARIABLES wlkof20d
 /METHOD=ENTER ag16g4
 /METHOD=ENTER male degree manager car goodhelf
 /METHOD=ENTER frtveg alcohol
 /METHOD=ENTER walkable
 /METHOD=ENTER segbin
 /CONTRAST (ag16g4)=Indicator
 /PRINT=CI(95)
 /CRITERIA=PIN(0.05) POUT(0.10) ITERATE(20) CUT(0.5).
```

APPENDIX B: INTERVIEW TOPIC GUIDE

A: **Introduction and consent**	[Provide an outline of the project ask for consent. Explain that the interview will be recorded and they can terminate at any point. Confirm name, age, where participant lives and how long they have lived there.]
B: ***Tell me about a typical day?***	*Talk me through a typical day for you? Weekdays and weekends?* ***"Thank you. Shortly I would like to ask for some more detail on your daily activities but now I would like use to talk a bit about where you live…"***
C: ***What is it like living in your neighbourhood?***	1. *What type of property is it?* 2. *Do you own or rent the property?* 3. *What date to you move into the property?* 4. *What is it about your neighbourhood that made you want to move there?* 5. *Do you know people who live in your area?* 6. *How would you rate you neighbourhood out of ten? Why?* 7. *How would you rate your local area (ten minutes walk) in terms of the following: Shops, grocers, public transport, green space, natural areas, playgrounds, libraries?* 8. *How often do you use each of these?* 9. *How much of a problem are the following in your neighbourhood: overcrowding, traffic, speeding, pollution, rubbish, graffiti, crime, antisocial behaviour, drunken behaviour, noise?* 10. *Using the map, can you draw an outline of your neighbourhood?* 11. *What would you change about your neighbourhood?* 12. *Anything else?* ***"Thank you. Now I would like to ask a bit about where you use to live before…"***
D: ***Where did you use to live?***	1. *Do you mind giving me your previous postcode?* 2. *So you moved out in xxx? [validation]* 3. *Why did you decide to move?* 4. *How does it compare to your current neighbourhood (thinking those aspects we have just discussed? [prompt on particular topics raise in previous section]* 5. *And before that, when you were at school, where did you live?* 6. *How did that compare to you current neighbourhood? (thinking of those aspects we have just discussed) [prompt on particular topics raise in previous section]* ***"Next I would like to hear some more detail about you daily activities…"***
E: ***Would you say that***	1. *Why is that?* 2. *Would you say that you are a sporty person? Why?* 3. *How much regular physical activity do you get in terms of exercise/ sport/*

you are a physically active person?	active travel? 4. [validate from section B] *For what length of time would you do xxx?* 5. *During this activity do you get out of breathe? Perspire?* 6. *Is this activity regular?* 7. *So in the last week how often did you xxx? And in the last month…?* 8. *How has your routine changed at all?* [prompt: years, since moving to..] 9. *How come?* [prompt: job, responsibility, access, practical considerations, affordability etc.] **"Thanks. Now I would like you to think more generally…"**
F: **What are your experiences of physical activity?**	1. *Are you friends and family similar to you, thinking in terms of exercise, sport, active travel?* [prompt for details] 2. *How about when you were younger, thinking in terms of exercise, sport, active travel?* [Prompt using neighbourhood information given in section D.] [This section is relatively open. Interviewer should prompt for details on sport, exercise, health, family background, active traveling, barriers and neighbourhood.]
G: **Demographic information**	[Confirm age, gender, employment status, job title, marital status, income, highest qualification, ethnicity, nationality and postcode]
H: **Interview close**	**"That is the end of the interview. Before I switch of the recorder; is there anything else you would like to add in regards to what we have been discussing?"** **"Thank you."**

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