

**Investigating the relationships between neighbourhood
social cohesion, economic deprivation and
residents' health**

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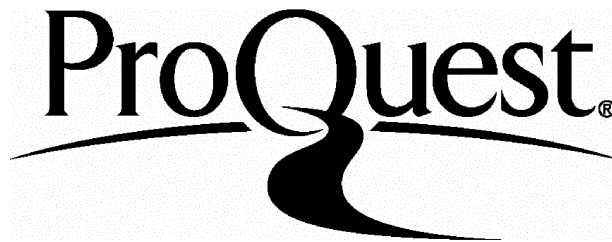
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For my parents and brother, who have given me much to live up to.

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Abstract

Attributes of places may influence health over and above effects of individual risk factors. This thesis describes investigation of the role of social cohesion and its joint effect with economic deprivation in explaining health inequalities between neighbourhoods.

Social cohesion was measured in over 250 neighbourhoods in England and Scotland by postal survey. Aggregated responses and economic deprivation data from the census data were linked to existing health databases from the Health Survey for England, the Scottish Health Survey and the Whitehall II study. One set of respondents reported on their perception of social cohesion in their neighbourhood and a different set of respondents (living in the same neighbourhoods) reported on their health, thus avoiding affect bias.

The prevalence of poor self-rated health was higher in neighbourhoods with more family ties, lower participation rates, less integration into wider society and lower levels of trust, attachment and tolerance, after accounting for participant's age, sex and socioeconomic position. Effect sizes were comparable with a 15 year increase in age. Greater contact with local family and lower integration were associated with increased smoking providing some evidence that local norms influence smoking behaviour. Residents in neighbourhoods with higher levels of trust and attachment had somewhat better social support and were less vigilant for threat, indicating two possible pathways linking the neighbourhood environment to individual health.

Neighbourhood social cohesion was highly correlated with economic deprivation. All associations between social cohesion and health listed above were attenuated after adjustment for economic deprivation. Whilst significant associations between social cohesion and several health indicators and plausible pathways linking these have been demonstrated, it appears that social cohesion and economic deprivation are closely coupled and independent effects of social cohesion could not be identified. A major conclusion of this study is that initiatives which seek to increase social cohesion while ignoring the structural factors that perpetuate economic deprivation are unlikely to have major impacts on health.

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Chapter 1: Introduction

1.1 Aims

The main aims of the project on which this thesis is based are twofold. Firstly, this project will examine to what extent social aspects of the residential environment are important in determining health. The particular focus in this thesis is on social cohesion. Secondly, this project will investigate the extent of health differences between areas in the UK and whether these differences can be explained by the characteristics of individuals living in those areas and by social cohesion in the area. Two levels of data are used in this project: a general population sample of adults living in a selection of small areas in the UK plus area level data describing the residential environment. The multilevel nature of the data and statistical software developments open up opportunities for investigating the relationship between a person's place of residence and their health in ways which have not been possible until recently.

This chapter sets the scene for the project by summarising the literature covering historical and current geographical inequalities in health, describing the various study designs which have been used to examine effects of the residential environment on health, listing the broad characteristics of residential areas that might be important for health, and briefly describing the national policy interest in residential areas. It then lays out several theoretical models relating economic deprivation and social cohesion in the area to residents' health. It concludes by listing the six main objectives of the analyses presented in this thesis.

1.2 Summary of the literature covering historical and current geographical inequalities in health

Interest in the distribution of morbidity and mortality across geographical areas has a long history in epidemiology. In fact, epidemiology has been defined as "the study of the distribution and determinants of health-related states or events in specified populations. Distribution refers to analysis by time, place, and classes of persons affected" (Last, 1995). Meade's model of health determined by habitat (the environment where people live and work), population (in terms of age, sex, and genetic predisposition), and

behaviour (determined by social norms and values and socioeconomic restrictions) also highlights the influence of environmental factors on an individual's health (Meade et al, 1988). As early as 1838, mortality statistics for England and Wales were presented by local area (Mortality and Geography Series DS9). Since then many studies of health have taken a geographical perspective, including the British Regional Heart Study (Pocock et al, 1991), more recent analyses of routinely-collected mortality data showing changes in local mortality rates from the 1950s to 1990s (Shaw et al, 1998) and Macintyre's work investigating contrasting neighbourhoods in Glasgow (Macintyre et al, 1993).

Medical research has been criticised for having become too focused on individual risk factors and health-related behaviour. The recent resurgence of interest in place of residence and its effect on health counteracts this trend. The ways in which the wider social environment shapes an individual's health and behaviour need to be explicitly considered (Krieger, 1994; Diez-Roux, 1997; Macintyre et al, 1993). Upstream or macro level factors (such as government policy and legislation as well as locally provided facilities and services) and downstream factors or individual level factors (such as smoking status and genetic make-up) should be studied. Individuals cannot be understood by simply looking at their biological and behavioural characteristics; researchers need also to look at the communities in which individuals live, work and socialise (Lomas, 1998).

Geographical variations in health are well documented. Recent work using historical data from graveyards in Tynemouth demonstrated geographical variations in lifespan in the first part of the 19th century (Gould & Chappel, 2000). National studies show that rates of mortality (Eames et al, 1993; Langford & Bentham, 1996; Sloggett & Joshi, 1994; Davey-Smith et al, 1998), cardiovascular disease and cardiovascular risk factors (Shaper & Elford, 1991; Williams & Lloyd, 1989; Kleinschmidt et al, 1995; Hart et al, 1997; Lawlor et al, 2003), psychiatric morbidity (Duncan et al, 1995; Weich et al, 2003), and self-reported health and limiting illness (Curtis, 1990; Humphreys & Carr-Hill, 1991; Jessop, 1992; Shouls et al, 1996; Wiggins et al, 1998; Stafford et al, 2001; Wiggins et al, 2002) vary systematically throughout the country. Differences between areas may be widening (Raleigh & Kiri, 1997; Marang-van de Mheen et al, 1998; Shaw et al, 1998). In other countries, area differences in mortality and morbidity have also been found (Haan

et al, 1987; Krieger, 1992; Karvonen & Rimpela, 1998; Anderson et al, 1997; Smith & Waitzman, 1997; Leclerc et al, 1998; Roberts, 1997; Diez-Roux et al, 1997; Kawachi et al, 1997; Yen & Kaplan, 1999; Walberg et al, 1998; Diez-Roux et al, 2001; Bosma et al, 2001; van Lenthe & Mackenbach, 2002; Martikainen et al, 2003). Longitudinal data also highlight the importance of area of residence on health. Participants in the British Regional Heart Study living in the south of England had lower CHD mortality than those living in the rest of the country. For migrants, those who moved from the south of England to places in the rest of the country were found to have CHD mortality that was lower than non-migrants in the rest of the country but higher than non-migrants in the south (Wannamethee et al, 2002). These data suggest that migrants take on some of the mortality risk of the area to which they move.

There is a wealth of evidence that health in certain areas is worse than in other areas. What is less clear is whether differences can be explained simply by the association between individual risk factors and health combined with the clustering of individuals with similar risk profiles into the same areas (a compositional effect), or whether they are due to additional effects of area of residence over and above individual risk factors (a contextual effect). There may also be effects of large numbers of individuals with similar characteristics living in the same area. When the concentration of people with similar characteristics reaches a certain level, there may be effects on health which are not accounted for by individual risk factors (called concentration effects (Wilson, 1991) or collective effects). The latter may also be called emergent properties; characteristics of areas may emerge as the number or proportion of people in an area with a particular characteristic increases (Cutrona et al, 2000).

Ecological analyses, in which population characteristics are related to population health, provide some of the early evidence for an effect of area of residence on health. Studies examining the effects of climate, pollution, or water quality, for example, have tended to use an ecological approach (Bobak & Leon, 1999). In some cases, the intended purpose of these studies was to look for individual determinants of health but limited data availability meant that analyses were conducted at an ecological level. For example, as a way of overcoming the lack of individual socioeconomic information on death certificates, a US study examined the association between deprivation in the census block (obtained from US census data) and mortality rate in the census block

(Krieger, 1992). Such studies are unable to determine whether the associations found at population level apply at an individual level. Higher mortality rates in deprived census blocks suggest that deprived individuals are more likely to die in any given period than less deprived individuals. However, it is theoretically possible that the deaths of affluent individuals living in deprived census blocks account for differences in mortality between census blocks. The assumption that associations at the aggregate level can be applied at the individual level may not hold. This type of mistaken inference is called the "ecological fallacy". Although these studies provide some early evidence that areas may be important for health, ecological analyses are not suitable for determining whether characteristics of an area affect health over and above individual risk factors and whether area effects are the same for all people living in an area or are confined to a subset of residents.

Studies that have data at both the area and the individual level are able to estimate the magnitude of associations between individual risk factors and health and between risk factors operating at the area level and individual health simultaneously. Such analyses are not subject to the ecological fallacy as individual characteristics are included. Spurious area level effects on health are less likely to arise because of omitted individual level variables. There is also less chance of committing the "atomistic fallacy" (spurious associations at the individual level arising because of omitted variables at the area level). Studies which have individual data alone fail to consider the potential effects of area level characteristics. This omission is avoided in multilevel studies.

Early studies with data at both area and individual level tended to simply cross-tabulate health according to the individual exposure and the area exposure. Using data on individual socioeconomic position and the region where death occurred, Fox et al (1984) found a social gradient in mortality rate within each region as well as regional differences in mortality rate within each social class. In other words, Fox found effects of individual socioeconomic status and region which were independent of each other.

The development of multilevel modelling techniques from the early 1990s onwards has allowed investigation of the relationships between area characteristics, individual characteristics and health to be taken even further. Multilevel analysis allows the investigation of the health of individuals living not just in the same type of area (for

example deprived or affluent area) but for individuals living in the same area, sharing the same physical space, the same transport, retail and health services, and the same neighbours. Analytically, health differences between areas and between individuals can be separated out. Macro and individual level influences on health can be investigated simultaneously. Duncan and colleagues pioneered the use of multilevel techniques in studies of the contextual determinants of health in the UK. Using data from the Health and Lifestyle Survey, they have demonstrated differences in smoking and psychiatric morbidity between regions and between electoral wards in the UK. These differences between areas were partly explained by the age, sex, and socioeconomic position of Health and Lifestyle Survey participants and partly by the level of deprivation in the areas (Duncan et al, 1993; Duncan et al, 1995).

1.3 What area characteristics might influence health?

Area variations in health may arise from differences in:

- (i) socio-cultural characteristics of an area, such as social cohesion
- (ii) economic characteristics, such as job vacancy rate, and local economic structure, often summed up in the terms “deprivation” or “affluence”
- (iii) physical characteristics of an area, such as climate and pollution
- (iv) infrastructure, such as health services, education and public transport

Detailed examination of all these aspects of an area is beyond the scope of this study. The focus here will be on social cohesion and its joint effects with economic deprivation. However, it must be noted that the area characteristics listed above may co-vary; more economically deprived areas are likely to have different physical and socio-cultural characteristics from more affluent areas. Physical aspects of the built environment are associated with neighbouring (Skjaeveland & Garling, 1997.). For example, semi-private space (buffers between the house and public space), living at street level compared with higher levels, and spaciousness are associated with greater neighbouring. The climate may promote or discourage socialising (Robinson et al, 1997). The presence of suitable meeting places facilitates social interaction (Cattell 2002; Witten et al., 2001). Industrial sites are more common in deprived areas (Dolk et al, 1995; Phillimore & Morris, 1991). Poor quality housing is more common in areas of the UK with a harsher climate (Blane et al, 2000). In an ecological analysis of areas in England, lower educational attainment

and greater economic deprivation were independently associated with higher mortality rates (Morris et al, 1996). Educational attainment of one generation was correlated with mortality in the previous generation. The authors suggested that educational attainment could be considered an index of the cultural level of an area and that these results point to a possible role for effects of both socioeconomic deprivation or affluence and socio-cultural factors in explaining geographical variations in health.

Another issue that makes it difficult to separate out the effects of physical, economic, and socio-cultural aspects of areas is that the measures used to capture them often overlap. For example, the percentage of people who are owner occupiers has been used as a marker of financial wealth (Macintyre et al, 1998) whilst the percentage of people who are not owner occupiers may be an indicator of social fragmentation (Whitley et al, 1999).

1.3.1 Social cohesion and economic deprivation

These two aspects of an area will be discussed more fully in the next chapter. Briefly, social cohesion covers the forms and quantity of relationships between people living in the same area and the impact of those relations on the quality of the residential social environment. Typically it is measured by rates of participation in associations and clubs, the extent to which people trust those around them, and the extent to which people help each other out.

Economic deprivation can be defined in absolute terms (the inability to obtain sufficient items and amenities for survival) and in relative terms (the inability to obtain sufficient items and amenities which are customary, or at least widely encouraged, in the society to which one belongs (Townsend, 1979)). For the purposes of this project, the level of economic deprivation in an area is defined as being more or less deprived relative to other areas. It is measured on a continuous scale, ranging from very deprived to not deprived and all stages in between. The term "economic deprivation" will be used throughout to indicate a graded scale rather than a threshold above which further improvements in economic circumstances do not matter for health. Reliable income data are not available at the small area level in the UK and so indices of economic deprivation rely on non-income based measures. More economically deprived areas are

typically characterised by high unemployment, a greater proportion of workers being employed in unskilled jobs, and overcrowding.

1.3.2 Physical characteristics of areas

Factors such as temperature, humidity, hours of sunlight, atmospheric pollution, water hardness, and proximity to industrial manufacturing sites are related to health (Schwartz, 1994; Wilmshurst, 1994; Geschwind et al, 1993; West & Lowe, 1976). (Note that this thesis describes a UK-based study and so the physical characteristics that may be important in developing countries, such as lack of safe drinking water, are not major public health issues here.)

A meta-analysis of studies investigating the effects of air pollution found a relative risk of death of 1.06 (95% confidence interval 1.05 to 1.07) per $100\mu\text{g}/\text{m}^3$ increase in total particulate concentration (Schwartz, 1994). (Changes in particulate concentration of this magnitude are unlikely to be routinely seen in the UK now. The mean particulate concentration was $174\mu\text{g}/\text{m}^3$ over the period 1959 to 1972 in London and $200\mu\text{g}/\text{m}^3$ in winter during the 1970s and 1980s in Cracow due to emissions from the steel work and power plant (Jezioro & Bokwa, 2003). Levels of particulate concentration have fallen since then.) An estimated decrease in total mortality of 1% for each 1°C increase in temperature was found in a meta-analysis of studies looking at temperature and mortality (Martens, 1998). Compared with the effects of economic circumstances on mortality, these effect sizes are modest. For example, in the Renfrew and Paisley study, the relative risk of mortality in the most compared with the least deprived areas was 1.34 (95% CI 1.17 to 1.54) (Davey Smith et al, 1998).

Physical factors operate at many different sizes of area. For example, several regions of the UK share similar temperature, humidity and hours of sunlight. Atmospheric pollution, on the other hand, may be localised, being particularly high near certain industrial sites or main roads. As physical factors tend to operate over such different units of area, and because many of these measures are not publicly available for the whole of the UK and would be costly to collect, this thesis will not investigate the effects of the physical environment on health. Whilst not wishing to understate the importance of the physical environment for specific health outcomes or in specific places, such as

metropolitan areas, current studies suggest that physical features are not a major determinant of population mortality and there is no evidence that mental health or health behaviours are associated with physical features. This suggests that the omission of physical features from the current investigation will not seriously bias the conclusions.

1.3.3 Infrastructure

Infrastructure refers to the quality and quantity of services provided by the public and private sector. Information on infrastructure is not at present routinely collected in a way that is suitable for quantitative analysis and few studies have investigated the effects of infrastructure on health. Those that have collected detailed data on infrastructure in the area of residence have focused on a small number of areas which limits generalisability. An example is work conducted in Glasgow where two areas with different health profiles were compared. The less healthy area was found to have fewer primary care centres, fewer transport and leisure facilities, and more expensive healthy foods in local grocery stores (Macintyre et al, 1993), but note that this was a pilot study and the authors did not claim that these associations should be interpreted as causal (Cummins & Macintyre, 2002). It is difficult to tease out the effects of supply and demand: was the lack of high quality, reasonably priced healthy foods in the less healthy area a result of lack of demand for these goods? This highlights the interdependence of person on place and place on person, a point which is returned to in the discussion.

Housing stock can also be considered as part of the infrastructure in an area. Two studies point to an inverse housing law in the UK (Mitchell et al, 2002; Blane et al, 2000). Participants in the Health and Lifestyle Survey exposed to a harsher climate were more likely to live in poor quality housing than were participants living in less harsh climates. In one study, the combination of poor quality housing and greater exposure to a cold climate was associated with raised blood pressure compared to those living in warmer climate and better quality housing. In the second study, poor quality housing was associated with poorer lung function in places with higher rainfall and lower temperature, though there was no such association in places which were dryer and warmer. Potential confounding factors at the environmental level were not considered explicitly. For example, northern areas tend to have harsher climate as well as fewer employment opportunities. Nevertheless, these studies suggest that, while climate alone may not be

an important determinant of health in the UK, its combination with poorer infrastructure may have effects on health.

Weich et al (2002) found an association between mental health and the built environment, with higher rates of poor mental health in areas with deck access (typical in local authority high-rise style housing), newer properties (built in the 1970s or later) and with fewer private gardens. Note that this study did not adjust for economic deprivation in the area.

Based on current evidence, it is not clear whether infrastructure is an important determinant of health. A recently completed project investigating facilities and services across England and Scotland should throw some light on this (Macintyre et al, 2002; Marmot et al, 2000). In fact, the areas to be studied are the same ones included in this thesis and so it will be possible to look at the joint effects of social cohesion and infrastructure on health.

This study will not investigate physical features or infrastructure but will investigate the association between social cohesion and health, taking into account the possible effects of individual risk factors and economic deprivation in the area.

1.4 Policy background to the study

This project was conceived in the early part of 1999 at a time when a number of government initiatives were area-based or incorporated ideas about geographical communities. Examples include New Deal for Communities, the Single Regeneration Budget, and Health, Education, and Employment Action Zones (Cabinet Office, 1998). In 1998, the Social Exclusion Unit published a report on deprived neighbourhoods (SEU, 1998) and, following on from this, 18 Policy Action Teams were set up to take forward the policy developments suggested within that report. Phrases such as “community involvement” and “developing community capacity” were contained within the report, indicating an acknowledgement that economic deprivation may not be the only issue to be tackled in socially excluded communities. For example, Policy Action Team 9, dealing with community self-help, was charged with increasing, or at least removing the barriers to, community activity. Strategies included funding and facilitating volunteering

opportunities and creating Community Chests which were set up to channel extra funds more directly to community groups. On the whole, communities were conceived of in geographical terms, in part because government services are organised along administrative boundary lines.

Interest in areas was further demonstrated by the announcement of National Health Inequalities targets in 1999, one of which is “starting with Health Authorities, by 2010 to reduce by at least 10% the gap between the quintile of areas with the lowest life expectancy at birth and the population as a whole”. More recently, the 2002 Cross-Cutting Review pointed to strengthening the physical and social fabric in disadvantaged communities as a way to tackle health inequalities (Department of Health, 2002).

This study takes place against a backdrop of political interest in neighbourhoods and communities. Despite the increasing emphasis on area-based initiatives, in fact very little was known about which aspects of areas are important for health. It is a continuing challenge for research investigating the residential context and health to identify and measure relevant contextual characteristics, including the social as well as the economic environment. In addition, it is important to know more about which sections of the population are most affected by contextual factors in order to determine whether interventions can be expected to reduce social inequalities in health.

1.5 How might area characteristics influence health?

Five models linking the economic and social relational characteristics of areas to residents' health have been put forward (Kawachi et al, personal communication, adapted from Jencks & Mayer, 1990). These are:

- (i) the contagion model
- (ii) the relative deprivation model
- (iii) the institutional resources model
- (iv) the social control model
- (v) the social cohesion model

1.5.1 Contagion model

Contagion models are usually used to represent communicable disease. The contagion model is tested by including community prevalence of disease X as a predictor of an individual's likelihood of contracting the disease. Kawachi et al proposed that this model could be adapted to describe health behaviours. If an individual lives in an area where many others engage in health risk behaviours such as smoking, consuming excess alcohol, taking illicit drugs, and not exercising then he/she is more likely to indulge in similar unhealthy behaviours. For example community smoking rate has been used to explain an individual resident's probability of smoking (Diehr et al, 1993). According to the contagion model, positive health behaviours are not encouraged and unhealthy behaviours are condoned by others in the community. Conversely, health-promoting behaviours of neighbours may also be "contagious". The disease (or behaviour) rate is an emergent property of the area; at a critical point, the number of people in an area with disease X begins to have implications for the health of other residents.

The contagion model will not be used in this thesis because it does not help explain why communities differ in their attitudes towards health risk behaviours; it simply shows that group health behaviour may predict an individual's health behaviour. To understand the reasons behind community differences, it would be necessary to consider structural or historical factors. For example, Ross and Taylor (1998) found that tobacco producing states in the US had lower tax on tobacco, fewer laws restricting smoking in public places, and higher smoking rates. Application of the contagion model to chronic rather than communicable diseases relies on the norms and values held by those living nearby influencing an individual's behaviour. Although the analysis presented here does not use the contagion model, local norms and values are part of the concept of social cohesion, which will be investigated.

1.5.2 Relative deprivation model

In the relative deprivation model, effects on health arise through differences between individuals living in the same area. Relative deprivation exists because there are inequalities in income. Differences in income between residents in an area imply that some are worse off than others; they are relatively deprived. Poorer individuals (or families) surrounded by wealthier neighbours are hypothesised to have worse health

than poorer individuals living in more homogeneously poor areas. Material and psychosocial explanations have been proposed. In more affluent areas, where more people have a higher disposable income and demand for certain goods and services is greater, the cost of living may be greater. Deprived individuals living in affluent areas can purchase fewer goods and services than deprived individuals living in less affluent areas. Those who are worse off than others in their local area may also find it more difficult to take a fully active part in local society. This may be because of feelings of shame and invidious social comparison (Wilkinson, 2002) or because they cannot afford to participate. Distinguishing between material and psychosocial explanations for the worse health of poor individuals is extremely difficult (Wilkinson, 1999; Lynch et al, 2000; Marmot & Wilkinson, 2001; Bartley, 2004). A person who cannot afford to fully participate in society may lack material (or physical) things and, at the same time, experience psychosocial stress because they lack esteem, status, and social contact as an equal with others. In the review of evidence relating to material/structural versus cultural/behavioural explanations for health inequalities, the Black report (Black et al, 1982) conceded that the distinction between the two explanations is artificial and that they are not mutually exclusive.

An underlying assumption of the application of the relative deprivation model to studies of the residential environment is that those living in the same residential area are an appropriate comparison group. Research into this issue is not advanced: to date there is neither empirical evidence nor theoretical development as to who is the relevant comparison group. Analysis of participants in the Whitehall II study provided no evidence that people of lower socioeconomic status living in more affluent areas considered themselves to be worse off than their counterparts living in more deprived areas (Stafford & Marmot, 2003). Participants in lower socioeconomic positions perceived themselves to be higher on the ladder of society and reported fewer financial problems if they were living in a more affluent neighbourhood than if they were in a deprived neighbourhood. Whilst relative position may be associated with health, these findings do not indicate that poorer people living in more affluent neighbourhoods are relatively more deprived than poorer people in deprived neighbourhoods.

Inequalities in income at the country or regional level may manifest themselves at a more local level as concentrated affluence and concentrated deprivation. Lack of

affordable housing in some areas combined with residential mobility over time are likely to lead to the spatial separation of rich and poor residents (Jargowsky, 1996; Massey, 1996). If this is the case then it would be appropriate to measure economic deprivation, rather than income inequality, at the small area level. This is the approach taken in this project.

1.5.3 Institutional resources model

According to the institutional resources model, living in an affluent neighbourhood may provide improved access to amenities and better services such as schools and municipal services. In areas where there are more resources in circulation, there may be more jobs available to everyone in the area. The ability of wealthier, more powerful individuals to attract high quality amenities and services may enhance the area for all residents. According to this model, people living in areas with better services should have better health than those living in areas that are less well served with amenities.

The health benefits of living in an area with more institutional resources may be greater for certain sections of the population. Some support for an institutional resources model and an interaction between area characteristics and individual socioeconomic position comes from analysis of the Whitehall II study (Stafford & Marmot, 2003). Civil servants living in more affluent areas had better health than those who lived in more deprived areas. In particular, the health differences between affluent and deprived areas were more marked for low grade civil servants. Institutional resources may be especially important for the poorer sections of a community. However, research has not yet identified the specific institutional resources that influence health, not least because data on the facilities and services available within localities is rather thin. Some data describing institutional resources are available but are not held centrally and the collation of information from disparate sources is a costly and time-consuming exercise (Cummins et al, forthcoming) which was beyond the scope of this thesis.

1.5.4 Social control model

The social control model, or collective socialisation model, postulates that the actions of one's neighbours are important for health. Whilst one person alone may have little

success in improving local living conditions, a group of neighbours may be more powerful. Informal social control exists when a critical mass of people enforces the same rules. Esteem, reputation, ostracism and sanctions motivate people to behave in ways acceptable to their community. Most investigators consider the social control model and the social cohesion model (see next section) to be part of the same social process.

1.5.5 Social cohesion model

According to the social cohesion model, more unified societies have better health. Greater cohesion may improve health because of better social support and higher levels of participation, leading to greater success in solving collective problems.

Kawachi and colleagues called this the social cohesion model but this is a fairly narrow use of the term. In this thesis, along with other research on social processes in the neighbourhood, a broader definition will be used. In this thesis, the term social cohesion encapsulates the quality and the quantity of social relationships amongst people living in the same neighbourhood, thus encompassing the first, fourth and fifth of Kawachi's proposed models. Sampson and colleagues found that social control (captured by people's willingness to intervene in various ways to help their neighbours) and cohesion (captured by trust, sharing the same values, and like-mindedness) were very highly correlated and argued that they were capturing the same latent construct. Putting the two together, they found that greater social control and cohesion were associated with lower homicide rates (Sampson et al, 1997). A discussion of the various uses of the term social cohesion and an overlapping concept, social capital, is given in the next chapter.

Although proposed as five or, as argued above, three separate models, it is possible to view these as interlinking. This is illustrated by a qualitative study by Stead et al (2001) who investigated smoking and quitting smoking in disadvantaged areas in Glasgow. Reasons for smoking included: i) coping with stress (a lack of facilities being one added stress in a multiply disadvantaged area), ii) availability of cheap cigarettes including from illegal sources, iii) popular meeting points being either a pub or on the streets and being bound up with drinking and smoking, iv) norms that encourage smoking (being

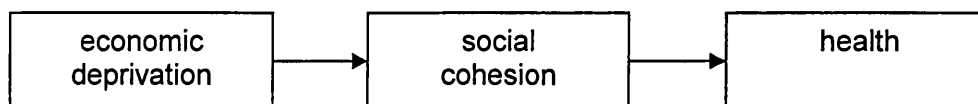
surrounded by smokers, friends pooling finances for cigarettes on a night out, families jointly collecting cigarette coupons) and lack of norms that discourage it (not having contact with wider society).

1.5.6 Extending Kawachi's proposed models

The models proposed by Kawachi et al are a useful starting point for this thesis. They were extended by explicitly considering the relationship between economic circumstances, social cohesion, and health. Interest in social cohesion and social relationships within neighbourhoods has been strongly influenced by the work of the Chicago School of Sociology (Park, republished 1969; Wirth, 1938), whose aim was to understand patterns of growth and development of cities at a time of rapid urbanisation. The correlation between physical and mental illness rates, residential turnover, unemployment and poverty, and social disorganisation in the inner-cities was noted. Appreciation of the importance of structural and economic characteristics of areas when studying social cohesion was central. A large body of work (reviewed in chapter 2) shows neighbourhood economic deprivation to be a strong and consistent determinant of morbidity and mortality and there is increasing evidence that economic deprivation is correlated with social cohesion (Pevalin & Rose, 2003). As Yen and Syme (1999) emphasise, the physical and social environments do not exist separately from one another. The joint effects of social cohesion and economic deprivation on health therefore need to be considered.

Four models linking economic deprivation, social cohesion and health can be proposed:

(i) Social cohesion may be on the causal pathway between economic deprivation and health.

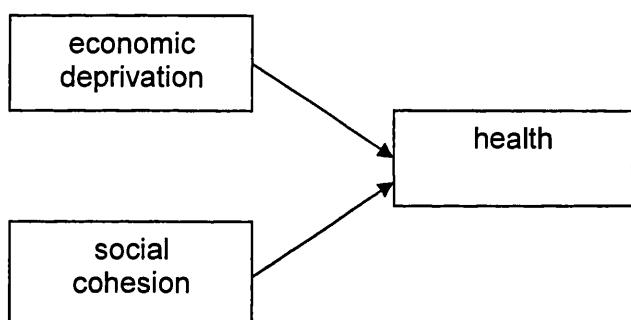


Quantitative studies of the relationship between economic deprivation and social cohesion do not exist but some causal links can be hypothesised. An economically deprived area will tend to have (relatively) low property prices. This may reduce the incentive for home-owners and landlords to maintain their properties, leading to a

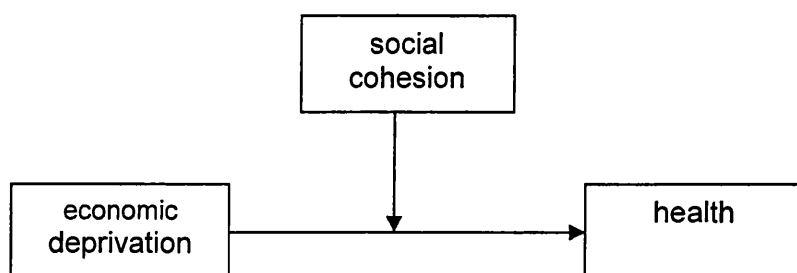
downward spiral in the built environment, which may ultimately discourage residents from spending time interacting outside. Economic deprivation may also reduce the viability of local services, including shops, bars and other meeting places. In both these scenarios opportunities for building and maintaining social cohesion would be reduced.

There may additionally be feedback in the relationship between economic deprivation and social cohesion. In areas where residents are in low paid, insecure jobs, there is a danger that local social contact will provide information about poorly paid, marginal jobs rather than about jobs which could lift people out of poverty.

(ii) Social cohesion and economic deprivation may be independent predictors of health. Those living in areas with higher levels of social cohesion may experience better health regardless of the state of the local economy.



(iii) There may be an interaction between social cohesion and economic deprivation. For example, high social cohesion in the area may buffer the effects of economic disadvantage on health.



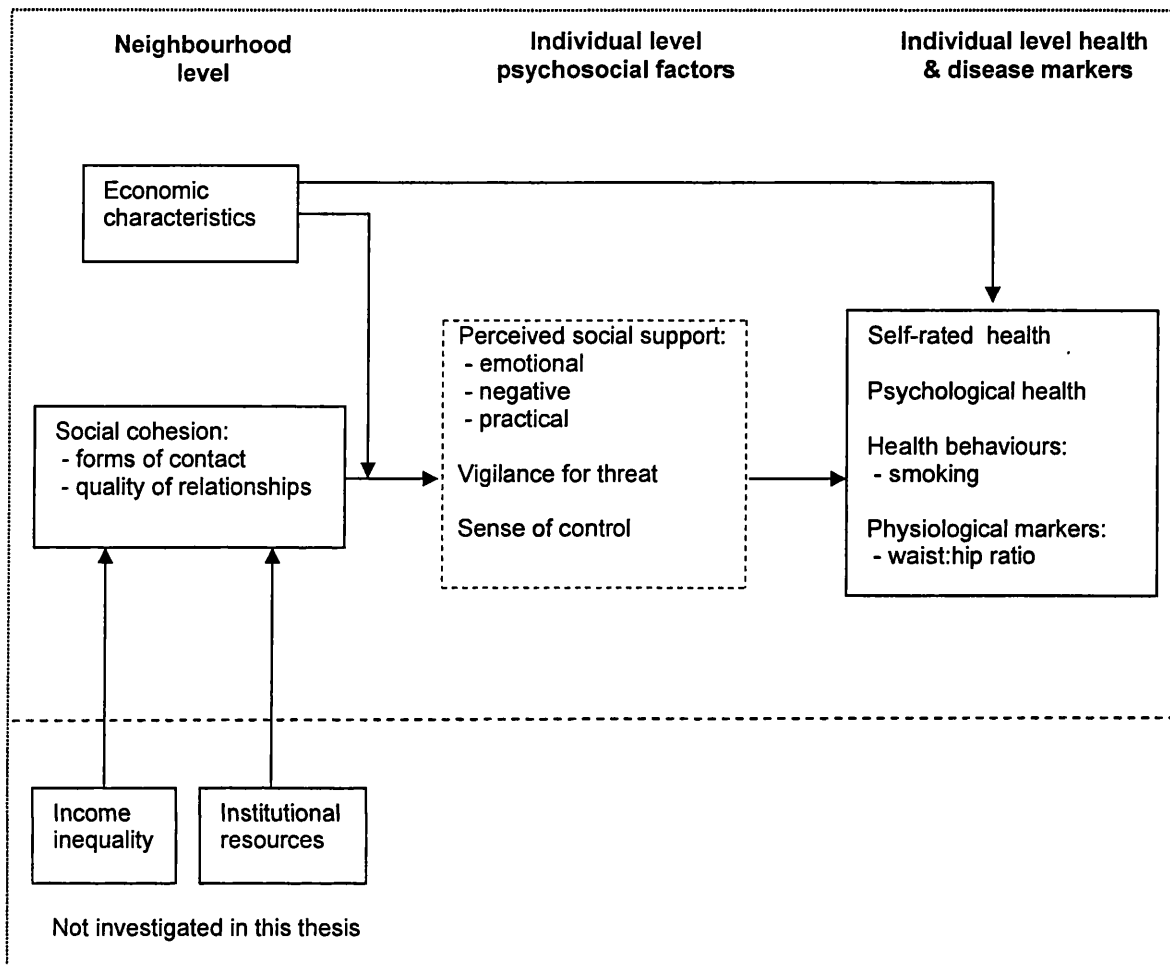
(iv) Economic deprivation may confound the association between social cohesion and health. In analytical terms, when economic deprivation is ignored, an association

between social cohesion and health is seen. When economic deprivation is taken into account, the magnitude of this association may be reduced or increased.

A second extension to the models proposed by Kawachi and colleagues allows for various subgroups of the population to be affected differentially by contextual factors or to be affected by different aspects of the residential environment. Those who spend more time in and around their home (including unemployed residents, parents looking after young children, and retirees) would be expected to be more exposed to their residential environment. Associations between characteristics of the area and health should be stronger for these residents. Elliott (2000) proposed that the social environment may also have different impacts on certain groups of people because of differential vulnerability. Living in a poor quality residential environment may magnify the health effects of individual stressors and may dampen the efficacy of individual resources. Using a neighbourhood context, Elliott showed that the health effect of individual financial strain (a stressor) was somewhat larger in poorer neighbourhoods. There was also a qualitative interaction between individual social interaction (a resource) and health by neighbourhood socioeconomic characteristics so that in less advantaged neighbourhoods, frequent social interaction was not protective against poor self-rated health or depression whereas in more advantaged areas, social interaction showed some protective effects on health. In other words, individual stressors appear to have greater health damaging effects in the context of neighbourhood socioeconomic disadvantage and individual resources appear to have greater health enhancing effects in the context of neighbourhood socioeconomic advantage. This scenario illustrates how neighbourhood socioeconomic characteristics might widen health inequalities between social classes.

Kawachi's proposed models do not indicate the processes by which an individual's health may be influenced by contextual factors. Berkman et al (2000) propose a number of ways in which social networks may link to health. Their proposed links have been adapted for use in this project investigating social cohesion in the area of residence and individual health status and are presented in Fig 1.1. This project will test whether social cohesion is associated with health and disease markers and will then explore possible pathways through individual psychosocial factors.

Figure 1.1 Theoretical model linking neighbourhood characteristics to individual health



1.6 Why study neighbourhoods?

There are reports of geographical variations in health over many different sizes of area, from countries, regions, and states through to enumeration districts and postcode sectors. The evidence for and interpretation of area differences in health will vary according to the unit of area chosen (Openshaw, 1983). The characteristics of areas listed in section 1.3 can be measured over various areal units and the importance of a given characteristic will vary according to the size of the area being considered. For example, climate will not be important in explaining health differences between enumeration districts (average population around 440 in 1991) as there will be little variation in climate over such a small area. At national or regional level, national government policies might be expected to have an impact on health, whereas differences in health between postcode sectors or electoral wards may be more

influenced by local government decisions and the norms and values of the local community. Social cohesion is a product of social interactions and so it is appropriate to describe levels of social cohesion over a relatively small geographical area, such as the neighbourhood. Sampson et al (2002) describe neighbourhoods as

“spatially defined areas whose identities and boundaries are formed through cultural, political and other ecological forces”.

In practice, administrative boundaries with populations of a few thousand are often used to approximate neighbourhoods. There are advantages and disadvantages with using administrative boundaries, as discussed in section 4.1.

It is recognised that the residential context is only one of a number of potentially important contexts, but it is appropriate to focus on geographical communities as this study aims to investigate area variations in health.

1.7 Study objectives

The main aims of this project are to investigate whether there are factors operating at a neighbourhood level which influence health over and above individual characteristics and to examine social cohesion as one potentially important neighbourhood level factor.

This study will:

- (i) describe levels of social cohesion in a selection of locations in England and Scotland
- (ii) determine the extent to which economic deprivation is correlated with social cohesion and investigate other demographic correlates of social cohesion (population age structure and racial mix, for example)
- (iii) investigate associations between levels of neighbourhood social cohesion and residents' health, over and above individual risk factors
- (iv) determine whether effects of social cohesion on health operate to the same extent for all residents or whether they are magnified in subgroups of the resident population
- (v) determine whether social cohesion moderates or mediates or is independent of the association between economic deprivation and health
- (vi) investigate the biological, behavioural and psychosocial mechanisms by which neighbourhood characteristics influence health.

1.8 Outline of subsequent chapters

The main literature review is in Chapter 2. Here the theoretical development of social cohesion and the related concept of social capital is summarised. The chapter goes on to review the empirical literature relating neighbourhood social cohesion to health and the literature relating neighbourhood economic deprivation to health. It concludes with a review and justification for the health outcomes selected for analysis in this thesis.

The third chapter outlines the specific hypotheses to be tested in the analytical part of this thesis. This chapter builds on the literature review by bringing together existing knowledge and what is currently not known about the associations between neighbourhood social cohesion, economic deprivation, and residents' health.

Chapter 4 describes the development of a new tool for measuring neighbourhood social cohesion. It covers the process and the findings of all stages of development, from piloting and psychometric testing, through to a description of levels of neighbourhood social cohesion and the socio-demographic correlates of social cohesion in the UK.

Chapter 5 describes the study design used to investigate the associations between neighbourhood social cohesion, economic deprivation and health. It details the individual level health, demographic, and socioeconomic data as well as the statistical methods which were used to test the hypotheses laid out in chapter 3.

The main findings are presented in Chapter 6. In order, this chapter describes the association between neighbourhood social cohesion and health, explores the psychosocial pathways that might link the two, describes the association between economic deprivation and health, and investigates the joint effects of social cohesion and economic deprivation.

The final chapter summarises the findings and interprets them in the light of current literature. Limitations of the work presented in this thesis are described and pointers to future work are given.

Chapter 2: Neighbourhood social cohesion and economic characteristics: a review of the literature

There are no widely accepted definitions of social capital or social cohesion and it is clear from the literature that these two concepts overlap to a great extent. Because of the lack of agreement on what constitutes social capital and how it is to be distinguished from social cohesion and because the richest literature dealing with the socio-cultural characteristics of areas and health has focused on what many researchers call “social capital”, this chapter will review the theoretical development of the two concepts. When social capital was first conceptualised, it was as a property of individuals or families. More recently, Putnam’s extensively published and quoted empirical work has used the term to capture characteristics of (geographical) communities. In this chapter, it is argued that social cohesion is a more appropriate term to use when describing the social fabric of a geographical community.

After reviewing the various definitions of social cohesion and social capital, the chapter will summarise what is currently known about the links between aspects of the socio-cultural environment and health. There follows a review of studies that have investigated economic characteristics of areas and health. It concludes with a justification of the health outcomes selected for this study.

2.1 Definitions of social capital

Aspects of what would now be thought of as social capital have been familiar to sociologists for many years. For example, Durkheim was writing about the social context and suicide in the late 19th century. The term “social capital” was reportedly first used in 1920 (Paxton, 1999) but was not widely introduced until the 1980s.

Definitions of physical and human capital may help to understand the concept of social capital. Physical capital is the equipment, machinery, and buildings useful for production. Human capital is the stock of expertise accumulated by an individual, valued for its potential use (Begg et al, 1987). Just as these two types of capital require investment to make them into a resource for future use, so also social capital requires

the investment in social relationships in order to be able to call upon the resources of the network later on.

Notions of physical and human capital come from the field of economics and are used to understand economic development. Bourdieu argued that the social world could not be understood unless one additionally considers other forms of capital – cultural capital and social capital. He defined social capital as:

“...the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance or recognition - or in other words, to membership in a group - which provides each of its members with the backing of the collectivity-owned capital” (Bourdieu, 1985).

He highlighted the material and symbolic benefits that are available to individuals by virtue of their relationships within groups. Networks are used to promote or maintain socioeconomic advantage and the benefits which arise are the very reason for the group's continued existence:

“...the profits which accrue from membership in a group are the basis of the solidarity which makes them possible” (Bourdieu, 1985).

Bourdieu's definition also suggests an intertwining of social capital and socioeconomic status. The groups which he speaks of in the previous quote may refer to social classes. Belonging to a low social class will therefore give access to a different, less advantageous, set of resources than belonging to a high social class. In this way, socioeconomic divisions within society are perpetuated.

Fukuyama also took an economic and political approach to social capital. He describes the function of social capital as the reduction of transaction costs. In situations where parties trust each other and adhere to certain norms of behaviour it is not necessary to use contractual and litigational ways of enforcing cooperation (Fukuyama, 2001). The political function of social capital, according to Fukuyama, is to make weak individuals strong through their coming together in civil associations.

Coleman's definition was an attempt to bring together the economist's approach to social capital and the social action approach, whereby an individual's actions are seen as

governed by the norms and obligations of the society around them. He defined social capital as:

"...a variety of entities with two elements in common: They all consist of some aspect of social structures, and they facilitate certain action of actors - whether persons or corporate actors - within the structure." (Coleman, 1988).

He emphasised the norms of reciprocity and rules of behaviour that govern the way two individuals will respond towards each other when they are both members of the same social network. According to Coleman, social networks are useful for controlling behaviour, through sanctions or approval and esteem. The link between socioeconomic position and social capital is less clear with Coleman's approach.

Coleman maintained that closure of social networks is necessary in order for norms to be effective. There must be sufficient links between members of the group in order that their actions can be approved or condemned. If individual A has relationships with B, C and D and individual B has relationships with A, X and Y then A and B are not in a closed network. Individual B cannot call upon the others in his network to apply sanctions to A because X and Y have no contact with A. There are examples of behavioural control when an immigrant community first settles and before it becomes more immersed in the culture of the host nation (Zhou & Bankston, 1996: described in a later section).

Coleman also argues that in societies where the welfare state is unreliable or not well developed there is a greater need for people to rely on their informal social networks whereas in affluent societies or where government welfare is available there is likely to be less need. This relates to current concerns about the possibility that government interest in social capital stems from a wish to replace adequate spending on community facilities and welfare provision with exhortations for a community to help themselves. Bartley and colleagues (Bartley et al, 1998) warn against initiating policies to increase social capital whilst ignoring the role of standard of living. Similar concerns have been raised in the US; Skocpol points out that residents are unlikely to simply organise themselves to solve local problems without any help from formal organisations, such as central and local government (Skocpol, 1996).

Whilst Bordieu defines social capital as the resources derived from a network, Coleman's definition does not distinguish so clearly between the networks that facilitate exchange and the benefits which are exchanged. Portes (1998) suggests that the vagueness of Coleman's definition resulted in a moving away from the original economic approach. He states that the three components of social capital, namely (i) the possessors of social capital, (ii) the sources of social capital, and (iii) the resources themselves, need to be distinguished if we are fully to understand the underlying processes. The possessors of social capital are those with a claim on the resources of others. Investment at some time in the past yields a potential for gain in the future so that the possessors of social capital can be thought of as creditors. They have done something for another person at some time in the past and are owed something in return. The sources of social capital are the people that owe something; they can be thought of as debtors. Whilst this distinction is useful for understanding the parallels between economic capital and social capital, it is not clear that the possessors and sources can be so clearly identified. Unless credits are given and repaid sequentially, it will be unclear to both parties who is the creditor and who is the debtor. Furthermore, as Portes points out, the currency of each transaction is not necessarily the same so it may not be clear as to who is the creditor at any given point in time. Coleman himself recognised that his definition groups together processes that should be distinguished in other situations but argues that it is useful to define social capital by its function rather than its form.

Loury's work had a lifecourse perspective on the role of social capital. He highlighted the interdependence between an individual and their social environment and wrote that:

"...the social context within which individual maturation occurs strongly conditions what otherwise equally competent individuals can achieve." (Loury, 1977).

According to Loury, the outcome of an individual depends not only on their own competence but also on the characteristics of those around them. This highlights the potential for multiplicative associations between an individual, their community and health. An interaction, if it exists, may operate in both directions. The socio-cultural environment may have a greater impact on the health of poorer individuals. People with few of their own resources who live in areas with good social networks may have better health than people with few of their own resources living in areas with poor social networks. An affluent individual may be more self-sufficient and able to purchase goods

and services and would not need to call upon a social network for help. In this scenario, social capital could be useful for reducing socioeconomic inequalities, although note that social capital can have negative as well as positive consequences (discussed further in the next section). Conversely, the socio-cultural environment may have a greater impact on the health of richer individuals. Those with more resources may benefit most from their social networks. In areas with good social networks, better off individuals may gain more from those networks than poorer individuals. In areas with poor social networks, there may be no gain for either rich or poor individuals. According to this model, access to good social networks is one of the ways in which health inequalities are perpetuated. The direction of an interaction between neighbourhood social networks, individual socioeconomic position, and health, if one exists, needs to be tested empirically using multilevel data. A regression model which includes data on area-level social networks and individual characteristics as explanatory variables can be used to determine whether characteristics of areas influence health over and above individual characteristics. By extending this model to include interactions between area-level factors and individual characteristics as explanatory variables, it is possible to look at how the residential context moderates the associations between individual characteristics and health. The current study will investigate both the main effects of area-level factors and their interactions with individual characteristics.

2.1.1 Social capital benefits

Various benefits or resources can be derived from a social network. The consequences of network membership can be negative as well as positive. Work investigating social capital has been criticised for focusing too heavily on the positive aspects and ignoring the negative effects on network members and non-members (Portes, 1998; Durlauf, 1999). Since one of the reasons for individuals to invest in social capital is to secure benefits for themselves, it should come as no surprise that this may be at the expense of others. The creation of social capital may result in zero-sum gain. On the other hand, co-operation may yield benefits without drawbacks for either the individuals co-operating or for those outside the network (Wright, 2001; Hume, as quoted in Putnam, 1993).

Membership in social networks has two main consequences, namely informal social control and benefits, which may be both practical and psychological. Informal social

control is brought about by the threat of sanctions and ostracism from the community, which deters certain behaviours. This is illustrated in a study on a Vietnamese community in the US (Zhou & Bankston, 1996). If an unmarried girl became pregnant, she would bring shame on herself and on her family. The control exerted by the family was added to by the control exerted by the community in which the family resided. As well as the positive or health-promoting aspect of social control, group attitudes may also be detrimental to health. The desire to conform that discourages unhealthy behaviours in one group may serve to encourage unhealthy behaviours in another group. In communities where the norm is not to have a job and not to obey laws, the pressure to conform will reduce opportunities rather than improve them. This is illustrated in a study in parts of Glasgow, where smoking rates were very high and strong local identity seemed to foster smoking (Stead et al, 2001). The situation of Vietnamese girls in New Orleans bringing shame on themselves and their families if they fell pregnant can be contrasted with that of teenage girls in Baltimore, where teenage pregnancy was recognised as being an attempt to gain adult status (Fernandez-Kelly, 1995). Social control can also place limits on individual free choice and privacy.

Social networks may also provide job opportunities, other types of information, financial resources, and psychological support. Portes cites examples where employees have been recruited from amongst friends and family or members of the same ethnic group rather than through public advertisement of job opportunities (Portes, 1998). Social networks may be divided into "strong" and "weak ties" (Granovetter, 1973). Strong ties tend to be with the immediate circle of family and close friends. Weak ties tend to be with less intimate friends or acquaintances. This distinction is very similar to what Putnam describes as "bridging ties" (which are inclusive and tend to come from repeated contact between diverse people from different social groups) and "bonding ties" (which are exclusive and tend to arise from episodic contact between people from the same social group) (Putnam, 2000). Weak ties (or bridging ties) may be more instrumental in providing information on jobs (Burt, 1992), whereas strong ties (or bonding ties) may be required for the provision of psychological support (Putnam, 2000). Financial support and other external assets may be provided both through weak ties in the form of a business arrangement (Granovetter, 1973) and through strong ties in the form of an informal loan or gift (Light, 1984). Granovetter links weak ties with the ability of a community to organise itself for common goals. Cliques (non-linking social groups) lead

to fragmentation and the interests of the wider community are lost. This has been termed “amoral familism” (Banfield, 1958). Woolcock also warns of the possible downsides of exclusive family ties, suggesting that strong familial attachments tend to discourage social and residential mobility (Woolcock, 1998), which may in turn have adverse health consequences.

Just as social control can have negative effects, there can be downsides to the sharing of resources within the network. Where there are special benefits for members of a network, those outside the network are discriminated against. There are examples of ethnic groups gaining a monopoly over certain industries. In the case of social capital at the area level, an area that is successful in attracting resources or campaigning against the construction of undesirable or unsightly buildings within its own boundaries may do so at the expense of other areas. Networks may also place heavy demands on their members.

2.1.2 Social capital and social cohesion: should we measure them at the individual level or the group level?

Whether social capital should be measured at the individual or group (community) level has been the topic of some debate. The focus of the above definitions has been on individuals reaping benefits by virtue of their membership of some group. It is not clear how social capital measured at the individual level differs from social support, received from friends, family, colleagues and neighbours. Measures of social support include the quantity and quality of relationships and the practical, emotional and negative support derived from these (Stansfeld, 1998). Putnam (2002) asserts that social capital refers both to the benefits an individual receives by virtue of their own social networks and the externalities (benefits received by the wider community, including people who do not directly participate in those social networks). He defines social capital as:

“features of social organisations, such as networks, norms, and trust, that facilitate action and co-operation for mutual benefit” (Putnam, 1993).

His empirical work has focused on group level measures of social capital, captured by rates of voter turnout, participation in associations, and trust in different regions in Italy or states in the US (Putnam, 1995; Putnam, 2000). Similarly, Durkheim’s social facts, characteristics of the social context which are stable over time even as individuals move

in and out of that context, are also conceptualised at some level above the individual. Coleman also pointed out that social capital is not the private property of an individual but is embedded in social structures. He pointed out that a person can invest in social capital but is not usually the sole beneficiary (Coleman, 1988).

There has been little success in harmonising the definitions and approaches to measuring social capital. However, Woolcock's view is of an emerging consensus across the social sciences that

"Social capital refers to the norms and networks that facilitate collective action"
(Woolcock, 2001).

In attempting to further refine what social capital is, he argued three points. Firstly, he argued that a definition should focus on the forms of social networks and should not include the consequences of those networks. Secondly, he argued that the forms of social networks can be divided into those which are bonding (relations between family and close friends), bridging (relations between less intimate friends, associates, and colleagues) and linking (relations beyond the immediate community). Thirdly, he argued that social capital is most easily understood as something which is sociological (about social relations) rather than psychological (about individual perceptions) or political (about institutions or national structures).

In this thesis, the focus is on groups of people who live in the same neighbourhood. Clearly, an individual could be involved in networks outside the neighbourhood (in the workplace, at church, and with others in the same ethnic group, for example). (These difficulties are not confined to studies of the socio-cultural environment: air pollution studies often assume equal exposure for all residents in a given area, regardless of the amount of time they spend in that area, and ignore exposure in the workplace and during leisure time.) The approach taken in this thesis is that a measure of the socio-cultural environment at the neighbourhood level captures something different from social support and may influence an individual's health over and above their personal social support. (This will be tested, as laid out in chapters 4 and 6.) As this study focuses on the social networks between people within a geographical area, there will be some underestimation of the total amount of social capital that may be available to any given resident. The degree of underestimation will depend on individual circumstances and probably relates to the amount of time spent in the neighbourhood. For example, the

social characteristics of the neighbourhood may be more important for people outside the workforce and those who work locally. The increasing numbers of women working outside the home, greater distances travelled to work, and longer working days may mean that many people's networks are located less in their neighbourhood than ever before. However, neighbourhood variations in health have been widely demonstrated and the focus of this study is to investigate whether these variations can be explained by economic and social characteristics in the residential context.

Sampson argued for a multilevel approach to the study of social ties within neighbourhoods. He suggested that social organisation at a neighbourhood level influences an individual's social integration in the community (Sampson, 1988). Berkman et al (2000) consider social networks as mezzo (or meso) level factors. Social networks are situated between the social and structural characteristics of societies (including laws, labour market structure, and urbanisation) and the psychosocial and socioeconomic characteristics of individuals (including perceived social support and job opportunities). Their model is applied to this project using a geographical perspective, with society defined as the country, the mezzo level defined as the neighbourhood, and individuals at the lowest level.

2.2 Definitions of social cohesion

Social cohesion has been defined as:

"...the networks, norms and trust that bring people together to take action" (Lavis & Stoddart, 1999).

The emphasis is on the quality and quantity of social interactions between individuals within a community rather than on the resources gained through those interactions.

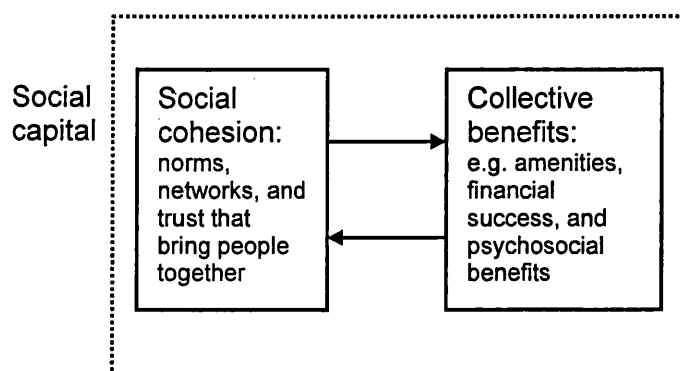
The terms "social capital" and "social cohesion" have been used interchangeably in the epidemiological literature (see, for example, Skrabski et al, 2003). Empirical studies in the health literature have almost exclusively considered geographical communities. They have included measures of the amount of contact with family and friends, the amount of participation in organised groups, the extent to which people report that they trust one another, and the degree of attachment people feel towards their neighbourhood. Such measures describe the forms of social contact between

individuals and the quality of those relationships. They typically do not include the full range of benefits derived from those social interactions, including access to economic and material resources, transfer of information, and social control, which are an integral part of the descriptions of social capital laid out in the previous section. It is therefore argued that social cohesion is a more appropriate term than social capital to describe the quantity and quality of social interactions within a geographical community (see Figure 2.1).

Social cohesion gives a snap-shot of the social environment – it is a static measure. It is a prerequisite to the collective action that may bring resources to the group but in itself it does not capture these actions and resources. The definitions summarised in section 2.1 point to social capital as a dynamic process. Furthermore, measures such as the amount of contact with friends and family, the degree of trust, and levels of participation do not capture the capital element of social capital. Hean et al (2003) see the capital element of social capital as being of crucial importance. They argue that it is the benefit gained from social interaction and the re-investment of this benefit which gives rise to capital.

The steps linking social cohesion between individuals within a community to collective efficacy (successful collective action) have been described as a four-runged ladder (Potapchuk et al, 1997). At the first step, individuals socialise with each other. At this level, bonds between individuals do not necessarily lead to collective action. At the second step, individuals and groups interact. At the next step, groups interact with each other. Groups may be formal or informal and it is at this level that the critical mass required for social change is attained. Finally, civic culture develops when individuals and groups share common values and norms and work towards the same goals. Areas with strong and supportive networks, in combination with available resources, are hypothesised to be more able to bring about successful collective action.

Figure 2.1 Framework linking social capital, social cohesion, and collective action as a dynamic process



As social cohesion is conceived of as being a constituent part of social capital in this thesis, the epidemiological literature relating to both these concepts will be reviewed together.

2.3 Existing literature on social capital, social cohesion and health

Based on a similar categorisation to that laid out in a review by Sampson and colleagues (2002), the relevant literature can be divided into three types of studies: i) ecological studies of aspects of social cohesion and health (where both are measured at the macro level), ii) studies that have measured aspects of social cohesion at the macro level and used multilevel methods to investigate the relationship with individual health status, and iii) studies that have measured aspects of social cohesion or social capital at the individual level in relation to health. This last group of studies forms the largest part of the literature. Of these studies, only those where the individual level measures of social cohesion or social capital relate in some way to the residential environment will be reviewed. For example, if participants were asked whether they trust their neighbours and the association between this individual level measure of trust and individual health status was investigated, then this study would be included in the review. Studies of social networks with family or friends and social supports which do not have a neighbourhood or other geographical perspective are outside the immediate focus of this project and are not reviewed, but see Seeman (1996) and Cohen and Syme (1985) for comprehensive reviews of social networks and social supports. The three types of

evidence are presented in turn and a critical summary of existing literature is given at the end of this section.

2.3.1 Ecological studies of aspects of social cohesion and health

Studies correlating ecological measures of social cohesion with ecological measures of health are summarised in Table 2.1. Much of this work comes from the US. Individual responses to items from the General Social Survey have been aggregated to capture state-level trust and reciprocity. These items include "Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?" and "Would you say that most of the time people try to be helpful, or are they mostly looking out for themselves?". A number of published studies have linked these aggregated measures to mortality rates (Kawachi et al, 1997; Kawachi & Kennedy, 1997; Kennedy et al, 1997) and other outcomes (Kennedy et al, 1998(a); Gold et al, 2002). Although these regularly cited studies form a substantial body of work supporting a link between social cohesion and health, it must be noted that they use the same data to capture social cohesion and so are not wholly independent of each other. These studies also have the limitation, along with all ecological studies, that it is not possible to take account of individual level determinants of health. The magnitude of association between social cohesion and morbidity or mortality may be over-estimated (or under-estimated) as individual risk factors could not be accounted for in these ecological studies.

The index of social cohesion developed by Veenstra used a combination of area level measures collected on individuals and aggregated up and area level measures collected at the ecological level (Veenstra, 2002). Associational participation was captured by the number of clubs in an area per head of population along with individual data from Statistics Canada covering membership and active participation in voluntary organisations. A reasonably high negative correlation between participation and mortality was found ($r = -0.33$) but this achieved only borderline significance due to the small number of areas studied ($p=0.08$).

Whitley et al made innovative use of data collected in the 1991 census to investigate the relative effects of economic deprivation and social fragmentation on health (Whitley et al, 1999). Their index of social fragmentation, originally proposed by Congdon (1996) was

based on private renting, single person households (aged <65), unmarried persons, and residential mobility. They found that suicide rates were higher in more socially fragmented areas. Social fragmentation was a better predictor of suicide than was economic deprivation captured by the Townsend index. Mortality from other causes was more strongly related to economic deprivation than to social fragmentation, although social fragmentation was an independent predictor. This study suggests that neighbourhood social organisation may influence health independently of the material and economic resources available, although individual characteristics were not controlled for here.

Only one longitudinal study was identified. Galea et al (2002) looked at the relationship between generalised trust (measured in the General Social Survey) and mortality from homicide in 32 US states from 1974 to 1993. A Markov model was used to estimate probabilities of change according to baseline categories. Markov models suggested that the probability of a state which was high trust/high violence at time t becoming low trust/high violence at time $t+1$ was higher than the probability of a state which was high trust/high violence at time t becoming high trust/low violence at time $t+1$. These time series data suggest that violence predicts social cohesion more strongly than social cohesion predicts subsequent violence. Note that trust was the only aspect of social cohesion that was examined in this study and other aspects which could be hypothesised to be related to violence were not included. The authors also noted that states had fairly stable levels of both violence and social cohesion over the period studied. Nevertheless, Galea et al's findings raise the possibility that social cohesion alone may not be sufficient to tackle violent crime.

In summary, the majority of ecological studies point to an inverse association between social cohesion and mortality and morbidity. Most of this literature comes from the US but studies in Brazil, Russia, Hungary and the UK also find inverse associations between social cohesion and mortality and morbidity and positive association between social cohesion and mental well-being. Three published studies failed to find an association between social cohesion and health and publication bias cannot be discounted as an explanation for the fact that most published studies demonstrated significant associations.

Table 2.1 Summary of ecological studies relating social cohesion to health

Authors	Data source	Areal unit of analysis	Area-level exposure	Main statistically significant findings
Barata et al, 1998	Sao Paulo, Brazil	57 subdistricts	Social exclusion (limited possibility for citizens to achieve their cultural and social needs)	Social exclusion --> (+)homicide
Burdine et al, 1999	Postal survey in 4 US states	Community within US states	Social capital - no details on how measured	Social capital --> (+)mental health (SF36).
Cohen et al, 2003	Routine mortality data linked to PHDCN	Neighbourhood clusters	Collective efficacy, broken windows	Collective efficacy --> (-)mortality rate Broken windows --> (+)mortality rate Collective efficacy & broken windows mediate relationship between concentrated disadvantage and mortality rate
Galea et al, 2002	General Social Survey (GSS) linked to mortality registration	US states	Trust	Trust --> (-)homicide mortality Δ trust --> (-)homicide Δ homicide --> (-)trust
Gold et al, 2002	GSS, US	US states	Participation in the community (membership of groups and associations) and trust	Trust -->(-)teen births
Hemenway et al, 2001	GSS linked to Needham Lifestyle Survey	US states	Civic engagement, informal networks	Club meetings --> (-)gun suicide/homicide Trust --> (-)gun suicide/homicide Informal networks --> (-)gun suicide/homicide
Kawachi et al, 1997	GSS, US	US states	Participation, trust and reciprocity	Participation --> (-)mortality Trust --> (-)mortality Reciprocity --> (-)mortality

Kawachi & Kennedy, 1997	GSS, US	US states	Participation	Participation --> (-)mortality
Kawachi et al, 1999	GSS, US	US states	Trust, family social capital (% single mothers)	Trust -->(-)Violent crime Family social capital -->(-)violent crime Trust --> (-)violent crime
Kennedy et al, 1997	national survey + mortality statistics	US states	Collective disrespect (a measure of racial discrimination)	Disrespect -->(+)mortality
Kennedy et al, 1998(a)	GSS, US	US states	Participation, trust	Participation --> (-)violent crime Trust --> (-)violent crime
Kennedy et al, 1998(b)	All-Russian Center for Public Opinion Research surveys	Regions	Trust in government, crime and conflict at work	Trust in local govt --> (-)mortality Crime --> (+)mortality
Kennelly et al, 2003	World Values Survey	Countries	Trust, participation	No clear association with life expectancy or infant mortality
Neeleman & Lewis, 1999	World Values Survey	Countries	Religious attendance, religiosity	Religious attendance --> (-)suicide
Pattussi et al, 2001	Oral health survey + census data, Brazil	Administrative regions	Per capita number in budget decision meetings	No association between participation in meetings and % free of caries
Siahpush & Singh, 1999	Australian Bureau of Statistics data	Australian states	% living alone, divorce rate, unionisation rate	% living alone --> (+)mortality divorce rate --> (+)mortality
Skrabski et al, 2003	Hungarostudy II	Hungarian counties	Trust, reciprocity, support from organisations	Trust -->(-)mortality Reciprocity -->(-)mortality Support -->(-)mortality

Veenstra, 2002	Routine statistics + survey, Canada	Health districts	Associational and civic participation (voter turnout, number of associations, associational membership)	Borderline association between participation and age-adjusted mortality
Whitley et al, 1999	1991 census data and mortality statistics	Parliamentary constituencies	Social fragmentation (high % single person households, unmarried persons, renters and movers)	Social fragmentation --> (+)suicide

2.3.2 Multilevel studies of aspects of social cohesion measured at the macro level and individual health

The limitations of ecological analysis were highlighted in the previous section. Multilevel studies of social cohesion and health are summarised in Table 2.2. Kawachi et al (1999(a)) extended their work using the General Social Survey by combining it with individual health data from the Behavioural Risk Factor Surveillance System in a multilevel framework. They found relationships between state-levels of participation, trust and reciprocity and individual self-rated health, adjusted for sex, age, ethnic group, household income, and health behaviours. The largest effects of social cohesion on health were observed for participants with the lowest household incomes.

Sampson et al's study (1997) in Chicago addresses many of the methodological challenges to studying neighbourhood social cohesion. The Public Health and Development in Chicago Neighbourhoods Study was set up in 1995 and aims to improve our understanding of the causes and pathways to juvenile delinquency, adult crime, and violence. Following 7000 individuals living in different parts of Chicago it incorporates longitudinal data at the neighbourhood level (which has been collected by questionnaire and by systematic observation) with individual outcomes and potential confounding factors at the individual level. The empirical measures of social cohesion have a clear theoretical basis and were designed to study social processes in the neighbourhood, whereas many studies have been based on secondary analysis and have had to identify social cohesion measures from existing data. This study did not originally have a health component although the most recent follow-up does include a number of health outcomes and mortality rates have been attached to the social cohesion data (Lochner et al, 2003; Wen et al, 2003). The design for the current project was greatly influenced by on-going work in the PHDCN study.

The analyses by Wen et al (2003) in the PHDCN study not only demonstrated an association between neighbourhood social cohesion and health, but also investigated the role of economic deprivation/affluence in this association. Self-rated health was better in more affluent neighbourhoods. This health advantage was mediated through better physical conditions (less litter, less graffiti, and less vacant land) and through better social resources (informal social control, social cohesion, and reciprocated

exchange). Arguably, lack of informal social control may be a precursor to physical disorder. The health advantage in more affluent neighbourhoods was not mediated by health-enhancing services.

The Social Capital Community Benchmark study designed by the Saguaro seminar at Harvard (Saguaro seminar 2001) includes data from over 26,000 respondents across the US. Individual reports of trust, having others to share confidences with, participation in politics, associational membership, informal social contact, and diversity of networks were aggregated up to state level. Health outcomes were not the focus of this study, though findings suggest that personal happiness is higher in places with greater levels of trust and social connectedness, even after adjusting for individual income and education.

As with the ecological studies, the majority of published studies using multilevel data were based in the US and show negative associations between social cohesion and mortality and positive associations between social cohesion and good health. Data from two other countries show that informal social control may be beneficial for health-related outcomes amongst younger people (Drukker et al, 2003; Frohlich et al, 2002).

Table 2.2 Summary of multilevel studies relating social cohesion to health

Authors	Data source	Areal unit of analysis	Area-level exposure	Main statistically significant findings
Buka et al, 2003	PHDCN + birth records	Neighbourhood clusters	Neighbourhood social support (combines social cohesion + reciprocated exchange)	Social support → (+)birthweight for white women only
Cutrona et al, 2000	Interviews of parents Child Services 1990.	Block group areas	Community cohesion, disorder	Cohesion → (-)psychological distress (p>0.05 after adjustment for individual risk factors) Disorder → (+)distress
Drukker et al, 2003	Survey of Maastricht residents	Neighbourhoods	Social control, trust	Social control → (+)self-rated health of children
Frohlich et al, 2002	Survey of families in Quebec, Canada	15 min walk from school location	Social control	Number of agents providing anti-smoking information → (-)smoking initiation "No smoking" signs → (-)smoking initiation
Kawachi et al, 1999	GSS linked to Behavioural Risk Factor Surveillance System	US states	Trust, reciprocity, participation	Trust → (+)self-rated health Reciprocity → (+)self-rated health Participation → (+)self-rated health
Lochner et al, 2003	PHDCN	Neighbourhood clusters	Trust, reciprocity, participation	Trust → (-)all-cause mortality, CVD mortality Reciprocity → (-)all-cause mortality, CVD mortality Participation → (-)all-cause mortality, CVD mortality

Saguaro Seminar, 2001	Social Capital Community Benchmark Survey	US states	Social connectedness, trust,	Community social connectedness --> (+)personal happiness
Sampson et al, 1997	PHDCN	Neighbourhood clusters	Social control, social cohesion	Social control --> (-)homicide Social cohesion --> (-)homicide
Weitzman & Kawachi, 2000	Harvard School of Public Health 1993 College Alcohol Study, US	Campuses	Volunteering	Greater mean time spent volunteering --> (-)binge drinking
Wen et al, 2003	PHDCN + Metropolitan Chicago Information Center Metro Survey	Neighbourhood clusters	Social resources (comprising social control, social cohesion, reciprocated exchange)	Social resources --> (+)self-rated health

2.3.3 Individual level measures purporting to capture aspects of social cohesion in the area and health

Some studies have related individual level measures of (perceptions of) social cohesion to individual health. Where the measures relate in some way to the participant's residential environment, the study has been summarised in Table 2.3. For example, using data from the Health and Lifestyles Survey, Cooper et al created a neighbourhood index for each participant based on their reported enjoyment of living in that neighbourhood, reciprocity, fear of crime, facilities and community activity (Cooper et al, 1999). This index was associated with self-rated health for women, but not for men. Because several aspects of the neighbourhood environment, including social cohesion, physical facilities and community action, were combined into a single index, this study does not provide clear evidence of an association between social cohesion and health.

Three other UK national surveys – the Health Survey for England, the British Household Panel Survey and the General Household Survey – have asked participants to rate aspects of their neighbourhood. The Health Survey for England has the advantage of including numerous health outcomes, including objective measures taken at screening. Trust was associated with poor self-rated health and obesity (defined as a body mass index of 30kg/m² or higher), after adjustment for age, social class, income, education, access to car and Townsend index of deprivation (Boreham et al, 2002).

The longitudinal design of the British Household Panel Survey allowed Pevalin and Rose (2003) to investigate changes in health status. Neighbourhood attachment (based on sense of belonging, friendships within neighbourhood, obtaining advice, exchanging favours, working together to improve neighbourhood, plan to stay, similar to others in neighbourhood, regularly talking to neighbours) was associated with lower risk of common mental illness and poor self-rated health at a single point in time. However, neighbourhood attachment did not predict subsequent change in mental and general health status. The lack of longitudinal association suggests that, if neighbourhood attachment is causally related to mental and general health status, the effect is fairly immediate and does not have a long lag time. Pevalin and Rose also investigated the relationship between social cohesion and individual socioeconomic characteristics. They found that the inclusion of various markers of social cohesion (contact with friends,

participation in organisations, and neighbourhood attachment) did not alter the associations between employment status, education or social class and health.

Longitudinal data were also utilised by Balfour and Kaplan (2002) to explore the relationship between social connectedness, neighbourhood problems and decline in physical function. Older residents in neighbourhoods with more problems (especially noise, poor lighting, and heavy traffic) experienced greater declines in functioning. Social connectedness was not on the pathway between neighbourhood problems and functioning, although the authors point out that other measures of social connectedness would be useful to explore this further.

Most of the other studies listed in Table 2.3 are based on secondary analysis of existing data so that only a limited number of aspects of social capital or social cohesion have been captured. There are three notable exceptions. Sooman and Macintyre (1995) investigated socio-environmental problems (including vandalism, litter, assaults and muggings, disturbance by youngsters, and discarded needles), the reputation of the area (based on whether taxi, ambulance, police or credit services had ever been refused on the basis of respondent's home address), neighbourliness (based on exchanging favours and perceptions of friendliness of people in the area), fear of crime, and satisfaction with the area (including an item on whether respondent wanted to move from the area). An overall score combined responses to these separate components, along with a scale measuring local amenities. A higher total assessment (indicating poorer quality neighbourhood) was associated with greater anxiety and poorer self-rated health, adjusting for social class, sex and age. Again, the analysis does not identify which of these components of the area of residence were associated with the health outcomes investigated. The authors point out that affect bias (the tendency to respond consistently negatively or consistently positively to all questions) could explain the associations seen. They made some adjustment for this by excluding anxiety and depression cases and found that the association with self-rated health remained, providing support for the hypothesis that living in an area that is perceived to be poor quality is not good for health. Another study by the same authors focused on social cohesion using the Buckner Neighbourhood Cohesion Scale in four areas in Glasgow (Macintyre & Ellaway, 2000). Neighbourhood cohesion was negatively associated with psychiatric morbidity (measured on the GHQ12), malaise symptoms, and physical symptoms, even after

adjustment for social class, employment status, sex and age. The Buckner scale comprises three components relating to attraction to neighbourhood, sense of community, and neighbouring behaviour, though the scales were not investigated individually in the multivariate analysis. Veenstra's study in Canada also included a wide range of features of the neighbourhood (Veenstra, 2000). Social engagement, including frequency of socialising with neighbours and belonging to a neighbourhood improvement association was not related to self-rated health. Trust in people living in the same part of the city, in people living in the same community, and in neighbours was not associated with health. Civic participation, which in Potapchuk et al's (1997) framework is related to social cohesion, was captured by frequency of reading the local newspaper, watching local television news, serving on the board of a community organisation, and contacting a local official about a problem. Civic participation also failed to show any association with health. Findings from this study suggest that individual social capital is not important for health. A question over the representativeness of the sample is raised, however, since income and education were not associated with the self-rated health of participants aged 18-39, and income was not associated with self-rated health for those aged 39-65.

Studies of social networks in Russia in the mid 1990s highlight the ways in which networks may have positive or negative consequences for health (Bobak et al, 1998; Rose, 2000). Both studies found that people relied on formal networks in some situations, informal networks in other situations, and in some situations did not have a network on which they could rely. Using friends for information was negatively associated with health whilst the association between health and reliance on market networks was positive, although the latter is arguably a measure of income as much as a measure of social capital. However, Rose found no association between living in a village that facilitated informal networks and health. It is unclear whether this item captures levels of infrastructure (such as meeting places) within a village, generally held attitudes towards socialising, or other features which facilitate the formation of networks, but it does suggest that residential networks may not be of central importance in Russia during this period.

The study by Hyppa and Maki (2001) focuses on communities in Finland defined in terms of both language and spatial separation. The Swedish-speaking community were

more trusting and more involved in various types of associations than the Finnish-speaking community. This provides some support for the notion that shared ethnic minority background is an experience that can draw people together. Trust and membership in a religious association were associated with good self-rated health, independently of income and residence in an urban area. In some, though not all parts of Finland, the Swedish-speaking community are a privileged layer in Finnish society so it is possible that the full range of socioeconomic factors were not adequately controlled for by the income variable.

The individual level studies on perceptions of aspects of neighbourhood social cohesion are less US-centric than studies based on ecological and multilevel data. Perceptions of social cohesion were found to be inversely associated with various health indicators including depression and poor mental health, poor self-rated general health, obesity, and all-cause and cause-specific mortality. A number of studies find that social disorder, possibly indicating a lack of social cohesion, is positively correlated with poor health and behavioural risk factors for poor health (gonorrhea, early sexual activity, and smoking). Note that in these studies, perceptions of the neighbourhood were reported by the same individuals who reported on their health. In such studies it is not possible to determine how much of any association seen is a result of affect bias.

Table 2.3 Summary of individual level studies capturing some aspect of neighbourhood social cohesion

Authors	Data source	Individual level indicator of neighbourhood social cohesion	Main statistically significant findings
Aneshensel & Sucoff, 1996	Los Angeles County survey of adolescents. Tracts sampled	Social connections (kids know one another, adults know one another, people are friendly)	Social connections --> (-)depression
Aye et al, 2002	Community sample, Ivory Coast	Belonging to village association	No association with health care use. (Estimates in expected direction but query sufficient power as very wide confidence intervals.)
Balfour & Kaplan, 2002	Alameda County Study 1994-5 follow-up of adults aged 55+	Perceived neighbourhood environment (including crime, litter, but also traffic, access to public transport)	Multiple problem neighbourhood --> (+)functional decline
Boreham et al, 2002	Health Survey for England. Postcode sectors sampled	Trust, neighbourhood problems	Trust --> (-)poor self-rated health Trust --> (-)obesity
Bosworth & Schaie, 1997	Seattle Longitudinal Study	Structural social networks, including number of neighbours could rely on, participation in church and other meetings	Structural social networks --> (-) health care utilisation for married participants only In less deprived neighbourhoods, maternal attachment to community --> (+)child's mental health
Cohen et al, 2000	New Orleans public health records. Block groups sampled	Neighbourhood disorder	Neighbourhood disorder --> (+)gonorrhea
Cooper et al, 1999	Health and Lifestyle Survey	Neighbourhood index of social capital & facilities (enjoy living there, look after one another, area safe & good facilities)	Neighbourhood social capital & facilities --> (-)LLTI Neighbourhood social capital & facilities --> (-)poor self-rated health

Dalgard & Haheim, 1998	Population sample, Oslo	Taking part in organised groups	Participation --> (-) all-cause mortality, CHD mortality, cancer mortality
Davidson & Cotter, 1991	Population sample, Alabama & South Carolina, US	Sense of community	Sense of community --> (+)well-being/happiness
Ellaway et al, 2001	West of Scotland Twenty-07 Study (4 Glasgow neighbourhoods)	Buckner neighbourhood cohesion scale	Social cohesion --> (+) self-rated health Social cohesion --> (+)mental health Social cohesion --> (-)symptoms
Elliott, 2000	Nevada survey of adults. Zip codes sampled	Social integration	Social integration --> (-)depression
Hyypä & Maki, 2000	Finnish & Swedish speakers, Finland. Municipalities sampled	Neighbourhood assistance, participation in community events, membership of community organisations	Not associated with self-rated health
Lancot & Smith, 2001	Rochester Youth Development study. Tracts sampled	Neighbourhood disorganisation	Neighbourhood disorganisation --> (+)early sexual activity
Lavis & Stoddard, 1999	World Values Survey. Country level data	Trust, participation	Trust --> (-)poor self-rated health
Lindstrom et al, 2000	Malmo Diet and Cancer Study	Social anchorage (sense of membership in formal and informal groups, including neighbourhood)	Social anchorage did not explain any of socioeconomic gradient in smoking cessation
Lindstrom et al, 2001	Malmo Diet and Cancer Study	Social anchorage as above	Social anchorage --> (+)physical activity

McCulloch, 2001	British Household Panel Survey	Neighbourhood social capital (items not listed but probably same as described in McCulloch, 2003: neighbourhood belonging, friendships, favours, shared identity), social disorganisation (problems with graffiti, vandalism, racial attacks)	Social capital --> (-)psychiatric morbidity
Molinari et al, 1998	Telephone survey in northwestern state in US	Perceptions of problems (incl drug use, crime, migration, domestic violence)	Perceptions of community problems --> (-)general self-rated health and functioning for women only. Perceptions of physical environmental problems --> (-)functioning for men.
Pevalin & Rose, 2003	British Household Panel Survey	Neighbourhood attachment (including belonging, friendships, exchange favours)	Neighbourhood attachment --> (-)common mental illness Neighbourhood attachment --> (-)poor self-rated health
Rose, 2000	New Russia Barometer surveys	Social networks, social integration (including participation, church attendance, face-to-face contact in village)	Social networks --> (+)self-rated physical health Social networks --> (+)self-rated emotional health Social integration --> (+)self-rated physical health Social integration --> (+)self-rated emotional health High contact village not associated with self-rated physical or emotional health
Ross, 2000	Community, Crime and Health Survey, Illinois. Tracts sampled	Perceived disorder (physical and social), social ties with neighbours	Disorder --> (+)depression Ties -->(-)depression, anxiety
Runyan et al, 1998	Longitudinal Studies of Child Abuse, US	Church attendance, neighbourhood support (reciprocity, watch over children)	Church attendance --> (+)childhood development Neighbourhood support --> (+ borderline) childhood development

Sooman & Macintyre, 1995	West of Scotland Twenty-07 Study	Reputation, neighbourliness, fear of crime, satisfaction with area, local problems, overall assessment	Overall assessment of community --> (+) mental health
Step toe & Feldman, 2001	Survey of London adults. Postcode sectors sampled	Neighbourhood problems (incl antisocial behaviour, threats to self/property), social cohesion, informal social control	Neighbourhood problems --> (+)psychological distress, (-)self-rated health, (-)physical functioning Social cohesion --> (+)physical function
Stiffman et al, 1999	Youth services project, St Louis. Tracts sampled	Perceived neighbourhood problems	Perceived neighbourhood problems --> (-)mental health
Tulle-Winton, 1997	Community survey, Castlemilk, Glasgow	Unfriendly neighbourhood	Unfriendly neighbourhood -->(+)poor mental health; women only
Veenstra, 2000	Survey of adults in Saskatchewan, Canada	Socialising with neighbours, participation in neighbourhood association, trust people from local community, trust neighbours, commitment to neighbourhood	No associations with self-rated health

2.3.4 In-depth studies of social cohesion and social capital

In the UK, in-depth work was undertaken by Campbell and colleagues, who investigated community relationships in two electoral wards in Luton (Campbell et al, 1998). (The wards were matched for economic deprivation, but there appeared to be quite large differences in employment status between participants in the two wards.) They showed that the ward with better health had higher levels of trust and confidence in the political power of ordinary citizens, whereas the ward with poorer health had a high level of local identity. Again, this illustrates that not all aspects of social cohesion are health-promoting; there may be aspects of social cohesion that are health-damaging. There was an indication that differences in age, ethnicity, housing tenure and individual deprivation between residents in the same neighbourhood undermined social cohesion and common identity.

Work by Cattell and Herring (2002) on the association between infrastructure and social cohesion and highlights the potential role that mainstream service providers can have in the formation and maintenance of social cohesion. A lack of local leisure facilities for younger people may be one explanation for the relatively low participation in that age group. Participants in their study expressed some agreement with the notion that social networks, norms of reciprocity, and trust within their locality were important for health. They also indicated the role of independence, free choice, and individual efficacy for health.

As well as the formal studies of aspects of social cohesion and social capital described above, it has been suggested that one explanation for the very high life expectancy in Japan and the high life expectancy in Kerala compared with other parts of India is the organisation of these societies and the cohesiveness of their social relations (Marmot, 2004).

2.3.5 Summary and limitations in existing health studies of social cohesion and social capital

In summary, the literature points to a role for social cohesion in the residential area in influencing some health outcomes. At present, there is no consistent message as to

which aspects of social cohesion are the most salient for health. There is less empirical evidence of a health-damaging effect, although this may be due to the framing of the research question and an interest in identifying positive influences on health rather than on understanding the links between social processes and health. Where socioeconomic factors have been considered explicitly, studies are divided as to whether a health effect of social cohesion remains.

Several limitations in existing studies are evident from the literature.

1. There is little agreement on what constitutes social capital at the individual level or social cohesion at the aggregate level and how to measure it. To some extent this can be explained by the fact that many studies are based on secondary analysis of existing data. Social cohesion has been operationalised using apparently relevant items that were collected for other purposes. Some studies have put together variables capturing aspects of social cohesion and variables capturing structural factors that are likely to be affected by macro policies more than by the local community (such as provision of facilities, unemployment, problems with traffic, and quality of housing) to form a neighbourhood index. There is a need to develop measures of social cohesion that are grounded in theory.
2. In some cases, only one or two of the dimensions of the socio-cultural environment have been included. Few studies have taken a multi-dimensional approach. Where more than one dimension has been measured, these have often been combined to form a summary index. It is important to look at each domain separately if we are to develop interventions and to consider the possible negative as well as positive health effects of social cohesion.
3. As Macinko and Starfield (2001) point out, studies of social capital and social cohesion have rarely presented details on the psychometric properties of the scales they use.
4. There are relatively few multilevel studies incorporating individual level health data, neighbourhood level characteristics, and potential confounding factors. Many studies purporting to investigate neighbourhood socio-cultural characteristics and health have used individual level data. It is not possible to tell from these studies whether the same relationships hold at the macro level. Where such studies have looked at self-reported health outcomes, it is impossible to tell how much of any reported association is due to

affect bias. A number of studies are ecological in design and have failed to control adequately for potential confounding factors.

5. Some studies have used multilevel techniques but do not appear to be powerful enough to estimate differences between areas reliably.
6. Area level measures have sometimes been calculated by aggregating data over individuals living within the same residential area. However, the items generally do not relate to the area of interest. For example, a neighbourhood measure of trust can be obtained by asking a sample of people living in the same neighbourhood whether they agree that “most people can be trusted”. Greater agreement with this statement gives a higher neighbourhood trust score. A more valid aggregate measure would be obtained by asking people living in the same neighbourhood whether they agree that “most people in this neighbourhood can be trusted”. The extent to which responses to these two questions differ is not known.
7. Subjective outcomes such as self-rated physical and mental health have been investigated in a number of studies. Few have looked at objective health outcomes or behavioural and biological pathways which may link social cohesion to health status.
8. There has been little investigation of how an individual's characteristics may magnify or reduce any effects of the neighbourhood social environment. In particular, it is not clear whether the relationships between social cohesion and health are the same for those of high and low socio-economic position.

This project aims to address each of these limitations through its multilevel design, its removal of affect bias in neighbourhood assessment, and its use of existing health data that includes a comprehensive range of objective as well as subjective health outcomes and a wide range of individual level potential confounding factors. The design is described fully in the next chapter.

2.3.6 Socio-demographic correlates of social cohesion

Neighbourhood social cohesion is an “emergent property”. It is not separate from the socio-demographic characteristic of individuals; rather, it arises from social interaction between individuals living in the same neighbourhood. Neighbourhood social cohesion was therefore expected to correlate with the socio-demographic characteristics of the resident population. The literature relating social cohesion to socio-demographic

characteristics is based on both individual level data and area level data and is described below. This evidence suggests that ethnicity, age and family structure, socioeconomic position, housing tenure, urbanisation, and residential instability may be correlated with the forms and frequency of social contact. The associations between neighbourhood social cohesion and the proportion of residents from minority ethnic backgrounds, the age distribution, economic deprivation, owner-occupancy rates, degree of urbanisation, and residential turnover in neighbourhoods will be investigated in this study (see Chapter 3).

2.3.6.1 Ethnicity

It has been suggested that ethnically diverse areas (Debertin, 1996) may have poorer quality social cohesion.

2.3.6.2 Age and family structure

Areas with more single adults may have poorer quality social cohesion (Whitley et al, 1999). Studies at the individual level show that adults with children report greater contact with neighbours (Henning & Lieberg, 1996). Cattell and Herring's study (2002) found that older people were more likely than younger people to actively participate in community life, although they noted that this may be due to a lack of suitable opportunities and facilities for younger people. They also found that local networks were of particular importance to mothers with young children and to older people. A study in Canada found that participation in clubs and organisations was higher in districts with an older population (over 65) (Veenstra, 2002).

Putnam's work also shows that older generations are more trusting than younger generations. For example, those born in the 1920s were more than twice as likely to trust other people as those born in the 1960s (Putnam, 1996).

2.3.6.3 Socioeconomic position

Blue collar workers have been found to name more relatives in their networks whereas white collar workers were more likely to mention friends (Henning & Lieberg, 1996). White collar workers also report networks which are more geographically extensive

(Henning & Lieberg, 1996). It is unclear whether these patterns hold true at the neighbourhood level as the associations between proportion of manual workers in a neighbourhood and social interaction patterns have not been documented.

Frequency of social participation in organised activities is positively correlated with educational attainment at the individual level (Putnam, 1996). Work is needed to determine whether neighbourhood economic deprivation is associated with lower participation rates in the UK as it is in the US (Lochner et al, 2003). Empirical work is also needed to establish whether the same types of organisation are important for social contact in deprived and affluent neighbourhoods.

2.3.6.4 Housing tenure

The incentive to work for a high quality local environment is likely to be higher amongst people that own their homes. Home ownership may also provide a more stable footing from which to build local relationships. Home ownership was therefore expected to be positively correlated with local social networks, as hypothesised by McCulloch (2003).

2.3.6.5 Urbanisation

Levels of contact with friends and family living locally may depend on the extent of urbanisation. Work in Scandinavia shows that people living in urban areas report social contacts which spread over a relatively large area compared with those in more rural areas (Henning & Lieberg, 1996). In the US, living in a bigger, more urban place was correlated with fewer visits to neighbours and more visits to friends living outside the neighbourhood (Monti et al, 2002). Participation in organisations may also vary by degree of urbanisation although the evidence here is unclear. One study found that people living in more city-like places participated more in unions and professional associations but less in church meetings and veterans groups (Monti et al, 2002). Another study found that residents in major metropolitan areas were less likely to attend public meetings, participate in community and church activities, and visit friends, even after adjustment for age, sex and educational attainment (Putnam, 2000). Veenstra (2002) found that membership and participation in clubs and organisations was higher in districts with a lower population density.

2.3.6.6 Residential instability

Residential instability may be a barrier to neighbourhood social organisation. Individuals who have lived in the same area for longer have been found to have more local friendships, greater attachment to the community, and greater participation in local affairs than those who have been resident for a shorter time (Sampson, 1988). Drukker et al (2003) found a negative correlation between the residential mobility and social cohesion in neighbourhoods in the Netherlands, after adjusting for economic deprivation. A study of neighbourhoods in the UK also showed a negative correlation between an index of residential instability (based on the proportion of residents who resided in a different house one year earlier plus the proportion of non-owner occupied homes) and social cohesion (McCulloch, 2003).

2.4 Economic characteristics of areas

Average income, wealth, economic growth or decline, levels of unemployment, the number of job opportunities, and house prices describe the economic well-being of an area. Unfortunately, most of these are not measured routinely in the UK. The majority of studies investigating the influence of the economic characteristics of areas on health have used measures of multiple deprivation, most often created from census data. Various indices of deprivation have been created. The Townsend Index includes percentage of adults that are unemployed and percentage of households that are not owner-occupied, do not have access to a car, or are overcrowded (Townsend et al, 1988). The Townsend Index is a frequently used area deprivation measure for studies investigating area variations in health in the UK. The Jarman Index was constructed to measure general practitioner workload, but uses many of the same census variables (Jarman, 1983). Another measure is the Carstairs Index, developed and most commonly used in Scotland (Carstairs & Morris, 1991). These three indices are highly correlated and predict mortality to a similar degree (Eames et al, 1993). Note that these indices capture low levels of economic well-being and, though on a continuous scale, do not include markers of affluence (proportion of residents with a degree or proportion of households with more than one car, for example). More recently, the Indices of Multiple Deprivation, which cover deprivation in the domains of income, employment, education and training, housing, health, crime, and geographical access, have been developed (Noble et al, 2000). Some studies have used area classifications based on cluster

analysis, where areas with similar characteristics are grouped together. Examples include the ACORN classification (CACI, 2000) and the ONS classification (Wallace et al, 1995). These are based on a larger number of census variables, including the age distribution, racial mix, household composition and tenure, and types of employment.

Deprivation indices are derived variables, created by aggregating data at the individual level up to some higher area level. They are hypothesised to be capturing information about the areas that is more than the sum of the individual data. Independent effects of area deprivation and individual deprivation on health have been demonstrated in many studies and these are summarised in the next section.

2.5 Existing literature on economic characteristics of areas and health

Many studies have found higher rates of morbidity and mortality in areas with greater economic deprivation, even after adjusting for the effects of individual deprivation (including Morgan & Chinn, 1983; Fox, 1984; Haan et al, 1987; Humphreys & Carr-Hill, 1991; Duncan et al, 1993; Jones & Duncan, 1995; Duncan et al, 1995; Shouls et al, 1996; Ecob, 1996; Kaplan et al, 1996; O'Campo et al, 1997; Diez-Roux et al, 1997; Roberts, 1997; Wiggins et al, 1998; Davey Smith et al, 1998; Robert, 1998; Sloggett and Joshi, 1998; Yen & Kaplan, 1998; Jerrett et al, 1998; Duncan et al, 1999; Soobader & LeClere, 1999; Jones et al, 2000; Stafford et al, 2001; Diez-Roux et al, 2001; Pickett & Pearl, 2001; Bosma et al, 2001; Martikainen et al, 2003). A recent analysis of the ONS Longitudinal Study showed that residence in a disadvantaged area (characterised by high unemployment and high proportion of manual workers) in childhood was associated with mortality and morbidity in adulthood, over and above individual characteristics and adult area of residence (Curtis et al, 2004). Health outcomes which have been associated with area deprivation include cardiovascular disease, mental health, disability and limiting illness, smoking, and physical activity. The literature covering area economic deprivation and health is huge has been reviewed by Yen and Syme (1999), Leventhal and Brooks-Gunn (2000), and Pickett and Pearl (2001). These authors conclude that there is a generally consistent pattern of high mortality and morbidity in more economically deprived areas, but that it is not yet clear whether the effects apply to some health outcomes and not others. Furthermore, they state that it is not clear whether there are direct effects of the neighbourhood socioeconomic context on health

or whether the pathway linking neighbourhood deprivation to health is indirect (through provision of local services and amenities or through social cohesion, for example).

A small number of studies did not find associations between economic characteristics of the area and residents' health once composition had been accounted for (Sloggett & Joshi, 1994; Ecob, 1996). Sloggett et al used data from the ONS Longitudinal Study to investigate associations between census ward deprivation and mortality. Subsequent analysis of these data, using multilevel modelling methods, has found effects of socio-economic classification of areas on limiting long-term illness (Wiggins et al, 1998). Growth areas and prosperous areas, identified by a wide variety of variables from the 1991 census, were found to have lower rates of limiting long-term illness than ports/industrial areas and coalfields. Ecob et al's study found independent effects of individual and economic deprivation for height, waist-hip-ratio, and reaction time but not for self-reported health, long-standing illness and respiratory function. Duncan et al (1995) found no evidence of variations in mental health between electoral wards but did find poorer mental health for the subgroup of the population who lived in urban places without a garden or adjacent open space. The authors point out that even though characteristics of areas did not appear to have a direct role in determining health, they may operate as mediating factors, on the causal pathway between individual socio-economic position and health.

Publication bias cannot be ruled out as an explanation for the relatively small number of studies showing no association between health and economic deprivation in the area. However, the overwhelming evidence from studies in several countries demonstrating an association between economic deprivation in the area of residence and a number of different health outcomes points to true effects. These effects are generally small in magnitude compared with the effect of individual socioeconomic position. However, as with studies of social cohesion and health, many were not originally set up to investigate contextual effects and limitations in statistical power and imprecision in the definition of the appropriate residential area would tend to underestimate contextual effects.

As described in Chapter 1, multilevel data allow us to look at the effects of characteristics of areas and of individuals simultaneously. Multilevel modelling of such data allows us to additionally look at how the variation in health is partitioned into that

which is between areas (and may be due to factors operating at the area level) from that which is between individuals. Some studies have found unexplained area variations in health remaining after allowing for individual factors and area deprivation (Humphreys & Carr-Hill, 1991; Jones & Duncan, 1995; Gould & Jones, 1996; Shouls et al, 1996; Ecob, 1996; Hart et al, 1997; Duncan et al, 1999). In other words, the socio-demographic composition and level of economic deprivation in the areas did not fully explain the different health profiles in the areas studied. This suggests that other characteristics of areas, such as social cohesion, may be important for residents' health.

Some studies have shown an interaction between area and individual deprivation, although there are conflicting results on the direction of the interaction. Greater health differences between affluent and deprived individuals have been found in more affluent areas in some studies (Sloggett & Joshi, 1998; Shouls et al, 1996; Ecob & Jones, 1998; Veugelers et al, 2001). In other studies, differences between individuals appeared to be greater in more deprived areas (Stafford et al, 2003; Stafford et al, 2001; Jones et al, 2000; Uren et al, 2001). These discrepancies may be a result of the different geographical coverage of studies, the different size of areas used to analyse contextual effects, the different measures of both individual and area deprivation used, and the different health outcomes investigated.

The steepness of the deprivation-health slope has been found to vary according to location in the UK. Eames et al (1993) found that, for any given level of economic deprivation, residence in Scotland was associated with higher mortality. One possible explanation for the steeper deprivation-mortality slope in Scotland is that social cohesion (for a given level of deprivation) is lower in Scotland. This hypothesis will be tested later (section 6.2.6). Phillimore and Reading (1992) found a steeper deprivation-mortality slope in urban areas compared with more rural areas. There are several possible reasons why urban economic deprivation may be more strongly related to health. Social contact in cities may be characterised by greater anonymity, transitory relationships, and the loosening of traditional family ties. This weakening of social relationships, or anomie, in cities may leave residents more vulnerable to the effects of economic deprivation. The accuracy with which economic deprivation indices capture the true economic conditions in urban and rural areas may also differ. An interaction between economic deprivation, urbanisation and health will be investigated (section 6.2.7)

Despite the plethora of neighbourhood studies, very few have used longitudinal data to investigate change in health status or disease incidence. However, two studies with longitudinal health data are described here. Living in a poverty area was associated with reporting of poor health for residents of Oakland, California (Yen & Kaplan, 1999). This association held for those who reported their health as excellent or good 9 years earlier, indicating that health selection did not explain these findings. These longitudinal results show that decline in self-rated health was associated with living in a poverty area and provides stronger evidence for contextual effects than a cross-sectional analysis. Diez-Roux et al (2001) reported greater incidence of coronary heart disease in the most disadvantaged neighbourhoods (defined as those with the lowest income and wealth, with the poorest educational and occupational attainment). Information describing neighbourhoods over time is difficult to obtain and is subject to a number of difficulties due to boundary changes and changes in data definitions (Gregory et al, 2001). There are no published studies relating changes in neighbourhood economic deprivation to changes in health status.

Understanding the health effects of living in a deprived area is made more difficult by the multiple dimensionality of measures such as the Townsend index. An association between an index of area deprivation and health may be driven by an association between one factor, such as unemployment in the area, or it may be due to several factors, such as unemployment in combination with over-crowding and low owner-occupancy. Deprivation indices are accepted measures of material standard of living. However, these indices are highly correlated with many other factors so that a high deprivation index may also describe an area that is materially and socially deprived in many ways. It is therefore difficult, and not always desirable, to separate out the effects of single elements of area deprivation that influence health. Nevertheless, it is difficult to formulate policy recommendations without some clearer idea of what are the important macro-level determinants of health. More specific measures at the area level are required (Macintyre et al, 2002).

2.6 Income inequality, social cohesion and health

As well as absolute economic deprivation, there is evidence that relative deprivation affects health. For districts in England, variation in deprivation within districts was found

to predict mortality independently of mean deprivation (Ben Shlomo et al, 1996). People living in districts that have pockets of deprivation and affluence side-by-side were more likely to die than those living in districts that had similar levels of deprivation throughout. At a smaller spatial scale, variation in deprivation in surrounding electoral wards was associated with limiting long-term illness over and above average deprivation (Gatrell, 1997). Another study based on data from the 1991 census estimated inequality in local government districts, based on the occupational structure in each district (Stanistreet et al, 1999). District-level occupational inequality was associated with mortality rates in an ecological analysis, suggesting that relative as well as absolute position might be important in the UK. There is a lack of reliable data on income inequality in the UK. For this reason, income inequality is not considered explicitly in this project. Outside the UK, places with greater income inequalities have been shown to have higher mortality rates (Wilkinson, 1992; Kaplan et al, 1996; Kennedy et al, 1996; Lynch et al, 1998), morbidity (Kennedy et al, 1998(c)), and abdominal weight gain (Kahn et al, 1998) although there have been several criticisms of the methods used to address this question and the debate on the importance of income inequality continues (Gravelle, 1998; Wagstaff & van Doorslaer, 2000; Deaton, 1999).

One reason for recent interest in the concept of social cohesion as a characteristic of neighbourhoods, communities, states and countries is that it may be useful in explaining the relationship between income inequality and health. It has been suggested that a widening gap between rich and poor leads to a break down in social cohesion (Kawachi et al, 1999(a)) although the underlying process has not been clearly specified. Kawachi and colleagues found that the association between state-level income inequality and all-cause mortality was mediated by social cohesion. This study took place in the US and the generalisability of its findings to other countries is not clear. Using national level data from 19 OECD countries, Kennelly et al (2003) found no clear evidence of an association between trust or participation (taken from the World Values Survey) and mortality but they did find an association between the share of health expenditure financed by government and mortality. Their findings are consistent with a view that the economic and structural organisation of a country is important for health and should not be ignored in a study of the effects of social cohesion. Using the same data, Lynch et al (2001) similarly found no consistent associations between age and sex specific all-cause mortality or cause-specific mortality and indicators of social cohesion. They concluded

that their results offered little support for the theory that the psychosocial environment explains health differences between rich countries. If this is the case, it remains unclear what does explain health differences between rich countries. Gross National Product and health care expenditure, for example, do not explain these differences (Hales et al, 1999; Nair & Karim, 1993; Mackenbach, 1991). It will not be possible to investigate whether social cohesion mediates the association between income inequality and poor health in the current project due to the lack of income data. In any case, it has been suggested that high income inequality in a country manifests itself at a neighbourhood level as affluence in some neighbourhoods and deprivation in others through the migration choices of those who can afford to move (Massey, 1996; Wilkinson, personal communication). In other words, the theory linking income inequality to health through social cohesion would not be expected to operate at a neighbourhood level. Country level inequalities in income would not be expected to translate into neighbourhood level inequalities in income.

2.7 Selection of health outcomes for current study

The health outcomes that will be investigated in this study are general self-rated health, minor psychiatric morbidity, smoking, and waist:hip ratio.

2.7.1 Self-rated health

Self-rated health was the outcome of primary interest and was chosen because it captures the cumulative effects of overt and sub-clinical disease. A person's rating of their health provides an overall assessment which encapsulates diagnosed disease, pre-clinical disease, and mental and physical well-being (Manderbacka, 1998). It predicts mortality, health service use, and sickness absence (Kaplan & Camacho, 1983; Mossey & Shapiro, 1982; Idler & Angel, 1990; Marmot et al, 1995). As self-rated health is a summary measure of health, it was expected that the largest effects of neighbourhood social cohesion and economic deprivation would be seen for this health outcome. Low social cohesion and economic deprivation are hypothesised to affect self-rated health through psychosocial, behavioural, and biological responses to these neighbourhood stressors.

2.7.2 Minor psychiatric morbidity

Residence in a neighbourhood with low social cohesion or economic deprivation may have negative consequences for mental well-being. Psychological distress can be a response to stressful situations, including stress at work (Stansfeld et al, 1997), unemployment (Dooley et al, 1994), armed conflict (Jones & Wessely, 2001), and marital conflict and divorce (Booth & Amato, 1991). Evidence points to an increased risk of both mortality (Huppert & Whittington, 1995) and cardiovascular disease (Stansfeld et al, 2002; May et al, 2002) amongst those reporting psychological distress. Depression is also associated with reduced efficiency at work and sickness absence (Simon et al, 2001). The effect of neighbourhood characteristics on mental health was tested using minor psychiatric morbidity as an outcome.

2.7.3 Smoking

Smoking was chosen a priori to investigate behavioural pathways between neighbourhood characteristics and health. Smoking can be seen as a way of coping with problems (Revell et al, 1985). A number of studies have shown area differences in smoking behaviour (Diehr et al, 1993; Duncan et al, 1993; Ellaway & Macintyre, 1996). Law and Morris's study (1998) showed that smoking accounts for most of the excess mortality in more deprived districts in England and Wales. They concluded that we need look for no further explanations, since little between-district variation remains once smoking is accounted for. Even if it were the case that smoking explains the excess mortality in deprived districts in statistical terms, Law and Morris's study does not elucidate the reasons why residents in more deprived areas smoke more. One possibility is that smoking can be a coping mechanism or a behaviour which is condoned (or discouraged) by one's community.

2.7.4 Waist:hip ratio

Waist:hip ratio is an objective physiological measure which may be a marker of disrupted metabolic function (Brunner et al, 1997) and is a predictor of cardiovascular disease and mortality (Folsom et al, 1993). Theory suggests that a high waist:hip ratio is associated with psychosocial stress (Bjorntorp, 1991). Waist:hip ratio was chosen to investigate a

biological pathway linking neighbourhood social cohesion and economic deprivation to health.

2.7.5 Psychosocial pathways from social cohesion to self-rated health

Three psychosocial pathways linking neighbourhood social cohesion to self-rated health were also investigated.

2.7.5.1 Perceived social support

Residents in neighbourhoods which are more socially cohesive were hypothesised to have greater levels of perceived social support. Neighbourhood social cohesion may facilitate the formation and maintenance of local social relationships which provide residents with various types of support. Stansfeld et al (1998) found two aspects of quality of social support were related to psychiatric morbidity, namely emotional support and negative aspects of support. For the present study, practical support was also investigated as it was thought that neighbourhood social cohesion may improve access to practical support for residents.

2.7.5.2 Vigilance for threat

Environmental demands coupled with danger or urgency may result in an individual continuously monitoring their environment for threatening cues. A second possible psychosocial pathway linking social cohesion to health is through vigilance for threat. Vigilance for threat has been defined as the "chronic search for potential threats in other people or in the environment" (Gump & Matthews, 1998). Someone who is constantly or frequently highly vigilant for threat is thought to have an aroused sympathetic system (Taylor, 1998). In a study of undergraduate students, Gump and Matthews found that those randomised to search a computer screen for threatening sentences had significantly higher blood pressure than those who were randomised to search the screen for non-threatening sentences (Gump & Matthews, 1998). Heightened vigilance may have long-term negative health consequences although the relationship between vigilance and overt disease is the subject of on-going research (Taylor, 1998). Poor quality social cohesion in the residential environment may invoke a greater sense of vigilance in residents, although it should be noted that the vigilance scale used here

captures general heightened vigilance and was not developed with the explicit purpose of investigating the effects of the residential environment.

2.7.5.3 Sense of control

The third psychosocial pathway to be tested relates neighbourhood social cohesion to health through sense of control. Poor quality social cohesion, such as lack of trust, low informal social control, and lack of success in working together to gain benefits for the community, may invoke a low sense of control over the residential environment among residents. Existing studies have not measured sense of control in the neighbourhood, but sense of control at home and general sense of control may be suitable proxies. Sense of control at home is associated with psychological morbidity (specifically, depression and anxiety) and coronary heart disease events (Chandola et al, forthcoming). Overall sense of control is associated with mortality, physical disability (borderline statistical significance), and self-rated health (Dalgard & Haheim, 1998; Mackenbach et al, 2001; Mackenbach et al, 2002).

2.8 Summary of literature review

- Social capital theory has been developed over the last 20 years but there is no agreed definition of what constitutes social capital or how to measure it. Social cohesion is a closely related concept which also lacks a clear, agreed definition.
- The term “neighbourhood social cohesion” is used within this thesis to capture the quantity and quality of social relationships between people sharing the same neighbourhood.
- More than twenty studies have demonstrated associations between aggregate social cohesion and health or health-related outcomes.
- Individual studies also suggest that social relationships in neighbourhoods may be important for health.
- A minority of published studies did not find an association between social cohesion and health, though the fact that they are small in number may be due to publication bias.
- The majority of existing literature is based on studies in the US. The generalisability of those findings to other countries has not been demonstrated.

- Despite this large body of evidence linking social cohesion to health, it is not clear which aspects of social cohesion are important, whether social cohesion has health-damaging effects, what are the biological and behavioural pathways from neighbourhood cohesion to individual health status, and whether the effects of social cohesion apply to all residents equally.
- Economic characteristics of the neighbourhood are related to health, over and above individual socioeconomic characteristics, though the effects of the former are probably smaller in magnitude.
- The joint effects of neighbourhood social cohesion and economic deprivation have been virtually ignored in existing literature.

Chapter 3. Study hypotheses

The preceding chapters have laid out the broad aims of the work described in this thesis and reviewed the current state of knowledge on neighbourhood characteristics (particularly neighbourhood social cohesion and economic deprivation) and health. Based on the model presented in Figure 1.1, this chapter describes the specific hypotheses to be tested. The neighbourhood level data used to test these hypotheses are described in the next chapter and the health and other individual level data used along with the statistical methods are presented in chapter 5.

Hypothesis 1: The prevalence of poor self-rated health varies across neighbourhoods.

As discussed, a large literature shows that mortality and morbidity rates vary across the UK. This will be tested using current data on self-rated health. Allowing for age and sex, some neighbourhoods are expected to have a greater prevalence of poor self-rated health than others.

Hypothesis 2: Socioeconomic position is associated with self-rated health and explains some of the between-neighbourhood variation in self-rated health.

It is expected that some of the health differences between neighbourhoods will be due to the fact that the socioeconomic characteristics of participants vary across neighbourhoods. Disadvantaged participants will tend to cluster together in spatially separate neighbourhoods from more advantaged participants. The age, sex, and socioeconomic characteristics of participants clustering together are a compositional explanation for neighbourhood variations in health.

Hypothesis 3: Neighbourhood social cohesion is associated with self-rated health and explains some of the between-neighbourhood variation in self-rated health, even after taking account of individual characteristics.

If neighbourhoods differ from each other in their levels of the eight domains of social cohesion measured in this study (namely Family ties, Friendship ties, Participation, Integration into wider society, Trust, Attachment, Able to rely on others for practical help, and Tolerance) and if these domains are associated with health, then there is evidence that the neighbourhood social context influences residents' health.

Hypothesis 4: The effects of neighbourhood social cohesion are greater for participants who are not currently employed.

One of Bradford-Hill's criteria for establishing causality states that a dose-response relationship is indicative of a causal relationship. People who are not in paid employment are likely, on average, to spend more of their time in their neighbourhood and less of their time exposed to other contexts. In particular, the workplace will not be an important context for this group of people. As well as increased exposure to the neighbourhood environment, those who are not employed may be more reliant on locally provided facilities and local social contacts because of fewer personal resources that would allow them to go elsewhere.

If associations between the neighbourhood social cohesion domains and self-rated health are found then three psychosocial pathways will be tested.

Hypothesis 5: Low social support is one explanation for the poorer self-rated health of people living in neighbourhoods with poor quality social cohesion.

Hypothesis 6: Increased vigilance is one explanation for the poorer self-rated health of people living in neighbourhoods with poor quality social cohesion.

Hypothesis 7: Low sense of control is one explanation for the poorer self-rated health of people living in neighbourhoods with poor quality social cohesion.

Hypothesis 8: Neighbourhood economic deprivation is associated with self-rated health and explains some of the between-neighbourhood variation in self-rated health.

Economic deprivation was expected to vary across neighbourhoods and to be associated with health.

Hypothesis 9A: The effects of social cohesion and economic deprivation on self-rated health are independent of each other.

Hypothesis 9B: Social cohesion acts as a buffer to protect against some of the effect of economic deprivation.

The possible pathways linking social cohesion, economic deprivation and health were proposed in chapter 1. There are at least three alternatives to hypothesis 9A: 1) social cohesion will not be associated with health once adjustment for economic deprivation

has been made but economic deprivation will be associated with health, 2) economic deprivation will not be associated with health once adjustment for social cohesion has been made but social cohesion will be associated with health, 3) neither social cohesion nor economic deprivation will be associated with health after mutual adjustment.

In the social support literature, the term “buffering” refers to a protective effect of social support which is limited to individuals exposed to stressful life events, such as severe illness, bereavement, major financial difficulty, or being a victim of crime (Stansfeld et al, 1998). A buffering effect of social cohesion in the presence of economic deprivation can be tested by adding interaction terms to the model. If the protective effect of social cohesion is present in the most deprived neighbourhoods only, this indicates that social cohesion has a buffering effect.

Hypothesis 10: The effects of neighbourhood economic deprivation are greater in Scotland than in England and are explained by differences in neighbourhood social cohesion in Scotland and England

Mortality rates are higher in Scotland than in England (Uren et al, 2001) and, as noted earlier, residence in Scotland was found to be associated with higher mortality for a given level of economic deprivation (Eames et al, 1993). This will be tested using current data on self-rated health status. Additionally, the extent to which differences in the deprivation-health slope in England and Scotland are explained by levels of social cohesion will be investigated.

Hypothesis 11: The effects of neighbourhood economic deprivation are greater in urban areas than in more rural areas and are explained by differences in neighbourhood social cohesion

Phillimore and Reading's finding (1992) of a steeper deprivation-mortality slope in urban areas will be tested using current data on self-rated health status. The extent to which urban/rural differences in the magnitude of this association can be explained by levels of social cohesion will be tested.

Hypotheses 1-3 and 9 will be re-examined for minor psychiatric morbidity, smoking, and waist:hip ratio. For brevity, the other hypotheses will not be tested for these secondary health outcomes.

Chapter 4. Measuring the social environment: neighbourhood social cohesion and economic deprivation

The design of the study is described more fully in chapter 5. Briefly, data from three on-going health surveys were used to investigate contextual influences on health. These are the Health Survey for England (HSE), the equivalent survey in Scotland, the Scottish Health Survey (SHS), and the Whitehall II study. These surveys provide data on several health outcomes as well as on individual demographic and socioeconomic characteristics. Data from these three surveys were extended by collecting new information on social cohesion and economic deprivation in the participant's area of residence in order to investigate the effect of the residential context on health. New social cohesion measures have been collected specifically for this study by postal survey. Responses to postal questionnaires were aggregated up to neighbourhood level to provide neighbourhood measures of social cohesion. Economic deprivation in the neighbourhood was measured using 1991 census data. The social cohesion and economic deprivation measures were then linked back (geocoded) to the three health surveys using unique area identifiers. Note that postal questionnaires were sent to people living in the same areas as Health Survey and Whitehall II participants, but not to participants themselves. In this way, information about the residential environment is external to the Health Survey and Whitehall II participants. Since one set of people reported characteristics of their area of residence and a different set of people reported their health, the problem of positive or negative affect driving a relationship between self-reported exposure and self-reported outcome is avoided. This chapter summarises the theoretical background, empirical development, and psychometric testing of the neighbourhood social cohesion tool and describes the distribution of social cohesion across England and Scotland. The measurement of economic deprivation in neighbourhoods and its relationship to social cohesion is also described. Firstly, an explanation of the definition of neighbourhood used in this thesis is given.

4.1 Definition of neighbourhood

In order to investigate geographical and spatial influences on health, the area of interest must be defined. Studies of geographical variations in health in England have often used administrative boundaries, such as enumeration district, electoral or census ward,

district, or region, to define areas. In Scotland, postcode sectors are often used. The evidence for and interpretation of area differences in health will vary according to the unit of area chosen (Openshaw, 1983; Boyle & Willms, 1999). This is called the “modifiable area unit problem”. It is therefore important to determine the most appropriate areal unit for the particular situation and to measure factors at that level. At national or regional level, central government policies might be expected to have an impact on health. Any health effects of the norms, values, and other socio-cultural aspects of the local community would be expected to operate over smaller areas, or neighbourhoods. In practice, an approximation to neighbourhood based on administrative boundaries is used for two reasons. Firstly, people do not agree about the boundaries of their neighbourhood. Even the same person will have different boundaries in mind when thinking about different factors in their area. Qualitative work has shown that respondents consider a very small area (covering their neighbours in the same and nearby streets) when asked to describe the degree of trust they have for one another in their local area but consider a much larger space when asked about the local health and retail facilities they have in their local area (Boreham, 1999). In order to study contextual factors operating over and above individual factors in a multilevel analysis, it is necessary to impose the same definition of neighbourhood across all participants. Secondly, information concerning the economic characteristics in the area of residence can be obtained for administrative boundaries but is not yet available for user-defined boundaries. In the current study, an approximation to neighbourhood was used based on census wards and postcode sector boundaries (average population 4500-5500). Whilst use of administrative units of area was to some extent based on pragmatic rather than theoretical grounds, these areas covers a fairly small geographical area that most residents could walk round and where they share the same shops, churches, pubs and so on and is therefore a reasonable approximation to a geographical community. The advantages of using administrative units of area are that:

- i) Census data are available for administrative boundaries. Census data provide the most complete coverage of information on the demographic and socio-economic characteristics of the population.
- ii) There are sufficient numbers of Health Survey and Whitehall II participants in wards or postcode sectors for analysis. (More details on the sample size requirements are given in section 5.4.)

- iii) The vast majority of other UK studies have used these same boundaries, thus facilitating comparison with other work.
- iv) Local government, local health authorities and other service providers use these boundaries for administrative purposes and this in itself might produce differences between areas.

The disadvantages of using administrative boundaries to define neighbourhoods are that:

- i) Administrative boundaries probably do not coincide completely with people's perceptions of their neighbourhood. However, Campbell and McLean's (2002) in-depth work found that many residents did express some identification with the census ward they lived in, suggesting a degree of overlap between psychologically defined communities and communities defined by an administrative geography. It is not clear that any definition of neighbourhood would be suitable across all the aspects of the social environment considered here nor that there is agreement between residents as to what constitutes their neighbourhood. This remains a challenge for quantitative neighbourhood research.
- ii) Heterogeneity within boundaries may be greater than if neighbourhoods had been defined according to local knowledge of each area. For example, Weich and colleagues (2001) defined housing areas as "geographically bounded areas in which the majority of the housing is homogeneous in form and character". In order to do this, an architect had to observe the whole study area and split it into appropriate units. The health of two neighbours living in the same housing area but in different administratively-defined neighbourhoods may be more similar than the health of two residents living at opposite ends of the same neighbourhood. Heterogeneity within neighbourhoods will inevitably lead to some misclassification and under-estimation of the effects of area characteristics.

Census wards in England and postcode sectors in Scotland have been chosen to define neighbourhoods for this project. The distribution of the population of England and Wales in 1991 according to various levels of administrative geography is shown below.

	Number of areas	Average adult population
England and Wales	1	49,890,000
County	54	923,889
District	402	124,104
Ward	9,135	5,461
Wards in Inner London [†]	297	8,419
Wards in Outer London	460	9,077

[†]excluding City of London

In Scotland, the administrative and postal geographies coincide. (This is not the case in England.) The population of Scotland in 1991 according to various areal units is shown below.

	Number of areas	Average adult population
Scotland	1	4,770,644
Health Board	12	397,554
District	56	85,190
Postcode sector	1,003	4,756

The term “neighbourhood” is used as shorthand for census ward and postcode sector from now on. Since many people do not know where the boundaries of their census ward or postcode sector lie, it was not feasible to ask respondents about the characteristics of their ward/postcode sector. An approximation was used and they were asked to think of their local area as “everywhere within a 20 minute walk (about a mile) of your home”.

4.2 Measuring social cohesion in the neighbourhood

4.2.1 A derived measure of social cohesion

Diez-Roux distinguishes between derived and inherent measures of neighbourhoods (Diez-Roux, 1997). Derived variables are created by aggregating characteristics of

individuals living in a given neighbourhood. For example, the percent of unemployed residents is calculated by dividing the number of unemployed residents by the total number of residents in a neighbourhood. Each resident's employment status is summed over the whole neighbourhood. Although derived variables are aggregate measures of individual attributes (whether an individual is employed or not, in the above example), they are hypothesised to be capturing characteristics of the neighbourhood that are more than the sum of individual factors. These measures may have "emergent properties": effects over and above an individual association between the characteristic and health may be seen when a number of individuals with the same characteristic share the same physical space. As an example, an unemployed person is at increased risk of poor mental and physical health because of financial difficulties, loss of self-esteem, and social isolation (Bartley, 1994). If they live in an area of high unemployment, there may be additional health risks due to higher competition for each job opportunity, greater hassle signing on, and less personal attention from job centre staff. Inherent variables have no corresponding attribute at the individual level and are measured by direct observation or from information held by service providers. Sampson et al have directly observed various features of neighbourhoods in Chicago, including the presence or absence of cigarettes on the pavement, graffiti, and prostitutes on the street (Sampson, 1999).

The measures of social cohesion used in this study were derived from responses to questionnaires. Postal questionnaires were sent to individuals living in a neighbourhood and their responses were aggregated to form a neighbourhood average. These neighbourhood averages capture social cohesion as an emergent property of the neighbourhood. As Yen and Syme put it,

"The common ideas, beliefs, customs, and tendencies of the social group created a "reality" that was more than the sum of individual ideas, beliefs, customs, and tendencies." (Yen & Syme 1999, pg 290.),

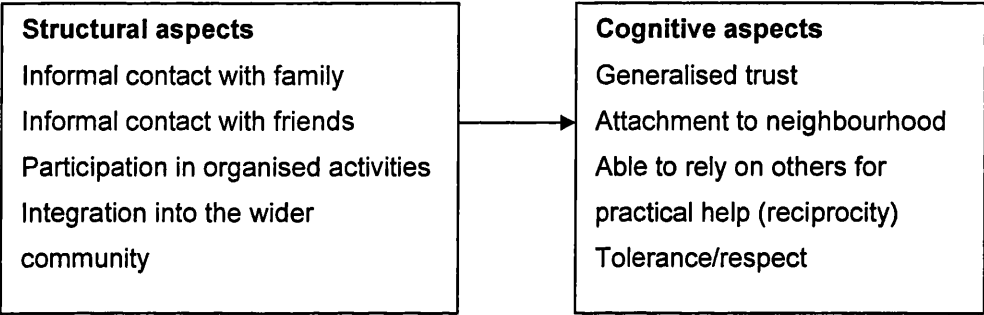
4.2.2 Aspects of social cohesion measured in this study

A review of the literature highlighted two broad themes considered important to describe a neighbourhood's level of social cohesion, namely the structural aspects of social cohesion (covering the forms that social networks take within the neighbourhood) and

the cognitive aspects (covering the quality of those social interactions) (Krishna & Shrader, 1999).

With cross-sectional data, it is not possible to examine the growth or decline of social cohesion. However, the underlying model of social cohesion utilised in this study is that neighbourhoods will vary in the predominant forms of social networks and quantity of social interaction and that that this will be manifested by varying levels of cognitive aspects. This model is illustrated in Figure 4.1.

Figure 4.1 Structural and cognitive aspects of social cohesion



4.2.2.1 Structural aspects

The literature indicates that there are four forms of social networks that should be captured in a measure of neighbourhood social cohesion.

Family ties and friendship ties

As discussed in section 2.1.1, social ties may be divided into strong and weak ties. The measure used in this project did not distinguish between close and less intimate friends, but contact with friends and contact with family who live in the same neighbourhood (but not in the same household) were measured separately using the following two items and constitute the first two forms of social networks.

Q When did you last do each of the following with **members of your family** who live in your local area (not counting those who live with you)?

Tick one per row

	In past week 1	In past fortnight 2	In past month 3	Longer ago 4	Never 5	Does not apply to me 6
Met up with family members who live in your local area (include both arranged and chance meetings)	☐	☐	☐	☐	☐	☐
Spoke on the phone to family members who live in your local area	☐	☐	☐	☐	☐	☐
Wrote to (or emailed) family members who live in your local area	☐	☐	☐	☐	☐	☐

Q And when did you last do each of the following with **friends** who live in your local area, not counting people who live with you?

Tick one per row

	In past week 1	In past fortnight 2	In past month 3	Longer ago 4	Never 5	Does not apply to me 6
Met up with friends who live in your local area (include both arranged and chance meetings)	☐	☐	☐	☐	☐	☐
Spoke on the phone to friends who live in your local area	☐	☐	☐	☐	☐	☐
Wrote to (or emailed) friends who live in your local area	☐	☐	☐	☐	☐	☐

Participation in organised activities

As well as informal contact with family and friends, social networks may take the form of membership of formal or organised associations. Social networks were therefore characterised according to whether participation in organised activities is high or low.

Within this, different types of formal associations are likely to differ in the type of social interaction they offer and may differ in the extent to which they promote health (Hyypä & Maki, 2001). Regular participation in a number of different types of organisations with people in the neighbourhood was measured, including Political or trade unions, Parent-Teacher Associations and tenant's groups, Church and other religious groups, Education groups (evening classes, for example), and Social clubs using the following question.

Participation in sports clubs was not included in the participation scale because effects

on health are likely to operate directly as well as through social cohesion. Participation in other (unspecified) types of organisation was not included in the participation scale because it would complicate interpretation of the scale.

Q Do you **regularly** join in the activities of any of these types of organisation **with people who live in your local area**?
Please include activities held both inside and outside your local area.

Tick as many as apply
223-236

Political parties, trade unions, environmental groups	☐	
Parent-Teacher Associations, tenants groups, residents' groups, Neighbourhood Watch, youth groups	☐	
Church or other religious groups, charitable organisations (eg collecting for charity, helping the sick, elderly, poor etc.)	☐	
Education, arts or music groups or evening classes	☐	
Social clubs (eg Rotary Club, Women's Institute, Townswomen's Guild, women's groups, mother and toddler groups, working men's clubs, elderly lunch groups)	☐	
Sports clubs, gyms, exercise classes	☐	
Other groups or organisations	☐	

OR... No, I don't regularly join in the activities of any of these organisations with people in my local area ☐

Integration into the wider community

The final element of structural aspects of social cohesion considered was the extent to which a neighbourhood is insular or integrated. Campbell contrasted two parts of Luton, one in which residents reported contact with people in their locality and further afield, and another in which social networks tended to be with others in the area but connections with people outside the area were less common (Campbell et al, 1998). A high degree of social interaction between people in the same neighbourhood may not be sufficient for good health. Bridging ties (Putnam, 2000) span different types of people

from different ethnic backgrounds, having different religious beliefs, and from different socio-economic circumstances and may be more useful in reducing social inequalities in health. More versus less integrated forms of social networks were therefore distinguished by measuring the extent to which people's relationships were mostly with people in the same area, mostly with people outside the local area, or spread between the two. Neighbourhoods where more residents reported that their relationships were spread equally between the local area and outside the local area were considered more integrated. A high score on the integration scale therefore requires that residents have relationships with one another and with people further afield.

Q Are your close relationships mostly with people who live in your local area, or outside your local area?

By 'your local area' we mean the area within a 20 minute walk (about a mile) of your home.

**Tick one
only**

Mostly with people in your local area

7

Mostly with people outside your local area

7

Equal numbers of relationships with people inside and outside your local area

7

4.2.2.2 Cognitive aspects

The quality of social interactions which take place within neighbourhoods is also important in a study of social cohesion and health. Four constructs were considered.

Trust

Generalised trust (trust in people who are not known personally as well as those that are personally known) derives from social interaction (Stolle & Rochon, 1998). Membership of associations may increase trust, although different types of associations are likely to differ in the type of social interaction they offer. Stolle points out that those associations with a more diverse membership are more likely to encourage generalised trust (Stolle & Rochon, 1998). Trust in institutions, including the government, may be distinguished from trust in other people, with the former capturing part of political capital. At the neighbourhood level, trust is required in order for people to be willing to act for the common good. Trust was measured using a series of opposing statements at either end

of a row of 7 boxes; respondents were asked to place a tick in the one box which best represented their agreement with these statements (see items below).

Q How do you feel about your local area? Please tick one box in each row. The closer your tick is to a statement the more strongly you agree with it.

Tick one per row

Most people in this area can be trusted

--	--	--	--	--	--	--

Most people in this area can't be trusted

People would be afraid to walk alone in this area after dark

--	--	--	--	--	--	--

People feel safe walking alone in this area after dark

People in this area will take advantage of you

--	--	--	--	--	--	--

People in this area will always treat you fairly

If you were in trouble, there are lots of people in this area who would help you

--	--	--	--	--	--	--

If you were in trouble, there is nobody in this area who would help you

People in this area would turn a blind eye if a house was being broken into

--	--	--	--	--	--	--

People in this area would do something if a house was being broken into

In this area people would stop children if they saw them vandalising things

--	--	--	--	--	--	--

In this area people do nothing if they see children vandalising things

Attachment to neighbourhood

Membership of a group or network can produce a sense of belonging or attachment, through both formal and informal contact with others. Having contact with family and friends nearby is expected to enhance a sense of attachment. Contact with less intimate ties may also build a sense of belonging, possibly by providing a meaningful social role in a formal organisation (Berkman et al, 2000) or through having met together around common interests.

Q How do you feel about your local area? Please tick one box in each row. The closer your tick is to a statement the more strongly you agree with it.

Tick one per row

I really feel part of this area	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	I feel that I don't belong in this area
Most people in this area are friendly	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	Most people in this area are unfriendly
People in this area have lots of community spirit	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	People in this area have no community spirit
People in this area do things to help the community	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	People in this area only look out for themselves
I often feel lonely living in this area	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	I never feel lonely living in this area

Able to rely on others for practical help

Being able to rely on others for help with everyday activities was also considered. This concept is sometimes referred to as reciprocity or reciprocated exchange in other studies (Kawachi et al, 1997; Wen et al, 2003). At the neighbourhood level it may be a measure of the help available from informal networks rather than reliance on state-provided help or services purchased from commercial organisations. Respondents were asked how comfortable they felt asking for help from a neighbour in a variety of situations.

- Q** How comfortable would you feel asking for help from your neighbours in each of the following situations?
By neighbours we mean everybody who lives within a couple of minutes walk of your home (If nobody lives this close then think of the people who live nearest to you).

How comfortable would you be asking a neighbour...	Tick one per row				Would not ask neighbour
	Very comfortable	Fairly comfortable	Fairly uncomfortable	Very uncomfortable	
	1	2	3	4	5
...to collect a prescription from the chemist for you if you were ill in bed?	☐	☐	☐	☐	☐
...if you could talk to them about a personal problem that you had?	☐	☐	☐	☐	☐
...to lend you £5 for a couple of days to pay an outstanding bill?	☐	☐	☐	☐	☐

Tolerance/respect

There are, however, potential downsides of social cohesion in that a strong group identity can result in exclusion of or prejudice against those seen as outsiders. Strong neighbourhood ties coupled with low exposure to diverse groups of people may encourage intolerance. A high degree of contact with others in the neighbourhood may also be associated with a lack of respect for other's privacy and may limit individual freedom of choice.

Tolerance/respect was measured using the following six items:

Q How do you feel about your local area? By your local area we mean everywhere within a 20 minute walk (about a mile) of your home.

Tick one per row

People in this area are tolerant of others who are not like them	☐ ☐ ☐ ☐ ☐ ☐ ☐	People in this area disapprove of others who are not like them
In this area there is pressure to behave like everyone else	☐ ☐ ☐ ☐ ☐ ☐ ☐	In this area there is no pressure to behave in particular ways
People in this area respect one another's privacy	☐ ☐ ☐ ☐ ☐ ☐ ☐	People in this area like to know everyone else's business
Everybody in this area should have equal rights and an equal say	☐ ☐ ☐ ☐ ☐ ☐ ☐	Some people in this area don't deserve equal rights or an equal say
In this area there are some people who belong and some who don't	☐ ☐ ☐ ☐ ☐ ☐ ☐	Everybody who lives in this area belongs just as much as everybody else
It is hard to earn people's respect in this area	☐ ☐ ☐ ☐ ☐ ☐ ☐	People in this area treat each other with respect

The ordering of the Items in the questionnaire was not the same as presented above and additional items were included which have not been included in the analysis. The full questionnaire can be seen in appendix 1.

4.2.3 Aspects of social cohesion not included

Themes were chosen after a review of the literature and the questionnaire was developed in conjunction with a panel of sociologists and survey methodologists (Boreham, 1999). Nevertheless, there are some potentially important aspects of social cohesion which have not been included or have not been well measured. Vertical relationships, the links between individuals and agencies, including local and national government, were difficult to capture by postal questionnaire and were not included.

There are no published empirical studies documenting the health effects of vertical relationships, such as the connections between individuals and institutions with formal power. Woolcock (2001) has named these connections "linking social capital" and has suggested that they may be useful for economic development. The focus of his work with the World Bank has been in developing countries, where he has discussed the need to capture contacts between individuals or communities and the institutions which have power over the allocation of social and economic resources. The relevance of linking social capital in the study of neighbourhood influences on health status in the UK has not been discussed in the literature.

4.2.4 Why not use existing tools to capture the socio-cultural environment?

There are existing tools to measure aspects of community social capital and social cohesion. Some have been summarised by Lochner and colleagues (1999) and others include the Social Action Research Project baseline survey (Health Development Agency, personal communication), a study of health and lifestyle in London (Steptoe & Feldman, 2001), the Social Capital Assessment Tool (World Bank), the quantitative pilot study of social capital and health in Luton (personal communication), the Health and Participation Survey in Adelaide (personal communication), and another study set in Australia to measure social capital in 5 communities in New South Wales (Bullen & Onyx, 1997). These tools were all developed to be administered and analysed at the individual level, although most of them relate, at least in part, to aspects of the residential environment. There was no single tool that included all the aspects of social cohesion which were considered important to capture following a review of both theoretical and empirical work. Some existing tools have undergone psychometric testing and validation, though some have not. Altogether, there was no single existing tool that fitted the requirements of this study, though a number of items have been adapted for use here.

Other tools have been developed during the lifetime of this project, including social capital modules for the General Household Survey (Coulthard et al, 2001), the Health Survey for England (Bajekal & Purdon, 2001; Boreham et al, 2002), and the study of change in social capital led by the Saguaro seminar (Saguaro seminar, 2001).

4.2.5 Development of the social cohesion questionnaire

The questionnaire was designed by a panel of researchers from UCL, the National Centre for Social Research and the University of Nottingham (Appendix 2) and proceeded in the following stages:

Stage 1: A review of the literature highlighted themes that were common to various definitions of social cohesion and deemed important to include in this study. Questions used in previous studies that related to these broad themes were collated.

Stage 2: Those considered to be most suitable for the present study were selected and amended where necessary. Changes to wording of questions were made in order to relate the items to the local area and to ensure questions were relevant to a British population.

Stage 3: New questions were devised in the case where no existing questions were available.

Stage 4: This process produced a first draft questionnaire that was piloted using cognitive interview techniques in order to:

- a) decide between alternative wordings of questions assessing the same themes
- b) test newly developed questions
- c) gain an understanding of how individuals interpreted these questions
- d) identify redundant questions.

The cognitive pilot is described below in section 4.2.5.1.

Stage 5: Based on the results of the cognitive pilot, a second draft questionnaire was drawn up.

Stage 6: This version was tested on colleagues at UCL in order to test questionnaire length and identify any remaining problems with completion or understanding of questions.

Stage 7: The final version of the questionnaire was mailed to respondents in two phases. After the first phase, the response rate was assessed so that problems with non-response could be addressed at the main mail-out. This is described in section 4.2.5.2.

4.2.5.1 Cognitive pilot

Thirty volunteers (15 male, 15 female, with ages ranging from 18 to 65 years, living in suburban and urban areas), were asked about each section in detail by trained interviewers. The socio-economic position of volunteers was not recorded.

Since social cohesion was being conceptualised as a characteristic of the local area, the questionnaire items related to the area of residence. It was important to determine how respondents understood the definition of area given in the questionnaire ("Think of your local area as everywhere within a 20 minute walk (about a mile) of your home"), and whether their responses made use of this definition. On the whole, respondents were able to think of the places that were approximately 20 minutes walk away, although they tended to use natural or physical boundaries (e.g. rivers, main roads) where these existed. Thus if a main road was located at 10 minutes walk from the respondent's house, some respondents visualised a smaller area than that defined. Note that administrative areas made up from enumeration districts also tend to follow natural boundaries as they were created as areas suitable for the physical collection of census data (Martin, 2004).

Where respondents had to describe characteristics of other people in their local area, they tended to give an average based on all the people they had contact with and their general impression. For example, the response of one person who had unfriendly neighbours on one side and friendly neighbours on the other side was based on an average of these two extremes.

Interviewers noted where pilot participants reported that they had trouble understanding an item or indicated that their understanding of the item was not the same as that intended by the survey developers. Based on this information, unreliable items were amended or dropped from the final questionnaire.

4.2.5.2 Postal pilot

The mail-out was conducted in two stages. A sample of 10 neighbourhoods, covering a range of population densities and deprivation, were selected for the first stage mail-out. The postal pilot indicated that response rates were not as high as anticipated, especially in London. Two strategies were employed in an attempt to increase the number of completed questionnaires returned per neighbourhood. Two reminder postcards and a second questionnaire were sent to those who did not respond initially. Additionally, the number of questionnaires mailed to neighbourhoods in London was increased. This increased the total number returned but of course did not increase the response rate.

With a response rate of 42%, there is the possibility that neighbourhood-level estimates of social cohesion could be biased. The effect of non-response on neighbourhood estimates is discussed in section 4.5.1.

Analysis of individual level data from the postal pilot revealed that the items were correlated with age, sex and socio-economic status in the expected direction. Previous studies have shown that older people and those with more education report higher levels of generalised trust (Putnam, 1996). Those who are unemployed participate less in community activities (including voluntary groups, religious groups and adult education classes) and women tend to participate more in community activities than do men (Cooper et al, 1999). In the final analysis, social cohesion data were not intended to be analysed at the individual level, nevertheless, the fact that the same patterns were confirmed in the pilot data provided some reassurance on the validity of the questionnaire items.

4.2.6 Selecting neighbourhoods for the study

Neighbourhoods were selected according to two main criteria. Firstly, health data from participants (from the HSE, the SHS, or the Whitehall II study) living in that neighbourhood must have been available. Secondly, a range of deprived and less deprived and urban and more rural locations was required. As indicated earlier, social cohesion may be correlated with economic deprivation and with degree of urbanisation. A range of different types of neighbourhood were included in order to allow investigation of the effects of social cohesion on health in different settings. Funding allowed a total of just over 13,000 social cohesion questionnaires to be analysed. These were spread across 259 neighbourhoods stratified by level of economic deprivation and urbanisation. (The sample size calculation was based on the primary analysis of the association between social cohesion and health status and is described in more detail in section 5.4.) Neighbourhoods were included as follows:

- i) 91 neighbourhoods were selected to provide contextual information about Whitehall II participants. These represent all the neighbourhoods in which at least 10 Whitehall II participants were resident and are located in London and the southeast.
- ii) 87 neighbourhoods were selected to provide contextual information about HSE participants. From a total of 166 eligible neighbourhoods in England (excluding

London and the southeast), which were stratified according to population density and Carstairs index of deprivation, a random sample of 69 neighbourhoods was drawn. Eligible neighbourhoods were those in which at least 40 HSE participants were living. A further 18 neighbourhoods in Camden and Islington (Inner London) were chosen as part of a sub-study of the HSE to investigate Health Action Zones.

iii) In Scotland, a stratified random sample of 81 neighbourhoods from the 141 eligible neighbourhoods was drawn. Eligible neighbourhoods in Scotland were those in which at least 25 participants were living.

Table 4.1. Description of neighbourhoods in England and Scotland in which social cohesion was measured.

	England (178 wards)		Scotland (81 postcode sectors)	
Location of neighbourhood (number of neighbourhoods)	Inner London (36) Outer London (59) Southeast (14) Southwest (9) Midlands (19) Northwest (12) Northeast (29)		Argyll & Clyde (5) Ayrshire & Arran (6) Borders (2) Dumfries & Galloway (7) Fife (7) Forth Valley (4) Grampian (3) Greater Glasgow (11) Highlands (6) Lanarkshire (6) Lothian (13) Orkney Islands (1) Shetland Islands (2) Tayside (8)	
Carstairs deprivation index	number (%) in sample	(%) in all England	number (%) in sample	(%) in all Scotland
< -4 (least deprived)	6 (3)	(4)	5 (6)	(14)
-3 to -2	51 (29)	(30)	16 (20)	(19)
-1 to 0	39 (22)	(27)	14 (17)	(21)
1 to 2	27 (15)	(16)	24 (30)	(15)
3 to 4	17 (10)	(10)	16 (20)	(9)
≥4 (most deprived)	38 (21)	(13)	6 (7)	(22)
Degree of urbanisation ^a	number (%) in sample	(%) in all England	number (%) in sample	(%) in all Scotland
In England:				
Wholly urban	151 (85)	(58)		
At least 75% urban	24 (14)	(12)		
50-75% urban	3 (2)	(6)		
<50% urban	0 (0)	(24)		
In Scotland:				
Part of Continuous block with 1,000,000+ residents			14 (17)	(22)
100,000-999,999 residents			17 (21)	(21)
10,000-99,999 residents			26 (32)	(27)
1,000-9,999 residents			16 (20)	(18)
fewer than 1,000 residents			8 (10)	(12)

^aDefinitions are slightly different in England and Scotland

The sample of English neighbourhoods contained a greater proportion of economically deprived neighbourhoods and a greater proportion of urban neighbourhoods than all of England. The Scottish sample of neighbourhoods somewhat under-represented the most deprived neighbourhoods in Scotland. (Note that eligibility of a neighbourhood was based on the number of Health Survey and Whitehall II participants resident there so the distribution of economic deprivation and urbanisation of eligible neighbourhoods did not match the distributions for the whole of England and Scotland.)

4.2.7 Selecting individuals for the study

A random sample from the electoral register was used to select individuals within each chosen neighbourhood.

4.3 Measuring economic deprivation in the area

The legal requirement to complete the census means that census data provide the most reliable information on the socio-demographic characteristics of the UK population. Although the last census was completed in 2001, data were not publicly available in time for use in this project. Data from the 1991 census were used to calculate an index of economic deprivation. Although now a decade out of date, these indices are strongly associated with health, even health measured in the late 1990s (Rainford et al, 2000). Pre-calculated Carstairs deprivation scores were available for England and Scotland from the Manchester Information and Associated Services (MIMAS) website and were used here. This combines % households with no car, % households overcrowded, % people in social class IV or V, and % men unemployed. Townsend deprivation scores were not available for Scotland and, more importantly, the Townsend deprivation index includes % households not owning their accommodation. A high proportion of renters is thought to influence social cohesion over and above the economic or material aspect of not owning one's home. In other words, the Carstairs deprivation index was considered a purer measure of economic deprivation in this analysis.

4.4 Statistical methods for assessing the psychometric and ecometric properties of the neighbourhood social cohesion scales

The ecometric property of a scale is a phrase coined by Raudenbush and Sampson (1999) to denote the suitability of the scale for measuring an ecological characteristic. The psychometric and ecometric properties of the eight scales capturing social cohesion which have been developed for this thesis were tested using a variety of statistical methods. The statistical methods used are described briefly in the following sections.

4.4.1 Confirmatory factor analysis

Factor analysis is used to analyse relationships within sets of variables and to identify a few latent (or hypothetical) variables which summarise these. A large set of variables is reduced to a smaller number of variables which account for the same information as the larger set. There are two basic types of factor analysis: exploratory (used for exploring relationships between variables and generating hypotheses about their inter-relationships) and confirmatory factor analysis (used to test a priori ideas about the structure of the variables and their inter-relationships). In section 4.2.2, several items were listed under each social cohesion domain. For each domain, confirmatory factor analysis was used to develop a suitable measurement model. (Testing of the measurement model confirms that the indicator variables are measuring the underlying construct of interest by investigating the extent to which the data supports the a priori factor structure (Bollen & Scott Long, 1993).) Individual responses to the social cohesion questionnaire were used for the factor analysis in the software package AMOS (Smallwaters, Chicago, USA). A distribution-free estimation procedure was used. Three types of statistic were used to gauge the adequacy of the hypothesised model: 1) a goodness of fit statistic, 2) the correlation between each item and the factor, and 3) modification indices. The goodness of fit for each scale was assessed by the RMSEA (root mean square error of approximation) and its 90% upper boundary. An RMSEA of less than 0.05 is accepted as indicating a good fitting model (McArdle & Bell, 2000). If the 90% upper boundary of the RMSEA is also less than 0.05, this provides even more evidence of a good fit. A number of goodness of fit measures could have been used: the RMSEA was selected as it is less sensitive to large sample sizes than some other measures. Note that factor solutions are not necessarily unique – other solutions may

be an equally good fit to the data. A low correlation between an item and the factor indicates that the item is not a good measure of the factor in question. A correlation of 0.40 is often taken to be an appropriate cut-off although 0.20 has also been suggested (Streiner & Norman, 1995). Usually in this case, a better fit is obtained when the item is not included in the factor. Where item deletion does not improve the model fit, the item may be left in if the researcher considers it to be an important component of the scale. The modification indices highlight ways in which the model could be improved, for example by indicating what the improvement in goodness of fit would be if an item were to be deleted.

Ideally, each scale is considered in turn by looking at how each item loads onto the underlying factor. In practice, some of the factors did not contain enough items (in other words, there were not enough degrees of freedom) for the goodness of fit to be assessed and so two scales were considered together. The results presented here come from two measurement models, one combining the structural aspects and one combining the cognitive aspects of social cohesion. An item that caused a large decrease in the goodness of fit was excluded.

Initially, all neighbourhoods included in the study were analysed together to test the hypothesised factor structure. Further testing of the neighbourhood social cohesion scales was undertaken to see whether the factor structure was consistent for different types of neighbourhoods. The factor structure was tested in England versus Scotland, deprived (Carstairs index of deprivation ≥ 0) versus not deprived (Carstairs index of deprivation < 0) areas, and urban (defined as at least 75% urban or population $\geq 100,000$) versus less urban locations. For example, a model constraining the factor loadings and the correlations between factors to be equal in England and Scotland was compared with a model which did not constrain the factor loadings and correlations between factors to be equal in the two countries. The change in chi-square¹ (another

¹ The chi-square goodness of fit statistic tests the null hypothesis that there is no statistically significant difference in the observed and theoretical covariance structure matrices. The higher the chi-square statistic the poorer the model fit for a given number of observations. The chi-square statistic is very sensitive to sample size so it is often unclear whether the statistical

goodness of fit measure) relative to the change in number of degrees of freedom can be compared with statistical tables to indicate whether the reduction in goodness of fit is statistically significant.

4.4.2 Internal consistency

Another way of evaluating whether a set of items measures a single unidimensional latent construct is to calculate the Cronbach's alpha coefficient. This measures the correlation between each individual item and the total scale (with that item removed). A high correlation between each item and the total scale indicates a scale which is consistent. When several items do not capture the same underlying construct, Cronbach's alpha will be low. Cronbach's alpha takes values between 0 (not consistent) and 1 (highest consistency). A value of 1 indicates that only 1 item is needed to capture the underlying construct and all other items are redundant. Santos (1999) refers to values of 0.7 and higher as indicating acceptable consistency, although lower thresholds are sometimes used in the literature. Scales that will be used for diagnostic purposes, for example the diagnosis of psychiatric morbidity in clinical practice, require a high internal consistency. It can be argued that a lower level of internal consistency is acceptable for an epidemiological study of the relationship between neighbourhood social cohesion and health.

4.4.3 Reliability

At the neighbourhood level, reliability incorporates the extent to which the measure reflects a true neighbourhood characteristic. In other words, differences in social cohesion between neighbourhoods should be reasonably large compared with differences within neighbourhoods (Sampson et al, 1997). This is an econometric property of the scale. Reliability runs between 0 and 1, with higher values indicating greater reliability. Reliability is a function of i) the number of respondents in a neighbourhood (more respondents gives a more reliable scale), and ii) the variation between neighbourhoods as a proportion of the total variation.

significance of the chi-square statistic is due to poor fit of the model or to the large size of the sample.

Reliability is estimated for each scale as

$$\text{reliability} = \sigma_{bn}^2 / (\sigma_{bn}^2 + (\sigma_{bi}^2 + \sigma_{wi}^2)/N)$$

where σ_{bn}^2 = between neighbourhood variation

σ_{bi}^2 = variation between individuals in same neighbourhood

σ_{wi}^2 = variation within individuals (between items for same individual)

N = average number of respondents per neighbourhood

A three level model (items nested within individuals nested within neighbourhoods) was used to estimate the within and between neighbourhood variance. The within-neighbourhood variation is made up of the variation between items (items not being consistently related to the scale) and variation between individuals (individual factors influencing perceptions of the neighbourhood). In the data presented here, a lower reliability indicates that: 1) the items within the social cohesion scale capture more than one underlying construct, or 2) individual characteristics influence an individual's perception of social cohesion and individuals within neighbourhoods are not homogeneous with respect to these characteristics. It is not possible to partition the variation when the outcome is a binary or ordinal response. For this reason, reliability coefficients for the structural aspects of social cohesion could not be computed.

4.4.4 Intraneighbourhood correlation coefficient

The intraneighbourhood correlation coefficient (ICC) is defined as the ratio of the between neighbourhood variance to the sum of the between and within neighbourhood variance, after removal of the variance due to item inconsistency (Raudenbush & Sampson, 1999). For continuous measures this is calculated as:

$$\text{ICC} = \sigma_{bn}^2 / (\sigma_{bn}^2 + \sigma_{wn}^2)$$

where σ_{bn}^2 = between neighbourhood variation

σ_{wn}^2 = variation within neighbourhoods

The intraneighbourhood correlation coefficient takes values between 0 and 1. A low coefficient for a social cohesion scale would indicate a relatively low agreement among residents within neighbourhoods on how they perceive that aspect of social cohesion. In this case, neighbourhoods defined by electoral ward and postcode sector would not be appropriate for investigating that aspect of social cohesion. There is no agreed cut-off to indicate where acceptable agreement within neighbourhoods has been obtained.

4.5 Empirical findings: description of neighbourhood social cohesion in England and Scotland

4.5.1 Response rate to social cohesion survey

A total of 12,403 respondents returned social cohesion questionnaires. The overall response rate was 35.5%, varying from 32.8% in Inner London to 42.5% outside London and in Scotland. Residential mobility is likely to account for some of the non-response. A low response rate could give biased estimates if respondents have different characteristics from non-respondents. However, if differences between non-responders and responders are the same in all neighbourhoods then rankings of the neighbourhood social cohesion scores should not be affected. This was confirmed by comparing unadjusted neighbourhood means with neighbourhood means weighted according to the age and sex composition of the neighbourhood at the time of the 1991 census. Comparing tertiles of un-weighted means with weighted means yielded a Kappa coefficient of 0.80, indicating good agreement. In other words, there was little evidence that the sex and age distribution of respondents resulted in neighbourhoods being classified into the wrong tertile of social cohesion.

Other surveys aimed at measuring area-based characteristics have had low response rates. The Social Capital Community Benchmark Survey (Saguaro Seminar, 2001) achieved a response rate of 28.9%, a survey of Saskatchewan residents in Canada achieved 33.4% (Veenstra, 2000), and a study of London neighbourhoods achieved a rate of 24% (Steptoe & Feldman, 2001).

The response rate may itself be an indicator of a neighbourhood's social characteristics. Voter turnout has frequently been used to capture political participation, a construct which has some overlap with social cohesion (Blakely et al, 2001). Completion of the social cohesion questionnaire may indicate general civic engagement. The association between response rate to the Social Cohesion survey and the health status of Health Survey participants will be investigated later.

4.5.2 Description of the respondents

Table 4.2 summarises the socio-demographic characteristics of those who completed the social cohesion questionnaire. Compared with the population living in these neighbourhoods (using data from the 1991 census), respondents were more likely to be female (57.8% of respondents compared with 52.7% of the 1991 census population). Respondents were less likely to be in the 16-34 year age bracket (22.5% compared with 36.2% at the 1991 census). The proportion of respondents aged 65 and older (22.8%) was similar to that in the 1991 census (19.1%).

Table 4.2. Socio-demographic characteristics of 12,403 respondents to postal social cohesion survey.

	Respondents % (n)
Female	57.0 (7075)
Missing	0.9 (110)
Age group (yrs)	
16-34	22.5 (2731)
35-49	28.3 (3430)
50-64	26.4 (3203)
65+	22.8 (2768)
Missing	2.2 (271)
Educational attainment	
Degree/other higher education	31.8 (3837)
A level or equivalent	10.6 (1274)
O level or equivalent	27.3 (3291)
Less than O level	30.4 (3662)
Missing	2.7 (339)
Length of time lived in the neighbourhood (yrs)	
<2	5.3 (642)
2-4	12.6 (1544)
5-9	13.9 (1695)
10-19	24.2 (2953)
20+	44.1 (5385)
Missing	1.5 (184)
In paid employment (complete data only)	
Male <65 yrs	76.9 (3006/3907)
Male 65+ yrs	7.8 (94/1213)
Female <65 yrs	68.6 (3711/5410)
Female 65+ yrs	2.5 (37/1480)

4.5.3 Psychometric properties of the neighbourhood social cohesion scales

4.5.3.1 Findings from the confirmatory factor analysis

A solution for three factors making up the structural aspects of social cohesion fitted the data well. (Integration into wider society was measured using a single item and could not be included in the factor analysis.) The RMSEA and upper boundary of the 90% CI was less than 0.05 for all pair-wise models and for a model considering the three factors simultaneously. Table 4.3 shows the factor loadings of each item onto its summary scale. The scales measuring family ties and friendship ties were captured by two items each. Five items load onto the overall participation scale, namely participation in: Political or trade unions; Parent-Teacher Associations and tenant's groups; Church and other religious groups; Education groups (evening classes, for example); and Social clubs. Political or trade union membership had a loading of 0.23 on the overall participation scale. Participation in education groups had a loading of 0.30 on the overall participation scale. Although these loadings were less than 0.40 their deletion did not result in improvement in the model fit and they were retained in the participation scale. The factor loadings were fairly similar for each item within a factor so neighbourhood scores were created by simply summing the items (ignoring the loadings) for each participant and then summing across all participants in the same neighbourhood. Scores were normally distributed.

Table 4.3. Structural aspects of social cohesion: factor loadings from a measurement model considering family ties, friendship ties, and participation in organised activities simultaneously.

Construct	Questionnaire item	All neighbour-hoods
Family ties	Met up with family members in local area in past fortnight	0.97
	Spoke on the phone to family members in local area in past fortnight	0.97
Friendship ties	Met up with friends in local area in past fortnight	0.84
	Spoke on the phone to friends in local area in past fortnight	0.90
Participate in organised activities	Regularly join in ... with people in local area Political parties, trade unions, environmental groups	0.23
	Parent-Teacher Association, residents' groups, Neighbourhood Watch, youth groups	0.41
	Church or other religious groups, charitable organisations	0.52
	Education, arts or music groups, evening class	0.30
	Social clubs (eg Rotary Club, WI, mother and toddler groups, working men's club)	0.40
Integration into wider society	Equal numbers of relationships with people inside and outside local area	n/a

n/a Not applicable: only 1 item in scale

Factor loadings for each item capturing the cognitive aspects of social cohesion are shown in Table 4.4. One of the five items thought to be capturing neighbourhood attachment did not fit the data well and its exclusion improved the model fit. The excluded item captured feeling lonely in the area with the statement "I often feel lonely living in this area" and the opposing statement "I never feel lonely living in this area". It is possible that this item is an indicator of personal characteristics which predispose a person to loneliness rather than an indicator of the quality of the local social environment. After exclusion of this item, the RMSEA and upper boundary of the 90% CI was less than 0.05 for all pair-wise models and for a model considering the four factors simultaneously. Again, the factor loadings for each item within a factor were considered similar enough to create a neighbourhood score by simple summation of

individual items. Scores representing the cognitive aspects of social cohesion were normally distributed.

Table 4.4. Cognitive aspects of social cohesion: factor loadings from a measurement model considering trust, attachment, being able to rely on others for practical help and tolerance simultaneously.

Construct	Questionnaire item	All neighbour-hoods
Trust	People in this area would do something if a house was being broken into	0.64
	In this area people would stop children if they saw them vandalising things	0.64
	People would be afraid to walk alone after dark	0.35
	People in this area will take advantage of you	0.73
	If you were in trouble, there are lots of people in this area who would help you	0.76
	Most people in this area can be trusted	0.67
Attachment to neighbour-hood	I really feel part of this area	0.68
	Most people in this area are friendly	0.78
	People in this area have lots of community spirit	0.76
	People in this area do things to help the community	0.79
Able to rely on others for practical help	Comfortable asking neighbour to collect prescription if ill in bed	0.75
	Comfortable confiding about a personal problem	0.88
	Comfortable asking neighbour to lend you £5	0.63
Tolerance/ Respect	Everybody in this area should have equal rights and an equal say	0.44
	People in this area treat each other with respect	0.82
	People in this area are tolerant of others who are not like them	0.73
	People in this area respect one another's privacy	0.63
	In this area there are some people who belong and some who don't	0.49
	In this area there is pressure to behave like everyone else	0.62

4.5.3.2 Findings on internal consistency

Table 4.5 shows the Cronbach's alpha coefficients for the 8 scales capturing social cohesion. The only scale for which internal consistency is low is that capturing participation in organisations. Deletion of the items capturing participation in Political groups or in Education groups did not improve Cronbach's alpha for the scale. A number of authors have pointed out that organisations vary greatly in their purpose and

mode of operating. It is a simplistic, though widespread practice, to sum participation in all types of organisations into a single scale. For ease of presentation, participation will be shown as a summary across all types of organisations in this thesis. More detailed investigation of different types of organisation and their association with other characteristics of neighbourhoods and with health will also be undertaken and highlighted where interesting differences between organisations are found.

Table 4.5. Cronbach's alpha for scales capturing structural and cognitive aspects of social cohesion.

	Cronbach's alpha
Structural aspects of social cohesion	
Family ties	0.96
Friendship ties	0.86
Participation in organisations	0.45
Integration into the wider society	n/a
Cognitive aspects of social cohesion	
Trust	0.73
Attachment	0.77
Able to rely on others for practical help	0.87
Tolerance/respect	0.87

n/a – only 1 item in scale

4.5.3.3 Testing the measurement model in different residential settings

Further testing of the neighbourhood social cohesion scales was undertaken to see whether the factor structure was consistent for different types of neighbourhoods. The factor structure was tested in England versus Scotland, deprived (Carstairs index of deprivation ≥ 0) versus not deprived (Carstairs index of deprivation < 0) areas, and urban (defined as at least 75% urban or population $\geq 100,000$) versus less urban locations.

Structural aspects of social cohesion

The factor loadings in different types of neighbourhood are presented in Table 4.6. There were no substantive differences in factor loadings or correlations between structural aspects of social cohesion in England and Scotland. The goodness of fit indices assuming equal factor loadings and equal correlations in England versus Scotland, deprived versus not deprived, and urban versus rural neighbourhoods are shown in Table 4.7. Examination of the change in chi-squared statistic indicates that a model allowing the factor loadings to be different in England and Scotland was an

improvement on a model which constrained them to be the same. Similarly, allowing the factor loadings to be different in deprived and not deprived settings gave a statistically significant improvement in fit. However, the change in chi-squared statistic appeared to be picking up very small differences between estimates in England and Scotland or deprived and less deprived settings: as noted above, the differences in factor loadings were small in magnitude. There was no evidence of a difference in factor structure between urban and rural settings.

Cognitive aspects of social cohesion

No substantive differences in factor loadings were seen by country, economic deprivation or degree of urbanisation (Table 4.8). Table 4.9 shows goodness of fit for the cognitive measurement model in a range of locations. The change in chi-squared statistics indicated a statistically significant reduction in the goodness of fit when factor loadings were constrained to be the same in England and Scotland, or in deprived and less deprived settings, or in urban and rural locations. Once again, very small differences in factor loadings were found and these were not considered to be scientifically relevant.

Table 4.6. Structural aspects of social cohesion: factor loadings in different types of neighbourhood

Construct	Questionnaire item	All neighbour- hoods	England	Scotland	Deprived	Not deprived	Urban	Rural
Family ties	Met up with family members in local area in past fortnight	0.97	0.96	0.96	0.96	0.96	0.97	0.94
	Spoke on the phone to family members in local area in past fortnight	0.97	0.98	0.95	0.96	0.98	0.97	0.98
Friendship ties	Met up with friends in local area in past fortnight	0.84	0.86	0.79	0.84	0.84	0.85	0.75
	Spoke on the phone to friends in local area in past fortnight	0.90	0.90	0.92	0.92	0.89	0.90	0.93
Participate in organised activities	Regularly join in ... with people in local area Political parties, trade unions, environmental groups	0.23	0.23	0.22	0.23	0.23	0.23	0.22
	Parent-Teacher Association, residents' groups, Neighbourhood Watch, youth groups	0.41	0.45	0.33	0.39	0.40	0.43	0.38
	Church or other religious groups, charitable organisations	0.52	0.51	0.55	0.47	0.54	0.51	0.56
	Education, arts or music groups, evening class	0.30	0.30	0.31	0.22	0.33	0.31	0.30
	Social clubs (eg Rotary Club, WI, mother and toddler groups, working men's club)	0.40	0.38	0.45	0.42	0.42	0.39	0.43
Integration into wider society	Equal numbers of relationships with people inside and outside local area	n/a	n/a	n/a	n/a	n/a	n/a	n/a

n/a Not applicable: only 1 item in scale

Table 4.7. Goodness of fit index for structural aspects of social cohesion in a variety of settings.

Setting	RMSEA (90% upper bound) for equal factor loadings and equal correlations between scales	Increase in chi-square compared with model for unconstrained factor loadings	Change in degrees of freedom	p-value
All neighbourhoods	0.033 (0.036)			
England versus Scotland	0.023 (0.025)	17.4	6	0.008
Deprived versus not deprived	0.023 (0.025)	18.8	6	0.005
Urban versus rural	0.023 (0.025)	9.3	6	0.2

Table 4.8. Cognitive aspects of social cohesion: factor loadings in different types of neighbourhood

Construct	Questionnaire item	All neighbour- hoods	England	Scotland	Deprived	Not deprived	Urban	Rural
Trust	People in this area would do something if a house was being broken into	0.64	0.64	0.65	0.61	0.69	0.64	0.68
	In this area people would stop children if they saw them vandalising things	0.64	0.64	0.65	0.59	0.67	0.64	0.67
	People would be afraid to walk alone after dark	0.35	0.35	0.33	0.32	0.33	0.35	0.33
	People in this area will take advantage of you	0.73	0.72	0.72	0.69	0.73	0.72	0.74
	If you were in trouble, there are lots of people in this area who would help you	0.76	0.75	0.77	0.72	0.78	0.75	0.79
	Most people in this area can be trusted	0.67	0.68	0.64	0.64	0.67	0.67	0.66
Attachment to neighbour- hood	I really feel part of this area	0.68	0.68	0.68	0.66	0.70	0.68	0.69
	Most people in this area are friendly	0.78	0.77	0.69	0.77	0.78	0.76	0.80
	People in this area have lots of community spirit	0.76	0.76	0.76	0.74	0.78	0.76	0.77
	People in this area do things to help the community	0.79	0.80	0.79	0.75	0.82	0.79	0.80
Able to rely on others for practical help	Comfortable asking neighbour to collect prescription if ill in bed	0.75	0.75	0.75	0.74	0.76	0.75	0.76
	Comfortable confiding about a personal problem	0.88	0.88	0.88	0.88	0.89	0.88	0.89
	Comfortable asking neighbour to lend you £5	0.63	0.63	0.62	0.63	0.63	0.63	0.61
Tolerance/ Respect	Everybody in this area should have equal rights and an equal say	0.44	0.45	0.45	0.39	0.46	0.45	0.46
	People in this area treat each other with respect	0.82	0.82	0.81	0.80	0.83	0.82	0.82
	People in this area are tolerant of others who are not like them	0.73	0.73	0.72	0.72	0.73	0.73	0.74
	People in this area respect one another's privacy	0.63	0.66	0.60	0.59	0.65	0.66	0.59
	In this area there are some people who belong and some who don't	0.49	0.49	0.48	0.46	0.49	0.50	0.49
	In this area there is pressure to behave like everyone else	0.62	0.63	0.62	0.64	0.62	0.62	0.62

Table 4.9. Goodness of fit index for cognitive aspects of social cohesion in a variety of settings.

Setting	RMSEA (90% upper bound) for equal factor loadings and equal correlations between scales	Increase in chi-square compared with model for unconstrained factor loadings	Change in degrees of freedom	p-value
All neighbourhoods	0.049 (0.050)			
England versus Scotland	0.035 (0.036)	141.0	15	<0.001
Deprived versus not deprived	0.036 (0.037)	214.0	15	<0.001
Urban versus rural	0.035 (0.036)	149.5	15	<0.001

4.5.3.4 Findings on reliability

Reliability coefficients for the scales capturing cognitive aspects of social cohesion are presented in Table 4.10. The reliability coefficients for the trust and attachment scales were comparable with other studies (Raudenbush & Sampson, 1999). For the practical help and tolerance scales, reliability was lower than for the trust and attachment scales. This indicates that: 1) individual characteristics influence an individual's perception of the availability of practical help and level of tolerance and individuals within neighbourhoods are not homogeneous with respect to these characteristics, or 2) the items within the help (tolerance) scale capture more than one underlying construct. The latter explanation can be ruled out as Cronbach's alpha coefficients were 0.87 for both the trust and tolerance scales, indicating high correlation between the items and overall scale and good internal consistency.

4.5.3.5 Findings on intraneighbourhood correlation coefficients

The intraneighbourhood correlation coefficients for the help and tolerance scales were lower than for the trust and attachment scales. This indicates that residents within neighbourhoods agreed less about levels of help and tolerance than they did about trust and attachment. To put it another way, neighbourhoods defined by electoral ward and postcode sector were less appropriate for investigating practical help and tolerance than for investigating trust and attachment. Nevertheless, Raudenbush and Sampson (1999) found intraneighbourhood correlation coefficients of similar magnitudes. They point out that a large effect size is not incompatible with a low intraneighbourhood correlation coefficient.

Table 4.10. Variation in cognitive aspects of social cohesion between and within neighbourhoods using data from residents in England and Scotland.

Social cohesion construct	Between neighbourhood variation (s.e.)	Between person (within neighbourhood) variation (s.e.)	Between item (within person) variation (s.e.)	Total variation	Reliability (based on average 42 respondents per neighbourhood)	Intraneighbourhood correlation coefficient (ICC)
Trust	0.253 (0.025)	0.158 (0.008)	2.626 (0.016)	3.037	0.79	0.62
Attachment	0.154 (0.015)	0.196 (0.011)	2.296 (0.018)	2.646	0.72	0.44
Able to rely on others for practical help	0.052 (0.007)	0.395 (0.017)	2.310 (0.021)	2.757	0.45	0.12
Tolerance/respect	0.056 (0.006)	0.212 (0.009)	2.698 (0.016)	2.966	0.45	0.21

4.5.4 The multidimensional nature of social cohesion

Table 4.11 summarises the correlations between the eight neighbourhood social cohesion scales.

The underlying model of social cohesion presented earlier in Figure 4.1 posits that greater local social contact will be positively associated with the cognitive aspects of social cohesion. There is some support for this in these cross-sectional data. Residents in neighbourhoods with greater contact with family felt more able to rely on others in the local area for practical help (correlation coefficient 0.39). There was a smaller positive correlation between family ties and trust or attachment. However, the correlation between family ties and tolerance was negative: neighbourhoods with greater family ties tended to have lower levels of tolerance. Large positive correlations between friendship ties and levels of trust, attachment, and being able to rely on others for practical help were seen (correlation coefficients ≥ 0.50), and tolerance was also higher in neighbourhoods with more friendship ties. In neighbourhoods with higher participation in organised activities, people had more contact with local friends and there were higher levels of trust, attachment, being able to rely on others for practical help, and tolerance of others. More detailed inspection revealed that participation in church and other religious groups or charitable organisations was positively associated with all these cognitive aspects. Participation in education, arts or music groups/evening classes was associated with higher levels of trust, attachment and tolerance/respect, but not with being able to rely on others for practical help. Neighbourhoods with greater participation in social clubs (such as Women's Institute, mother and toddler groups and working men's clubs) tended to have higher levels of trust, attachment, and being able to rely on others for practical help, but not tolerance/respect. Integration was moderately positively correlated with trust and attachment.

Trust, attachment to neighbourhood, and tolerance were highly correlated. Being able to rely on others for practical help was higher in neighbourhoods with more trust and attachment but the correlation with tolerance was less clear.

Table 4.11. Correlations between structural and cognitive aspects of social cohesion: all neighbourhoods

	Family ties	Friendship ties	Participation in orgs	Integration	Trust	Attachment	Practical help
Friendship ties	0.26						
Participation in orgs	-0.10	0.30					
Integration	0.11	0.26	0.17				
Trust	0.21	0.51	0.45	0.28			
Attachment	0.24	0.54	0.50	0.25	0.88		
Practical help	0.39	0.50	0.28	0.18	0.62	0.68	
Tolerance	-0.12	0.32	0.31	0.18	0.69	0.59	0.32

The possible negative aspects of social cohesion were highlighted in section 2.1.1. The tolerance scale includes two items which capture the negative aspects of social control (pressure to behave like others in the neighbourhood and lack of privacy). Detailed analysis of these two items is presented in Table 4.12. Greater pressure to conform to behavioural norms was experienced in neighbourhoods with greater participation in organised activities. Closer inspection revealed that pressure to conform was greater in neighbourhoods with higher participation rates for Parent-Teacher associations/tenant's groups/Neighbourhood Watch (correlation coefficient = 0.17) and in neighbourhoods with higher participation rates for education/arts & music groups/evening classes (correlation coefficient = 0.22). Residents in neighbourhoods with more family ties were more likely to report that "people in this area like to know everyone else's business" whereas residents in neighbourhoods with more friendship ties and greater participation were more likely to report that "people in this area respect one another's privacy". These findings highlight the need to be more precise about the forms of social contact within neighbourhoods and their implications for residents. Contact with family and participation in some types of organisation appeared to have some negative implications for individual freedom.

There was no evidence that local social contact was associated with labelling of people as being in or out of the group. The correlation between reporting that "In this area there

are some people who belong and some who don't" was not positively correlated with family ties, friendship ties, or participation. It was significantly negatively correlated with participation in church/religious groups/charitable organisations ($r=-0.14$) and education, arts or music groups/evening classes ($r=-0.28$).

Table 4.12. Correlations between negative aspects of social control and other social cohesion domains: all neighbourhoods

	Family ties	Friendship ties	Participation in orgs	Integration	Trust	Attachment	Practical help
Pressure to behave	-0.10	0.00	0.19	0.00	-0.01	0.00	0.03
Lack of privacy	0.25	-0.18	-0.24	-0.13	-0.50	-0.37	-0.14

The correlations between the eight social cohesion domains in different settings are summarised in Tables 4.13-4.15. Many of the correlation coefficients were in the same direction and of similar magnitude in England and Scotland. However, in Scotland, greater contact with family was negatively correlated with trust, tolerance, and participation. This compares with weaker negative or even positive correlations between family ties and trust, tolerance, and participation in England. Larger positive correlations between family ties and attachment to neighbourhood, trust, and being able to rely on others for practical help were seen in more deprived neighbourhoods compared with neighbourhoods which were less deprived. Neighbourhoods in urban settings showed positive correlations between family ties and attachment and trust. In rural settings, these correlations were larger and negative. A large negative correlation between family ties and participation in organised activities was also seen in rural settings, though not in urban settings. To summarise, evidence presented in Tables 4.13-4.15 shows that contact with family tends to be positively correlated with the cognitive aspects of social cohesion in urban and deprived areas. In rural areas, contact with family is not positively associated with cognitive aspects or participation. In-depth work is required to understand the nature of contact with family in various settings.

Table 4.13. Correlations between structural and cognitive aspects of social cohesion:
separately for England (top of cell) and Scotland (lower part of cell)

	Family ties	Friend- ship ties	Particip	Integrat	Trust	Attach	Practical help
Friendship ties	England 0.27 Scotland 0.08						
Participation in orgs	-0.05 -0.23	0.24 0.46					
Integration	0.15 0.01	0.28 0.21	0.20 0.13				
Trust	0.21 -0.17	0.45 0.56	0.30 0.49	0.47 0.24			
Attachment	0.21 0.02	0.48 0.60	0.28 0.19	0.52 0.52	0.88 0.86		
Practical help	0.42 0.29	0.43 0.58	0.23 0.38	0.24 0.10	0.64 0.55	0.68 0.66	
Tolerance	-0.08 -0.24	0.32 0.38	0.30 0.32	0.19 0.18	0.71 0.75	0.65 0.58	0.37 0.24

Table 4.14. Correlations between structural and cognitive aspects of social cohesion:
separately for not deprived neighbourhoods (top of cell) and deprived¹ neighbourhoods
(lower part of cell)

	Family ties	Friend- ship ties	Particip	Integrat	Trust	Attach	Practical help
Friendship ties	Not deprived 0.27 Deprived 0.39						
Participation in orgs	-0.04 -0.01	0.27 0.12					
Integration	0.19 0.14	0.25 0.15	0.19 -0.09				
Trust	0.26 0.49	0.40 0.47	0.31 0.14	0.21 0.20			
Attachment	0.23 0.47	0.41 0.53	0.42 0.30	0.19 0.12	0.83 0.86		
Practical help	0.33 0.52	0.37 0.54	0.22 0.15	0.25 0.06	0.54 0.63	0.60 0.70	
Tolerance	0.09 -0.10	0.18 0.24	0.05 0.13	0.10 0.04	0.43 0.58	0.40 0.48	0.18 0.25

¹Neighbourhoods in which Carstairs index of deprivation is 0 or greater were categorised as deprived.

Table 4.15. Correlations between structural and cognitive aspects of social cohesion: separately for urban¹ neighbourhoods (top of cell) and rural neighbourhoods (lower part of cell)

	Family ties	Friendship ties	Particip	Integrat	Trust	Attach	Practical help
Friendship ties	Urban 0.23 Rural -0.15						
Participation in orgs	-0.09 -0.50	0.28 0.29					
Integration	0.09 -0.10	0.22 0.22	0.20 0.13				
Trust	0.17 -0.42	0.42 0.58	0.22 0.60	0.42 0.35			
Attachment	0.20 -0.28	0.46 0.58	0.47 0.61	0.21 0.24	0.88 0.83		
Practical help	0.37 0.11	0.45 0.50	0.18 0.33	0.25 0.05	0.59 0.56	0.64 0.67	
Tolerance	-0.11 -0.30	0.33 0.36	0.30 0.39	0.17 0.24	0.73 0.72	0.66 0.52	0.34 0.23

¹Neighbourhoods in England which are >75% urban and neighbourhoods in Scotland with populations of 100,000 or more were categorised as urban.

4.5.5 Economic deprivation and social cohesion

Seven out of the eight social cohesion scales were negatively correlated with economic deprivation. The size of the correlation with economic deprivation was especially large for the trust, attachment, and tolerance scales (-0.57 and larger). The high degree of correlation makes it difficult to separate out the effects of social cohesion and economic deprivation using regression modelling. Contact with family was not associated with economic deprivation.

Table 4.16. Correlations between neighbourhood social cohesion scales and economic deprivation

Social cohesion scale	Correlation with Carstairs index of deprivation (Pearson correlation coefficient)
Family ties	0.04
Friendship ties	-0.35
Participation in organised activities	-0.43
Integration into wider society	-0.25
Trust	-0.75
Attachment to neighbourhood	-0.57
Able to rely on others for practical help	-0.31
Tolerance	-0.61

4.5.6 Socio-demographic correlates of social cohesion

Data from the 1991 census capturing ethnic group, age, occupation, owner occupancy, urbanisation, and residential mobility were used to investigate associations between the socio-demographic make-up of a neighbourhood and the social cohesion domains.

Table 4.17 suggests that neighbourhoods with more minority ethnic group residents have lower levels of family and friendship ties, trust, attachment, and practical help (correlation coefficients below -0.30) after adjustment for economic deprivation.

Tolerance/respect was not associated with proportion of minority ethnic group residents after adjustment for economic deprivation, indicating that predominantly white neighbourhoods are not necessarily the most tolerant ones. Studies at an individual level show that indicators of social cohesion and social capital are positively correlated with age (Putnam, 2000; Cooper et al, 1999), but at the neighbourhood level there was no clear association between the age distribution of residents and social cohesion.

Exceptions were the lower levels of family ties, trust, attachment and practical help in neighbourhoods with a higher proportion of 18-44 year olds. There was a large and positive correlation between density of family ties and the proportion of people in mining and manufacturing trades. Levels of trust, attachment and practical help were also higher in mining and manufacturing areas. The stereotypical view of these areas being cohesive was to some extent supported by these data; there are aspects of social cohesion that are higher in mining and manufacturing areas. Before adjustment for economic deprivation, home ownership rates were positively associated with trust, attachment, being able to rely on others for practical help, tolerance, family ties, integration, and participation. Home ownership was not associated with most aspects of

social cohesion, after adjustment for economic deprivation. The correlation between home ownership rates and social cohesion appeared to be largely due to economic conditions; separate effects of commitment to the local neighbourhood in places of high home ownership were not evident. The negative correlations between home ownership and levels of trust and attachment to neighbourhood were unexpected. There was a degree of collinearity between economic deprivation and owner-occupancy rates and some inflation of variance when both were included in the model, suggesting that the estimated negative correlation may be unstable. (Note that the Carstairs index does not include owner-occupancy rates.) However, analysis of data from the British Household Panel Survey also showed no association between owner occupation and social cohesion amongst men (McCulloch, 2003). Put together, these findings suggest that high rates of home ownership may not have positive effects on neighbourhood social cohesion over and above other socioeconomic factors. Contact with local family and friends tended to be higher in more rural neighbourhoods. Higher levels of trust and attachment were also seen in more rural areas. Closer inspection revealed that contact with local family was common in more deprived rural areas but less so in less deprived rural (possibly commuter) areas (Table 4.18). As expected, contact with local family and friends was lower in neighbourhoods with greater residential mobility. Greater mobility was also associated with lower levels of trust, attachment, and practical help.

The correlation between specific types of organisation and residents' socio-demographic characteristics are shown in Table 4.19. Participation in Parent-Teacher Associations, tenant's groups and similar tended to be higher in neighbourhoods with a larger proportion of people from minority ethnic groups and was lower in more rural neighbourhoods. Participation in social clubs was less common in neighbourhoods with more ethnic minority residents and with more people aged 18-44. It was higher in mining and manufacturing areas. Note from section 4.5.4 that participation in social clubs was positively correlated with trust, attachment and practical help but not with tolerance. With the exception of social clubs, there were no substantial correlations between participation and residential mobility. Organisations such as trade unions, parent-teacher associations, and church or other religious groups do not appear to experience drops in membership when residential mobility is high. However, in areas of high residential turnover, there is less participation in more informal social clubs.

Table 4.17. Correlation between neighbourhood social cohesion and demographic composition according to 1991 census for neighbourhoods in England and Scotland, adjusted for Carstairs deprivation index.

	% black	% south asian	% aged 0-4	% aged 18-44	% aged 65+	% mining/ manufacturing	% owner occupiers	% rural	mobility ^a
Structural aspects									
Family ties	-0.65	-0.57	0.18	-0.48	-0.03	0.66	-0.05	0.43	-0.50
Friendship ties	-0.32	-0.35	0.02	-0.23	0.04	0.19	-0.15	0.30	-0.21
Participation	0.05	0.01	-0.12	-0.16	0.21	-0.13	-0.09	-0.02	-0.09
Integration	-0.09	-0.15	-0.01	-0.12	0.04	0.10	-0.09	0.14	-0.06
Cognitive aspects									
Trust	-0.50	-0.47	-0.05	-0.35	0.14	0.33	-0.23	0.43	-0.25
Attachment to neighbourhood	-0.45	-0.45	-0.09	-0.41	0.18	0.29	-0.25	0.37	-0.37
Practical help	-0.37	-0.37	0.12	-0.35	0.13	0.28	-0.13	0.26	-0.40
Tolerance/respect	0.08	0.05	-0.19	-0.01	-0.03	-0.07	0.01	-0.07	0.01

^aPercentage of residents who were not living in the same neighbourhood one year earlier

Table 4.18. Family ties and urbanisation at varying levels of economic deprivation in English and Scottish neighbourhoods.

	Degree of urbanisation ^a				
Tertile of Carstairs deprivation index	1 (urban)	2	3	4	5 (rural)
	mean contact with family ^b (number of neighbourhoods)				
Lower (less deprived)	1.03 (53)	1.07 (18)	1.11 (4)	1.16 (6)	1.18 (5)
Middle	1.00 (49)	1.26 (12)	1.31 (18)	1.32 (5)	1.34 (3)
Upper (more deprived)	1.04 (63)	1.33 (11)	1.41 (7)	1.51 (5)	n/a (0)

^aDegree of urbanisation defined as: In England 1= Wholly urban, 2= At least 75% urban, 3= 50-75% urban, 4= <50% urban. In Scotland 1= Part of Continuous block with 1,000,000 or more residents, 2= 100,000-999,999 residents, 3= 10,000-99,999 residents, 4= 1,000-9,999 residents, 5= fewer than 1,000 residents.

^bFamily ties score ranges from 0 (no regular contact with local family) to 2 (regular face-to-face and telephone contact with family)

Table 4.19. Correlation between participation in various types of organisation and demographic composition according to 1991 census for neighbourhoods in England and Scotland, adjusted for Carstairs deprivation index.

	% black	% south asian	% aged 0-4	% aged 18-44	% aged 65+	% mining/ manufacturing	% owner occupiers	% rural	mobility
Type of organisation									
Trade union and pressure groups	0.09	0.05	-0.07	0.06	0.09	-0.20	-0.15	0.00	0.12
PTA, neighbourhood groups	0.32	0.28	-0.17	-0.02	0.24	-0.28	0.08	-0.31	0.06
Church and religious groups	-0.11	-0.02	-0.05	-0.18	0.03	-0.04	-0.20	0.14	-0.07
Education groups, evening classes	0.27	0.20	-0.16	0.12	0.19	-0.30	0.02	-0.18	0.14
Social clubs	-0.42	-0.45	0.08	-0.33	0.06	0.42	-0.08	0.28	-0.38

4.7 Summary of development of tool to measure neighbourhood social cohesion

- A new tool describing neighbourhood social cohesion was developed for this study. Eight domains were captured: family ties, friendship ties, participation in organised activities, integration into wider society, trust, attachment to neighbourhood, being able to rely on others for practical help, and tolerance of others.
- The psychometric and econometric properties of this tool were tested. The factor structure is consistent across types of area (rural/urban, deprived/not deprived, England/Scotland). Acceptable reliability was found for the scales capturing cognitive aspects of social cohesion but the reliability could not be tested for the scales capturing structural aspects. The response rate was similar to that obtained in other studies of similar design.
- The eight domains were generally positively correlated with each other. An exception was that family ties was negatively correlated with participation and tolerance and was only moderately positively correlated with integration.
- Economic deprivation was highly negatively correlated with seven of the eight social cohesion domains (the exception being family ties).
- The direction and magnitude of the correlations between socio-demographic characteristics of the resident population and social cohesion depend on the domain in question. This supports an approach which considers each social cohesion domain separately rather than creating a summary index of social cohesion.
- Over and above economic deprivation, the proportion of minority ethnic group residents was negatively correlated with family and friendship ties, trust, attachment, and availability of practical help. The neighbourhood age structure was not clearly related to social cohesion. Owner occupancy was hypothesised to be positively associated with social cohesion but there was no empirical evidence for this here. More rural areas and mining/manufacturing areas had higher family and friendship ties, trust, attachment, and practical help.
- These findings indicate that the neighbourhood social cohesion measures have acceptable psychometric properties and show some variation across

neighbourhoods. This makes them suitable for the investigation of neighbourhood social cohesion and health status.

Chapter 5. Study design and statistical methods: modelling individual and neighbourhood characteristics

Chapter 5 begins with a description of the individual health and socio-demographic data used and how these were linked to the neighbourhood measures. There follows a description of multilevel modelling techniques which are used to partition differences in health into those which are between neighbourhoods and those which are between residents in a given neighbourhood. This implies that the effects of neighbourhood characteristics on health can be separated out from individual risk factors. In practice, the relationship between an individual and their area of residence is complex and the hypotheses to be tested in this project have necessarily been simplified. This chapter discusses some of the complexities in modelling area variations in health and describes the modelling strategy adopted.

5.1 Measuring health and the determinants of health

5.1.1 The Health Survey for England and the Scottish Health Survey

Every year since 1994, a group of around 15,000 people has been invited to take part in the Health Survey for England (HSE). Prior to 1994 the HSE sample was smaller and is not included in the analyses presented in this thesis. The Scottish Health Survey (SHS) was carried out in 1995 and 1998. These surveys are cross-sectional and representative of the general populations of England and Scotland. Data for Wales were not available. For the purposes of this work, data from the HSE and SHS were analysed together.

There is a natural clustering of participants within areas as a multi-stage sample was used. Postcode sectors form the primary sampling units. A random sample of postcode sectors was selected each year, stratified on health authority and percentage of households headed by someone in a non-manual occupation. This resulted in approximately 700 postcode sectors, although exact numbers vary slightly from year to year. The stratification seeks to ensure a final sample which is both regionally and

economically representative of the population. Each postcode sector is selected with probability in proportion to the number of households within it (i.e. postcode sectors with more households have a greater probability of selection).

Within each postcode sector, a random sample of approximately 19 households was drawn from the small user Postcode Address File. It is estimated that less than 1% of private households are not on the Postcode Address File. This yields a total selected sample of around 14,000 addresses. Within each household, all adults were invited to participate. Children were not included in the analyses for this project. The data used in this study come from all participants aged 16 and over, living in neighbourhoods where social cohesion information was collected. The sampling strategy for the Scottish Health Survey followed the same design, although fewer individuals and households were selected for inclusion each year and the survey only took place in 1995 and 1998. Full details of the methods used to obtain the HSE and SHS samples are given in the reports published by the Stationery Office each year (Erens & Primatesta, 1998; Shaw et al, 2000). Permission to use existing HSE and SHS data for the current study were obtained from the Department of Health and the Scottish Executive.

The number of HSE and SHS participants included in the present study of neighbourhood social cohesion and health by year is shown in Table 5.1.

Table 5.1. Number of Health Survey participants included in the social cohesion study by year

	Health Survey for England	Scottish Health Survey
1994	1138	2110
1995	1248	
1996	1434	
1997	662	3226
1998	1252	
1999	679	
Total	6413	5336

An interview with each eligible person (at which questionnaire data were collected) was followed by a visit from a trained nurse (at which blood samples and other physical measurements were collected). Data covering the following topics has been used in this project:

- self-rated general health
- minor psychiatric morbidity
- smoking
- measurements of waist and hip (collected by nurse)
- perceived social support
- demographic and socio-economic indicators

Table 5.2 Availability of health and socio-demographic indicators by year in the Health Survey for England and Scottish Health Survey

	England						Scotland	
	1994	1995	1996	1997	1998	1999	1995	1998
Self-rated health	•	•	•	•	•	•	•	•
Psychological health	•	•		•	•	•	•	•
Smoking	•	•	•	•	•	•	•	•
Waist-hip ratio	•			•	•	•	•	•
Age	•	•	•	•	•	•	•	•
Sex	•	•	•	•	•	•	•	•
Socioeconomic position	•	•	•	•	•	•	•	•
Social support	•	•			•	•		

5.1.1.1 Health outcomes

Self-rated health was the primary outcome studied here. Although self-rated health is a subjective outcome, the design of this study is such that the people who report their health status are not the same people who rate their neighbourhood. This avoids the issue of associations being solely due to the tendency for some respondents to report negatively about all aspects of their lives (including health and where they live). Whilst the importance of peoples' perceptions of their neighbourhood and of their health should not be ignored, it is not the focus of the current study. The policy implications of finding that perceptions of the area of residence are associated with perceptions of health may be different from the implications of finding that objective measures of the area of residence influence peoples' subjective and objective health status. General self-rated health was measured on a 5 point scale with possible responses ranging from very good, good, fair, bad, through to very bad. See Appendix 3 for the full question and response wording. Responses were dichotomised and the odds of reporting less than good self-rated health were modelled. It is theoretically possible to use the full range of responses by modelling self-rated health as an ordinal outcome. However, the

proportions of people reporting bad or very bad health were close to zero so that statistical power was not sufficient to take this approach using these data.

Minor psychiatric morbidity was captured using the General Health Questionnaire, known as the GHQ (Goldberg, 1992). The 12-item form of the GHQ was used here (Appendix 3). The GHQ12 captures various aspects of psychological functioning such as problems concentrating or sleeping, difficulty in making decisions and overcoming difficulties, and feelings of worthlessness. Participants who scored 4 or more out of 12 were classed as having a high GHQ score.

Smoking status was self-reported and participants were split into two groups on the basis of their current smoking status (current smoker versus ex-regular smoker or never smoker). In this thesis, current smoking is used as shorthand for current cigarette smoking. Data on cigar and pipe smoking were not used here.

Waist-hip ratio was derived from measures of waist and hip circumference. These were measured to the nearest millimetre three times by a trained nurse and waist:hip ratio was calculated as the average waist circumference divided by the average hip circumference.

5.1.1.2 Other individual level variables

Social class was based on the current occupation (or previous occupation if not currently working) of the participant using the Registrar General's social classification (as used in the 1991 census). Economic activity was categorised into four groups: currently in paid employment, unemployed (according to the International Labour Organisation definition), retired, and economically inactive for other reasons. The last group is heterogeneous and includes, for example, people looking after the home or caring for family/friend and the long-term sick. The reasons for not being in paid employment are likely to differ between men and women. This is allowed for in the modelling by inclusion of an interaction term for sex by economic inactivity. Social class plus economic activity captured a Health Survey participant's socioeconomic position.

5.1.1.3 Linking individual and neighbourhood level data

Individual level data from the Health Surveys were linked to (or geocoded to) measures of neighbourhood social cohesion and economic deprivation through participant's postcode. Health Survey participant's postcodes were supplied by the National Centre for Social Research. Permission to link the individual data to neighbourhood level data was obtained from the Department of Health and the Scottish Executive.

5.1.1.4 Description of Health Survey participants

Section 3.2.6 outlined the way in which neighbourhoods were selected for inclusion in the study. There was a degree of overlap in the areas of residence of HSE and Whitehall II participants. For this reason, even though 87 neighbourhoods were selected for the investigation of contextual effects on HSE participants, HSE data were available for 174 English neighbourhoods which were covered by the Social Cohesion Survey. (Only 87 of these neighbourhoods had at least 40 HSE participants living there but all are included in the analyses presented here.) This yielded a total of 6,594 HSE participants living in 174 neighbourhoods in England and 4,515 SHS participants living in 80¹ neighbourhoods in Scotland: a total of 11,109 Health Survey participants were resident in 254 neighbourhoods. Of these, 1035 had missing data on social class and a further 1 participant had missing data on economic activity. This left 10,073 participants with complete data on age, sex, socioeconomic position, health status, neighbourhood social cohesion, and neighbourhood economic deprivation. Analyses are based on these 10,073 participants, although the exact numbers varies according to the health outcome of interest.

The characteristics of Health Survey participants included in the analysis are presented in Table 5.3. The small number of participants from minority ethnic groups limited the extent to which the association between ethnic group, social cohesion and health could be investigated.

¹ Social cohesion was measured in 81 neighbourhoods in Scotland but 1 of these was selected in error and did not contain any Health Survey participants.

Table 5.3 Description of the Health Survey participants included in the social cohesion study

	Women (Total 5507) n (%)	Men (Total 4566) n (%)
Age group (yrs)		
16-34	1719 (31)	1359 (30)
35-49	1587 (29)	1458 (32)
50-64	1294 (24)	1075 (24)
65+	907 (16)	674 (15)
Registrar General's Social class		
I	134 (2)	321 (7)
II	1268 (23)	1227 (27)
IIINM	2066 (38)	527 (12)
IIIM	510 (9)	1544 (34)
IV	1074 (20)	692 (15)
V	455 (8)	255 (6)
Economic activity		
In paid employment	2991 (54)	2982 (55)
ILO Unemployed	134 (2)	314 (7)
Retired	1020 (19)	782 (17)
Other economically inactive	1362 (25)	488 (11)
Ethnic group		
White	4608 (84)	3736 (82)
Black	99 (2)	91 (2)
South Asian	104 (2)	152 (3)
Other or missing	696 (13)	587 (13)
Less than good self-rated health	1358 (25)	1157 (25)
High GHQ score ^a	885 (19)	523 (14)
Current smoker ^b	1420 (31)	1130 (29)
Waist:hip ratio ^c	mean (sd) 0.796 (0.066)	mean (sd) 0.908 (0.069)

^aComplete data on GHQ available for 4663 women and 3815 men

^bComplete data on smoking status available for 4630 women and 3867 men

^cComplete data on waist:hip ratio available for 3292 women and 2752 men

Health Survey participants resident in neighbourhoods which were included in the social cohesion study were very similar to participants resident in neighbourhoods which were not included (Table 5.4). The procedure used to select neighbourhoods for inclusion in the study does not appear to have introduced any bias.

Table 5.4 Comparison of Health Survey participants included in the social cohesion study and those not included

	Included (%)	Not included (%)
Women	55	55
Age group (yrs)		
16-34	32	32
35-49	28	28
50-64	20	22
65+	20	18
Registrar General's Social class		
I	4	4
II	26	25
IIINM	25	25
IIIM	20	20
IV	18	18
V	7	7
Economic activity		
In paid employment	53	54
ILO Unemployed	4	5
Retired	20	18
Other economically inactive	23	23
Less than good self-rated health	24	25

The distribution of Health Survey participants in neighbourhoods is summarised in Table 5.5. Data from an average of 42 participants per neighbourhood, ranging from 20 in Inner London to 51 in Scotland, were included. (Note that neighbourhoods in Greater London were selected because Whitehall II participants were living there and so do not include a minimum of 40 Health Survey participants.)

Table 5.5. Location of Health Survey participants in neighbourhoods in England and Scotland.

Location	Number of neighbourhoods	Number of Health Survey participants living in neighbourhoods	Average number of participants per neighbourhood
Inner London	35	716	20
Outer London	56	1279	23
Rest of England	83	3989	48
Scotland	80	4089	51
Total	254	10073	42

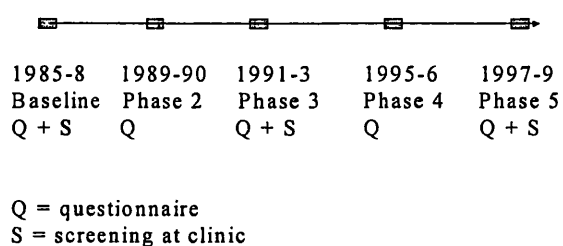
Many of the same measurement tools and survey techniques were employed in the HSE and SHS so these data have been analysed together for this thesis. Data from Health Survey participants were used to investigate the relationships between neighbourhood characteristics and the four health outcomes. These data were not used to investigate psychosocial pathways linking neighbourhood characteristics to health because appropriate psychosocial measures were not available.

5.1.2 The Whitehall II study

The Whitehall II study is a longitudinal study of civil servants which was set up in 1985 to investigate the social gradient in health. There has been detailed investigation of the role of the work environment in determining health but so far the residential environment has not been considered. Whilst this sample is not representative of the general population, it is longitudinal and offers a much richer variety of measures of health determinants and possible disease mechanisms. The effects of conditions at work may be more homogeneous in this sample of office-based workers than samples drawn from the general population and this may increase the power to detect effects of the residential context.

The study began in 1985 when all civil servants in the selected age bracket (35-55 years) working in 20 London departments were invited to participate. The final cohort consisted of 10,308, with an overall response rate of 73%. At the first phase and every odd phase, data were collected by questionnaire and attendance at a screening clinic (Figure 5.1). At even phases, data were collected by questionnaire only. Data from the fifth phase were used for this project. Only participants who were living in the same neighbourhood at phases 3 and 5 were included. In other words, the analyses presented here are based on data from participants who had not changed neighbourhood in the last 5 years.

Figure 5.1 Phases of the Whitehall II study.



The following data have been used in this thesis:

- social support
- vigilance for threat
- sense of control
- self-rated health
- demographic and socioeconomic indicators

5.1.2.1 Individual outcomes and socio-demographic characteristics

Three aspects of perceived social support were investigated in this thesis: emotional support, practical support, and negative support. These were measured for the respondent's closest person using the Close Persons questionnaire (Stansfeld et al, 1998) and have been validated against standard social support tools. The emotional support scale captures sharing interest, boosting self-esteem, and reciprocity using items such as "How much in the last 12 months could you rely on this person?". The practical support scale captures major and minor practical help received using items such as "How much in the last 12 months did this person give you practical help with major things?". The negative support scale captures negative interaction and perceived inadequacy of support from the closest person using items such as "How much in the last 12 months did this person give you worries, problems and stress?". See appendix 3 for full question wordings. Emotional and practical support range from 0 (indicating least support) to 9 (greatest support). Negative support ranges from 0 to 12 (indicating the most negative support). The perceived social support scales were approximately normally distributed.

Vigilance for threat was measured using 3 items: (i) I'm always on my guard for things that might come at me, (ii) I'm not someone who worries about who's coming up behind me (reverse coded), and (iii) I'm on my guard in most situations. Five possible responses ranged from strongly agree to strongly disagree and a total score ranging from 0 (not at all vigilant for threat) to 12 (highest vigilance for threat) was created. Vigilance scores were normally distributed.

Two items capturing participant's sense of control (in general, and at home) were investigated. Participants who reported that they agreed or disagreed only slightly that what happens in their life is determined by factors beyond their control were classified as having low general sense of control. Those who reported that they disagreed or agreed only slightly that they have control over what happens at home were classified as having low sense of control at home.

Participants who reported that their health in general was not excellent or very good were deemed to have poor self-rated health. The wording of the question and possible responses differs from the wording of the question and responses in the Health Surveys so the prevalence of poor self-rated health cannot be compared with Whitehall II data.

Civil service grade of employment was used as a measure of socioeconomic position. Twelve non-industrial salary based grade levels were combined to create 3 groups, namely (1) managerial grade (highest grades) including Permanent Secretary to Senior Principals, (2) professional and executive grade including Principals and Executive Officers, and (3) clerical grade including clerical officers and clerical assistants. For participants who had left the civil service, last available grade was used.

Individual level data were linked to neighbourhood level data using participant's postcode. Postcodes which were missing or incomplete were obtained from addresses using Postcode Provider (AFD Software Limited, Isle of Man).

5.1.2.2 Description of Whitehall II study participants

A total of 1,079 Whitehall II participants had complete data on age, sex, employment grade, and neighbourhood social cohesion. Their socio-demographic characteristics and psychosocial and health outcomes are summarised in Table 5.6.

Table 5.6 Description of the Whitehall II participants included in the social cohesion study

	Women (Total 372) n (%)	Men (Total 707) n (%)
Age group (yrs)		
44-49	58 (16)	161 (23)
50-54	91 (24)	195 (28)
55-59	90 (24)	149 (21)
60-69	133 (36)	202 (29)
Employment grade		
High	63 (17)	367 (52)
Medium	153 (41)	296 (42)
Low	156 (42)	44 (6)
Good/fair/poor self-rated health ^a	186 (57)	334 (51)
Low general sense of control ^b	122 (41)	191 (30)
Low sense of control at home ^c	48 (15)	113 (18)
	mean (sd)	
Emotional support	6.6 (1.7)	6.6 (1.8)
Practical support	4.4 (2.7)	4.9 (2.4)
Negative support	2.3 (1.8)	2.5 (1.8)
Vigilance for threat	5.8 (2.1)	6.2 (2.1)

^aSelf-rated health complete for 319 women and 656 men

^bGeneral sense of control complete for 301 women and 638 men

^cSense of control at home complete for 310 women and 642 men

The characteristics of Whitehall II participants resident in neighbourhoods which were included in the study were very similar to those of participants resident in neighbourhoods which were not selected for inclusion into the social cohesion study (Table 5.7)

Table 5.7 Comparison of Whitehall II participants included in the social cohesion study and those not included

	Included (%)	Not included (%)
Women	34	30
Age group (yrs)		
44-49	20	20
50-54	27	29
55-59	22	21
60+	31	30
Employment grade		
High	39	42
Medium	42	44
Low	19	14
Less than good self-rated health	53	52
Low general sense of control	33	30
Low sense of control at home	17	16
	Mean	
Emotional support	6.6	6.5
Practical support	4.7	4.5
Negative support	2.4	2.4
Vigilance for threat	6.1	6.2

Whitehall II participants included in the social cohesion study were living in 119 neighbourhoods in England. Most participants were resident in Greater London (Table 5.8). Data from the Whitehall II study are analysed separately from Health Survey data because of differences in the target populations and the survey methods used.

Table 5.8. Location of Whitehall II participants in neighbourhoods in England.

Location	Number of neighbourhoods	Number of Whitehall II participants living in neighbourhoods	Average number of participants per neighbourhood
Inner London	34	188	6
Outer London	59	787	13
Rest of England	26	104	4
Total	119	1079	9

Whitehall II data were used to investigate the psychosocial pathways linking neighbourhood characteristics to health. For brevity, the associations between health and neighbourhood characteristics based on Whitehall II data are not presented in as much detail as for Health Survey participants.

5.1.3 Comparison of Health Survey for England/Scottish Health Survey and Whitehall II studies

Using data from the Health Surveys and the Whitehall II study allows different aspects of the association between neighbourhood social cohesion and health to be investigated.

The advantages and disadvantages of each are listed in Table 5.9.

Table 5.9. Comparison of Health Survey for England/Scottish Health Survey and Whitehall II studies for use in investigating neighbourhood social environment and health

	Advantages	Disadvantages
HSE/SHS	▪ natural clustering of individuals within areas increases statistical power ▪ representative of the general population, including those not in the formal labour force ▪ includes residents throughout England and Scotland	▪ cross-sectional ▪ less data relating to processes linking neighbourhood environment to individual health
Whitehall II study	▪ rich data on psychosocial measures which may link neighbourhood environment to health ▪ longitudinal study – can look at change in health and can identify movers/non-movers ▪ occupational cohort may be more similar to each other in unobserved variables than a general population sample	▪ occupational cohort study (though some participants have now retired) so doesn't include full socio-economic or age range of British population ▪ majority of participants live in London and the southeast which limits generalisability of findings on neighbourhood effects

5.2 Why use multilevel models to investigate neighbourhood variations in health?

The structure of the data can be thought of as hierarchical, with individuals (level 1, lower level) nested within neighbourhoods (level 2, higher level). Using multilevel models, the total variation in health can be split into variation within neighbourhoods and variation between neighbourhoods (Goldstein, 1995). It is then possible to examine how the components of variance change as the factors of interest are included in the model. When individual demographic characteristics are included in the model, compositional

effects are being accounted for. When neighbourhood characteristics are included, contextual effects can be examined.

Multilevel models are appropriate for this analysis for four reasons. Firstly, they allow for the clustering of subjects living in the same neighbourhood. If there are neighbourhood variations in health, an individual will be more similar to other individuals living in the same neighbourhood than to those living in other neighbourhoods. Ordinary regression techniques make the assumption that observations are independent. When this is not the case the standard errors are smaller than they should be and spurious significant results can be found. More complex variance structures, allowing for correlation between individuals within neighbourhoods, can be modelled using multilevel techniques.

Secondly, variation between neighbourhoods can be modelled and estimated explicitly. It is possible to account for clustering effects (often called design effects in survey research) by applying a correction factor to the standard errors obtained from ordinary regression but this method does not explicitly model the variation in health. Multilevel models allow the researcher to test compositional and contextual explanations for neighbourhood variations in health.

Thirdly, multilevel models allow the relationship between exposure and outcome to vary in different neighbourhoods. For example, the regression slope for the relationship between individual age and health may be shallower in some neighbourhoods than in others. Factors operating in some places may protect against the health consequences of being older. It is not possible to model this complexity using ordinary regression.

As well as generalising relationships over neighbourhoods, it is sometimes of interest to identify neighbourhoods that are outliers. Case studies in places that do not seem to fit general patterns may improve our understanding of the effects of the residential contextual on health. The fourth advantage of multilevel models is that predicted values for each neighbourhood use data from that neighbourhood and from the pooled data across all neighbourhoods. Estimates for neighbourhoods containing a small number of individuals are pulled towards the overall average. The smaller the number of observations in a neighbourhood, the greater the shrinkage. By "borrowing" information

from other neighbourhoods, predicted values in neighbourhoods with fewer data points are more precise (Jones et al, 1991).

5.3 Which came first - the neighbourhood characteristics or the individuals?

It could be argued that the provision of certain local facilities reflects demand from the local population. If a business cannot generate sufficient revenue in an area, it cannot survive there; public transport is not provided unless there are a certain number of users; a core number of people are required to keep an association going. In a study comparing rates of mental disorder in urban and rural areas, higher rates were found in more urban areas (Reijneveld & Schene, 1998). The authors point out that such areas have more mental health service provision and that this in itself might "attract" people with poor mental health. This highlights the complex relationship between places and people and the difficulties in separating out individual characteristics from area characteristics. Some factors that are considered as neighbourhood level characteristics may be more accurately called "emergent" properties. When a certain concentration of similar individuals lives in a neighbourhood, effects that are more than the sum of the individual effects may emerge. As discussed earlier, social cohesion is an example of an emergent property which is influenced by the demographic profile of the neighbourhood. In a sense, the demographic profile is a factor which is upstream from social cohesion. According to this view, it is not appropriate to adjust for the population demographics when modelling the relationship between social cohesion and health. (Other authors have taken a different view and have suggested that the non-independence of neighbourhood social cohesion from the socio-demographic characteristics of residents should be allowed for in regression models (Subramanian et al, 2003)

It is not only the case that socio-demographic composition can influence contextual characteristics: the reverse can also be true. There are contextual characteristics that can affect who moves in and out. For example, local authority housing policy in the 1980s was to place the poorest and most vulnerable tenants together on the same, least desirable estates (Morris & Winn, 1990).

An individual's socio-economic position will tend to determine where he or she lives. Those who earn less will be less able to afford housing in affluent areas. There may be a feedback mechanism operating; it has been shown that the socio-economic characteristics of the area of residence during the formative years affect individual educational attainment, income and occupation (Cook 1996, Jencks 1990, Brooks-Gunn 1993). This in turn affects the choice of area of residence in adulthood.

More detailed examination of the history of areas and how areas and resident populations have changed over time is required to clarify the relationship between area and individual characteristics (Popay et al, 1998, Popay, 2000). As Satariano and McAuley (2003) point out, health status is influenced by an interaction between behaviour, biology and the environment. This interaction is a dynamic one that unfolds over the life course of individuals, families and communities. It was not feasible to consider these factors in the current study, due to the large number of areas included and the lack of available data. Although multilevel models allow the effects of neighbourhood characteristics and individual characteristics to be separated out statistically, the complex relationship between neighbourhood and individual factors is acknowledged.

5.4 Sample size and power of the study

With individual level data, the sample size is increased simply by adding more individuals. With multilevel data of individuals within neighbourhoods, the sample size may be increased by adding more individuals in an existing neighbourhood or by adding individuals in a new neighbourhood. A power calculation for a multilevel analysis needs to incorporate the power to detect associations between neighbourhood characteristics and health differences and the power to detect differences in health status between neighbourhoods. Less bias and more efficiency in the estimation of between-neighbourhood variation in health is obtained if a larger number of neighbourhoods are included (Mok, 1995). However, the study design had to maximise the number of neighbourhoods included whilst at the same time ensuring a sufficiently accurate measure of neighbourhood social cohesion. An accurate measure of neighbourhood social cohesion requires more respondents to the social cohesion questionnaire per

neighbourhood which effectively means including fewer neighbourhoods (since there were sufficient resources were available to allow around 13,000 social cohesion questionnaires to be analysed).

In its simplest form, a multilevel analysis of the association between neighbourhood social cohesion and health status can be considered as a comparison of two proportions with adjustment for the clustering of individuals within neighbourhoods. For example, the prevalence of poor health can be compared in neighbourhoods with high social cohesion and those with low social cohesion. Based on this simplified analysis and not allowing for measurement error, the power of this study was estimated using Hsieh's method for testing two proportions in a cluster randomised study (Hsieh, 1988). At the planning stage, with 6225 participants in 186 neighbourhoods, it was estimated that this study would yield over 80% power to detect a difference in prevalence of poor self-rated health of 5% between neighbourhoods in the top and bottom tertiles of social cohesion. This assumed that the prevalence of poor self-rated health would be 20% in neighbourhoods with social cohesion in the top tertile and was based on the calculation that 4.6% of the total variation in self-rated health was between neighbourhoods². Allowing for error in the measurement of neighbourhood social cohesion, the "true" difference in health that can be observed between the top and bottom tertiles of social cohesion is given by:

² The proportion of variation in self-rated health which is between neighbourhoods, called the intraneighbourhood correlation coefficient, was calculated using existing data from the Health Survey for England and was based on the approximation (Hedeker & Mermelstein, 1996):

$$\text{intraneighbourhood correlation coefficient (between neighbourhoods)} = \sigma_{bn}^2 / (\sigma_{bn}^2 + \pi^2/3)$$

where σ_{bn}^2 = variation between neighbourhoods

An Intraneighbourhood correlation coefficient of 0 indicates that all the variation in health is between individuals and there is no clustering of health in neighbourhoods. An intraneighbourhood correlation coefficient nearer to 1 indicates that differences in health status between neighbourhoods are larger than differences between individuals within neighbourhoods.

true difference = observed difference / reliability coefficient (Purdon, personal communication). For a social cohesion scale with reliability of 0.45, the true difference between top and bottom tertiles of social cohesion that could be detected would be $5\% \times 0.45 = 11\%$. The final dataset contained self-rated health data on 10,073 participants resident in 254 neighbourhoods.

With an estimated 910 Whitehall II participants resident in 91 neighbourhoods (10 in each neighbourhood), there would be 85% power to detect a difference of 0.25 standard deviations in vigilance between those in neighbourhoods with social cohesion in the top versus bottom tertile (Hsieh, 1988). This calculation was based on an intraneighbourhood correlation coefficient for vigilance of 0.008. Allowing for error in the measurement of social cohesion, the true difference in vigilance that could be detected for a scale with reliability of 0.45 would be 0.56 standard deviations. The final dataset contained information from 1,079 Whitehall II participants living in 112 neighbourhoods.

5.5 Models and hypotheses

Figure 1.1 in chapter 1 outlined the underlying model linking the neighbourhood environment to health and the potential behavioural, biological and psychosocial pathways that may be involved. This underlying model was operationalised using several hypotheses that were tested using regression models. These models were built up sequentially from the simplest model, allowing for the age and sex of participants, through to more complex models, simultaneously adjusting for socioeconomic composition, social cohesion and economic deprivation. Age and sex are established determinants of health. It is not possible to intervene to change these determinants and they are not a focus of this thesis. Age and sex adjustment will be the starting point in the regression models shown here. There is a huge literature highlighting socioeconomic position as an important determinant of health. It was therefore considered important to take account of individual socioeconomic position when examining the association between neighbourhood characteristics and health. All regression models are adjusted for individual socioeconomic position before addition of neighbourhood characteristics. However, adjustment for socioeconomic position may be

something of an over-adjustment. People do not always choose to live where they do; personal circumstances constrain an individual's options and opportunities and determine the neighbourhood level factors to which they will be exposed.

Neighbourhood level factors may be one of reasons why those of lower socioeconomic position have poor health. To some extent, this will be investigated in the current study. If the effect of individual socioeconomic status is attenuated when neighbourhood characteristics are included in the model, this indicates that living in a certain type of neighbourhood is one of the ways in which those higher up the social scale come to have better health.

5.5.1 Modelling the relationship between neighbourhood social cohesion and health

Hypotheses 1-4 and 8-11 were tested using Health Survey data. Each hypothesis is illustrated using self-rated health as the outcome of interest but applies also to high GHQ score and smoking. Waist:hip ratio was modelled as a continuous variable so regression estimates have a slightly different interpretation (see below). Hypotheses 4-6 were tested using Whitehall II data.

Hypothesis 1: The prevalence of poor self-rated health varies across neighbourhoods.

Poor self-rated health is a binary variable which takes the value 1 if a participant rates their health as fair, bad or very bad and 0 if health is good or very good. The responses therefore take the form of a binomial distribution. A logit transformation was used to ensure that the estimated probability of having poor health lies between 0 and 1 as required. The log odds of having poor self-rated health was modelled as follows:

$$y_{ij} = \log \frac{p_{ij}}{1 - p_{ij}} = \beta_0 + (u_{0j} + e_{ij})$$

where y_{ij} is the log odds ratio of i^{th} person in the j^{th} neighbourhood having poor health and p_{ij} is the probability that i^{th} person in the j^{th} neighbourhood has poor health. By back-transforming β_0 , we get the estimated prevalence of poor health over all neighbourhoods. This is the fixed part of the model and looks like an ordinary logistic regression. Multilevel models extend this by allowing a different prevalence of poor health in each neighbourhood. u_{0j} is the difference in the log odds of poor health in

neighbourhood j from the overall prevalence and a positive u_{0j} indicates that the log odds of poor health in neighbourhood j is higher than average. We can back-transform using $\text{antilog}(\beta_0 + u_{0j})$ to get the prevalence of poor health in the j^{th} neighbourhood. There is the same number of u_{0j} s as neighbourhoods and these u_{0j} s have a normal distribution (in a good fitting model). The variance of this distribution, $\text{var}(u_{0j})$, is called σ_{u0}^2 and it represents the amount of variation in (log odds of) self-rated health there is between neighbourhoods. Note that the u_{0j} s are “shrunk” towards the mean so neighbourhoods with few participants contribute less to the variance estimates than do neighbourhoods with a larger number of participants. The e_{ij} s represent the variation in (log odds of) self-rated health between individuals living in the same neighbourhoods. $u_{0j} + e_{ij}$ is the random part of the model. This partitioning of variation in self-rated health into that which is between and within neighbourhoods comes from the increased flexibility of multilevel analysis over ordinary regression.

There is evidence of statistically significant variation between neighbourhoods if σ_{u0}^2 is more than twice its standard error³. The value σ_{u0}^2 is not easy to interpret, but it is useful for calculating reference ranges. For example, 95% of neighbourhoods have a prevalence of poor health between $\text{antilog}(\beta_0 - 1.96 \sigma_{u0})$ and $\text{antilog}(\beta_0 + 1.96 \sigma_{u0})$. It is also useful to calculate the intraneighbourhood correlation coefficient (see section 5.4). This represents the between-neighbourhood variation as a proportion of the total variation and is calculated as $\sigma_{u0}^2 / (\sigma_{u0}^2 + \pi^2/3)$.

The binomial distribution has a mean of p (the proportion with poor health in the population) and a variance of $p/(1-p)$. In some cases, there may be evidence of under- or over-dispersion, where the variance is less or more than $p/(1-p)$. This can happen when the mean is very near 0 (the vast majority of participants don't have poor health) or very near 1. It can also happen when there are a small number of participants in each neighbourhood. A multiplier can be used to allow for this extra variation (called extra-binomial variation). There was no evidence of significant extra-binomial variation in the outcomes modelled here and so the models presented are based on binomial variation.

³ For binary outcomes, this is an approximate test of significance of between-neighbourhood variance (Goldstein, 1995). The Wald test is used for formal tests of significance of the between-neighbourhood variation.

To this basic model, explanatory variables are added to allow for the demographic make-up of each neighbourhood.

$$\text{Model 1: } y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + (u_{0j} + e_{ij})$$

where y_{ij} is the log odds ratio of i^{th} person in the j^{th} neighbourhood having poor health, female_{ij} is 1 if participant $_{ij}$ is female and 0 if male. β_1 represents the increase in log odds ratio of poor health for women (compared with men, the reference group). β_2 represents the increase in log odds ratio of poor health per 1 year increase in age (centred on average age). Sex and age are entered as fixed effects, in other words, their effects are assumed to be constant across all neighbourhoods. (This assumption was tested and found to hold.) $\text{Antilog}(\beta_0)$ is the estimated prevalence of poor health for men of average age. The random part of the equation is interpreted as follows: $\text{var}(u_{0j}) = \sigma_{u0}^2$ is the between-neighbourhood variation in health adjusting for demographic composition. Adjustment for the demographic composition usually decreases σ_{u0}^2 , or in other words the u_{0j} s usually get smaller when age is added to the model because part of the explanation for health differences between neighbourhoods is that older residents tend to cluster together in the same places.

Hypothesis 2: Socioeconomic position is associated with self-rated health and explains some of the between-neighbourhood variation in self-rated health.

$$\begin{aligned} \text{Model 2: } y_{ij} = & \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{social class}_{ij} + \beta_4 \text{unemployed}_{ij} + \\ & \beta_5 \text{retired}_{ij} + \beta_6 \text{other inactive}_{ij} + \beta_7 \text{other inactive}_{ij} \times \text{female}_{ij} + \\ & (u_{0j} + e_{ij}) \end{aligned}$$

where y_{ij} is the log odds ratio of i^{th} person in the j^{th} neighbourhood having poor health, β_3 represents the increase in log odds ratio of poor health for a 1 unit increase in social class, β_4 represents the increase in log odds ratio of poor health for unemployed participants (compared with employed participants, the reference group), β_5 represents the increase in log odds ratio of poor health for retired participants (compared with employed participants), β_6 represents the increase in log odds ratio of poor health for other economically inactive men (compared with employed men), and β_7 represents the

increase in log odds ratio of poor health for other economically inactive women (compared with other economically inactive men). Note that by treating social class as a continuous variable a linear association between social class and self-rated health is assumed. (This assumption was tested and found to hold.)

The association between individual socioeconomic position and health is estimated by the coefficients $\beta_3 - \beta_7$ as in ordinary logistic regression. σ_{u0}^2 is now interpreted as the between-neighbourhood variation in health allowing for demographic and socioeconomic composition. A reduction in σ_{u0}^2 in model 2 compared with model 1 indicates that individual socioeconomic position explains some of the health differences between neighbourhoods. The variation between neighbourhoods is expected to decrease when residents' socioeconomic characteristics are accounted for.

Hypothesis 3: Neighbourhood social cohesion is associated with self-rated health and explains some of the between-neighbourhood variation in self-rated health, even after taking account of individual characteristics.

Model 3: $y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{social class}_{ij} + \beta_4 \text{unemployed}_{ij} + \beta_5 \text{retired}_{ij} + \beta_6 \text{other inactive}_{ij} + \beta_7 \text{other inactive}_{ij} \times \text{female}_{ij} + \beta_8 \text{medium social cohesion}_j + \beta_9 \text{low social cohesion}_j + (u_{0j} + e_{ij})$

Neighbourhoods were grouped into three tertiles according to their level of social cohesion on each of the 8 scales. In other words, model 3 was run 8 times, once for each scale. (It was considered easier to interpret the effects of high, medium, and low social cohesion rather than treating social cohesion as a continuous variable and interpreting the effect of a 1 unit increase in social cohesion.) The statistical significance of the social cohesion indicator variables can be assessed simultaneously using the Wald test in MLwin (Goldstein, 1995). As before, a reduction in σ_{u0}^2 compared with model 2 indicates that neighbourhood social cohesion explains some of the health differences between neighbourhoods.

Hypothesis 4: The effects of neighbourhood social cohesion are greater for participants who are not currently employed.

This hypothesis was tested by repeating model 3 separately for employed and unemployed/retired/other economically inactive participants. Ideally, the latter group would be split further but there was not sufficient statistical power to do this.

5.5.2 Modelling psychosocial pathways linking neighbourhood social cohesion to health

The following hypotheses were tested using Whitehall II data.

Hypothesis 5: Low social support is one explanation for the poorer self-rated health of people living in neighbourhoods with poor quality social cohesion.

Hypothesis 6: Increased vigilance is one explanation for the poorer self-rated health of people living in neighbourhoods with poor quality social cohesion.

Hypothesis 7: Low sense of control is one explanation for the poorer self-rated health of people living in neighbourhoods with poor quality social cohesion.

As a first step, the Pearson's correlation coefficient between individual social support and each neighbourhood social cohesion domain score (on a continuous scale) was calculated. Where a statistically significant correlation was found, the following models were used to investigate the extent to which social support mediates the relationship between social cohesion and self-rated health:

$$\text{Model 3: } y_{ij} = \beta_0 + \beta_1 \text{ female}_{ij} + \beta_2 \text{ age}_{ij} + \beta_3 \text{ grade}_{ij} + \beta_8 \text{ medium social cohesion}_j + \beta_9 \text{ low social cohesion}_j + (u_{0j} + e_{ij})$$

$$\text{Model 5: } y_{ij} = \beta_0 + \beta_1 \text{ female}_{ij} + \beta_2 \text{ age}_{ij} + \beta_3 \text{ grade}_{ij} + \beta_8 \text{ medium social cohesion}_j + \beta_9 \text{ low social cohesion}_j + \beta_{10} \text{ social support}_{ij} + (u_{0j} + e_{ij})$$

Comparison of β_8 and β_9 in model 5 compared with model 3 indicates how much of the effect of neighbourhood social cohesion can be explained by participant's social support. This is presented as percentage change in β_9 in the next chapter. The above analyses were repeated using vigilance for threat and sense of control in place of social support to test alternative psychosocial pathways:

Model 6:
$$y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{grade}_{ij} + \beta_8 \text{medium social cohesion}_j + \beta_9 \text{low social cohesion}_j + \beta_{10} \text{vigilance}_{ij} + (u_{0j} + e_{ij})$$

Model 7:
$$y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{grade}_{ij} + \beta_8 \text{medium social cohesion}_j + \beta_9 \text{low social cohesion}_j + \beta_{10} \text{sense of control}_{ij} + (u_{0j} + e_{ij})$$

5.5.3 Modelling the joint effects of economic deprivation, social cohesion and health

Hypothesis 8: Neighbourhood economic deprivation is associated with self-rated health and explains some of the between-neighbourhood variation in self-rated health.

Model 8:
$$y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{social class}_{ij} + \beta_4 \text{unemployed}_{ij} + \beta_5 \text{retired}_{ij} + \beta_6 \text{other inactive}_{ij} + \beta_7 \text{other inactive}_{ij} \times \text{female}_{ij} + \beta_8 \text{medium deprivation}_j + \beta_9 \text{high deprivation}_j + (u_{0j} + e_{ij})$$

This model is interpreted in the same way as model 3.

Hypothesis 9A: The effects of social cohesion and economic deprivation on self-rated health are independent of each other.

Hypothesis 9B: Social cohesion acts as a buffer to protect against some of the effect of economic deprivation.

Model 9A:
$$y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{social class}_{ij} + \beta_4 \text{unemployed}_{ij} + \beta_5 \text{retired}_{ij} + \beta_6 \text{other inactive}_{ij} + \beta_7 \text{other inactive}_{ij} \times \text{female}_{ij} + \beta_8 \text{medium social cohesion}_j + \beta_9 \text{low social cohesion}_j + \beta_{10} \text{medium deprivation}_j + \beta_{11} \text{high deprivation}_j + (u_{0j} + e_{ij})$$

β_8 and β_9 now represent the effect of social cohesion adjusting for composition and for economic deprivation. These estimates can be compared with those obtained from model 3 to indicate how much the effect size is reduced on adjustment for economic deprivation. Similarly, β_{10} and β_{11} represent the effect of economic deprivation adjusting for composition and social cohesion.

One way of testing a buffering effect of social cohesion in the presence of economic deprivation is to add interaction terms (social cohesion x economic deprivation) to model 9A. An alternative method is to stratify the analysis by level of economic deprivation.

Hypothesis 10: The effects of neighbourhood economic deprivation are greater in Scotland than in England and are explained by differences in neighbourhood social cohesion in Scotland and England

This hypothesis was tested using the following model.

Model 10: $y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{social class}_{ij} + \beta_4 \text{unemployed}_{ij} + \beta_5 \text{retired}_{ij} + \beta_6 \text{other inactive}_{ij} + \beta_7 \text{other inactive}_{ij} \times \text{female}_{ij} + \beta_8 \text{Scotland}_j + \beta_9 \text{medium dep}_j + \beta_{10} \text{high dep}_j + \beta_{11} \text{medium dep}_j \times \text{Scotland}_j + \beta_{12} \text{high dep}_j \times \text{Scotland}_j + \beta_{13} \text{medium social cohesion}_j + \beta_{14} \text{low social cohesion}_j + (u_{0j} + e_{ij})$

Hypothesis 11: The effects of neighbourhood economic deprivation are greater in urban areas than in more rural areas and are explained by differences in neighbourhood social cohesion

This hypothesis was tested by adding terms representing social cohesion and economic deprivation by urbanisation interaction in the same way as for hypothesis 10.

5.5.4 Modelling continuous health outcomes

As mentioned earlier, waist:hip ratio is a continuous variable which is approximately normally distributed and was modelled using:

$$y_{ij} = \beta_0 + (u_{0j} + e_{ij})$$

where y_{ij} is the waist:hip ratio of i^{th} person in the j^{th} neighbourhood and β_0 is the overall mean waist:hip ratio. u_{0j} is the difference from the overall mean waist:hip ratio in neighbourhood j and, as before, $\text{var}(u_{0j}) = \sigma_{u0}^2$ is the between-neighbourhood variation in waist:hip ratio. $\text{var}(e_{ij}) = \sigma_e^2$ is the within-neighbourhood variation in waist:hip ratio. For normally distributed outcomes, there is no need to back-transform the estimates to interpret them. The sum of σ_{u0}^2 and σ_e^2 make up the total variation in waist:hip ratio. The intraneighbourhood correlation coefficient can be calculated as $\sigma_{u0}^2 / (\sigma_{u0}^2 + \sigma_e^2)$. Explanatory variables can be added to this model as above.

5.5.5 Extending the models to investigate complex between-neighbourhood variation

All the above models are called variance components models and they simply allow each neighbourhood to have a different prevalence of poor health. The effects of any explanatory variables on health are constrained to be the same for all neighbourhoods. Complex random variation can also be modelled, allowing the effects of age, sex, and socioeconomic position to vary by neighbourhood.

Complex random variation model:
$$y_{ij} = \beta_0 + \beta_1 \text{female}_{ij} + \beta_2 \text{age}_{ij} + \beta_3 \text{social class}_{ij} + (u_{0j} + u_{3j} \text{social class}_{ij} + e_{ij})$$

where

u_{0j} is the difference in the prevalence of poor self-rated health in neighbourhood j compared with the prevalence across all neighbourhoods

u_{3j} is difference in the social class-health slope in neighbourhood j compared with the slope across all neighbourhoods.

A statistically significant $\text{var}(u_{3j})$ indicates that the effect of social class on health varies across neighbourhoods; in other words, the social gradient is steeper in certain neighbourhoods. For example, the social gradient may be steeper in neighbourhoods where social cohesion is poor quality. This can be tested by adding social cohesion to the model and seeing whether $\text{var}(u_{3j})$ decreases in magnitude.

5.6 Estimation procedure

When modelling binary data, there is a tendency for the random parameters (the variation between neighbourhoods) to be underestimated in the default estimation procedures provided in MLwin. This is a particular problem when there are a small number of participants per neighbourhood and when the prevalence of the binary outcome is near 0 or 1. In the Health Survey data, there are at least 30 participants per neighbourhood and the health outcomes investigated tend to have a prevalence of around 20% and so the limitation described above was not expected to pose a problem

in this study. Two ways of minimising any underestimation of random parameters were also employed. Firstly, predictive quasi-likelihood (PQL) estimates were used in the analyses presented here. Model convergence is obtained by an iterative process. Starting from an initial value, new estimates are calculated based on minimisation of the difference between the data and the regression equation. In the PQL procedure, the random parameters are included in the estimation of the fixed parameters and this process tends to give more reliable random parameter estimates. Secondly, other methods of estimation were explored in order to see if the estimates changed substantially. If more than one approach yields similar results, the analyst can have more confidence in the estimates (Goldstein et al, 1998). The parametric bootstrap and Markov Chain Monte Carlo methods are ways of sampling data points and calculating new estimates. Repeated sampling yields a distribution of parameter estimates. These methods avoid the underestimation of random parameters described above. However, they are time-consuming to run and are not practical for use in sequential model-building and testing; they will be used only to confirm findings from final models.

5.7 Summary of design and statistical methods

- Individual level health data were linked to external neighbourhood level social cohesion and economic deprivation indicators.
- Health Survey for England and Scottish Health Survey data were merged and used to investigate associations between neighbourhood characteristics and four health outcomes (self-rated health, minor psychiatric morbidity, smoking, and waist:hip ratio).
- Whitehall II data were used to investigate psychosocial pathways linking neighbourhood characteristics to self-rated health. The psychosocial factors of interest were perceived social support, vigilance for threat, and sense of control.
- Multilevel models which account for the hierarchical nature of the data (individuals clustered within neighbourhoods) were built up sequentially to investigate:
 - I. differences in the age and sex adjusted prevalence of poor health across neighbourhoods
 - II. the contribution of participant's socioeconomic position to this variation

- III. the additional contribution of neighbourhood social cohesion and economic deprivation to this variation
- IV. the direction and strength of any association between neighbourhood characteristics and health
- V. differences in the direction or size of neighbourhood effects on health according to type of location (England versus Scotland, for example)
- VI. differences in the direction or size of neighbourhood effects on health for different types of individual (employed versus not employed, for example).

Chapter 6: The residential environment and health: findings from the Health Survey for England, the Scottish Health Survey and the Whitehall II study

This chapter summarises investigation of the associations between neighbourhood social cohesion and self-rated health (using data from the Health Survey for England and Scottish Health Surveys), explores possible psychosocial pathways linking the two (using Whitehall II data), and goes on to consider the joint effects of social cohesion and economic deprivation on self-rated health (using Health Survey data once more). The associations between social cohesion and three other health outcomes are then considered using Health Survey data, although in less detail than for self-rated health.

6.1 Distribution of Health Survey participants by neighbourhood social cohesion and economic deprivation

Tables 6.1 and 6.2 summarise the socio-demographic characteristics of Health Survey participants by levels of social cohesion and economic deprivation in the neighbourhood. Neighbourhoods were split into tertiles based on their level of social cohesion. The distribution of men and women across tertiles of social cohesion was fairly even for all scales. The age distribution of Health Survey participants was also fairly similar across tertiles of social cohesion. Older people were slightly under-represented in neighbourhoods with high family ties: 38% of participants aged 65 and over were living in neighbourhoods with high family ties compared with 45% and 44% of participants aged 36-64 and ≤ 35 respectively. Younger people were slightly over-represented in neighbourhoods with low participation. Participants aged 36-64 were slightly over-represented in neighbourhoods with low trust and attachment. Participants employed in manual occupations were over-represented in neighbourhoods with high family ties, low participation, low trust, and low tolerance. There was a slight over-representation of non-working participants in neighbourhoods with low trust and low tolerance.

Men and women were evenly distributed across levels of economic deprivation. Participants in manual occupations or not in employment were over-represented in neighbourhoods with greater economic deprivation (Table 6.2).

By adjusting regression models for age, sex, social class, and economic activity, these small differences in the distribution of participants' socio-demographic characteristics across tertiles of neighbourhood social cohesion were accounted for.

Table 6.1. Characteristics of Health Survey participants by dimensions of neighbourhood social cohesion.

		Male	Female	Aged ≤35	Aged 36-64	Aged 65+	Non-manual social class	Manual social class	Employed	Not working
		column %	column %	column %	column %	column %	column %	column %	column %	column %
Family ties	low	23	22	23	21	28	27	17	23	22
	medium	33	34	33	34	34	38	29	35	32
	high	43	44	44	45	38	35	54	42	46
Friendship ties	low	29	28	30	28	30	29	29	28	30
	medium	35	35	33	36	37	35	35	35	35
	high	36	36	36	37	33	36	36	37	35
Participation in organised activities	low	33	33	36	31	33	29	38	31	36
	medium	34	34	34	35	32	33	35	34	34
	high	33	33	30	33	36	37	27	34	31
Integration into wider society	low	32	31	33	31	29	30	34	32	31
	medium	33	33	32	32	37	33	33	31	35
	high	35	36	35	37	34	37	34	37	33
Trust	low	30	29	33	27	31	25	35	27	33
	medium	33	33	33	33	33	34	32	34	32
	high	37	38	34	40	36	41	33	40	34
Attachment to neighbourhood	low	29	28	32	25	29	26	31	27	30
	medium	34	33	33	33	35	33	34	33	34
	high	38	39	35	41	36	41	35	40	36
Able to rely on others for practical help	low	29	29	32	28	30	30	29	29	29
	medium	32	34	31	33	34	34	32	33	33
	high	39	37	37	39	37	37	40	38	38
Tolerance	low	33	32	35	31	33	28	39	30	37
	medium	35	35	35	35	35	35	35	36	34
	high	32	32	30	34	32	37	26	34	29

Table 6.2. Characteristics of Health Survey participants by neighbourhood economic deprivation.

		Male	Female	Aged ≤35	Aged 36-64	Aged 65+	Non-manual	Manual	Employed	Not working
		column %	column %	column %	column %	column %	column %	column %	column %	column %
Carstairs index of deprivation	low	30	31	28	32	32	39	21	33	27
	medium	34	35	35	35	33	34	35	36	32
	high	36	34	38	33	35	27	44	31	41

6.2 Neighbourhood characteristics and self-rated health

6.2.1 Neighbourhood social cohesion and self-rated health

A total of 10073 Health Survey participants (4566 men) living in 254 neighbourhoods in England and Scotland had complete data on self-rated health and were included in these analyses. The prevalence of poor health was higher among older participants, in the lower social classes, and for those not in paid employment (Table 6.3). Men who were economically inactive for reasons other than retirement had especially high rates of poor health: two in three of these men rated their health as poor.

Table 6.3. Health status by individual demographic and socioeconomic characteristics using data from the Health Surveys

		% with poor self-rated health	
		Women n = 5507	Men n = 4566
Age group	16-29	16.4	14.6
	30-44	17.3	18.7
	45-59	27.9	27.4
	60-65	32.3	42.5
	>65	40.1	41.5
Social class	I	11.2	10.0
	II	17.0	16.5
	IIINM	20.1	19.0
	IIIM	31.4	32.5
	IV	33.2	32.5
	V	42.9	37.7
Economic activity	employed	14.3	14.0
	unemployed	30.6	31.9
	retired	37.1	40.3
	other inactive	36.6	66.8

The unadjusted prevalence of poor self-rated health at each level of the dimensions of neighbourhood social cohesion and economic deprivation is shown in Table 6.4. A difference in the prevalence of poor self-rated health of over 10% was found between neighbourhoods in the top versus the bottom tertiles of trust and tolerance.

Table 6.4. Health status of Health Survey participants by dimensions of neighbourhood social cohesion.

		% poor self-rated health
Family ties	low	22
	medium	22
	high	28
Friendship ties	low	26
	medium	25
	high	24
Participation in organised activities	low	28
	medium	25
	high	23
Integration into wider society	low	27
	medium	26
	high	22
Trust	low	31
	medium	25
	high	21
Attachment to neighbourhood	low	28
	medium	24
	high	23
Being able to rely on others for practical help	low	25
	medium	25
	high	25
Tolerance	low	30
	medium	24
	high	20

Table 6.5 shows the odds ratio of poor self-rated health obtained from the multilevel model. All estimates were adjusted for Health Survey participant's age, sex, social class, and current economic activity. The social cohesion scales were included one at a time and are not adjusted for the other 7 scales. People living in neighbourhoods with denser family ties were more likely to rate their health as poor. Residence in a low family ties neighbourhood was associated with a 21% reduction (95% confidence interval between 7% and 33%) in the odds of poor health. Living in a neighbourhood where participation was low or a neighbourhood which was not well integrated into wider society was also associated with poorer self-rated health; those living in a neighbourhood in the lowest tertile of integration were 1.18 (95% confidence interval 1.01 to 1.38) times as likely to rate their health as poor compared with those living in the most integrated neighbourhoods.

Lower levels of attachment to neighbourhood were also associated with poorer health. Trust and tolerance/respect of others had the largest effects, with people living in low trust or low tolerance neighbourhoods being more than 1.45 times as likely to have poor health as those in the high attachment or high tolerance neighbourhoods. This effect is comparable with a 15 year increase in age. It is worth pointing out again that one set of respondents reported on their health and a different set reported on their perceptions of social cohesion in the neighbourhood. In other words, positive or negative affect bias cannot explain the associations seen here.

The response rate to the social cohesion survey was associated with self-rated health. For every 10% increase in the response rate, the odds ratio of poor self-rated health was 0.92 (95% CI 0.85 to 0.99). Residents in a neighbourhood with a response rate of 50% were 0.92 times as likely to rate their health as poor as those living in a neighbourhood with a response rate of 40%.

Table 6.5. Neighbourhood social cohesion and self-rated health, adjusted for individual age, sex, Registrar General's social class and current economic activity using data from the Health Surveys.

		Odds ratio (95% CI) of poor health adjusted for composition
Family ties	low (bottom tertile)	0.79 (0.67,0.93)
	medium (middle tertile)	0.83 (0.72,0.96)
	high (top tertile)	1
Friendship ties	low	1.09 (0.94,1.27)
	medium	1.09 (0.94,1.26)
	high	1
Participation in organised activities	low	1.18 (1.02,1.38)
	medium	1.05 (0.90,1.22)
	high	1
Integration into wider society	low	1.18 (1.01,1.38)
	medium	1.12 (0.96,1.30)
	high	1
Trust	low	1.48 (1.28,1.71)
	medium	1.18 (1.02,1.36)
	high	1
Attachment to neighbourhood	low	1.26 (1.08,1.47)
	medium	0.98 (0.84,1.14)
	high	1
Being able to rely on others for practical help	low	1.04 (0.89,1.21)
	medium	1.03 (0.89,1.20)
	high	1
Tolerance of others	low	1.47 (1.27,1.70)
	medium	1.16 (1.01,1.35)
	high	1
Response rate	Per 10% increase in response rate	0.92 (0.85,0.99)

Mutually adjusted associations between individual characteristics and self-rated health are shown in Table 6.6. There was an interaction between economic activity and sex so estimates are presented as both log odds ratios and odds ratios. As expected, increasing age was associated with increasing likelihood of reporting poor health. The association between social class and self-rated health was inverse and linear; those in the lower social classes were more likely to report poor health. Unemployed and retired participants were more likely to report poor health than those in paid employment. Men who were not economically active and were not classed as retired were 9.32 times as likely to rate their health as poor as men in employment. A high proportion of men who are economically inactive for reasons other than retirement are long-term sick or experiencing a disability (Nickell & Quintini, 2002). The effect of being in this

economically inactive group was smaller for women, many of whom will be unavailable for paid work due to family responsibilities.

Table 6.6 Mutually adjusted individual socio-demographic characteristics and self-rated health using data from the Health Surveys.

	Reference group	Log odds ratio (s.e.) of poor health adjusted for all other variables listed	Odds ratio of poor health adjusted for all other variables listed
Women	Men	-0.02 (0.06)	0.98
Age	per 10 year increase	0.24 (0.02)	1.27
Social class coded from 1 (highest class) to 6 (lowest class)	per 1 class decrease	0.26 (0.02)	1.29
Economic activity:	Men in paid employment		
ILO unemployed		0.92 (0.11)	2.51
Retired		0.64 (0.09)	1.89
Other economically inactive men		2.23 (0.11)	9.32
Other economically inactive women		-1.19 (0.13)	2.77

6.2.2 Social cohesion and self-rated health amongst the employed and those not in paid employment

Table 6.7 shows the relationship of each dimension of social cohesion with health separately for employed participants and those not in paid employment. With the exception of the attachment scale, the effects of social cohesion were larger in magnitude amongst participants who were not working, as hypothesised. The effect of attachment to neighbourhood was larger for employed participants than for those not in paid employment. Formal significance tests indicated the presence of an interaction for seven of the eight scales (all scales except the tolerance scale).

The effects of neighbourhood social cohesion by employment status were qualitatively different for some domains. Living in a neighbourhood with lower contact between local friends was associated with an increased odds ratio of poor health for non-working participants but with a decreased odds ratio for participants in paid employment. Non-working participants may be more dependent on friendships within the local area to provide their social support. This is explored further in section 6.2.3.1. The group of

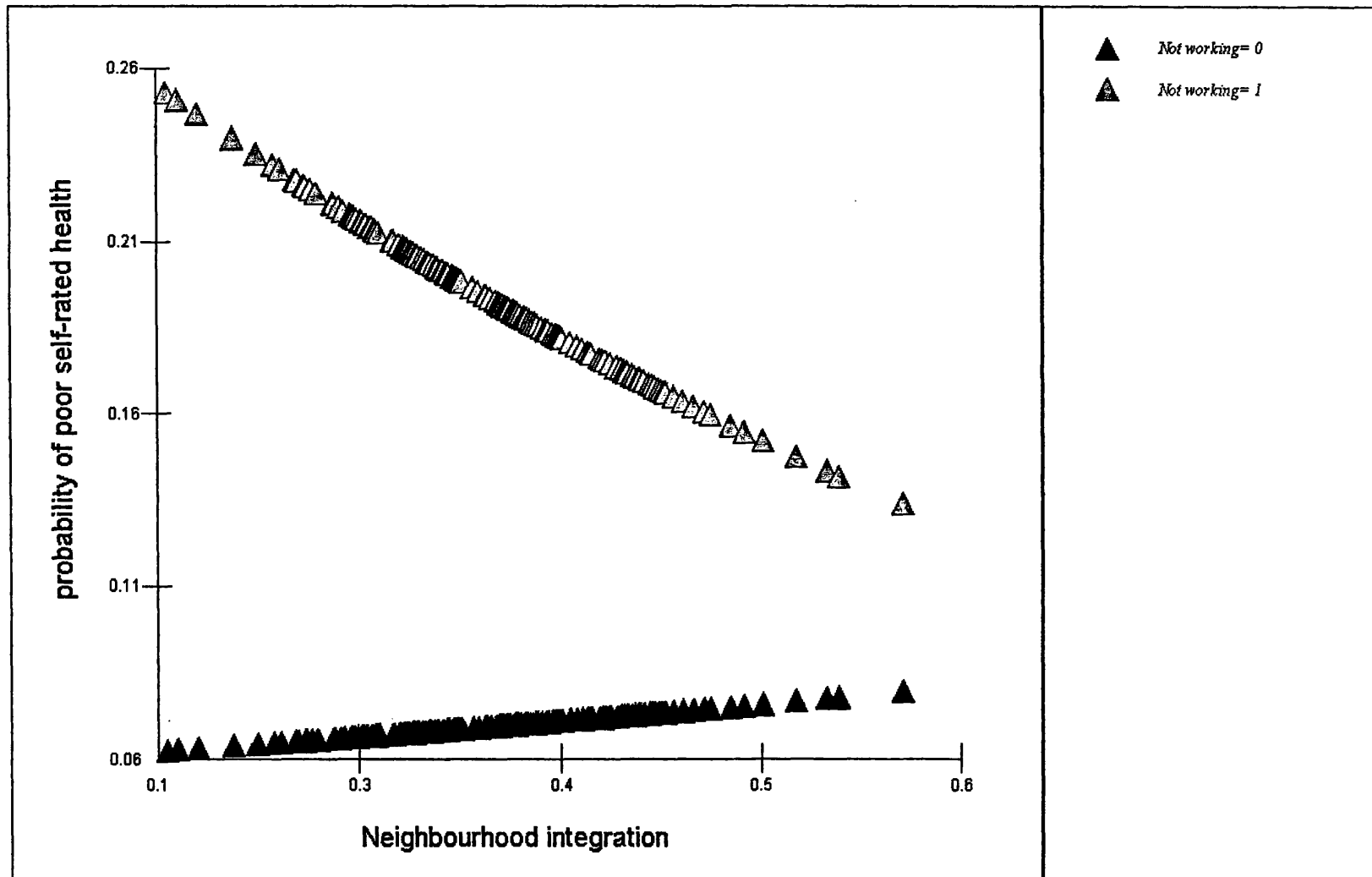
employed people may have more work-based friendships and, for these people, a lack of local friendships does not have negative health consequences.

Lower integration into wider society was associated with an increased odds ratio of poor health for non-working participations but not for participants in work (Table 6.7 and Figure 6.1). For those seeking employment, access to information relating to job opportunities may be lower in places which are less integrated. It was not possible to investigate this, but one possibility is that job seekers in less integrated neighbourhoods have been out of work for a longer period of time than job seekers in more integrated neighbourhoods. This may translate into increased financial worries and lower confidence in the ability to secure a job in the future in less integrated neighbourhoods. The group of participants not in paid employment also contains people who may benefit from other types of information, for example relating to welfare provision. Again, this may be less readily available in places where integration is low. Previous work suggests that extensive social networks and contact with a large number of acquaintances can be effective ways of transferring useful information whereas close friends and family may share old, redundant information (Granovetter, 1973). The integration scale is a function of contact with people in the same neighbourhood plus contact with others further afield. Information from outside may be transferred through the neighbourhood by local contact. The current study thus provides support for the hypothesis that weak ties (or bridging ties) in the neighbourhood can have health benefits.

Table 6.7. Neighbourhood social cohesion and self-rated health, separately for working and non-working participants, adjusted for age, sex, and social class using data from the Health Surveys.

		Odds ratio (95% CI) of poor health amongst those not in paid employment n = 4100	Odds ratio (95% CI) of poor health for working participants n = 5973
Family ties	low (bottom tertile) medium (middle tertile) high (top tertile)	0.75 (0.61,0.92) 0.71 (0.59,0.86) 1	0.85 (0.69,1.04) 0.97 (0.82,1.16) 1
Friendship ties	low medium high	1.23 (1.00,1.50) 1.08 (0.89,1.31) 1	0.92 (0.75,1.12) 1.06 (0.89,1.28) 1
Participation in organised activities	low medium high	1.37 (1.12,1.68) 1.22 (0.99,1.49) 1	0.98 (0.81,1.19) 0.87 (0.72,1.05) 1
Integration into wider society	low medium high	1.38 (1.13,1.69) 1.23 (1.01,1.50) 1	1.03 (0.86,1.24) 0.98 (0.81,1.18) 1
Trust	low medium high	1.60 (1.32,1.93) 1.27 (1.04,1.54) 1	1.32 (1.09,1.59) 1.11 (0.92,1.33) 1
Attachment to neighbourhood	low medium high	1.19 (0.98,1.46) 1.00 (0.82,1.22) 1	1.28 (1.07,1.53) 0.94 (0.78,1.12) 1
Being able to rely on others for practical help	low medium high	1.06 (0.87,1.29) 0.96 (0.79,1.16) 1	0.98 (0.81,1.19) 1.08 (0.90,1.31) 1
Tolerance of others	low medium high	1.62 (1.33,1.97) 1.19 (0.98,1.45) 1	1.30 (1.07,1.57) 1.11 (0.92,1.34) 1

Figure 6.1. Association between neighbourhood integration and self-rated health, separately for working and not working Health Survey participants



The group of participants who are not working is a heterogeneous one, comprising retirees, participants who are unemployed, and people (mostly women) who were not working for other reasons (such as care of the home and family). Ideally, this group would be broken down more but the study was not sufficiently powered for this. However, it was possible to look at how the association between social cohesion and health differed for men and women (Table 6.8). Women living in neighbourhoods with low integration were more likely to have poor health than women living in more integrated neighbourhoods but no effect of neighbourhood integration was found for men (test for interaction $p=0.006$). Effects of the cognitive aspects of social cohesion (trust, attachment to neighbourhood, and tolerance) tended to be higher for women. Living in a neighbourhood with low practical help was associated with increased reporting of poor health for women but decreased reporting of poor health for men (test for interaction $p=0.09$). The social roles typically filled by women (especially women who are not working) may be more dependent on the residential environment than those typically filled by men.

Table 6.8. Neighbourhood social cohesion and self-rated health, separately for men and women, adjusted for age, social class, and economic activity using data from the Health Surveys.

		Odds ratio (95% CI) of poor health: women n = 5507	Odds ratio (95% CI) of poor health: men n = 4817
Family ties	low (bottom tertile) medium (middle tertile) high (top tertile)	0.80 (0.65,0.98) 0.83 (0.69,1.00) 1	0.83 (0.68,1.01) 0.84 (0.71,1.00) 1
Friendship ties	low medium high	1.14 (0.93,1.38) 1.02 (0.85,1.24) 1	1.03 (0.85,1.24) 1.15 (0.97,1.38) 1
Participation in organised activities	low medium high	1.18 (0.97,1.43) 1.10 (0.83,1.23) 1	1.16 (0.96,1.40) 1.07 (0.89,1.29) 1
Integration into wider society	low medium high	1.41 (1.16,1.70) 1.19 (0.98,1.43) 1	0.95 (0.79,1.14) 1.00 (0.84,1.20) 1
Trust	low medium high	1.59 (1.32,1.91) 1.31 (1.09,1.57) 1	1.30 (1.08,1.56) 1.05 (0.88,1.26) 1
Attachment to neighbourhood	low medium high	1.36 (1.12,1.64) 1.03 (0.85,1.24) 1	1.10 (0.91,1.32) 0.92 (0.77,1.11) 1
Being able to rely on others for practical help	low medium high	1.17 (0.96,1.42) 1.07 (0.88,1.29) 1	0.88 (0.73,1.06) 0.96 (0.80,1.15) 1
Tolerance of others	low medium high	1.61 (1.33,1.94) 1.19 (0.99,1.44) 1	1.29 (1.07,1.55) 1.14 (0.94,1.38) 1

For most scales, there was a slightly increased effect of social cohesion amongst lower social classes (Table 6.9). This was not statistically significant for any of the scales, with the exception of family ties: there was a protective effect of living in a neighbourhood with low family ties for a resident in social class I but this protective effect was not evident for residents in social class V (test for interaction $p=0.025$). The health effects of poor quality social cohesion tend to be larger for residents occupying lower socioeconomic positions, whether the latter is measured as current economic activity or as occupation-based social class. However, the effect modification was smaller (and generally not statistically significant) according to social class. This may be because non-working residents experience both increased exposure and increased vulnerability to neighbourhood social cohesion whereas residents in lower social classes experience increased vulnerability but do not spend greater amounts of time in their neighbourhood

than residents in higher social classes. Although data were not available directly to address the question of whether participants not in paid employment spend more time in their local area, it seems reasonable to assume that, on average, this is true. Health Survey participants were asked neither how much of their time they spent in their neighbourhood nor how long they had lived at their current address. Data from the social cohesion survey indicated that men aged less than 65 who did not have a paid job had lived an average of 5 years longer in their local area than men who did have a paid job. Women under 65 with no paid job had lived an average of 3.5 years longer in their local area than women in paid employment. Lack of paid employment may be a barrier to residential mobility. Those outside the labour force are likely to experience greater exposure to neighbourhood stressors because they do not spend time in the workplace and because they tend to have lived in the same area for a longer time.

Table 6.9. Multiplicative effects of neighbourhood social cohesion and social class on self-rated health, adjusted for age and economic activity using data from the Health Surveys.

	Low social cohesion	High social cohesion
Family ties		
Social class I	0.49 (0.33,0.72)	1
Social class v	2.60 (1.31,5.14)	2.70 (2.06,3.56)
Friendship ties		
Social class I	0.88 (0.60,1.28)	1
Social class v	3.32 (1.68,6.56)	2.80 (2.05,3.83)
Participation in organised activities		
Social class I	1.32 (0.92,1.91)	1
Social class v	4.08 (2.06,8.07)	3.58 (2.54,5.04)
Integration into wider society		
Social class I	0.87 (0.60,1.26)	1
Social class v	3.89 (1.98,7.64)	2.94 (2.13,4.07)
Trust		
Social class I	1.41 (0.97,2.04)	1
Social class v	5.02 (2.56,9.84)	3.34 (2.41,4.61)
Attachment to neighbourhood		
Social class I	1.13 (0.78,1.30)	1
Social class v	4.56 (2.33,8.72)	3.49 (2.55,4.78)
Being able to rely on others for practical help		
Social class I	1.00 (0.68,1.45)	1
Social class v	3.74 (1.91,7.35)	3.54 (2.61,4.80)
Tolerance of others		
Social class I	1.44 (0.99,2.08)	1
Social class v	4.68 (2.34,9.37)	3.13 (2.20,4.45)

6.2.3 Investigating psychosocial pathways linking neighbourhood social cohesion to self-rated health

Three possible psychosocial characteristics were hypothesised to be on the pathway linking neighbourhood social cohesion to self-rated health: 1) individual social support, 2) vigilance for threat, and 3) sense of control. Perceived social support and a sense of control were hypothesised to be higher in neighbourhoods which were more socially cohesive. Vigilance was hypothesised to be higher in neighbourhoods with poorer quality social cohesion. The data used to test psychosocial pathways linking neighbourhood social cohesion to health status come from the Whitehall II study, since the psychosocial measures were not available in the HSE and SHS.

6.2.3.1 Neighbourhood social cohesion and social support

Analysis of the association between social cohesion and social support was based on 946 Whitehall II participants living in 111 neighbourhoods. Emotional support tended to be higher among older participants whereas negative aspects of support tended to be higher among younger participants (Table 6.10). For both emotional and practical support, participants in higher employment grades tended to have greater support, although these associations were not linear.

Table 6.10. Socio-demographic factors and perceived social support for Whitehall II participants.

	Number of participants	Emotional support mean(sd)	Practical support mean(sd)	Negative support mean(sd)
Men	617	6.6 (1.8)	4.9 (2.4)	2.4 (1.8)
Women	291	6.6 (1.7)	4.5 (2.7)	2.3 (1.8)
Age group				
44-49	188	6.5 (1.7)	5.2 (2.6)	2.7 (1.8)
50-54	250	6.6 (1.8)	4.6 (2.5)	2.5 (1.8)
55-59	193	6.6 (1.9)	4.6 (2.5)	2.3 (1.8)
60-64	197	6.7 (1.7)	4.7 (2.3)	2.2 (1.8)
65-69	80	6.7 (1.7)	4.8 (2.5)	2.0 (1.8)
Employment grade				
High	383	6.8 (1.7)	5.1 (2.5)	2.3 (1.7)
Medium	383	6.4 (1.8)	4.4 (2.5)	2.5 (1.9)
Low	142	6.5 (1.9)	4.7 (2.3)	2.3 (1.8)

Table 6.11. Correlation between Whitehall II participant's perception of their social support and neighbourhood social cohesion, adjusted for individual age, sex, and employment grade.

	Perceived social support		
	Emotional support	Practical support	Negative support
Neighbourhood social cohesion			
Family ties	-0.02	-0.05	-0.03
Friendship ties	0.01	-0.02	-0.02
Participation	0.06	-0.03	-0.03
Integration into wider society	-0.03	-0.07	-0.05
Trust	0.08*	-0.01	-0.10*
Attachment	0.10*	0.00	-0.09*
Practical help	0.01	-0.03	-0.06
Tolerance	0.04	-0.04	-0.09*

**p<0.05

Most of the social cohesion scales were not correlated with perceived social support (Table 6.11). Partial correlation coefficients were small in magnitude (0.10 and smaller

for all associations). However, three of the scales did show statistically significant correlations with social support. Trust and attachment to neighbourhood were positively correlated with emotional support and negatively correlated with negative aspects of support. Tolerance was negatively correlated with negative aspects of support.

For these three scales (trust, attachment, and tolerance), mean social support in each tertile of neighbourhood social cohesion was estimated by regressing social support on neighbourhood social cohesion using a two-level model adjusting for individual age, sex, and employment grade. Participants living in neighbourhoods with the highest levels of trust (in the highest tertile of trust) averaged 6.5 on the emotional support scale whereas those in neighbourhoods with the lowest levels of trust averaged 6.1. Participants living in neighbourhoods with the highest levels of attachment averaged 6.6 on the emotional support scale compared with 6.0 for those in neighbourhoods with low attachment (Table 6.12). Participants living in neighbourhoods with the highest levels of trust, highest levels of attachment, or highest levels of tolerance averaged 2.4 on the negative support scale whereas those in neighbourhoods with the lowest levels averaged 2.7 (Table 6.13).

For the dimensions of social cohesion which were correlated with social support, their position on the pathway linking social cohesion to self-rated health was tested. Table 6.12 shows the odds ratio of poor self-rated health for Whitehall II participants in neighbourhoods with low trust compared with high trust firstly without adjustment for social support and then with adjustment for social support. Participants living in low trust neighbourhoods were 1.16 times as likely to rate their health as poor as participants in high trust neighbourhoods. Emotional support explained 48% of the association between neighbourhood trust and poor health. Participants living in low attachment neighbourhoods were 1.28 times as likely to rate their health as poor as participants living in neighbourhoods with high attachment. Emotional support explained 20% of this association.

Negative aspects of social support explained 9% and 14% of the association between poor health and residence in neighbourhoods with the lowest levels of trust and attachment respectively (Table 6.13). There was no association between tolerance and self-rated health in the Whitehall II dataset: participants in the least tolerant

neighbourhoods were 1.03 times as likely to rate their health as poor as those living in the most tolerant neighbourhoods.

In section 6.2.2, it was suggested that participants without paid employment may be dependent on their neighbourhood for social support whereas employed people may be more likely to have access to support in other arenas. The Whitehall II data provide no evidence for this: correlations between social support and social cohesion were similar for employed participants and for those not in paid employment, although note that these findings from an essentially occupational cohort may not be generalisable to the general population.

Table 6.12. Perceived emotional support as a mediator of the association between social cohesion domains and self-rated health, adjusted for individual age, sex, and employment grade using data from the Whitehall II study.

Social cohesion scale	Tertile	Mean emotional support ^a	Not adjusted for emotional support	Adjusted for emotional support	
			Odds ratio poor self-rated health	Odds ratio poor self-rated health	% change in log odds ratio
Trust	High	6.5	1	1	48%
	Low	6.0	1.16	1.08	
Attachment	High	6.6	1	1	20%
	Low	6.1	1.28	1.22	

^aEstimated for man of average age in middle employment grade

Table 6.13. Perceived negative aspects of social support as a mediator of the association between social cohesion domains and self-rated health, adjusted for individual age, sex, and employment grade using data from the Whitehall II study.

			Not adjusted for negative support	Adjusted for negative support	
Social cohesion scale	Tertile	Mean negative support ^a	Odds ratio poor self-rated health	Odds ratio poor self-rated health	% change in log odds ratio
Trust	High	2.4	1	1	14%
	Low	2.7	1.16	1.14	
Attachment	High	2.4	1	1	9%
	Low	2.7	1.28	1.25	
Tolerance	High	2.4	1	scale not associated with self-rated health	
	Low	2.7	1.03		

^aEstimated for man of average age in middle employment grade

These data are consistent with the idea that some of the health effect of social cohesion acts through residents' perceived social support. In particular, the cognitive aspects of social cohesion (trust, attachment to neighbourhood, and tolerance) were related to emotional and negative aspects of social support. Lower levels of perceived emotional support explained part of the increased odds ratio of poor health for participants living in neighbourhoods with the lowest levels of trust and attachment. Higher levels of perceived negative support explained a small part of the increased odds ratio of poor health for participants in neighbourhoods with the lowest levels of trust and attachment. It should be noted that the social support scales at phase 5 of the Whitehall II study relate only to support obtained from the respondent's closest person. This may be the spouse, someone outside the neighbourhood, or someone living nearby. It is maybe not surprising, then, that the correlations between perceived social support and the social cohesion scales were small in magnitude. Data on participant's overall level of social support were not available. Further work is needed to explore this pathway, using a measure of social support which is not limited to support obtained from the closest person.

6.2.3.2 Neighbourhood social cohesion and vigilance for threat

In total, 959 Whitehall II participants living in 112 neighbourhoods had complete data on vigilance for threat and neighbourhood characteristics. Their socio-demographic characteristics are described in Table 6.14. The mean vigilance score for all participants was 6.9 (standard deviation 2.1). Participants occupying less advantaged socioeconomic positions had higher vigilance scores. Age and sex were not associated with vigilance over and above socioeconomic position.

Table 6.14. Socio-demographic factors and vigilance for threat for Whitehall II participants.

	Number of participants	Mean (s.e.) vigilance for threat
Men	646	6.8 (0.1)
Women	313	7.2 (0.1)
Age (yrs)		
45-49	169	6.9 (0.1)
50-54	275	7.6 (0.3)
55-59	196	8.2 (0.4)
60-69	319	7.4 (0.5)
Employment grade		
High	397	6.5 (0.1)
Medium	406	7.1 (0.1)
Low	156	7.6 (0.1)

The correlations between vigilance for threat and the 8 neighbourhood social cohesion scales are shown in Table 6.15. The correlations were not large in magnitude but 5 of the social cohesion scales (integration, trust, attachment, practical help, and tolerance) were statistically significantly correlated with vigilance.

Table 6.15. Correlation between Whitehall II participant's vigilance for threat and neighbourhood social cohesion, adjusted for individual age, sex, and employment grade.

	Vigilance for threat
Neighbourhood social cohesion	
Family ties	0.01
Friendship ties	-0.05
Participation	-0.05
Integration into wider society	-0.08*
Trust	-0.08*
Attachment	-0.10**
Practical help	-0.08*
Tolerance	-0.07*

**p<0.05, *p<0.10

Table 6.16 shows mean levels of vigilance for threat by tertiles of neighbourhood social cohesion and the extent to which vigilance for threat mediated the association between social cohesion and self-rated health. Participants living in a neighbourhood with low levels of integration had a mean vigilance for threat score of 7.2 compared with a mean of 6.9 for participants living in neighbourhoods with high levels of integration. However, integration was not associated with self-rated health in the expected direction in the Whitehall II dataset. Vigilance for threat was slightly higher for participants living in

neighbourhoods with low trust (mean 7.5) compared with those living in neighbourhoods with high trust (mean 7.1). Increased vigilance for threat explained 51% of the association between self-rated health and neighbourhood trust. Vigilance for threat explained 16% of the effect of residence in a low attachment neighbourhood. Practical help and tolerance were not associated with self-rated health and the role of vigilance in mediating these associations was not explored.

Table 6.16. Vigilance for threat as a mediator of the association between social cohesion domains and self-rated health, adjusted for individual age, sex, and employment grade using data from the Whitehall II study.

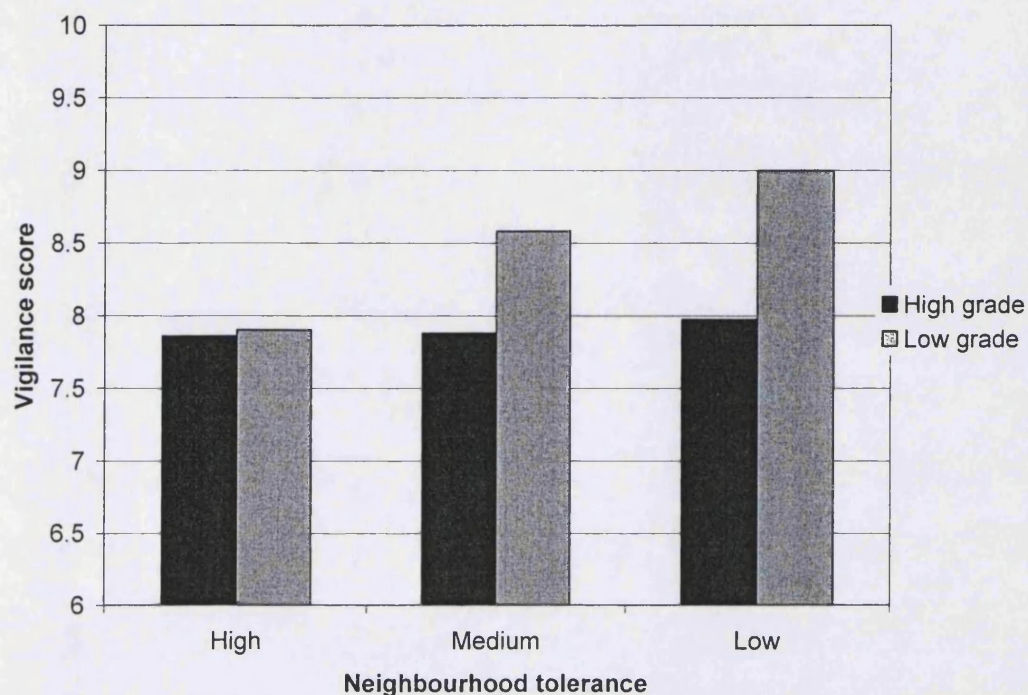
			Not adjusted for vigilance	Adjusted for Vigilance	
Social cohesion scale	Tertile	Mean vigilance for threat ^a	Odds ratio poor self-rated health	Odds ratio poor self-rated health	% change in log odds
Integration	High Low	6.9 7.2	1 0.83	scale not associated with self-rated health in expected direction	
Trust	High Low	7.1 7.5	1 1.16	1 1.07	51%
Attachment	High Low	7.0 7.1	1 1.28	1 1.23	16%
Practical help	High Low	7.0 7.3	1 0.96	scale not associated with self-rated health	
Tolerance	High Low	6.9 7.2	1 1.03	scale not associated with self-rated health	

^aEstimated for man of average age in middle employment grade

Interestingly, neighbourhood economic deprivation was not associated with vigilance for threat. Being on one's guard may be a response to social interactions and the quality of social relationships rather than a response to economic aspects of neighbourhoods.

There was a suggestion of an interaction between employment grade and neighbourhood tolerance. Individuals in high and low grades living in high tolerance neighbourhoods had similar levels of vigilance whereas individuals in low grades living in less tolerant neighbourhoods tended to be more vigilant (Figure 6.2). The interaction term did not reach formal statistical significance (test for interaction $p=0.1$).

Figure 6.2. Vigilance scores by neighbourhood tolerance separately for high grade and low grade Whitehall II participants.



In summary, there was a suggestion of fairly small differences in vigilance for threat according to neighbourhood social cohesion for the whole sample. Exploratory analysis suggested that there may be certain sections of the population who react to low levels of tolerance by being more vigilant. The difference in vigilance for threat scores amongst low grade participants in low versus high tolerance neighbourhoods was large in magnitude. Previous experience of subordination or discrimination in other spheres may have primed an increased vigilance in the neighbourhood. However, it is not yet clear that increased vigilance for threat has long-term implications for morbidity and mortality. This is a topic of on-going research (Taylor, 1998).

These results indicate that the raised odds ratios of poor health for participants living in neighbourhoods with low levels of trust and attachment are partly mediated by an increased vigilance for threat in these places.

6.2.3.3 Neighbourhood social cohesion and sense of control

A total of 942 participants in 111 neighbourhoods were included in the analysis of social cohesion and sense of control. Low general sense of control was more common for women and those in lower employment grades (Table 6.17). Socio-demographic differences in control at home were less clear in this sub-sample of the Whitehall II cohort.

Table 6.17. Socio-demographic factors and sense of control for Whitehall II participants.

	Number of participants	Low general sense of control (%)	Low control at home (%)
Men	626	30.2	6.2
Women	299	40.5	7.0
Age group			
45-49	189	33.3	6.9
50-54	256	33.2	5.5
55-59	196	31.6	6.6
60-64	205	36.6	8.8
65-69	79	31.7	2.5
Employment grade			
High	385	25.2	6.5
Medium	395	39.0	5.1
Low	145	40.7	10.3

There was no evidence that levels of neighbourhood social cohesion were associated with participant's general sense of control (data not shown). Sense of control at home was not significantly associated with most of the social cohesion scales (Table 6.18). Contrary to expectations, residence in a neighbourhood with low friendship ties was associated with a reduced reporting of low sense of control. Participants in neighbourhoods with the lowest friendship ties were 0.66 (95% CI 0.43 to 1.00) times as likely to report low sense of control as those in neighbourhoods with high friendship ties. General sense of control did not affect the magnitude or the direction of the association between friendship ties and self-rated health (data not shown).

Table 6.18 Low control at home by neighbourhood social cohesion, adjusted for Whitehall II participant's age, sex, and employment grade.

	Odds ratio (95% CI) of low control at home		
	Low social cohesion	Medium social cohesion	High social cohesion
Family ties	1.18 (0.77, 1.83)	1.17 (0.77, 1.79)	1
Friendship ties	0.66 (0.43, 1.00)	0.62 (0.41, 0.94)	1
Participation	1.02 (0.67, 1.56)	0.89 (0.59, 1.35)	1
Integration into wider society	0.88 (0.58, 1.33)	0.92 (0.60, 1.39)	1
Trust	1.25 (0.80, 1.93)	1.11 (0.73, 1.68)	1
Attachment	1.28 (0.83, 1.99)	1.07 (0.70, 1.64)	1
Practical help	0.99 (0.65, 1.53)	0.89 (0.59, 1.34)	1
Tolerance	1.00 (0.66, 1.53)	1.02 (0.67, 1.55)	1

These findings do not support the hypothesis that residence in a neighbourhood with poor quality social cohesion is detrimental to health because it reduces one's sense of control. However, the two items measuring sense of control which were available in the Whitehall II dataset may not be capturing the appropriate aspect of control. Ideally, sense of control over one's local environment would have been investigated here. Previous work shows that problems with the neighbourhood and housing problems mediate the association between economic deprivation in the neighbourhood and self-rated health (Stafford et al, 2001). Participants who reported problems with their housing were more likely to report low general control and low control at home. Participants who reported problems with their neighbourhood were not more likely to report low control, either at home or in general. This indicates that whilst reporting low control at home is, to some extent, dependent on whether participants experience housing problems, reporting low general control is not influenced by neighbourhood problems.

6.2.4 Economic deprivation and self-rated health

Having investigated possible psychosocial pathways linking social cohesion to self-rated health, the next stage of the analysis brought in economic deprivation in the neighbourhood in order to consider its joint effects with social cohesion. This section describes the association between economic deprivation and health using nationally representative data from the Health Surveys.

The prevalence of poor self-rated health ranged from 18% in the least economically deprived neighbourhoods to over 30% in the most deprived neighbourhoods (Table 6.19).

Table 6.19. Health status of Health Survey participants by levels of neighbourhood economic deprivation.

		% poor self-rated health
Economic deprivation	low	18.0
	medium	24.3
	high	31.8

Adjusting for participant's age, sex, social class, and economic activity, residence in one of the most economically deprived neighbourhoods was associated with a 71% increase in the odds of reporting poor health compared with residence in the least deprived neighbourhoods (Table 6.20).

Table 6.20. Neighbourhood economic deprivation and self-rated health, adjusted for individual age, sex, Registrar General's social class and current economic activity using data from the Health Surveys.

		Odds ratio (95% CI) of poor health adjusted for composition
Economic deprivation	low	1
	medium	1.34 (1.16,1.55)
	high	1.71 (1.47,1.98)

The health effect of neighbourhood economic deprivation was considerably larger for those who were not in paid employment (test for interaction $p=0.001$) (Table 6.21 & Figure 6.3). The health effect of economic deprivation was also larger for women than for men (Table 6.22). There are at least two possible explanations. One, non-working participants are financially less well-off and tend to live in the poorer parts of the neighbourhood. One way of decreasing the within-neighbourhood heterogeneity is to use smaller areal units. This was not possible here because of sample size limitations. Work in another study revealed that high status individuals do tend to live in the "better" parts of the electoral ward (for example with higher levels of owner-occupancy and lower levels of unemployment and public sector housing). Nevertheless, it was possible to identify some high status individuals living in more deprived residential conditions and

some low status individuals living in less deprived conditions (Stafford & Marmot, 2003). Alternatively, those with fewer personal financial resources may be either more exposed to, or more vulnerable to, economic hardship in the local area.

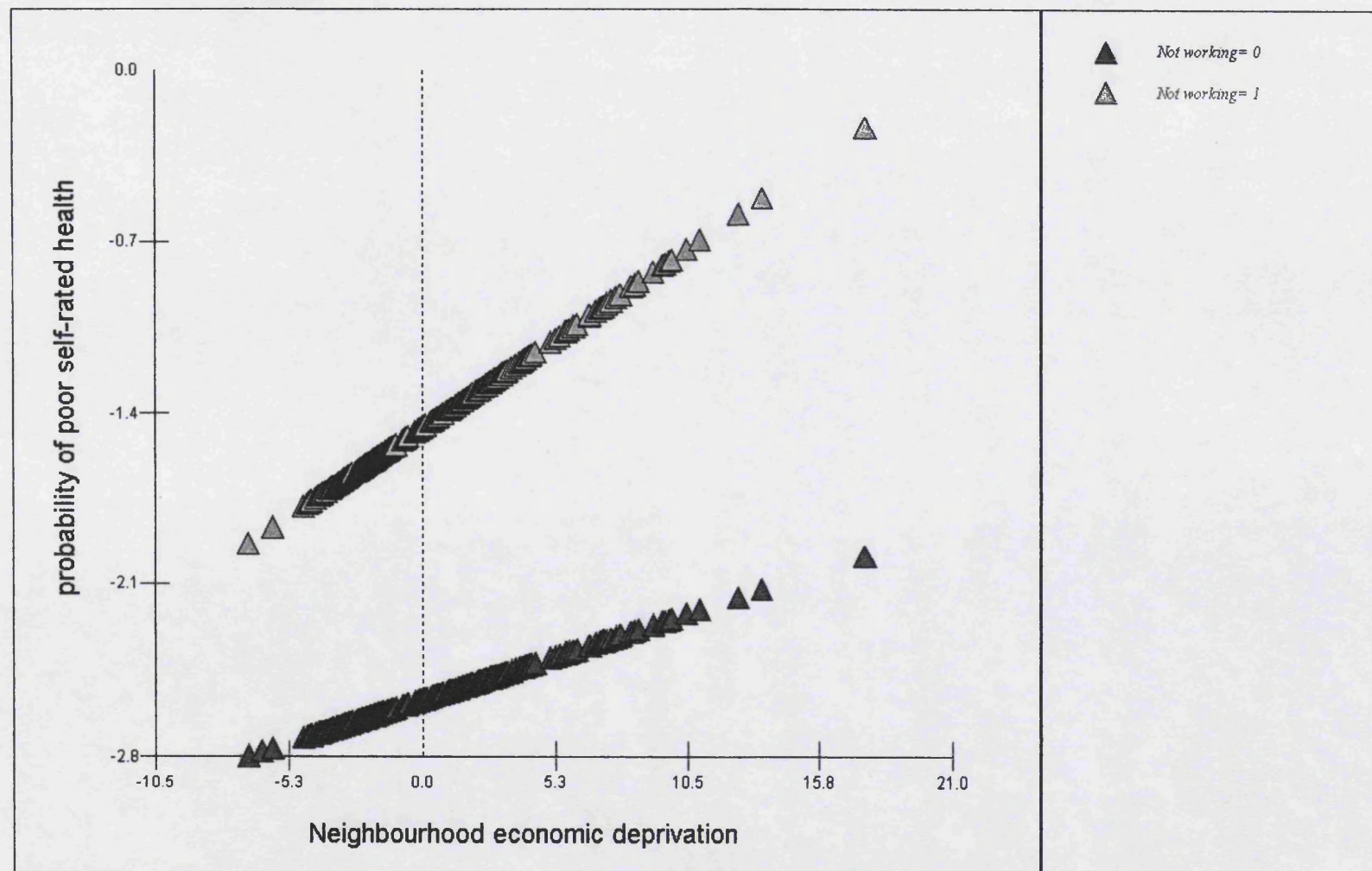
Table 6.21. Neighbourhood economic deprivation and self-rated health, separately for economically active and inactive participants, adjusted for age, sex, and social class using data from the Health Surveys.

		Odds ratio (95% CI) of poor health amongst those not in paid employment n = 4100	Odds ratio (95% CI) of poor health for working participants n = 5973
Economic deprivation	low	1	1
	medium	1.45 (1.19,1.77)	1.24 (1.03,1.50)
	high	2.03 (1.67,2.46)	1.38 (1.14,1.68)

Table 6.22. Neighbourhood economic deprivation and self-rated health, separately for men and women, adjusted for age, social class, and economic activity using data from the Health Surveys.

		Odds ratio (95% CI) of poor health: women n = 5507	Odds ratio (95% CI) of poor health: men n = 4817
Economic deprivation	low	1	1
	medium	1.38 (1.14,1.67)	1.29 (1.06,1.57)
	high	1.81 (1.50,2.18)	1.54 (1.26,1.87)

Figure 6.3. Association between economic deprivation and self-rated health, separately for working and not working Health Survey participants



6.2.5 Joint effects of economic deprivation and neighbourhood social cohesion on self-rated health

Once economic deprivation was added to the regression model, the effects of each of the social cohesion domains were attenuated and became non-significant (Table 6.23). For example, on adjustment for economic deprivation, the odds ratio of poor health for someone living in a neighbourhood with low integration was reduced from 1.18 to 1.02. The poorer health experienced by those living in places with poorer quality social cohesion could also be due to the high levels of economic deprivation in these places.

Table 6.23. Neighbourhood social cohesion and self-rated health, sequentially adjusted for composition (participant's age, sex, social class and current economic activity) and neighbourhood economic deprivation using data from the Health Surveys.

		Odds ratio (95% CI) of poor health adjusted for composition	Odds ratio (95% CI) of poor health adjusted for composition + economic deprivation
Family ties	low (bottom tertile) medium (middle tertile) high (top tertile)	0.79 (0.67,0.93) 0.83 (0.72,0.96) 1	0.90 (0.77,1.05) 1.00 (0.86,1.16) 1
Friendship ties	low medium high	1.09 (0.94,1.27) 1.09 (0.94,1.26) 1	0.96 (0.83,1.11) 1.01 (0.88,1.16) 1
Participation in organised activities	low medium high	1.18 (1.02,1.38) 1.05 (0.90,1.22) 1	0.90 (0.77,1.05) 0.86 (0.75,0.99) 1
Integration into wider society	low medium high	1.18 (1.01,1.38) 1.12 (0.96,1.30) 1	1.02 (0.88,1.18) 1.03 (0.90,1.19) 1
Trust	low medium high	1.48 (1.28,1.71) 1.18 (1.02,1.36) 1	1.11 (0.92,1.33) 1.04 (0.89,1.20) 1
Attachment to neighbourhood	low medium high	1.26 (1.08,1.47) 0.98 (0.84,1.14) 1	0.97 (0.83,1.14) 0.89 (0.77,1.02) 1
Being able to rely on others for practical help	low medium high	1.04 (0.89,1.21) 1.03 (0.89,1.20) 1	0.92 (0.80,1.07) 1.00 (0.87,1.15) 1
Tolerance of others	low medium high	1.47 (1.27,1.70) 1.16 (1.01,1.35) 1	1.15 (0.97,1.37) 1.08 (0.93,1.24) 1
Response rate	Per 10% increase in response rate	0.92 (0.85,0.99)	1.02 (0.95,1.10)

There was some attenuation of the effect of economic deprivation on self-rated health on adjustment for some of the dimensions of social cohesion (Table 6.24). Participants living in the most economically deprived areas were 1.71 (95% CI 1.47 to 1.98) times as likely to rate their health as poor as those living in the least deprived areas, adjusted for individual characteristics only. When neighbourhood trust was added to the regression model, this effect was reduced to 1.59 (95% CI 1.32 to 1.92). The corresponding odds ratio for living in the most deprived neighbourhoods was 1.57 (95% CI 1.32 to 1.87) when neighbourhood tolerance was accounted for. Neighbourhood tolerance and trust are highly correlated and adjustment for both these domains did not further reduce the effect of residence in an economically deprived neighbourhood (odds ratio 1.55 (95% CI 1.27 to 1.88)). This indicates that a small part of the explanation for increased rates of poor health in more economically deprived areas is that these areas have lower levels of trust and tolerance of others.

Table 6.24. Social cohesion as a possible explanation for the association between self-rated health and economic deprivation using data from the Health Surveys.

Model adjusted for composition +	Odds ratio (95%CI) of poor self-rated health		
	In lower tertile of economic deprivation	In middle tertile of economic deprivation	In upper tertile of economic deprivation (most deprived)
No other adjustment	1	1.34 (1.16,1.55)	1.71 (1.47,1.98)
(Each scale added one at a time)			
Family ties	1	1.31 (1.13,1.53)	1.69 (1.44,1.98)
Friendship ties	1	1.34 (1.16,1.56)	1.72 (1.48,2.00)
Participation in organised activities	1	1.39 (1.19,1.62)	1.81 (1.54,2.14)
Integration into wider society	1	1.33 (1.15,1.54)	1.70 (1.45,1.98)
Trust	1	1.32 (1.13,1.54)	1.59 (1.32,1.92)
Attachment	1	1.37 (1.18,1.59)	1.72 (1.46,2.03)
Practical help	1	1.35 (1.17,1.57)	1.74 (1.50,2.02)
Tolerance of others	1	1.31 (1.12,1.52)	1.57 (1.32,1.87)

Three conclusions can be drawn about the association between social cohesion, economic deprivation, and health:

1) The eight social cohesion domains investigated were not related to self-rated health once adjustment for levels of economic deprivation in the neighbourhood had been made. One possibility is that these domains are markers of other structural and economic characteristics of the neighbourhood which are more fully captured by the Carstairs index of deprivation. Alternatively, if social cohesion were poorly measured but

were on the causal pathway between economic deprivation and self-rated health, then adjustment for economic deprivation would be expected to reduce the magnitude of the social cohesion-health association. Multiple regression models that contain collinear variables may attribute effects of one variable incorrectly to another. If measurement error differs between two collinear explanatory variables, the multiple regression model tends to attribute health effects to the one that has least measurement error, rather than to the one which is affecting health (Keatinge, 2003). It is possible that the health effects were attributed to economic deprivation because it has less measurement error than the social cohesion scales.

- 2) There are moderately large and consistent effects of neighbourhood economic deprivation on health even after adjustment for a variety of social cohesion indicators.
- 3) Some of the health effect of economic deprivation operates through reduced neighbourhood trust and tolerance.

Evidence presented so far suggests that social cohesion is associated with health but that the effects may be due to confounding by economic deprivation. There was no evidence of independent effects of social cohesion and economic deprivation on health. An alternative model linking neighbourhood characteristics to health posits that there is an interaction between social cohesion and economic deprivation. One way to test this possibility formally would have been to add to the models a term for the interaction between Carstairs deprivation index and each dimension of social cohesion. Due to the high correlation between most of the social cohesion scales and the Carstairs index, this method led to a doubling of the neighbourhood level standard errors. This level of variance inflation was unacceptably high and for this reason an analysis stratified by Carstairs index was performed instead. By confining the analysis to those neighbourhoods which were more economically deprived, it was possible to test whether social cohesion acts as a buffer in the face of economic deprivation. For the subgroup of 5131 participants living in the 124 most economically deprived neighbourhoods (Carstairs index of deprivation > 0) the relationships generally look similar to those for all neighbourhoods, although there are some exceptions (Table 6.25).

Table 6.25. Social cohesion and self-rated health in deprived versus less deprived neighbourhoods, adjusted for age, sex, social class and current economic activity using data from the Health Surveys.

		Odds ratio (95% CI) of poor health in deprived [†] neighbourhoods n = 5131	Odds ratio (95% CI) of poor health in less deprived neighbourhoods n = 4942	Odds ratio (95% CI) of poor health in all neighbourhoods n = 10073
Family ties	low medium high	1.05 (0.87,1.27) 1.07 (0.88,1.30) 1	0.73 (0.55,0.96) 0.91 (0.71,1.16) 1	0.79 (0.67,0.93) 0.83 (0.72,0.96) 1
Friendship ties	low medium high	1.00 (0.84,1.19) 0.95 (0.79,1.13) 1	0.95 (0.74,1.22) 1.15 (0.92,1.42) 1	1.09 (0.94,1.27) 1.09 (0.94,1.26) 1
Participation in organised activities	low medium high	0.98 (0.78,1.23) 0.97 (0.76,1.22) 1	0.92 (0.72,1.18) 0.78 (0.62,0.97) 1	1.18 (1.02,1.38) 1.05 (0.90,1.22) 1
Integration into wider society	low medium high	1.13 (0.94,1.36) 1.04 (0.85,1.25) 1	0.85 (0.66,1.10) 1.01 (0.81,1.26) 1	1.18 (1.01,1.38) 1.12 (0.96,1.30) 1
Trust	low medium high	1.20 (0.95,1.52) 1.14 (0.90,1.46) 1	1.29 (0.91,1.81) 0.89 (0.72,1.11) 1	1.48 (1.28,1.71) 1.18 (1.02,1.36) 1
Attachment to neighbourhood	low medium high	0.94 (0.77,1.14) 0.86 (0.71,1.05) 1	1.17 (0.88,1.56) 0.81 (0.65,1.01) 1	1.26 (1.08,1.47) 0.98 (0.84,1.14) 1
Being able to rely on others for practical help	low medium high	1.01 (0.85,1.19) 1.10 (0.91,1.31) 1	0.85 (0.66,1.10) 0.95 (0.77,1.18) 1	1.04 (0.89,1.21) 1.03 (0.89,1.20) 1
Tolerance of others	low medium high	1.17 (0.93,1.47) 1.06 (0.83,1.35) 1	1.07 (0.74,1.55) 1.04 (0.85,1.27) 1	1.47 (1.27,1.70) 1.16 (1.01,1.35) 1

[†]Neighbourhoods where Carstairs index >0

In more economically deprived places, living in a neighbourhood where family ties were low was not associated with a decreased odds ratio of poor health. This is in contrast to less deprived neighbourhoods, where low family ties were protective. In more deprived neighbourhoods, there may be fewer publicly available services (such as childcare facilities or community care provided by social services), making help provided by family more important. The relative costs and benefits to contact with family may vary according to the level of publicly provided services. Regular contact with family may have different meanings in deprived and less deprived neighbourhoods. Geographical mobility is higher amongst those of more advantaged socio-economic status so that it is less common to find members of these social groups living close to their families. It was not possible to investigate this in more detail with the current data.

The direction of the association between integration and self-rated health was different in deprived versus less deprived locations. In deprived locations, residence in a neighbourhood with low integration was associated with an increased odds ratio of poor health in deprived locations but was associated with a decreased odds ratio of poor health in less deprived locations (though neither of these associations was statistically significant).

In the full dataset, residence in a neighbourhood with low attachment was associated with increased reporting of poor health. When the analysis was confined to economically deprived neighbourhoods only, residence in a low attachment neighbourhood was associated with decreased reporting of poor health (though this effect was small and not statistically significant).

Caughy et al (2003) found that contact with neighbours was not beneficial in economically deprived areas but did have benefits in less deprived areas. In their study of children's health and development, living in very deprived neighbourhoods and having a mother who knew very few of the neighbours was protective (children had fewer behavioural problems and better mental health) compared with having a mother who had more contact with her neighbours. In the less deprived neighbourhoods, maternal contact with neighbours was associated with better children's mental health. There was no evidence in the current data that local social contact (with friends, family, or in organised groups) had a more health protective effect in less deprived neighbourhoods, although note the cut-off point of Carstairs deprivation above zero is arbitrary and cannot be said to distinguish between affluent and deprived neighbourhoods.

Table 6.25 also indicates that the associations between many of the domains of social cohesion and self-rated health seen in the full dataset were due to confounding by economic deprivation.

6.2.6 Differential effects of neighbourhood social cohesion and economic deprivation on self-rated health in Scotland and England

The age and sex adjusted prevalence of poor self-rated health was 22% in England and 25% in Scotland (test for difference $p = 0.02$). Regression terms representing the interaction between social cohesion, country, and self-rated health were added to the models to investigate whether associations between the dimensions of social cohesion were associated with health in the same way in England and Scotland. Interactions which were significant at the 10% threshold are presented in Table 6.26. For the majority of the social cohesion domains, the association with self-rated health was similar in Scotland and England. The effect of neighbourhood trust was larger in Scotland than in England. Compared with people living in a high trust neighbourhood in England, those living in a low trust neighbourhood in England were 1.34 times as likely to rate their health as poor and those living in a low trust neighbourhood in Scotland were 1.58 times as likely to rate their health as poor. Economic deprivation also had larger effects on self-rated health in Scotland compared with England.

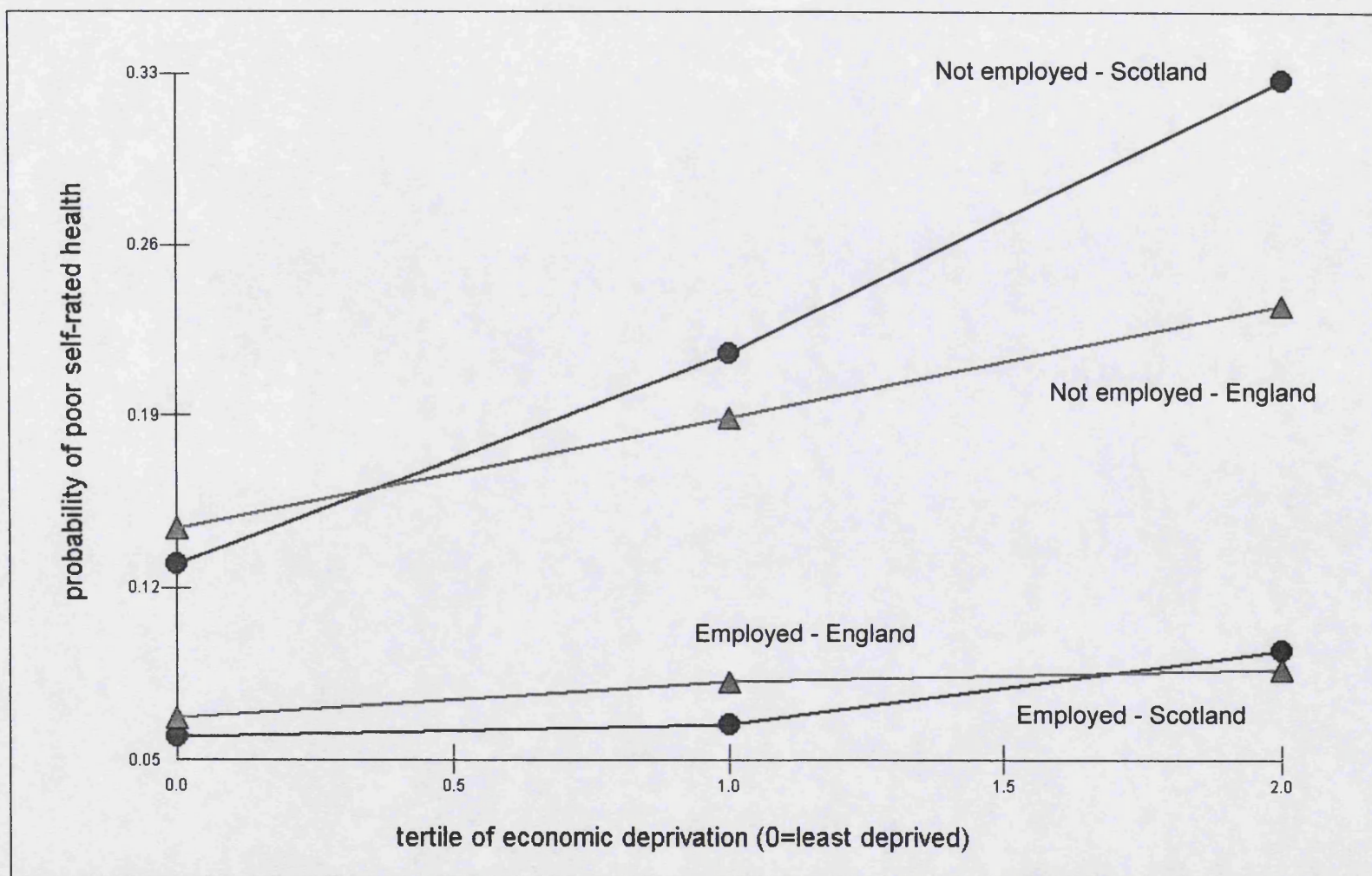
There was no evidence that the social cohesion domains captured here explained the excess poor health in more economically deprived neighbourhoods in Scotland compared with England. In the regression model, addition of the social cohesion domains (one at a time) did not substantially reduce the magnitude of the economic deprivation by Scotland interaction.

Table 6.26. Neighbourhood characteristics and self-rated health in Scotland and England, adjusted for age, sex, social class and current economic activity using data from the Health Surveys.

	Tertile of social cohesion	Log odds ratio (s.e.) of poor health	Odds ratio of poor health	Test for interaction
Trust	High (reference)	0	1	p = 0.06
	Middle	0.04 (0.10)	1.04	
	Low	0.29 (0.10)	1.34	
	Middle Scotland	0.34 (0.15)	1.35	
	Low Scotland	0.25 (0.15)	1.58	
Economic deprivation	Low	0	1	p = 0.09
	Middle	0.30 (0.08)	1.35	
	High	0.44 (0.09)	1.55	
	Middle Scotland	0.05 (0.10)	1.32	
	High Scotland	0.25 (0.12)	1.84	

Having found that the effects of economic deprivation were magnified amongst participants who were not in employment (section 6.2.4), an extension of this was to examine whether this effect modification applied in both Scotland and England. Three-way interactions between individual employment status, neighbourhood economic deprivation, and country were examined. There was no increase in poor health by economic deprivation for employed participants in Scotland or in England (Figure 6.4). The self-rated health of participants in England who were not employed declined with increasing economic deprivation. This increase was even more dramatic for participants in Scotland who were not employed. Being outside of paid employment and living in Scotland increased susceptibility to the health effects of economic deprivation in the neighbourhood. Sample size requirements meant that it was not possible to look at unemployed, retired, and otherwise economically inactive participants separately.

Figure 6.4. Probability of poor self-rated health by employment status and economic deprivation for England and Scotland using data from the Health Surveys



6.2.7 Differential effects of neighbourhood social cohesion and economic deprivation on self-rated health according to degree of urbanisation

There was a suggestion of an interaction between urbanisation and the practical help and family ties scales. (Note that many of the social cohesion domains were highly correlated with urbanisation so the study was under-powered for investigating interactions using formal statistical tests. The investigation of associations between social cohesion and health according to level of urbanisation was therefore exploratory.) The protective effect of residence in a neighbourhood with low family ties was greater in less urban areas than in more urbanised areas. In more urban areas, residence in a neighbourhood with lower levels of practical help was associated with poor self-rated health whereas in less urban areas this association was less clear. These analyses are exploratory in nature but the finding of practical help being more beneficial to health in urban areas than in rural areas was counterintuitive. It might be expected that people in rural areas would be more dependent on their neighbours, as there are likely to be fewer local facilities.

Table 6.27. Neighbourhood characteristics and self-rated health in urban and less urban locations, adjusted for age, sex, social class and current economic activity using data from the Health Surveys.

	Tertile of social cohesion	Log odds ratio (s.e.) of poor health	Odds ratio of poor health	Test for interaction
Family ties	High	0		p = 0.06
	Middle	-0.18 (0.19)	0.84	
	Low	-0.10 (0.19)	0.91	
	Middle less urban	0.00 (0.08)	0.83	
	Low less urban	-0.18 (0.09)	0.75	
Practical help	High	0	1	p = 0.009
	Middle	0.03 (0.18)	1.03	
	Low	0.50 (0.20)	1.65	
	Middle less urban	0.02 (0.07)	1.07	
	Low less urban	-0.32 (0.11)	1.20	

6.3 Between-neighbourhood variation in self-rated health

The estimated variation between neighbourhoods is presented for a series of regression models in Table 6.28. In the age and sex adjusted model, the between-neighbourhood

variance (on a log scale) was 0.210 (standard error 0.033). This amounted to 6.0% of the total variation in self-rated health. Whilst this suggests that characteristics of the neighbourhood are likely to be of less importance in determining health than individual factors, it should be noted that explanatory variables in regression models for individual level data typically do not explain a high percentage of the total variation in individual level health. In other words, much of the total variation in health remains unaccounted for by age, sex, socioeconomic position, and other health risk factors. Note also that neighbourhoods have been defined using administrative boundaries. It is likely that larger differences between neighbourhoods defined in more theoretical ways (and therefore being less socially heterogeneous) would be found.

On adjustment for individual social class and economic activity, the between-neighbourhood variation in the prevalence of poor self-rated health was reduced by over 60%. In other words, over 60% of the neighbourhood variation in self-rated health was due to the spatial distribution of social class and economic activity of the Health Survey participants. Around 2.4% of the total variation in self-rated health occurred between neighbourhoods once age, sex, and socioeconomic position were accounted for.

Further addition of each of the social cohesion scales (each scale added one at a time) explained up to 29% of the remaining between-neighbourhood variation. Addition of economic deprivation to model 2 explained 48% of the between-neighbourhood variation.

The model with the lowest between-neighbourhood variation included economic deprivation and tolerance as well as participant's age, sex and socioeconomic position (not shown). This model had a variance of 0.040 (se 0.017); only 1.2% of the total variation in self-rated health occurred between neighbourhoods in this model. Thus there was a small but statistically significant amount of between-neighbourhood variation in self-rated health remaining after adjustment for individual characteristics and the characteristics of neighbourhoods measured in this study. This highlights the possibility for future research to identify other features of the neighbourhood which influence health and explain geographical health inequalities.

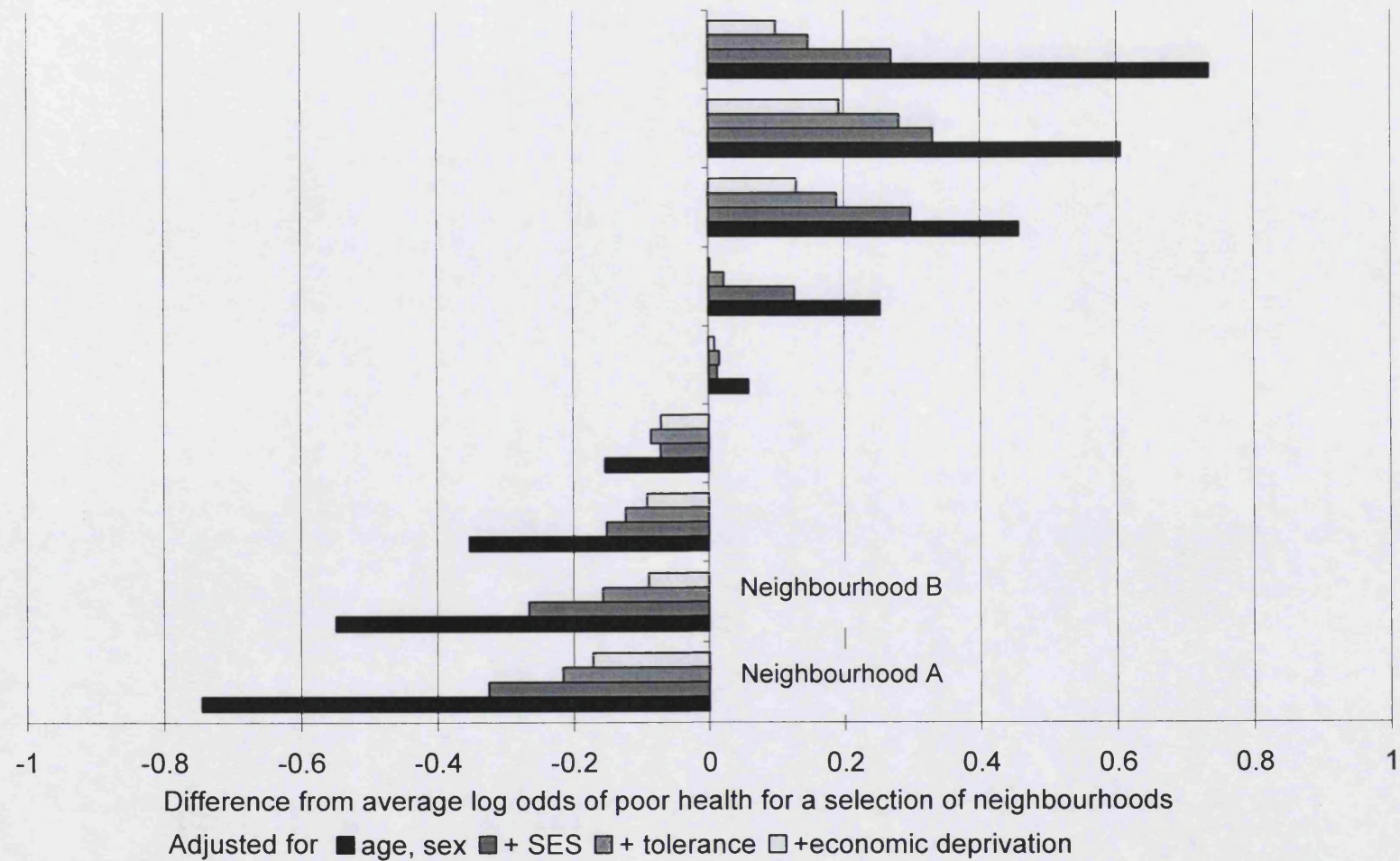
Table 6.28. Variation in self-rated health between neighbourhoods using data from the Health Surveys.

	Variation between neighbourhoods (standard error) [†]	Change in variation from previous model	Percent of total variation which is between neighbourhoods
Model 1: Adjusted for age and sex	0.210 (0.033)		6.0
Model 2: Model 1 + SES	0.082 (.0.021)	61%	2.4
Model 3: Model 2 + social cohesion (one scale at a time)		change from Model 2	
family ties	0.077 (0.021)	6%	2.3
friendship ties	0.082 (0.021)	0%	2.4
participation	0.078 (0.021)	5%	2.3
integration	0.077 (0.021)	6%	2.3
trust	0.059 (0.019)	28%	1.8
attachment	0.076 (0.021)	7%	2.3
practical help	0.082 (0.021)	0%	2.4
tolerance	0.058 (0.019)	29%	1.7
M4: M2 + economic deprivation	0.043 (0.017)	change from Model 2 48%	1.3

[†]Variance is on a log scale

The stepwise explanation of between-neighbourhood variance is additionally illustrated in Figure 6.5. A subgroup of nine neighbourhoods from across the distribution of residuals is represented by nine clusters of horizontal bars (Neighbourhood A, Neighbourhood B etc). The vertical axis through zero is the average level of poor health across all neighbourhoods in the study. Neighbourhood A has the most negative difference from average poor health. In other words, neighbourhood A has the lowest proportion of residents with poor health. The neighbourhood at the top of the figure has the most positive difference from average, i.e. the highest proportion of residents with poor health. This figure shows that in the age and sex adjusted model, the differences between neighbourhoods were largest. With subsequent adjustment for individual socioeconomic position, for neighbourhood tolerance, and for economic deprivation, these differences were reduced.

Figure 6.5. Neighbourhood differences in the log odds of poor health with sequential adjustment for composition, neighbourhood tolerance, and economic deprivation using data from the Health Surveys



An extension to the multilevel models presented so far is to relax the assumption that the effects of the explanatory variables on health are the same in each neighbourhood (section 5.5.5). Larger between-neighbourhood differences in the prevalence of poor health were seen for women (compared with men) and for participants who were not in paid employment (compared with working participants). This is consistent with the finding that neighbourhood social cohesion and economic deprivation were more strongly related to women's health and the health of those who were not in paid employment.

6.3.1 Alternative methods of estimation

As discussed in section 5.6, there are some limitations to the PQL estimation procedure in MLwin. Replication of the analysis using the parametric bootstrap method yielded the same estimate of the between-neighbourhood variation in self-rated health. Replication using the MCMC method indicated that the estimate of the between-neighbourhood variation had been underestimated by a negligible amount (Table 6.29). The data presented so far are therefore based on a reliable calculation of between-neighbourhood variation which was confirmed using alternative estimation methods. Changes in all other parameter estimates were also negligible. The conclusions reached in this study would not be altered by use of alternative estimation procedures.

Table 6.29. Between-neighbourhood variation using alternative estimates procedures.

	PQL generalised least squares	Parametric bootstrap	MCMC method
Estimate of between- neighbourhood variation in health (σ_{u0}^2)	0.082	0.082	0.084
90% range for σ_{u0}^2	0.048 to 0.116	0.047 to 0.112	0.045 to 0.128

6.4 Neighbourhood characteristics and psychiatric morbidity

A total of 8478 participants living in 239 neighbourhoods had complete data on psychiatric morbidity and neighbourhood characteristics. On the whole, women reported more psychiatric morbidity than men. Reporting of psychiatric morbidity increased with decreasing social class. Particularly high rates of minor psychiatric morbidity were seen amongst participants who were unemployed or other economically inactive (but not retired) (Table 6.30). Table 6.31 shows the unadjusted prevalence of psychiatric morbidity by neighbourhood characteristics.

Table 6.30. Psychiatric morbidity by individual demographic and socioeconomic characteristics using data from the Health Surveys

		% with minor psychiatric morbidity	
		Men n = 3815	Women n = 4663
Age group	16-29	11.6	19.9
	30-44	13.8	20.7
	45-59	15.6	24.5
	60-65	16.6	14.6
	>65	11.2	15.7
Social class	I	10.5	12.8
	II	13.5	16.7
	III/NM	12.5	18.5
	IIIM	13.8	20.6
	IV	14.0	20.5
	V	19.9	24.0
Economic activity	employed	9.5	15.0
	unemployed	25.0	37.9
	retired	12.0	16.4
	other inactive	34.3	28.1

Table 6.31. Psychiatric morbidity of Health Survey participants by neighbourhood characteristics.

		% with minor psychiatric morbidity
Family ties	low	17.2
	medium	15.4
	high	17.2
Friendship ties	low	17.1
	medium	16.1
	high	16.7
Participation in organised activities	low	17.6
	medium	17.1
	high	15.0
Integration into wider society	low	16.7
	medium	17.2
	high	16.0
Trust	low	17.3
	medium	16.5
	high	16.2
Attachment to neighbourhood	low	16.5
	medium	15.9
	high	17.2
Being able to rely on others for practical help	low	17.0
	medium	16.2
	high	16.6
Tolerance	low	17.3
	medium	16.6
	high	15.9
Economic deprivation	low	14.8
	medium	16.6
	high	18.1

Associations between psychiatric morbidity and neighbourhood social cohesion adjusted for the individual characteristics of Health Survey participants and subsequently for economic deprivation in the neighbourhood are summarised in Table 6.32. Adjusting for Health Survey participant's age, sex, and socioeconomic position, none of the social cohesion scales showed a statistically significant association with psychiatric morbidity. Residence in a more economically deprived area was not associated with an increased odds ratio of high psychiatric morbidity.

Table 6.32. Neighbourhood characteristics and psychiatric morbidity, adjusted for age, sex, social class and current economic activity using data from the Health Surveys.

		Odds ratio (95% CI) of psychiatric morbidity adjusted for composition
Family ties	low medium high	1.09 (0.93,1.28) 0.94 (0.81,1.09) 1
Friendship ties	low medium high	1.03 (0.88,1.20) 0.97 (0.83,1.12) 1
Participation in organised activities	low medium high	1.12 (0.96,1.31) 1.12 (0.96,1.31) 1
Integration into wider society	low medium high	1.00 (0.86,1.17) 1.04 (0.89,1.21) 1
Trust	low medium high	0.97 (0.83,1.13) 0.98 (0.85,1.14) 1
Attachment to neighbourhood	low medium high	0.90 (0.78,1.05) 0.87 (0.76,1.01) 1
Being able to rely on others for practical help	low medium high	1.04 (0.90,1.21) 0.98 (0.84,1.14) 1
Tolerance of others	low medium high	1.00 (0.85,1.17) 1.01 (0.87,1.14) 1
Economic deprivation	low medium high	1 1.09 (0.93,1.28) 1.10 (0.94,1.29)

Table 6.33 shows the between-neighbourhood variation in psychiatric morbidity. The log odds of having a GHQ12 score of 4 or more was modelled so the variance is estimated on a log scale. In the age and sex adjusted model, the variance estimate was of borderline statistical significance ($p=0.05$). With adjustment for individual socioeconomic position, the between-neighbourhood variance was almost halved and no significant variation between neighbourhoods remained. In summary, the prevalence of psychiatric morbidity did not vary across neighbourhoods once compositional effects had been accounted for, neither was there evidence of an association between neighbourhood social cohesion or economic deprivation on psychiatric morbidity

Table 6.33. Variation in psychiatric morbidity between neighbourhoods.

	Variation between neighbourhoods (standard error) [†]	Change in variation from previous model	Percent of total variation which is between neighbourhoods
Model 1: Adjusted for age and sex	0.042 (0.022)		1.3
Model 2: Model 1 + SES	0.023 (.0.020)	45%	0.7
Model 3: Model 2 + social cohesion (one scale at a time)		change from Model 2	
family ties	0.021 (0.020)	8%	0.6
friendship ties	0.022 (0.020)	4%	0.7
participation	0.021 (0.020)	8%	0.6
integration	0.023 (0.020)	0%	0.7
trust	0.022 (0.020)	4%	0.7
attachment	0.017 (0.019)	26%	0.5
practical help	0.022 (0.020)	4%	0.7
tolerance	0.022 (0.020)	4%	0.7
M4: M2 + economic deprivation	0.022 (0.020)	change from Model 2 4%	0.7

[†]Variance is on a log scale

6.5 Neighbourhood characteristics and smoking

A total of 8497 participants living in 254 neighbourhoods had complete data on smoking status and were included in the analyses presented here. Smoking was more prevalent amongst younger people and tended to be higher in the lower social classes although the relationship between smoking and social class was not linear. Unemployed men and women were more likely than employed people to smoke, but smoking was less common amongst women who were economically inactive for other reasons (Table 6.34).

Table 6.34. Smoking status by individual demographic and socioeconomic characteristics using data from the Health Surveys

		% current smokers	
		Men n = 4014	Women n = 5029
Age group	16-29	37.3	36.2
	30-44	31.5	32.2
	45-59	28.8	29.1
	60-65	21.3	28.4
	>65	20.0	25.3
Social class	I	21.2	26.0
	II	22.9	29.4
	IIINM	31.6	29.1
	IIIM	31.6	32.3
	IV	37.2	34.9
	V	35.3	32.8
Economic activity	employed	29.8	32.2
	unemployed	40.4	39.1
	retired	20.2	27.4
	other inactive	37.4	29.0

The unadjusted proportion of Health Survey respondents who reported smoking are presented by neighbourhood social cohesion and economic deprivation in Table 6.35.

Table 6.35. Smoking status of Health Survey participants by neighbourhood characteristics.

		% current smoker
Family ties	low	26.3
	medium	28.7
	high	33.7
Friendship ties	low	29.9
	medium	29.7
	high	30.5
Participation in organised activities	low	31.9
	medium	29.9
	high	28.3
Integration into wider society	low	32.6
	medium	29.9
	high	27.9
Trust	low	33.6
	medium	29.1
	high	28.0
Attachment to neighbourhood	low	32.2
	medium	29.1
	high	29.2
Being able to rely on others for practical help	low	31.7
	medium	28.1
	high	30.4
Tolerance	low	34.5
	medium	29.1
	high	26.7
Economic deprivation	low	26.2
	medium	29.2
	high	34.4

In the multilevel analysis, living in a neighbourhood with fewer family ties was associated with a reduced odds ratio of smoking. This association was virtually unchanged with adjustment for economic deprivation in the neighbourhood (Table 6.36). Participants living in less integrated neighbourhoods were more likely to smoke. Adjustment for economic deprivation attenuated this association although a small increased risk of smoking in less integrated neighbourhoods was still apparent. Accounts from residents in disadvantaged communities in Glasgow illustrated a lack of opportunity to get away from the immediate environment combined with a tendency for these environments to encourage smoking (Stead et al, 2001). For example, for men, the social focus tended to be in groups gathering to drink and smoke either in the pubs or on the streets. Several respondents highlighted smoking as a relatively cheap way of gaining some respite from everyday stressors and passing time with local friends or family. A qualitative study of smoking behaviour among Canadian adolescents provides further

support that economic deprivation combined with behavioural norms are closely associated with smoking (Frohlich et al, 2002). In the current study, the integration scale may be capturing part of the norms and customs prevalent within a neighbourhood that encourage or discourage smoking. Trust and tolerance were also associated with smoking. Participants living in the least tolerant neighbourhoods were 1.40 (95% CI 1.19 to 1.65) times as likely to smoke as residents in the most tolerant neighbourhoods. This association persisted, with some attenuation, on adjustment for economic deprivation.

Table 6.36. Neighbourhood characteristics and smoking status sequentially adjusted for composition (participant's age, sex, social class, and economic activity) and neighbourhood economic deprivation.

		Odds ratio (95% CI) of current smoking adjusted for composition	Odds ratio (95% CI) of current smoking adjusted for composition + economic deprivation
Family ties	low medium high 1	0.71 (0.60,0.84) 0.83 (0.71,0.97) 1	0.74 (0.62,0.88) 0.91 (0.77,1.07) 1
Friendship ties	low medium high 1	1.00 (0.84,1.18) 0.98 (0.83,1.15) 1	0.92 (0.78,1.09) 0.93 (0.80,1.10) 1
Participation in organised activities	low medium high 1	1.12 (0.95,1.32) 1.08 (0.91,1.28) 1	0.96 (0.79,1.15) 0.98 (0.82,1.16) 1
Integration into wider society	low medium high 1	1.24 (1.05,1.46) 1.09 (0.93,1.29) 1	1.14 (0.96,1.35) 1.04 (0.88,1.23) 1
Trust	low medium high 1	1.23 (1.04,1.45) 1.01 (0.86,1.19) 1	1.00 (0.81,1.25) 0.94 (0.79,1.12) 1
Attachment to neighbourhood	low medium high 1	1.08 (0.92,1.27) 0.94 (0.80,1.10) 1	0.90 (0.75,1.09) 0.89 (0.75,1.04) 1
Being able to rely on others for practical help	low medium high 1	1.07 (0.91,1.26) 0.90 (0.77,1.06) 1	1.00 (0.84,1.17) 0.90 (0.76,1.05) 1
Tolerance of others	low medium high 1	1.40 (1.19,1.65) 1.09 (0.92,1.27) 1	1.28 (1.05,1.56) 1.06 (0.90,1.25) 1
Economic deprivation	low medium high	1 1.11 (0.94,1.31) 1.37 (1.16,1.62)	

Table 6.37 summarises the variation in smoking status which was found between neighbourhoods. Adjusting for age and sex, 4.3% of the total variation in smoking status was found between neighbourhoods. This was slightly reduced on adjustment for individual socioeconomic position. Neighbourhood tolerance explained the largest proportion of remaining between-neighbourhood variation.

Table 6.37. Variation in smoking status between neighbourhoods.

	Variation between neighbourhoods (standard error) [†]	Change in variation from previous model	Percent of total variation which is between neighbourhoods
Model 1: Adjusted for age and sex	0.149 (0.027)		4.3
Model 2: Model 1 + SES	0.133 (.0.026)	11%	3.9
Model 3: Model 2 + social cohesion (one scale at a time)		change from Model 2	
family ties	0.120 (0.024)	10%	3.5
friendship ties	0.133 (0.026)	0%	3.9
participation	0.133 (0.026)	0%	3.9
integration	0.126 (0.025)	5%	3.7
trust	0.127 (0.025)	5%	3.7
attachment	0.132 (0.026)	1%	3.9
practical help	0.129 (0.025)	3%	3.8
tolerance	0.116 (0.024)	13%	3.4
M4: M2 + economic deprivation	0.120 (0.024)	change from Model 2 10%	3.5

[†]Variance is on a log scale

6.6 Neighbourhood characteristics and waist:hip ratio

Waist:hip ratio and body mass index were available for 5809 participants living in 219 neighbourhoods. Women had a lower waist:hip ratio than men and waist:hip ratio increased with age. Participants employed in manual occupations had higher mean waist:hip ratio than those in non-manual occupations. Participants who were retired or otherwise economically inactive had higher mean waist:hip ratio than working participants. Mean waist:hip ratio by demographic and socioeconomic characteristics of participants and by neighbourhood characteristics are shown in Tables 6.38 and 6.39, separately for men and women.

Table 6.38. Mean waist:hip ratio by individual demographic and socioeconomic characteristics using data from the Health Surveys.

		Men n = 2656	Women n = 3153
Age group	16-29	0.849	0.762
	30-44	0.899	0.784
	45-59	0.931	0.807
	60-65	0.947	0.822
	>65	0.941	0.829
Social class	I	0.897	0.761
	II	0.908	0.789
	IIINM	0.889	0.787
	IIIM	0.914	0.809
	IV	0.910	0.806
	V	0.908	0.822
Economic activity	employed	0.898	0.783
	unemployed	0.898	0.786
	retired	0.939	0.827
	other inactive	0.926	0.802

Table 6.39. Mean waist:hip ratio of Health Survey participants by neighbourhood characteristics.

		Men n = 2656	Women n = 3153
Family ties	low	0.899	0.789
	medium	0.906	0.792
	high	0.912	0.801
Friendship ties	low	0.905	0.795
	medium	0.908	0.795
	high	0.909	0.796
Participation	low	0.910	0.797
	medium	0.910	0.797
	high	0.902	0.792
Integration	low	0.909	0.796
	medium	0.910	0.794
	high	0.904	0.797
Trust	low	0.909	0.798
	medium	0.910	0.796
	high	0.904	0.794
Attachment to neighbourhood	low	0.912	0.801
	medium	0.905	0.796
	high	0.907	0.792
Practical help	low	0.904	0.792
	medium	0.911	0.797
	high	0.907	0.797
Tolerance	low	0.913	0.802
	medium	0.907	0.796
	high	0.902	0.792
Economic deprivation	low	0.901	0.788
	medium	0.906	0.796
	high	0.915	0.803

Because the variation in waist:hip ratio was small and regression coefficients were preceded by a number of zeroes, values were converted to z-scores to aid presentation. Z-scores were created by subtracting the sex-specific mean waist:hip ratio from each participant's measure and dividing the resulting value by the sex-specific standard deviation. Table 6.40 shows the association between waist:hip ratio z-score and neighbourhood characteristics, adjusting for participant's body mass index, age, sex, and socioeconomic position. Participants living in the most economically deprived neighbourhoods had, on average, higher waist:hip ratios than participants living in the least deprived neighbourhoods. The difference between the most and the least deprived neighbourhoods was 0.14 standard deviations. Adjusting for participant's age, sex, socioeconomic position, and body mass index, residence in a neighbourhood with lower levels of participation, trust, attachment, and tolerance was associated with a higher waist:hip ratio. Residence in a neighbourhood with higher levels of family ties was associated with a higher waist:hip ratio. On further adjustment for economic deprivation, the associations between each of the social cohesion domains and waist:hip ratio were attenuated and became non-significant. A suggestion of raised waist:hip ratio in the least tolerant neighbourhoods and in the neighbourhoods with the highest level of family ties remained.

To the extent that waist:hip ratio adjusted for body mass index can be considered a marker of physiological response to chronic stress, these findings indicate that exposure to a neighbourhood experiencing economic deprivation is a stressor. Lack of tolerance in a neighbourhood may also be a stressor, although the evidence for this is less clear.

Table 6.40. Neighbourhood characteristics and waist:hip ratio sequentially adjusted for composition (participant's age, sex, social class, economic activity, and body mass index) and neighbourhood economic deprivation using data from the Health Surveys.

		Mean (se) difference from reference group waist:hip ratio z-score adjusted for composition	Mean (se) difference from reference group waist:hip ratio z-score adjusted for composition and economic deprivation
Family ties	low	-0.092 (0.037)	-0.069 (0.038)
	medium	-0.071 (0.034)	-0.025 (0.035)
	high	0	0
Friendship ties	low	0.019 (0.037)	-0.023 (0.037)
	medium	-0.025 (0.035)	-0.050 (0.034)
	high	0	0
Participation in organised activities	low	0.079 (0.035)	0.014 (0.040)
	medium	0.067 (0.036)	0.020 (0.038)
	high	0	0
Integration into wider society	low	0.031 (0.035)	-0.014 (0.036)
	medium	-0.027 (0.036)	-0.050 (0.035)
	high	0	0
Trust	low	0.091 (0.036)	-0.011 (0.047)
	medium	0.021 (0.035)	-0.017 (0.036)
	high	0	0
Attachment to neighbourhood	low	0.092 (0.036)	0.026 (0.041)
	medium	0.021 (0.035)	0.016 (0.035)
	high	0	0
Being able to rely on others for practical help	low	-0.006 (0.036)	-0.039 (0.035)
	medium	0.020 (0.035)	0.012 (0.034)
	high	0	0
Tolerance of others	low	0.141 (0.036)	0.082 (0.043)
	medium	0.073 (0.035)	0.054 (0.035)
	high	0	0
Economic deprivation	low	0	
	medium	0.043 (0.036)	
	high	0.143 (0.036)	

Women may have greater physiological reactivity to negative aspects of social relationships than men (Seeman & McEwan, 1996). There was no evidence here of an interaction between any of the eight social cohesion scales and sex.

Adjusting for age, sex, and body mass index, less than 4% of the total variation in waist:hip ratio was between neighbourhoods. Adjustment for socioeconomic position explained 17% of this variation. Further adjustment for family ties and for tolerance explained a further 11% and 18% respectively. In summary, there were small but statistically significant differences in mean waist:hip ratio between neighbourhoods, after adjustment for demographic and socioeconomic composition. These differences were

partly explained by levels of contact with family and tolerance as well as by economic deprivation in the neighbourhood.

Table 6.41. Variation in waist:hip ratio between neighbourhoods.

	Variation between neighbourhoods (standard error)	Change in variation from previous model	Percent of total variation which is between neighbourhoods
Model 1: Adjusted for age, sex and body mass index	0.023 (0.005)		3.5
Model 2: Model 1 + SES	0.019 (.0.004)	17%	2.9
Model 3: Model 2 + social cohesion (one scale at a time)		change from Model 2	
family ties	0.017 (0.004)	11%	2.6
friendship ties	0.019 (0.004)	0%	2.9
participation	0.018 (0.004)	5%	2.8
integration	0.019 (0.004)	0%	2.9
trust	0.018 (0.004)	5%	2.8
attachment	0.018 (0.004)	5%	2.8
practical help	0.019 (0.004)	0%	2.9
tolerance	0.016 (0.004)	18%	2.5
M4: M2 + economic deprivation	0.016 (0.004)	change from Model 2 18%	2.5

6.7 Summary of findings linking neighbourhood social cohesion to health

- Higher levels of participation, integration, trust, attachment to neighbourhood, and tolerance were associated with a lower prevalence of poor health. Less contact with local family was associated with a lower prevalence of poor self-rated health. These effects were seen after adjustment for the demographic and socioeconomic composition of neighbourhoods.
- The design of the study is such that affect bias cannot explain the associations between the neighbourhood social domains and health, because one set of respondents reported their perceptions of neighbourhood social cohesion and a different set of respondents reported their health.
- The effects of many of the neighbourhood social cohesion domains were larger for participants who were not working than for employed participants. Those not in paid employment appear to be more dependent on locally provided social networks and the quality of the local social environment.

- There was some indication that emotional and negative aspects of social support partially mediate the social cohesion – health association. Vigilance for threat also partially mediated this association and there was a suggestion that it may be particularly relevant for people in lower socioeconomic positions, perhaps because they are exposed to danger or threat in other contexts.
- Economic deprivation in the neighbourhood was strongly associated with reporting of poor health.
- When the joint effects of economic deprivation and social cohesion were considered, economic deprivation emerged as the best predictor of self-rated health. The high correlation between economic deprivation and most of the social cohesion scales warrants some caution over the interpretation of the regression estimates; nevertheless, these results suggest that social cohesion does not influence health over and above economic deprivation.
- Neither neighbourhood social cohesion nor economic deprivation was associated with psychiatric morbidity. The prevalence of psychiatric morbidity did not vary across neighbourhoods once residential composition was allowed for.
- Behavioural and biological pathways linking neighbourhood characteristics to health were investigated. Smoking was more common in neighbourhoods characterised by low levels of integration, trust, and tolerance and by high levels of contact with family. Residence in neighbourhoods with lower levels of participation, trust, attachment, and tolerance or in neighbourhoods with high contact with family was associated with a higher waist:hip ratio. There is therefore evidence in support of both behavioural and biological pathways from neighbourhood environment to ill health.
- The specific domains of social cohesion that were associated with health varied for the outcome of interest, indicating that several pathways may be operating. Many of the domains were related to self-rated health, a general measure of health and well-being. The tendency for smoking to be higher in more insular areas (indicated by lack of integration and high family ties) suggests a form of informal behavioural control may be operating. Poor quality social interactions in the neighbourhood (characterised by low trust, low attachment, and low tolerance) may be a source of stress which has consequences for residents' smoking status (as a coping strategy) and fat distribution (possibly indicating metabolic disturbance).

Chapter 7. Discussion and conclusions

7.1 Summary and interpretation of findings

7.1.1 The concept of social cohesion

Based on a comprehensive review of the social capital and social cohesion literature, a new tool was developed to capture neighbourhood social cohesion. This review highlighted eight social cohesion domains which are frequently discussed in research papers and are potentially related to health. These eight domains can be divided into the structural aspects of social cohesion (comprising the forms of social ties between people in the same neighbourhood and the frequency of contact) and the cognitive aspects of social cohesion (comprising the quality of the social interactions between people in the same neighbourhood). Although the social cohesion data collected for this thesis are cross-sectional, the data provided some support for an underlying model linking the structural and cognitive aspects of social cohesion. Level of contact with local friends and participation in organised activities were positively correlated with trust, attachment, availability of practical help, and tolerance. Level of contact with local family was positively correlated with trust and attachment but negatively correlated with tolerance. Critics of social cohesion/social capital have suggested that lack of tolerance towards those not in the "in-group" may be a possible side-effect of group bonding (Portes, 1998; Stolle & Rochon, 1998). The findings from this study suggest that lack of tolerance is a possible but not inevitable result of neighbourhood social interaction.

Other potential downsides of social ties include limitations on personal freedom. Participation in some types of associations (e.g. Parent-Teacher Association/tenant's groups/Neighbourhood Watch and education/arts & music groups/evening classes) was positively correlated with pressure to conform to behavioural norms. Such pressure does not necessarily have negative implications for health; it simply illustrates the possible downsides of social interaction. In their in-depth study in London, Cattell and Herring (2002) found that collectivism and individualism can co-exist and that both are important for people's perception of their health.

The social cohesion domains were correlated with the socio-demographic composition of the neighbourhood. For example, over and above economic deprivation, neighbourhoods with a greater proportion of residents aged 18 to 44 tended to have lower trust, lower attachment, and lower availability of practical help. Social cohesion was also found to be correlated with inherent or truly contextual properties of the area. For example, levels of trust, attachment, and practical help were higher in less urban areas. Predominant industry also correlated with a number of aspects of social cohesion. The distinction between mining/manufacturing areas and areas dominated by other types of industry may reflect historical attitudes towards and opportunities for local social contact. The dangers of the occupation and the need for support due to the injury or death of the breadwinner may have contributed to the socially cohesive aspects of these areas. High levels of trust and attachment in the neighbourhood may also reflect what Portes (1998) calls “bounded solidarity”: a collective identity arising from shared vulnerability because of attacks from “outside” (when mines and factories were threatened with closure and subsequently closed down, for example).

Researchers have been divided over the most appropriate level at which to measure social capital. In the field of epidemiology, the health effects of social support have been known for a long time. Interest in social capital has therefore focused mainly on its potential external effects – the contribution of social networks or groups to the health of wider society. The findings presented here suggest that the aggregate quantity and quality of relationships between people in the same neighbourhood have some health effects on an individual resident, over and above that resident’s social support. This supports an approach which considers not only the individual-level risk factors for disease but also the macro-level determinants of health.

7.1.2 Neighbourhood variations in health

This work has demonstrated variations in self-rated health across neighbourhoods in England and Scotland. Some of this variation can be explained by the socio-demographic characteristics of residents: there was a substantial reduction in between-neighbourhood variance once age, sex and socioeconomic position of residents were allowed for. However, these individual characteristics did not explain all of the variation. Differences between neighbourhoods remained after adjustment for these individual

characteristics. Some of the social cohesion domains further explained between-neighbourhood differences.

Behavioural and biological risk factors (smoking and waist:hip ratio) also showed differences across neighbourhoods, after controlling for demographic and socioeconomic composition. Again, social cohesion explained some of this residual variation.

These findings add to current literature showing that there are geographical inequalities in various health outcomes in the UK.

7.1.3 Associations between social cohesion and health

A number of the social cohesion domains were associated with self-rated health, over and above effects of individual sex, age, and socioeconomic position. Residents in neighbourhoods with high levels of participation, integration, trust, attachment, and tolerance were less likely to report poor health. Residents in less economically deprived neighbourhoods with low levels of family ties were less likely to report poor health. The design of this study was such that one set of respondents reported on their perceptions of social cohesion and a different set reported on their health. Affect bias cannot explain the associations between the domains of social cohesion and health reported here. The magnitude of the association between trust and tolerance and self-rated health was moderate. Participants in low trust neighbourhoods were 1.48 (95% confidence interval from 1.28 to 1.71) times as likely to rate their health as poor as those in high trust neighbourhoods. An effect on self-rated health of this magnitude is comparable with a 15-year increase in age in this general population sample.

Social cohesion was found to have both positive and negative associations with health. Theorists have discussed the possible negative impact of social cohesion, although empirical studies have not so far demonstrated negative effects on health. One possible explanation for the increased reporting of poor health in neighbourhoods with high family ties is that greater contact with local family is more common in economically deprived areas. On stratifying by economic deprivation, the association between low family ties and better health was seen only in less deprived neighbourhoods. It is not immediately

clear what contact with family is capturing here, but the stratified analysis suggests that the meaning of family ties may be different in deprived and less deprived settings. It is possible that the balance of the costs and benefits of contact with family varies according to factors such as the level of facilities and services and job opportunities in the local area.

Low tolerance was also related to poor self-rated health. Participation in some types of organisation was positively correlated with a sense of pressure to conform (one aspect of low tolerance). The effect of tolerance on self-rated health demonstrated here suggests that social contact within neighbourhoods is not sufficient for good health. Social relationships which are characterised by respect for diversity and tolerance of different attitudes and lifestyles are health-promoting. Two other studies have considered the association between tolerance and health. Kennedy et al (1997) found that the state level proportion of people who believed that blacks lacked innate ability was positively correlated with both black and white age-adjusted mortality rates. Reidpath (2003) found a positive association between racial heterogeneity (measured by per cent black in the state) and all-cause mortality, adjusting for state poverty level. Interestingly, both the black and white mortality rate was higher in more racially mixed states. Reidpath suggests a role for social cohesion here. Racial antagonism may create competition for resources and this may have negative effects on social cohesion. Failure to work together for the common good may result in a lose-lose situation for the majority as well as the minority population. Tolerance of racial or ethnic diversity was not explicitly captured by the social cohesion questionnaire used in this thesis. The population groups deemed to "not belong in this area" may have been defined by ethnicity, socioeconomic position, or other behavioural characteristics. However, these findings do support the hypothesis that lack of tolerance has negative implications for health.

The finding of negative as well as positive effects of social cohesion has implications for future empirical studies. It suggests that the creation of a social cohesion index which ranges from high to low may be an over-simplification and may mask some of the complexities in the relationship between social cohesion and health. Social cohesion may be best thought of as umbrella term for a number of related, but separate, constructs. It is a short-hand description but empirical research using the concept

seldom distinguishes between the various benefits and drawbacks which are available through these networks. Different forms of networks can lead to different combinations of benefits and drawbacks and can have different effects on health. It is misleading to talk of high and low social cohesion.

The dimensions of social cohesion that contributed towards explaining some of the residual neighbourhood differences in health (remaining after adjustment for composition) were trust and tolerance. Future work could focus on trust and tolerance, aiming to capture these characteristics more fully and to examine what residents understand by these aspects of the neighbourhood and why they are important for health.

7.1.4 Pathways linking neighbourhood social cohesion to health

Different social cohesion domains relate to different health outcomes, suggesting that multiple pathways linking social cohesion to health may be operating. Behavioural and biological pathways that may link social cohesion to health status were examined in the general population sample. Family ties, integration, trust, and tolerance were related to smoking status. Family ties, participation, trust, attachment, and tolerance were related to waist:hip ratio. For smoking, family ties and integration into wider society are two scales which tap into the extensiveness of social networks and may indicate the extent to which local norms of behaviour influence residents. This accords with qualitative work (Stead et al, 2001). Residence in a low tolerance neighbourhood also increased the likelihood of smoking. It is hypothesised that residence in a low tolerance neighbourhood is a stressor and that smoking is a behavioural coping mechanism. More detailed data were not available to examine this further. For waist:hip ratio, the cognitive aspects of social cohesion were more important. This supports the hypothesis that residence in a place where people do not trust each other, do not feel attachment to their neighbourhood, and are not tolerant of others is a chronic stressor which has long-term implications for physiology and, in turn, metabolic function. Effects of neighbourhood social cohesion on physiology may act directly and/or through behavioural pathways (such as smoking).

Three possible psychosocial pathways linking neighbourhood social cohesion domains to health were investigated using data from the Whitehall II study. Neighbourhood levels of trust and attachment were correlated with emotional and negative aspects of social support. There was evidence that a resident's emotional and negative social support mediated the associations between neighbourhood trust and attachment and participant's self-rated health. Residents in neighbourhoods with lower levels of trust and attachment had, on average, higher vigilance for threat scores than residents in neighbourhoods with higher levels of trust and attachment. Vigilance for threat also partly mediated the associations between neighbourhood trust and attachment and self-rated health. The findings also suggest that residents from less advantaged backgrounds may be more vigilant for threat in less tolerant neighbourhoods. The findings are not conclusive because of a limited sample size and need to be replicated elsewhere. The relationship between vigilance for threat and aspects of the social environment are currently being studied in the PHDCN study and will make an interesting comparison. There was no indication that sense of control was related to neighbourhood social cohesion. The findings do not generally support the hypothesis that sense of control is on the pathway between social cohesion and health, although limitations in the measures of sense of control have been noted.

It is rather surprising that mental well-being in the general population sample was not related to features of the neighbourhood. Pevalin and Rose (2003) found an association between two indicators of the neighbourhood environment (fear of crime and neighbourhood attachment) and psychiatric morbidity, assessed by the GHQ12. These associations remained after adjustment for age, sex, socioeconomic position, and marital status. It is possible that affect bias is responsible for the Pevalin and Rose result because the same set of respondents reported on their perceptions of the neighbourhood and their mental health. It may be fruitful to examine depression and anxiety rather than the summary GHQ12 score in future work.

Multiple testing of the associations between eight different social cohesion scales across 4 different health outcomes would be expected to throw up some statistically significant associations even if no true effects existed. It is possible to make statistical corrections for multiple comparisons, although the various hypotheses being tested were closely related to each other and it is not clear that statistical adjustments are appropriate in

such a case. A way forward is to be more specific about how the various social cohesion domains may influence a given health outcome and measure the relevant exposures, confounding factors and possible mediators using tools which are tailor-made for the research question. The study described in this thesis was set up to investigate neighbourhood influences on self-rated health. The findings for the other health outcomes provide a useful direction for future work.

7.1.5 Economic deprivation and social cohesion

Economic deprivation, captured by the Carstairs index of deprivation, was associated with poor health and contributed to explaining neighbourhood differences in health. The findings presented here indicate that social cohesion and economic deprivation are highly correlated. On adjustment for economic deprivation, the health effect of each of the social cohesion domains was attenuated and became non-significant. This study provided no evidence that social cohesion and economic deprivation are independently related to self-rated health. The difficulties of interpreting regression models with correlated explanatory variables have been highlighted, but these findings suggest that efforts to raise levels of social cohesion are unlikely to succeed unless efforts to improve economic and material conditions run concurrently. A buffering model (where social cohesion buffers residents from some of the effect of economic deprivation) could not be formally tested because of the high correlation between social cohesion and economic deprivation. However, it remains possible that social cohesion may be most useful to communities under threat (from closure of public services or from economic deprivation at greater levels than studied here, for example).

In this cross-sectional study, it is difficult to disentangle the effects of concentrated economic deprivation from poor quality social cohesion. Drukker et al (2003) propose over-sampling economically deprived neighbourhoods with high social cohesion as well as affluent neighbourhoods with low social cohesion as a way of teasing out the relationships between economic deprivation, social cohesion and health. This approach can be useful for establishing the independence of effects, but the fact remains that economically deprived neighbourhoods by and large have poor quality social cohesion. It is possible that the two reinforce each other over time. Wilson (1991) suggests that the cultural cannot be simply separated from the structural and notes that groups are

“stratified in terms of the material assets or resources they control, the benefits and privileges they receive from these resources, the cultural experiences they have accumulated from historical and existing economic and political arrangements, and the influence they yield because of those arrangements”.

In his account of inner-city poverty in certain parts of Chicago, he shows that economic deprivation is reinforced by the social setting. At the neighbourhood level, deteriorating social order and physical fabric may lead to the exit of business and associated job losses. The experience of concentrated deprivation, not receiving a “fair” share of wealth and resources, may increase distrust and social isolation (Skogan, 1990) and may reduce the ability to oppose environmental degradations such as having pylons or rubbish dumps placed in one’s neighbourhood. A regression model which includes neighbourhood level social cohesion and economic deprivation as covariates cannot model this complexity, with the two neighbourhood characteristics reinforcing each other over time. Ross (2000) used a slightly different approach to show that perceived neighbourhood disorder mediates the association between neighbourhood economic disadvantage and poor mental health. Perceived neighbourhood disorder was reported by individual residents and entered into the regression model as an individual level covariate and in this way problems with collinearity were avoided, although affect bias (the tendency to report negatively about order in the neighbourhood and about mental health) is a possible explanation for Ross’s findings.

A number of researchers have pointed out the covariance of multiple neighbourhood-level risk factors (Evans & Kantrowitz, 2001; Blane, 2001; Kaplan, personal communication). Evans and Kantrowitz’s review covered the physical environment at home, work, school, and in the neighbourhood and it illustrates that lower social classes consistently have the poorest conditions across many attributes of these environments, although evidence of health effects of these attributes is limited at present. The effect of a single environmental characteristic considered in isolation from other contextual features may be an underestimate of its effect in the real world. Existing studies generally point to fairly small effects of contextual features on health once individual socioeconomic position is adjusted for. One conclusion is that the residential environment is a relatively unimportant determinant of health. An alternative is that the cumulative effects of economic deprivation, poor housing, poor quality or quantity of local amenities, along with a lack of social cohesion do have effects on health though the

effect of each one considered in isolation is small in magnitude. This could be tested by creating a multiple index which captures the cumulative effects of these various contextual characteristics. There is a tension between isolating analytically the specific characteristics of the neighbourhood environment that affect residents' health and capturing the complex combinations of neighbourhood stressors and resources in a way which more accurately reflects residents' experiences (Kaplan, personal communication; Marmot & Fuhrer, 2003).

Measurement error must also be considered as an explanation for the lack of independent associations between social cohesion domains and health. The underlying construct "economic deprivation", captured by four variables from the 1991 census, may be more accurately measured than the underlying construct "social cohesion", captured by the eight domains based on questionnaire data.

7.1.5 Do neighbourhood characteristics affect all residents equally?

Neighbourhood social cohesion and economic deprivation appeared to be more important for certain sections of the population. For those not in paid employment, larger effects of economic deprivation and six of the eight social cohesion domains (exceptions being practical help and attachment to neighbourhood) were found. The group of participants not in paid employment is heterogeneous and sample size requirements restricted the extent to which this group could be broken down further. A substantial proportion of this group will be on low incomes and have fewer financial resources at their disposal. There are two possible explanations for the differential effects of neighbourhood characteristics on employed participants and participants not in paid employment: differential exposure and differential vulnerability. Those not in paid employment may spend more time in their neighbourhood and less time exposed to other contexts. The greater neighbourhood effects seen amongst people not working may be indicative of a dose-response relationship between neighbourhood characteristics and health. The differential vulnerability explanation posits that those not in the paid labour force are less able to afford private services and are therefore more dependent on publicly provided services, which may be lower in quantity and/or quality in more economically deprived areas. The suggestion of a steeper association between social cohesion and health among people in lower social classes also indicates greater

vulnerability for some residents. They may also have less access to social networks outside their neighbourhood and therefore be more dependent on local social contacts.

Women also make up a substantial proportion of the group of participants not in paid employment. The effects of economic deprivation and several of the neighbourhood social cohesion domains were larger for women (statistically significantly so for the integration and practical help scales). The sex differences in neighbourhood effects may be because women spend more time in their neighbourhood, have lower financial status, and are more reliant on neighbourhood facilities due to the social roles they typically fulfil (for example, maintaining the home and caring for children).

Put together, these findings suggest that neighbourhoods do not affect all residents equally. Loury (1977) stated that the characteristics of the social context condition what a person can achieve. Equally, the characteristics of an individual condition the extent to which the residential context can influence health.

It is worth pointing out here that the effects of social class and current economic activity were larger than the effects of the social cohesion domains. An interest in investigating the role of social cohesion on health does not preclude an appreciation of the well-documented health effects of low socioeconomic position. However, that is not the focus of this thesis.

7.2 Limitations of the study

7.2.1 Unmeasured variables

As with all non-randomised studies, the omission of important variables may be responsible for the associations presented here. Work from the US suggests that concentrated affluence (captured by proportion of households with income above \$50,000, for example), rather than concentrated deprivation, is most strongly related to social cohesion (Robert, 1998; Morenoff et al, 2001). Analysis of concentrated affluence has not yet been undertaken in the UK and data included in the 1991 census would not easily allow the construction of such a measure. Therefore it was not possible to include a measure of concentrated affluence in this study. As discussed earlier, the temporal

sequence linking concentrated deprivation (or affluence) and social cohesion to health is not clear. However, it would be interesting to investigate the correlations between a measure of concentrated affluence and the eight social cohesion scales.

Neighbourhood effects may appear to be present because of incomplete adjustment for an individual's socioeconomic position. Here, socioeconomic position was captured using occupation-based social class along with participant's current economic activity. Additional adjustment for household income would have strengthened the conclusions of this study but these measures were not available for a majority of participants. However, it can be argued that an individual's choice of residential environment largely depends on their household income. Taking this approach, income would not be an omitted confounding variable; rather, the effects of the residential environment would be seen as on the pathway linking income to health.

7.2.2 Cross-sectional study design

The cross-sectional design of this study makes it impossible to establish causality. It is not clear whether changes in neighbourhood social cohesion domains predict future changes in health status. Indeed, it is not clear whether neighbourhood social cohesion domains do change over time and, if they do, how quickly that change occurs. There is a lack of suitable time series data that would allow us to monitor change over time. A further complication is that the nature of social cohesion may change over time. Only a handful of quantitative studies have described aspects of social cohesion or social capital over time and each used spatial units that were larger than neighbourhoods. In the US, Putnam has shown declines in participation in some types of organised groups (including church-related groups, parent-teacher associations, and traditional women's groups), voter turnout, and trust over the last 30-60 years (Putnam, 1995; Putnam, 1996; Putnam, 2000). His work has been criticised for taking a limited view of what constitutes social capital and others have argued that volunteering and connectedness are on the increase (Wills, 2000). For example, women's increasing participation in the labour force has resulted in a shift in kinds of groups they participate in - towards professional associations and away from traditional women's groups (Skocpol, 1996). In the UK, there has been a similar decline in the number of women participating in traditional

women's organisations, but an increase in participation in environmental organisations, youth organisations, and outdoor recreational activities for both sexes (Hall, 1999).

One qualitative study has focused on the changing characteristics of neighbourhoods in London. Butler and Robson (2001) described the process of gentrification of a neighbourhood in Battersea that had become homogeneous with respect to household income, predominant employment (many residents were employed in the City), and university education (many residents had Oxbridge degrees). Despite this homogeneity, there was little social interaction or collective action within this neighbourhood. This was contrasted with a neighbourhood in Greenwich that had also been gentrified but where residents appeared to have a greater sense of local identity and were more involved in collective action, especially action to improve the local school. This example highlights the complexity in the relationship between changes in employment structure and changes in social engagement. The Battersea neighbourhood appeared to have a higher socioeconomic status but the Greenwich neighbourhood had developed a higher level of social engagement. (One explanation for the seeming lack of interest in the local schools in the Battersea neighbourhood could be that children attend private schools.) The example also illustrates the importance of local interests in the formation of social cohesion. Clearly, the demonstration of a causal link between social cohesion and health will be challenging.

A prospective study designed to investigate predictors of high quality neighbourhood social cohesion would take many years, as studies over larger areas suggest that fairly small changes in social cohesion occur over a number of years. It may be possible to conduct a retrospective study in a limited area to examine the historical political, cultural, and economic influences on social cohesion. The importance of historical influences have been stressed by Popay (2000) and are illustrated in this study by the positive correlation between some aspects of social cohesion and the proportion of residents employed in mining/manufacturing industries.

As well as a lack of suitable data, statistical techniques which allow for feedback over time in the relationship between social cohesion and other features of the neighbourhood in a multilevel framework have only recently become available and are not yet in widespread use.

7.2.3 Within-neighbourhood variation in social cohesion

One question arising from this work is whether it is appropriate to measure social cohesion at the neighbourhood level. The eight social cohesion scales had acceptable reliability and intraneighbourhood correlation coefficients, nevertheless, substantial within-neighbourhood differences in social cohesion were found. The social capital literature is replete with examples of immigrant communities sharing the same culture, immigrant status, and physical space (at least on first arrival in the host country). For these communities, the notion of social capital operating within spatial boundaries seems appropriate. The extent to which this is generalisable over the population of a whole country is not clear. Communities defined by ethnic background, religious beliefs, or workplace could be an interesting next step.

The derived nature of the social cohesion measures also leads to within-neighbourhood differences. Residents were asked about their perceptions of the neighbourhood; perceptions are influenced by factors such as age, gender, and education. This could be avoided by using an inherent measure, such as systematic social observation (Sampson, 1999), although this approach is not without limitations. For example, there are a number of social cohesion domains which could not be observed directly.

A third reason for the within-neighbourhood variation is that the definition of neighbourhood imposed at the analytical stage may not match respondent's experience of their neighbourhood boundary. Campbell and McLean (2002) noted that most of their respondents expressed some identification with the electoral ward they lived in, suggesting a degree of overlap between geographically and psychologically defined communities. In this thesis, each of the eight social cohesion scales was assumed to operate over the same neighbourhood unit of analysis. Future work could investigate whether this assumption is correct by looking at within- and between-neighbourhood variation for a variety of areal units. Galea et al (2002) suggest that mass media may standardise attitudes over relatively large areas whereas social networks may be more localised, though this has not yet been tested empirically. It may be possible, in the future, to allow each participant to define their own neighbourhood boundaries and to obtain data capturing the residential context for user-defined areas. For example, if data

were available at the postcode level, the user could then aggregate up to a range of larger areal units. However, local service providers use administrative areas for planning and monitoring and so, to the extent that local infrastructure and local organisations might have an influence on social cohesion, there is an argument for continuing to use administrative areas for research purposes.

7.2.4 The use of multilevel regression models to investigate contextual influences on health

The separation of variations in health into those which are between individuals and those which are between neighbourhoods is a statistical tool used for the multilevel analysis of person and place. This approach has been useful in highlighting the influence of the residential context on health. The separation is, however, an artificial one. To ask the question "do people, regardless of how they differ on individual characteristics, have different health status according to where they live?" (which is what is done when area level and individual level variables are included together in a multilevel model), is to ignore the reality of residential segregation and the limited option for mobility experienced by some sections of the population. Previous housing policy and market forces have resulted in residential segregation, with poorer individuals being obliged to live in cheaper, less salutory areas. Personal socioeconomic disadvantage therefore increases the risk of being exposed to residential socioeconomic disadvantage. This means that attempts to separate out the effect of area of residence from individual risk factors are somewhat hypothetical. Thrift goes as far as to say that locales (such as home, workplace, and school) structure people's lives along class divisions and are the setting for daily routine, socialisation, exclusion and conflict (Thrift, 1992, quoted in Curtis & Rees Jones, 1998). Empirical work has shown that the family's links to the community is associated with better educational and employment outcomes for Baltimore youths (Furstenburg & Hughes, 1995). Parental engagement in cultural and sporting activities is also associated with better educational outcomes for youths in Germany (Buchel & Duncan, 1998). The two-way influence of person on place as well as place on person should be recognised.

The software used in this thesis is appropriate for hierarchical data but it does not model the spatial variation. Spatial distances and proximity to other types of neighbourhood

are not considered in MLwin. Software has recently been developed which allows both the spatial and hierarchical distribution of the data to be considered. This promises to be an exciting extension to the study of neighbourhood effects on health. In their study of crime and social disorder in Chicago, Morenoff et al (2001) have shown that, regardless of collective efficacy in the focal neighbourhood, homicide rates are lower in neighbourhoods that are spatially close to areas with high collective efficacy. In the epidemiological literature, there has been virtually no investigation of the neighbourhood, its surrounding area, and their interplay.

The difficulty of assessing the true effects of explanatory variables which are highly correlated was raised in chapter 6. This issue relates to the high correlation between some aspects of social cohesion and economic deprivation found in this study. It is possible that the health effects were attributed to economic deprivation because it has less measurement error rather than because of a true causal association. Regression models are therefore limited in their ability to test causal pathways and the interpretation of regression estimates which are correlated and may be on the same pathway to health is difficult. An improvement would be to test an a priori causal model linking social cohesion, economic deprivation and health using structural equation modelling. Software allowing the testing of causal pathways in a multilevel framework was not available within the project at the time of the analysis.

7.2.5 Residential migration

One explanation for the higher rates of poor health in more economically deprived or less socially cohesive areas is the drift hypothesis. Out-migration of healthy individuals and in-migration of sick individuals would result in relatively high morbidity rates in an area. Studies of migration patterns show that the association between health and moving varies by distance moved and by age. Boyle et al (2002) found that people who moved over long distances were more healthy than non-migrants, and that non-migrants were more healthy than those who moved over short distances. Using data from the Sample of Anonymised Records (SARs), they found no evidence that migration accounts for the association between economic deprivation and ill health. Amongst younger people, healthy individuals are more likely to move than those who are ill and people tend to move to areas with similar socioeconomic characteristics. This would

tend to argue against the possibility that all the effects of neighbourhood deprivation are due to migration. Amongst older people, those who are ill are more likely to move, either into residential care or downsizing their home. If older, sicker people were more likely to move to deprived areas than to affluent areas, then the drift hypothesis would be an explanation for the observed association between deprivation and health.

Analysis of the association between neighbourhood social cohesion domains and self-rated health was repeated excluding participants aged 65 and over. Negligible differences in the estimates were obtained, indicating that residential migration amongst older people was not driving the associations presented in Chapter 6.

Furthermore, it is unlikely that health alone determines one's decision on whether to move and to which location. Individual socioeconomic position is thought to be more important in constraining a person's choices of where to move to. All the models presented in this thesis have been adjusted for individual socioeconomic position. Only a tendency for less healthy people to move to more deprived areas, irrespective of their socioeconomic position, has not been accounted for here (Morenoff, personal communication). Note also that the analyses of Whitehall II data included only participants who had not moved in the last 5 years.

7.3 Implications for policy and for future research

It is clear that neighbourhood-based initiatives to improve health should not focus on improving social cohesion without also considering ways in which local economic deprivation may be reduced. The World Bank's interest in social capital and social cohesion has focused on their use in stimulating economic development. Physical and human capital are thought to amount to more when social connections facilitate the use of these forms of capital (Woolcock, 2001). Woolcock emphasises linking bonds and sees intermediaries such as NGOs as important players who can link marginalised individuals to national institutions and welfare programs. Cattell (2001) also underlines the importance of bridging bonds and calls for policy interventions which increase opportunities for different groups to mix. The present findings should further motivate us to look for initiatives that will widen the social connections of residents living in economically deprived areas, especially in areas where there is a high level of contact

with local family. Such connections may improve access to economic and practical resources and may have additional psychological benefits. Whether these connections should take the form of participation in organised groups or casual contact outside of organised groups does not seem to matter; on the whole, participation in organised groups and contact with friends were associated with positive cognitive benefits (greater tolerance, attachment, and trust) and better health. However, participation in Parent-Teacher associations/tenant's groups/Neighbourhood Watch and in Education/arts & music groups/evening classes was associated with some reported pressure to conform to local behavioural norms (although note that pressure to conform is not necessarily associated with poorer health (Cutrona et al, 2000)). The role of government and other organisations which influence society's structures, which in turn influence local social relations (Bowles, 1999; Lynch et al, 2000), is acknowledged although the project on which this thesis is based did not set out to determine what influences local social connections. However, national and local government may consider their roles in providing suitable meeting places, funding for local groups, and trained personnel who can be a resource for residents who want to set up and run local groups. This probably falls under the existing remit of Community Chests and other Neighbourhood Renewal programmes. Possible barriers facing residents who want to extend their social connections include lack of public transport, long working hours, and lack of financial resources.

The relationship between socioeconomic inequality and social cohesion is complex. According to one view, social networks and group identity are used to preserve inequalities (the "old school tie" for example). On the other hand, research in the US shows that income inequality is negatively correlated with social cohesion: states with higher levels of trust and reciprocity have lower income inequality (Kawachi et al, 1997). This apparent contradiction may be due to the way that social cohesion and social capital have been defined as both community level and individual level characteristics. There has been a lack of theoretical development concerning how they relate to health and health inequalities. According to Bourdieu's perspective, social networks tend to run along class lines and preserve social class differences (Bourdieu, 1985). Unless a low status person has connections with others of higher status, the resources available to him through his social networks may not help him to improve his social and economic situation. Equally, a high status person with connections to others of high status will

have access to more resources through his social networks. Networks that are divided along class lines will not contribute to reducing health inequalities. At the neighbourhood level, there is increasing spatial separation of high and low status residents.

Concentrated deprivation and concentrated affluence are increasing (Massey, 1996). If the most wealthy and powerful people live in different places from poorer, jobless, disadvantaged people then they will not use the same services or experience the same physical environment and they are less likely to share the same concerns. This may lead to a situation where the most wealthy, powerful people in society have little incentive to increase the tax base to improve poor services and address the decaying physical fabric of social housing and other public buildings. In the US, spending on services in poor neighbourhoods is more likely to be cut than in more affluent neighbourhoods (Williams, 2001). The possible isolation of economically disadvantaged residents from economic opportunities, from groups with political power, and from other potentially health-enhancing public and private services has been described by Ross et al (2001). Social networks may compound this economic disadvantage: information about employment opportunities, welfare benefits, and health promotion will be transferred less easily when social networks are insular. Neighbourhood social networks that do not cross social boundaries to link affluent and deprived groups are unlikely to contribute to reducing health inequalities. Theoretical development of the notions of social cohesion and social capital and how they relate to structural inequalities is needed. As has been highlighted, empirical studies should begin to look at spatial effects, including spatial segregation. International comparisons may be useful in identifying policies that contribute towards reducing inequality and spatial segregation and examining their impact on social cohesion (Stafford et al, forthcoming).

An obvious extension to this study would be to collect repeat measures of neighbourhood social cohesion to examine change in social cohesion in relation to health and to identify the determinants of change in social cohesion. Studying neighbourhood social cohesion over time presents many challenges, however. The changing nature of social cohesion has already been mentioned; participation in certain types of organisations may have declined over the last few decades but new forms of participation have emerged over this period. An additional challenge in studying neighbourhoods is distinguishing change in features of the neighbourhood from change in the resident population (Carmon & Baron, 1994).

Four markers of health were considered in this thesis. One of these (waist:hip ratio) was an objective measure. Future work could look at other objective health indicators as well as mortality. Investigation of the associations between neighbourhood social cohesion domains and cause-specific mortality may shed further light on the important features of neighbourhood social organisation that influence residents' health.

As has been noted, the separation of variation in health into that which is within and between neighbourhoods is a simplification and analytical software to deal with feedback in the relationship between person and place has yet to be developed. This separation also tends to underestimate neighbourhood effects. The childhood neighbourhood environment may influence educational attainment, which leads to lower socioeconomic position in adulthood. Adjustment for adult socioeconomic position therefore captures some of the effect of childhood residential context. Birth cohort studies will be useful in examining the effects of the residential environment through the life-course. It is now possible to model multiple membership (which allows people to move between areas) using standard software (Browne et al, 2001).

The Carstairs index and similar indices measure multiple economic deprivation. They are highly correlated with morbidity and mortality (see review by Pickett & Pearl, 2001 for example) but it is not clear precisely what these multidimensional indices are capturing. Further work is needed to describe the physical and service infrastructure in places with a high Carstairs index to begin to identify suitable points for intervention. Measurement of neighbourhood infrastructure, capturing physical, service, and political aspects of the neighbourhood, is currently being undertaken in the same neighbourhoods described in this thesis (Macintyre et al, 2002). This will also provide information on the relationship between the physical/service environment and social cohesion.

Despite the general pattern of close association between poor quality social cohesion and high economic deprivation, it was possible to identify a small number of neighbourhoods with high economic deprivation and high levels of trust, attachment, tolerance, integration, or participation. Case studies to confirm these findings and to investigate historical trends in these areas may highlight important messages for policy.

7.4 Concluding remarks

Evidence of associations between several aspects of neighbourhood social cohesion and self-rated health has been presented in this thesis. Associations between some neighbourhood social cohesion domains and both smoking and waist:hip ratio suggest that behavioural and biological pathways link neighbourhood characteristics to health status. These associations are not due to affect bias; the study design ensured that the outcome and exposure were not reported by the same participants. The associations may be explained, in part, through facilitation of social support in places which are socially cohesive. Poor quality social cohesion, most notably a lack of tolerance/respect for others, may additionally be an environmental stressor which increases certain resident's vigilance for threatening or dangerous situations. This adds to the increasing literature supporting contextual effects on health and suggests that social cohesion may be responsible for part of this effect. However, a high correlation between economic deprivation and most aspects of social cohesion was noted and the effects of neighbourhood social cohesion on the indicators of health studied here were greatly attenuated once economic deprivation in the neighbourhood was accounted for. These findings suggest that efforts to raise levels of social cohesion are unlikely to succeed unless efforts to improve economic and material conditions run concurrently.

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Your Local Area

CONFIDENTIAL

What is the survey about?

This is a survey among the general public about life in their local area. Even if you have only recently moved into your area, we are still interested in your views.

Most of the questions relate to your local area. We would like you to think of your local area as everywhere within a 20 minute walk (about a mile) of your home.

Who should complete the questionnaire?

The questions should be answered by the person named on the enclosed letter. If that person needs help to complete the questionnaire, the answers should still be given from his/her point of view – not the point of view of the person helping.

Questions or help

If you have any queries about this study, please call the *National Centre for Social Research* on 0171 250 1866. The office is open between 9.30 am and 5.30 pm Monday to Friday and will be connected to an Answerphone at other times.

How to complete this questionnaire

Please use a blue or black pen

Most questions can be answered by simply ticking the box alongside the answer that applies to you.

Example

Do you live in a house or flat?
A house
A flat

Please ignore the numbers printed by the boxes – these are for office use.

Don't worry if you make a mistake; simply cross out the mistake and put a tick in the correct box.

Example

Do you live in a house or flat?
A house
A flat

SN 1-7
Card 8-9
Batch 10-14

Yourself

Q 1

Are you male or female?

Male

Female

Tick one only
215

1

2

Q 2

What is your age in years?

Please write in age

Write in

216-218

Length of time in your local area

Q 3

How long have you lived in your local area?
(If you have lived in this area previously, moved away and come back again, please just answer about the current period of time that you have lived in your local area.)
Think of your local area as everywhere within a 20 minute walk (about a mile) of your home.

Write in
219-220

Years

Write in
221-222

Months

Organised activities with local people

Q 4

Do you regularly join in the activities of any of these types of organisation with people who live in your local area? Please include activities held both inside and outside your local area.

Political parties, trade unions, environmental groups

Parent-Teacher Associations, tenants groups, residents' groups, Neighbourhood Watch, youth groups

Church or other religious groups, charitable organisations (eg collecting for charity, helping the sick, elderly, poor etc.)

Education, arts or music groups or evening classes

Social clubs (eg Rotary Club, Women's Institute, Townswomen's Guild, women's groups, mother and toddler groups, working men's clubs, elderly lunch groups)

Sports clubs, gyms, exercise classes

Other groups or organisations

OR... No, I don't regularly join in the activities of any of these organisations with people in my local area

Tick as many as apply
223-236

01

02

03

04

05

06

07

08

2

Q 5 When was the last time that you did any of the following things?

	Tick one per row			
	In the past 12 months 1	Longer ago 2	Have never done this 3	
Talked to people living near you about an issue in your local area	☐	☐	☐	237
Signed a petition about an issue in your local area	☐	☐	☐	238
Attended a meeting or joined a group to campaign about an issue in your local area	☐	☐	☐	239
Contacted a local councillor or a member of parliament about an issue in your local area	☐	☐	☐	240
Wrote a letter to a newspaper or magazine about an issue in your local area	☐	☐	☐	241
Contacted someone from a radio or television company about an issue in your local area	☐	☐	☐	242
Made a formal complaint to someone in authority about a problem in your local area	☐	☐	☐	243

Q 6 How do you feel about your local area? Please tick one box in each row. The closer your tick is to a statement the more strongly you agree with it.

	Tick one per row							
	1	2	3	4	5	6	7	
I really feel part of this area	☐	☐	☐	☐	☐	☐	☐	I feel that I don't belong in this area 244
Vandalism and graffiti are a big problem in this area	☐	☐	☐	☐	☐	☐	☐	There is no problem with vandalism and graffiti in this area 245
I often feel lonely living in this area	☐	☐	☐	☐	☐	☐	☐	I never feel lonely living in this area 246
Most people in this area can be trusted	☐	☐	☐	☐	☐	☐	☐	Most people in this area can't be trusted 247
People would be afraid to walk alone in this area after dark	☐	☐	☐	☐	☐	☐	☐	People feel safe walking alone in this area after dark 248
Most people in this area are friendly	☐	☐	☐	☐	☐	☐	☐	Most people in this area are unfriendly 249
People in this area will take advantage of you	☐	☐	☐	☐	☐	☐	☐	People in this area will always treat you fairly 250
This area is kept very clean	☐	☐	☐	☐	☐	☐	☐	This area is always full of litter and rubbish 251
If you were in trouble, there are lots of people in this area who would help you	☐	☐	☐	☐	☐	☐	☐	If you were in trouble, there is nobody in this area who would help you 252

Relationships with your family and friends

Q 7

Not counting people who live with you, which of the following statements best describes how many people you have a close relationship with?

Tick one only

253

I have close relationships with lots of people

☐

1

I have close relationships with some people

☐

2

I have one or two close relationships

☐

3

I don't have any close relationships

☐

4

Q 8

And are these relationships mostly with people who live in your local area, or outside your local area?

By 'your local area' we mean the area within a 20 minute walk (about a mile) of your home.

Tick one only

254

Mostly with people in your local area

☐

1

Mostly with people outside your local area

☐

2

Equal numbers of relationships with people inside and outside your local area

☐

3

Q 9

When did you last do each of the following with members of your family who live in your local area (not counting those who live with you)?

Tick one per row

Does not apply to me

	In past week 1	In past fortnight 2	In past month 3	Longer ago 4	Never 5	Does not apply to me 6	
Met up with family members who live in your local area (include both arranged and chance meetings)	☐	☐	☐	☐	☐	☐	255
Spoke on the phone to family members who live in your local area	☐	☐	☐	☐	☐	☐	256
Wrote to (or emailed) family members who live in your local area	☐	☐	☐	☐	☐	☐	257

Q 10

And when did you last do each of the following with friends who live in your local area, not counting people who live with you?

Tick one per row

Does not apply to me

	In past week 1	In past fortnight 2	In past month 3	Longer ago 4	Never 5	Does not apply to me 6	
Met up with friends who live in your local area (include both arranged and chance meetings)	☐	☐	☐	☐	☐	☐	258
Spoke on the phone to friends who live in your local area	☐	☐	☐	☐	☐	☐	259
Wrote to (or emailed) friends who live in your local area	☐	☐	☐	☐	☐	☐	260

We would now like you to think about your family and friends. By family we mean those who live with you as well as those elsewhere.

Here are some comments people have made about their family and friends. We would like you to say how far each statement is true for you.

Please answer ALL the questions, ticking the box which you think most applies to you.

Q 11 There are people I know -
amongst my family or friends -
who do things to make me happy

Tick one only
261

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Q 12 There are people I know -
amongst my family or friends -
who make me feel loved

Tick one only
262

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Q 13 There are people I know -
amongst my family or friends -
who can be relied on no matter
what happens

Tick one only
263

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Q 14 There are people I know -
amongst my family or friends -
who would see that I am taken
care of if I needed to be

Tick one only
264

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Q 15 There are people I know -
amongst my family or friends -
who accept me just as I am

Tick one only
265

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Q 16 There are people I know -
amongst my family or friends -
who make me feel an important
part of their lives

Tick one only
266

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Q 17 There are people I know -
amongst my family or friends -
who give me support and
encouragement

Tick one only
267

Not true	☐	1
Partly true	☐	2
Certainly true	☐	3

Neighbours

Q 18 How comfortable would you feel asking for help from your neighbours in each of the following situations?
By neighbours we mean everybody who lives within a couple of minutes walk of your home (If nobody lives this close then think of the people who live nearest to you).

How comfortable would you be asking a neighbour...	Very comfortable 1	Fairly comfortable 2	Fairly uncomfortable 3	Very uncomfortable 4	Would not ask neighbour 5	
...to collect a prescription from the chemist for you if you were ill in bed?	☐	☐	☐	☐	☐	268
...if you could talk to them about a personal problem that you had?	☐	☐	☐	☐	☐	269
...to lend you £5 for a couple of days to pay an outstanding bill?	☐	☐	☐	☐	☐	270

Q 19 How do you feel about your neighbours? The closer your tick is to a word the more strongly you feel it applies to most of your neighbours.

	Tick one per row								
	1	2	3	4	5	6	7		
Friendly	☐	☐	☐	☐	☐	☐	☐	Unfriendly	271
Inconsiderate	☐	☐	☐	☐	☐	☐	☐	Considerate	272
Helpful	☐	☐	☐	☐	☐	☐	☐	Unhelpful	273
Trustworthy	☐	☐	☐	☐	☐	☐	☐	Untrustworthy	274
Rude	☐	☐	☐	☐	☐	☐	☐	Polite	275
Caring	☐	☐	☐	☐	☐	☐	☐	Uncaring	276
Threatening	☐	☐	☐	☐	☐	☐	☐	Unthreatening	277
Community-minded	☐	☐	☐	☐	☐	☐	☐	Self-centred	278

Spare 279-280

Q 20 Which of these statements best describes how you feel about your neighbours?

	Tick one per row								
	1	2	3	4	5	6	7		
I sometimes avoid my neighbours if I see them in the street	☐	☐	☐	☐	☐	☐	☐	I never avoid my neighbours if I see them in the street	310
I consider my neighbours to be my friends	☐	☐	☐	☐	☐	☐	☐	I don't consider any of my neighbours to be my friends	311
I have had lots of problems with my neighbours	☐	☐	☐	☐	☐	☐	☐	I have never had any problems with my neighbours	312
I have mostly good relationships with my neighbours	☐	☐	☐	☐	☐	☐	☐	I have mostly bad relationships with my neighbours	313

This area

Q 21 How do you feel about your local area? By your local area we mean everywhere within a 20 minute walk (about a mile) of your home.

Tick one per row

People in this area have lots of community spirit	1 2 3 4 5 6 7	People in this area have no community spirit	314
People in this area would turn a blind eye if a house was being broken into		People in this area would do something if a house was being broken into	315
People in this area are tolerant of others who are not like them		People in this area disapprove of others who are not like them	316
In this area there is pressure to behave like everyone else		In this area there is no pressure to behave in particular ways	317
People in this area respect one another's privacy		People in this area like to know everyone else's business	318
Everybody in this area should have equal rights and an equal say		Some people in this area don't deserve equal rights or an equal say	319
People in this area do things to help the community		People in this area only look out for themselves	320
In this area there are some people who belong and some who don't		Everybody who lives in this area belongs just as much as everybody else	321
In this area people would stop children if they saw them vandalising things		In this area people do nothing if they see children vandalising things	322
It is hard to earn people's respect in this area		People in this area treat each other with respect	323

Your health

Q 22 How is your health in general? Would you say it was...

	Tick one only 324
Very good	1
Good	2
Fair	3
Bad	4
Very bad	5

Other information

Q 23

Which of the following qualifications have you obtained?

University degree, NVQ5 or equivalent

Other higher education below degree level or NVQ4

A levels, SCE highers, NVQ3 or equivalent

GCSE/O levels, SCE, NVQ2 or equivalent

Other qualifications including City & Guilds, RSA, trade qualifications

None of the above qualifications

Tick as many as apply

325-329

☐

1

☐

2

☐

3

☐

4

☐

5

☐

6

Q 24

Do you and your household own your home (including buying with a mortgage)?

Yes

No

Tick one only

330

☐

1

☐

2

Q 25

How many children aged 15 and under live with you?

Please write in the number of children aged 5 and under

Please write in the number of children aged between 6 and 15

Write in

331-332

333-334

Q 26

How many cars or vans are available for use by you and other people in this household?

Please write in the total number of cars and vans

Write in

335-336

Q 27

Do you currently have a paid job?

Yes

No

Tick one only

337

☐

1

☐

2

Q 28

If at some future date we wanted to talk to you further about similar issues, may we contact you to see if you are willing to help us again?

Yes

No

Tick one only

338

☐

1

☐

2

THANK YOU VERY MUCH FOR YOUR HELP

Please post this questionnaire back in the envelope provided. No stamp is needed

Spare 339-380

Appendix 2. Social cohesion questionnaire development group

Mai Stafford
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Appendix 3. Complete question wording of items capturing health and psychosocial outcomes

1. From the Health Survey for England and Scottish Health Survey

Self-rated health

"How is your health in general? Would you say it was..."

Possible responses:

"Very good / Good / Fair / Bad / Very bad"

General Health Questionnaire (GHQ12)

"Have you recently..."

...been able to concentrate on whatever you're doing?" (R)

...lost much sleep over worry?"

...felt you were playing a useful part in things?" (R)

...felt capable of making decisions about things?" (R)

...felt constantly under strain?"

...felt you couldn't overcome your difficulties?"

...been able to enjoy your normal day-to-day activities?" (R)

...been able to face up to your problems?" (R)

...been feeling unhappy and depressed?"

...been losing confidence in yourself?"

...been thinking of yourself as a worthless person?"

...been feeling reasonably happy, all things considered?" (R)

Possible responses:

"Not at all / No more than usual / Rather more than usual / Much more than usual"

(R) reverse coded

Each item = 1 if response is Rather more than usual or Much more than usual.

Sum of 12 items gives GHQ12 score ranging from 0 to 12.

Cigarette smoking

"Do you smoke cigarettes nowadays?"

"Have you ever smoked cigarettes?"

"How frequently did you used to smoke?"

Possible responses:

"Current smoker / Ex-regular smoker / Never regular smoker"

Waist:hip ratio

Trained nurses took 3 measurements of the waist circumference and 3 measurements of the hip circumference. The waist:hip ratio was calculated as the mean waist circumference divided by the mean hip circumference.

2. From the Whitehall II study

Perceived social support

Introduction: "Thinking about the person you are closest to, please tell us how you would rate the practical and emotional support they have provided for you in the last 12 months"

i) emotional support

"How much in the last 12 months could you rely on this person (was this person there when you needed him/her?"

"How much in the last 12 months did this person make you feel good about yourself?"

"How much in the last 12 months did you share interests, hobbies and fun with this person?"

ii) practical support

"How much in the last 12 months did you need practical help from this person with major things (e.g. look after you when ill, help with finances, children)?"

"How much in the last 12 months did this person give you practical help with major things"

"How much in the last 12 months did this person give you practical help with small things when you needed it? (e.g. chores, shopping, watering plants etc)"

iii) negative support

"How much in the last 12 months did this person give you worries, problems and stress?"

"How much in the last 12 months would you have liked to have confided more in this person?"

"How much in the last 12 months did talking to this person makes things worse?"

"How much in the last 12 months would you have liked more practical help with major things from this person?"

Possible responses:

"Not at all / A little / Quite a lot / A great deal"

Each item coded 0 (Not at all) to 3 and items within each scale summed to give emotional and practical support scores ranging from 0-9 and negative support scores ranging from 0-12.

Vigilance for threat

"I'm always on my guard for things that might come at me"

"I'm not someone who worries about who's coming up behind me" (R)

"I'm on my guard in most situations"

Possible responses:

Strongly agree / Agree / Neutral / Disagree / Strongly disagree

Each item coded 0 (Strongly agree) to 4 and items summed to create vigilance for threat scale ranging from 0 to 12.

Sense of control

"I feel that what happens in my life is often determined by factors beyond my control"

"At home, I feel I have control over what happens in most situations"

Possible responses:

Strongly disagree / Moderately disagree / Slightly disagree / Slightly agree / Moderately agree / Strongly agree

Self-rated health

"In general, would you say your health is:-"

Possible responses:

Excellent / Very good / Good / Fair / Poor